

THE WITNESS OF SCIENCE

to the

TESTIMONIES OF THE SPIRIT OF PROPHECY

by

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PREFACE

We are now nearing the end of the work of the remnant church of Christ in this world, the church “which keep the commandments of God, and have the testimony of Jesus Christ.” Revelation 12:17. This testimony of Jesus, defined by John the revelator to be the spirit of prophecy, has given a most extensive delineation of health reform, medical missionary evangelism, sanitarium procedures, and the medical work of Christian physicians. Soon we must give an account of our stewardship. How faithfully has the blueprint and pattern been followed? Though principles of health healing laid down fifty to seventy-five or more years ago have now been amply demonstrated by medical research, yet these same principles are still largely unknown or disregarded by the majority of both the people of the world and the medical profession. It is interesting that scientific principles of diet, nutrition, and the healing art can be stated today in such non technical language, yet their import be clear and their meaning exact.

The testimonies (that group of writings that has come through the Spirit of prophecy) have brought to Seventh-day Adventists a greater perplexity than comes to other Christian peoples of this modern age. Since we acknowledge that these writings are of divine origin, we must also acknowledge that they are reliable in matters of health and medical science. If purported light from God upon a matter of science is unreliable, how can these writings be trusted on matters of religion and faith? This is a severe test. If the testimonies will not stand this test, then our faith in them is vain and we are of all people most adrift in an age of the greatest perplexity and uncertainty.

The testimonies are constantly urging us to a study of the Bible and to have faith in it as the word of God, and in Christ as the Creator. The testimonies tie themselves so completely to the Bible as it reads that this, too, must prove a severe test. Will this tie stand the strain put upon it? Although I was brought up in a home where the mother was a Seventh-day Adventist and I grew up with the full acceptance of these principles, this strain came almost to the breaking point during the four years of my, medical course, begun in 1899. Especially during the latter half of this course the controversy was a most disturbing one. In fact, it took a full year after coming to the Pacific Coast before the fog occasioned by this

environment and openly voiced opposition over fundamental matters of faith and denominational teachings cleared so that I recovered my bearings.

To the youth of today, and especially to medical students and physicians, I would commend a guiding light, should similar perplexities arise in your experience. It is this: "The greatest minds, if not guided by the word of God in their research, become bewildered in their attempts to trace the relations of science and revelation." - Patriarchs and Prophets, page 113. That small group who are endeavoring to bring to light the scientific evidences of the Biblical account of the Deluge as recorded in Genesis are following this guidance. These evidences are needed for those outside the ranks of Seventh-day Adventists. For the fuller establishment and prosperity of the principles of our health and medical work among Seventh-day Adventists, this guide must be followed. "Believe in the Lord your God, so shall ye be established; believe His prophets, so shall ye prosper." "To such a student, scientific research will open vast fields of thought and information. As he contemplates the things of nature, a new perception of truth comes to him. The book of nature and the written word shed light upon each other. Both make him better acquainted with God by teaching him of His character and of the laws through which He works." - The Ministry of Healing, page 462. "God is the author of science." - Counsels to Parents, Teachers, and Students, page 426. If this is true, then the testimonies which purport to come from God must of necessity agree with what can properly be called true science.

"Ignorance may try to support skepticism by appealing to science; but instead of upholding skepticism, true science contributes fresh evidences of the wisdom and power of God. Rightly understood, science and the written word agree, and each sheds light on the other." - Ibid., page 426. "There should be a settled faith in the divinity of God's Holy Word. The Bible is not to be tested by men's ideas of science, but science is to be brought to the test of this unerring standard. When the Bible makes statements of facts in nature, science may be compared with the written word, and a correct understanding of both will always prove them to be in harmony. One does not contradict the other." - Signs of the Times, March 13, 1884. If the testimonies were given by divine enlightenment, then they were given by the Creator of the human body, who "spoke, and it was," who "commanded, and it stood fast." What we call the laws of nature are the Creator's laws; they are fixed and unchangeable. They are indeed the same yesterday, today, and forever. It is only human knowledge of them that is limited or defective. It puts no strain upon the Creator's omniscience to tell us things past or future, or matters still unknown to human understanding. The most intimate and minute biochemical laws of physiology, nutrition, and healing are alike open to Him who made all things. What Christ, through the spirit of prophecy, reveals regarding diet and nutrition, health, healing, the effects of drugs and chemicals upon the human mechanism, is reliable, dependable, certain and unchangeable, now as when stated, whether or not it agrees with human knowledge at the time it was given. We may, therefore, take it as a safe and certain guide to the study of matters of importance concerning health and disease, to the minister, the physician, the nurse, and the people.

"Since the laws of nature are the laws of God, it is plainly our duty to give these laws careful study. We should study their requirements in regard to our own bodies, and conform to them. Ignorance in these things is sin." - Testimonies, Volume 6, P. 369. "He who remains in willing ignorance of the laws of his physical being, and who violates them through ignorance, is sinning against God." - Christ's Object Lessons page 348

During my medical course, David Paulson, M.D., set the feet of the medical students in the way of researches into the operations and laws of physiology. The first book we studied under his guidance was I. P. Pavlov's *Work of the Digestive Glands*. Since then such monographs have followed one after another, and many of these have been added to my library. Two classes of such research have been followed: First, investigations into the normal operations of the organs and functions of the body in health. Second, those which have revealed the causes of disease.

In connection with the diagnosis of disease the testimonies state that the causes should be ascertained and that the physician may then set about to remedy the disease by removing such causes and by applying those remedial agencies which aid nature in combating the disordered function. With these medical principles must go as of first importance the seeking of divine guidance and conformity to the will of God. "The sick are to be healed through the combined efforts of the human and the divine." "The influence of the Spirit of God is the very best medicine that can be received by a sick man or woman." "What the physician attempts to do, Christ can accomplish." "Sickness, suffering, and death are work of an antagonistic power. Satan is the destroyer; God is the Restorer." "He it is who forgives all your iniquities; who heals all thy diseases; who redeems thy life from destruction; who crowns thee with loving-kindness and tender mercies." - *Medical Ministry*, pages 11-13.

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“God is the author of science. Scientific research opens to the mind vast fields of thought and information, enabling us to see God in His created works. Ignorance may try to support skepticism by appealing to science; but instead of upholding skepticism, true science contributes fresh evidences of the wisdom and power of God. Rightly understood, science and the written word agree, and each sheds light on the other. Together they lead us to God, by teaching us something of the wise and beneficent laws through which He works.” - E. G. White, *Counsels to Parents, Teachers, and Students*, page 426.

1. ADVANCED INFORMATION

FORTY years of medical and surgical practice, with much time for research work, has left me with some settled conclusions regarding the reliability of scientific statements made in the messages on health and medical practice. Many of these statements were published at a time when they were contrary to ideas generally accepted among physicians and could not have been proved by the reports of any research work then extant. So sound have these guiding principles been in pointing out the necessity of conforming to physiologic law and the use of nature’s aid in the treatment of the sick, that following them would have saved, and did save, many Seventh-day Adventist physicians from making serious mistakes in the treatment of the sick, mistakes which have been common among medical men in the nineteenth and twentieth centuries.

Drugs

The harmful effects of certain drugs pointed out in the testimonies given in 1865 were not demonstrated by scientific research until after the turn of the century and some of them not until ten or fifteen years after 1900. The description of the effects of strychnine (the active principle of nux vomica) was so clear and so accurate as given in the little book *How to Live* (1865), which I had read as a boy, that when I saw a person who had been using the drug as a heart stimulant I recognized the symptoms at once, though no such description was given in any medical book. A retired clergyman had called me to see him in Burbank, California, in 1904, where I first practiced medicine. Upon entering the room of the patient, I pushed away a rug that had been placed to prevent any draft from entering under the door. The windows were all shut and covered with blankets to keep out drafts. The man was in bed with many blankets over him and a shawl pulled tightly around his head. The weather was warm, and it was the middle of the day. Questioning brought out the fact that small doses of strychnine had been prescribed by a physician as a heart stimulant, and the patient continued to take the drug. Note the accuracy of the description as given by E. G. White, who could have had no knowledge of such drug effects and which effects could not have been found in any medical book or medical writing at the time:

“The second case was again presented before me. The patient had appeared better under the influence of nux vomica. She was sitting up, folding a shawl closely around

her, and complaining of chilliness. The air in the room was impure. It was heated and had lost its vitality. Almost every crevice where the pure air could enter was guarded to protect the patient from a sense of painful chilliness, which was especially felt in the back of the neck and down the spinal column. If the door was left ajar, she seemed nervous and distressed, and entreated that it should be closed, for she was cold. She could not bear the least draft of air from the door or windows. A gentleman of intelligence stood looking pityingly upon her, and said to those present: "This is the second result of nux vomica. It is especially felt upon the nerves, and it affects the whole nervous system. There will be, for a time, increased forced action upon the nerves. But as the strength of this drug is spent, there will be chilliness and prostration. Just to that degree that it excites and enlivens, will be the deadening, benumbing results following."

"Its effects are always tending to death. The condition the system is in, at the time these poisons are received into it, determine the life of the patient. Nux vomica can cripple, paralyze, destroy health forever, but it never cures."-How to Live, page 58. Published in 1865.

In addition to the accuracy of the description of the manifest effects of the drug note also the complete agreement of the last two statements in this with the ultimate effects of strychnine as given by George W. Crile, M.D., from animal experiments, record of which was published in his book, *On the Blood Pressure in Surgery*, pages 266, 268 (1903), and in the *Detroit Medical Journal* for May, 1903, pages 38, 39:

"After each dose, when the effect had worn off, the blood pressure fell to a lower level than it was before the injection was given, until finally it reached the level, usually between 20 and 30 mm. which was not altered by an additional dosage....

"In a series of experiments in which strychnine was given in various degrees of shock in such dosage as to cause a stimulation, the effect was proportional to the degree of shock, i.e., when but little shock was present, a marked effect from strychnine was obtained; and when most profound, there was no effect. In the intervening degrees the effects were proportional, but after giving the strychnine the animals not yet in complete shock always passed into a deeper degree of shock."

"In any degree of shock, after the administration of a therapeutic dose of strychnine, the animals passed into deeper shock."

"Later in the research it is found that the most convenient and certain method of producing shock for experimental purposes, is by the administration of physiologic doses of strychnine. The treatment of shock, then, by therapeutic doses of strychnine is inert, and in physiologic doses dangerous."

There are details of the effects of strychnine given in the, *Testimonies for the Church* which are not in Dr. Crile's experimental research, and vice versa. One is in non technical language, the other in scientific terms, but there is no disagreement.

It seems, however, that physicians have at least partly learned their lesson about strychnine, because in these days it rarely happens that large enough doses are prescribed to produce such effects as are described above.

Refined Processed Foods

Very early in E. G. White's messages the harmfulness of refined flour products was made known. Only the researches of the last thirty years have established the scientific basis of these facts. Their damaging effects did not become so fully known as to attract general attention until the draft rejections of World War II and other investigations of specialists in nutritional diseases brought out the fact that some of our population are partially or seriously undernourished chiefly because of the use of refined foods. The testimonies pointed out the danger years before science discovered these facts.

It would be too long a story to tell of the many other statements in the messages which are hard to understand or which seem contradictory and which have been misunderstood by some because of preconceived notions. Some called them unscientific and even held them up to ridicule because they disagreed with currently accepted ideas. One of these most discounted statements was a positive testimony against butter, along with tea, coffee, meat, tobacco, and alcohol. In 1901 someone who had brought on himself a serious case of pernicious anemia, which at that time was invariably fatal, was instructed by a personal testimony to put back into his diet those things which he had discarded—milk and eggs. As a medical student I had counted the blood cells of this person many times and so had a vivid picture of his condition.

Beginning in 1908 on down to 1920, Anitschow and other Russian physiologists demonstrated conclusively that cholesterol, which is contained in both butter and egg yolk as well as in all flesh foods, when used freely produces the serious disease arteriosclerosis. In 1933 this was confirmed by Timothy Leary, M.D., in a similar piece of research which included both animal experiments and human pathology. In the autumn of that year, while taking a course in major urology at the Boston City Hospital where Dr. Leary is pathologist, I became acquainted with him and he spent some time showing me the results of this research the year before it was published. These experiments revealed the cause of arteriosclerosis with its many serious results. In that same year, 1933, Edmund V. Cowdry, M.D., published a treatise on arteriosclerosis to which there were twenty-three contributors. This book revealed not only the primary cause, the chemical substance always involved in the disease, but also the secondary or contributing causes of this disease. In 1924 W. D. Sansum, MD of Santa Barbara, California, had published experimental work with three different types of diet—one high in protein and containing cholesterol, one high in protein but containing no cholesterol; both of these were acid in ash. The third was high in protein but alkaline in ash and contained no cholesterol. These three diets revealed definite differences in effects upon blood pressure, the blood vessels, the kidneys, and the accumulation of protein wastes in the blood. They explained in greater detail the much-misunderstood causes of high blood pressure, hardening of the arteries, Bright's disease; and they revealed why these conditions are so variable in occurrence, in degree, and in combination. Together these various researches enable the formation of principles and rules for the content of the diet in amounts and proportions of the structural and fuel elements of food to avoid the life-shortening diseases and preserve the characteristics of youth.

The latest vital statistics show that this one group of diseases is responsible for 44 per cent of deaths at all ages in the United States and 62, per cent of all deaths for ages sixty-five and over.

These experimental facts reveal the consistency and importance of the statement written in 1870: "We bear positive testimony against tobacco, spirituous liquors, snuff, tea, coffee, flesh meats, butter, spices, rich cakes, mince pies, a large amount of salt, and all exciting substances used as articles of food." - Testimonies, Volume 3, Page 21. Of the full list of foods causing degenerative diseases there need be added today only eggs to the dietary factors, and to secondary causes, competitive athletics. Of two of these dietary causes-butter and eggs-it has been clearly shown to be a quantitative matter. Moderate or limited use is healthful and necessary, while free or large use is conducive to degenerative diseases of the vital organs-the heart, blood vessels, and kidneys.

On the other side of this seemingly contradictory statement of 1901, in explaining the reason for the advice to use eggs, the testimony explained that eggs contain remedial agencies which counteract certain poisons. From the circumstances of the case of pernicious anemia, one must come to the conclusion that these poisons are from wholesome food. For many years I kept my eyes open to find any research which would explain how one food (eggs) could counteract poisons in other good food. Not until 1932, thirty-one years after this was written and about twenty after I had first read it, was my search rewarded. I found the explanation in the work done in England by the researchers Mervish and Sir Edward Melleriby, M.D. These researches revealed that a diet excessive in cereal grains contains acid poisons which both vitamins A and D of egg yolk counteract, each in a different way. A full account was printed in The Ministry for June, July, and August, 1940. My confidence in the counsel on the use of eggs was for many years entirely faith, not science, for science is human knowledge, which in this case came thirty years later. Likewise, folic acid, the biochemical stimulant or regulator of red bone marrow, where blood cells are made, was not discovered and proved to be such by animal experiments and application to human disease until 1942-1946.

Diet Often Cause of Disease

One of the most helpful principles in medical practice was stated in the testimonies in 1887. It concerned the investigation of the habits of the sick which have laid the foundation for disease, particularly the habits of eating and drinking. It is called the diet history. This is now being advocated and extensively used by investigators in nutrition and applied in medical practice. In 1936, following this instruction as a clew to the treatment of a disease of unknown cause, I was sure I had found the key to the situation in a patient, a boy of eleven years, who ate no fruit or vegetables. The disease had received most extensive description in medical works for many years, but no cause for it had been discovered. I had previously seen five or six cases of the same type of hemorrhagic disease-purpura haemorrhagica of Schonlein-Henoch type. The diagnosis was confirmed by a professor of medicine at Stanford University Medical School and later in Lane-Stanford Hospital. Failing to gain results by attempts at feeding these foods by mouth, I put down a feeding tube through the nose of the patient, past the stomach and into the duodenum, and began with a half-ounce feeding of citrus fruit juices and later other concentrated liquid foods. The boy made a complete recovery and was sent home from the local hospital in a little more than two and a half weeks. Soon after the patient's recovery, there came the announcement from Europe that Albert Szent-Gyorgyi, M.D., of the University of Szeged, Hungary, had discovered and isolated from lemon peel and citrus fruit juices a vitamin that cures this

hemorrhagic disease. He proposed to call it “vitamin P.” A number of investigators have experimented with vitamin P in citrin, as the crude product is called. The relationship of this vitamin to this certain hemorrhagic disease, and its distinction from vitamin C and scurvy, have been confirmed by other researchers, particularly by H. Scarborough, M.D., of Scotland.

The testimonies throw light on other problems of diet such as the needs and abilities of the body in the utilization of protein, the matter of overeating and fasting, and eating between meals. Important basic principles of medical practice, nature’s aid (physiological therapy) in the treatment of disease, the damaging effects of poisonous or toxic drugs, the place and importance of trust in God (religion) in the recovery of the sick, are all discussed, principles which were unknown at the time they were presented by E. G. White and which are much neglected even today.

As early as 1861 the French Academy of Science published a list of fifty-one statements advanced by scientists in their day as true to science, every one of which is now rejected. Yet in the testimonies are a number of volumes on health, diet, nutrition, and medical practice written by one who had no medical or scientific education, and only two facts or principles remain to be explained or corroborated by scientific research. Not a single one of these many important facts regarding the physical welfare of the human body has been proved incorrect.

2. NATURAL LAW

THE knowledge that man is to be a temple for God, a habitation for the revealing of His glory, should be the highest incentive to the care and development of our physical powers. Fearfully and wonderfully has the Creator wrought in the human frame, and He bids us make it our study, understand its needs, and act our part in preserving it from harm and defilement.” -The Ministry of Healing, page 271.

“Know ye not that ye are the temple of God, and that the Spirit of God dwells in you? If any man defile the temple of God, him shall God destroy; for the temple of God is holy, which temple ye are.” 1 Corinthians 3: 16, 17.

There is among Seventh-day Adventists no more oft-quoted statement of the principles and objectives of healthful living than this: “To make plain natural law, and urge the obedience of it, is the work that accompanies the third angel’s message to prepare a people for the coming of the Lord.” - Testimonies, Volume 3, Page 161. It is a statement of the spirit of prophecy that will bear careful, analytic study. The principal objective is the preparation of a people for the second advent of Christ. It is Christ who knows what this preparation should be. “There was never a time when God instructed His people more earnestly than He instructs them now concerning His will, and the course that He would have them pursue.” - Ibid., Volume 5, Page 661.

There is a special reason given for the place and purpose of health reform in the message: “God’s people are not prepared for the loud cry of the third angel. They have a work to do for themselves which they should not leave for God to do for them. He has left this work for them to do. It is an individual work; one cannot do it for another.... In order to

be fitted for translation, the people of God must know themselves. They must understand in regard to their own physical frames.” - Counsels on Diet and Foods, pages 32, 33. If such a statement were made by a physician, it could scarcely be regarded in any other light than as a fantastic exaggeration of the importance of physical health in spiritual well-being, as if “biologic living” were the substance of salvation. Personally, I would not advance such an idea on my own initiative. That this statement is not intended to make healthful living a means in itself of spiritual regeneration is self evident from its stated relation to the third angel’s message; namely, that it is the work that accompanies this message, not the message itself.

This accompanying work is to make natural law plain. To do this means first of all to ascertain what are natural or physiological laws. This is done by studying the operations of nature, the functions of the tissues and organs of the body. Only when it is ascertained that these tissues and structures invariably operate in precisely the same way under the same conditions is it considered that a physiological law has been discovered. Moreover, this is not generally accepted as a scientific fact until others have made the study and found the same occurrences from the same causes. Physiological laws are fixed, invariable, constant; there is no working one way one day and another the next. A certain effect is not produced in one white rat and an entirely different effect in another white rat under the same conditions. The laws of human physiology, though in some respects different from those of rats and other laboratory animals, are nevertheless as fixed and constant.

The fact of this constancy of effects from given causes is clearly stated in the testimony discussion concerning the welfare of Daniel and his three associates. “Right physical habits promote mental superiority. Intellectual power, physical strength, and longevity depend upon immutable laws. There is no happen so, no chance, about this matter. Nature’s God will not interfere to preserve men from the consequences of violating nature’s laws.” - Counsels on Diet and Foods, page 29. “God has not changed, neither does He propose to change our physical organism, in order that we may violate a single law without feeling the effects of its violation. But many willingly close their eyes to the light By indulging their inclinations and appetites, they violate the laws of life and health; and if they obey conscience, they must be controlled by principle in their eating and dressing, rather than be led by inclination, fashion, and appetite.” - Ibid., page 161. “Our tables are frequently spread with luxuries neither healthful nor necessary, because we love these things more than we love self-denial, freedom from disease, and soundness of mind.” - Testimonies, Volume 27, Page 203.

A skilled researcher who has spent his whole professional life in many lands in the work of disease prevention, Victor G. Heiser, M.D., of the Rockefeller Foundation, with evidently the same illogical situation in mind, exclaims: “Impounded rats, eating perforce what they are furnished, may thrive and grow vigorous. Reasoning man, with laboratory knowledge at his disposal remains a slave to dietary habits, sacrificing his health and sometimes even his life.” – “We Are What We Eat,” The Reader’s Digest, March, 1938. How alike are the messages which God sends to men and women today through the spirit of prophecy and some of those which come from men of scientific research. “The strange absence of principle which characterizes this generation, and which is shown in their disregard of the laws of life and health, is astonishing. Ignorance prevails upon this subject, while light is shining all around them.” - Counsels on Diet and Foods, page 119. Weston A.

Price, D.D.S., in his monumental work, Nutrition and Physical Degeneration, several times mentions this character factor as the largest obstacle in the way of correcting physical degeneration even when it is most obvious and rampant and when those afflicted have the needed knowledge. But he is unable to offer any suggestion for remedying this character defect, as dissemination of knowledge is, in this case, no help at all.

“Christ began the work of redemption just where the ruin began. The fall of our first parents was caused by the indulgence of appetite. In redemption, the denial of appetite is the first work of Christ.” - The Sufferings of Christ, page 12 “Since the laws of nature are the laws of God, it is plainly our duty to give these laws careful study. We should study their requirements in regard to our own bodies, and conform to them. Ignorance in these things is sin.” - Testimonies, Volume 6, Page 369. “He who remains in willing ignorance of the laws of his physical being, and who violates them through ignorance, is sinning against God.” Christ’s Object Lessons, page 348.

Ignorance is no excuse now for the transgression of law. The light shines clearly, and none need be ignorant.” - Counsels on Health, page 21. “A practical knowledge of the science of human life is necessary in order to glorify God in our bodies.” -Ibid., page 38.

While these messages emphasize the importance of physiological laws and give many broad principles pertaining to them, they do not embody a precise statement of these laws or constitute a textbook of laws of physiological functions. In the creation of man, God devised the physiological laws of his being which it is therefore plainly our duty to study. He would not state something in the testimonies of His Spirit which is directly contrary to these laws which He Himself created. The two must and do agree. “Rightly understood, science and the written word agree, and each sheds light on the other.” - Counsels to Parents, Teachers, and Students, page 426.

“In ancient times God spoke to men by the mouth of prophets and apostles. In these days He speaks to them by the testimonies of His Spirit.” - Testimonies, Volume 5, p. 661. The testimonies are not a substitute for the writings of the apostles and prophets, but an amplification and explanation, the applying of truth to the needs of our times. “The book of nature and the written word shed light upon each other. They make us acquainted with God by teaching us something of the laws through which He works.” - Education, page 128.

“From the very nature of these rules they are inviolable, and continued existence depends upon strict adherence to them. ‘Obey and live; disobey and perish,’ is written upon every rule. The consequences of disobedience are not penal in their nature; they are a result of transgression, the wages of sin rather than a punishment for sin. The man who drinks poison violates the rules of life and suffers the consequences. The punishment is inherent in the act itself.”-M. L. Andreasen, The Book of Hebrews, page 298.

Let us enter, therefore, upon a careful detailed study of the testimonies on healthful living, correlating them with scientific research into physiological laws which God has pointed out as i-plainly our duty.” Since not all that purports to be science is actually scientific, nor all that is written by men of science is true science, we need some certain guiding principles if precious time is not to be wasted in the study of mere opinions and of impractical material. This guiding principle is plainly stated: “His word is given for our instruction; there is nothing in it that is defective or misleading. The Bible is not to be tested

by men's ideas of science, but science is to be brought to the test of the unerring standard." - Counsels to Parents, Teachers, and Students, page 425.

As does the Bible, so do the testimonies contain some things hard to understand, which those who are unstable and unlearned twist or misconstrue to their own harm and often to that of others as well. The Bible is considered unreliable in matters of science by many people in civilized lands. The testimonies are similarly regarded by some Adventists who are apparently in good and regular standing. Attempts at an explanation of some statements on diet, foods, drugs, or causes of disease clearly reveal skepticism on the part of some persons. Individuals strain some statements out of their obvious normal setting, so that essentially they are explained away. The importance of many facts and principles which were contrary to accepted ideas of the time in which they were written has now been clearly and conclusively corroborated and explained by scientific research. Little still remains unexplained. With the exception of the two statements regarding leprosy and cancer in which research is incomplete and has not as yet reached any definite conclusion, I know of none that has not now been demonstrated by modern science, or is not in its main features fully in accord with discovered facts of scientific research, even though these facts may not yet be accepted generally by medical men.

The testimonies are a safe and reliable guide in the study of science. If I cannot understand them I do not reject them and say that they are wrong. I hold them as truth and wait to explain them until research makes them understandable to me. "There are some professed believers who accept certain portions of the testimonies as the message of God, while they reject those portions that condemn their favorite indulgences." - Counsels on Diet and Foods, page 37. I must not set myself up as a judge of what is right and what is wrong in God's messages, for thus I assume a wisdom superior to that of the Giver of these messages.

There are still other ways by which we virtually reject or ignore vitally important messages designed for the benefit of God's people. One is to consider these as unimportant in some respects, or allow some preconceived ideas to be put ahead of them, to feel that they do not apply to my particular case, by defects in the translation of thought from written language, by plain disregard or lack of careful study. Some seem to feel that the messages on diet and food are good grandmotherly advice but not at all to be taken seriously in these days of modern science. When I read *The Desire of Ages* alongside the four Gospels I feel the same Spirit speaking to me and giving the gracious invitation that is found in the Scriptures. When I read *The Ministry of Healing*, I sense that its messages are given by the same One who inspired the books of Exodus and Leviticus. I find no personal expression of my convictions and faith in the testimonies as a reliable and practical guide to the science of physiological law quite equal to this statement in the book *Education* regarding the Bible: "It is one thing to treat the Bible as a book of good moral instruction, to be heeded so far as is consistent with the spirit of the times and our position in the world; it is another thing to regard it as it really is, the word of the living God, the word that is our life, the word that is to mold our actions, our words, and our thoughts. To hold God's word as anything less than this is to reject it. And this rejection by those who profess to believe it, is foremost among the causes of skepticism and infidelity in the youth." - *Education*, page 260.

Light on the Food Question

“The light that God has given and will continue to give on the food question is to be to His people today what the manna was to the children of Israel. The manna fell from heaven, and the people were told to gather it, and prepare it to be eaten.” - Medical Ministry, page 267. In speaking of manna as an illustration of light on the food question, the statement says that it fell from heaven. It is also from heaven that light on the nutritive values of food comes to us. Scientific research finds this light and makes it available. Yet, as in the case of manna, it is necessary that it be gathered. God does not spoon-feed us even though He does provide the food. The light He provides must also be gathered. A little study of the human endeavor that must have been required to gather the manna helps us better to understand the illustration. Each one gathered an omer a day. The rabbis give an omer as equal to 0.45 of a gallon; Josephus gives it in a measure equal to 0.86 of a gallon. To gather from two to more than three quarts of manna like coriander seed would necessitate considerable time, as anything so small could not be scooped up with the hands or any utensil, without getting much sand and dirt along with it. The children of Israel must have had to get up early in the morning, for it melted away when “the sun waxed hot.”

The other human endeavor was the preparing of the manna to be eaten. To make the knowledge we have concerning foods and nutrition into a practical, workable daily program is the* task God expects us to accomplish. Reasons as well as proper methods and technique must be made known. It is not uncommon for patients to say to the doctor: “Tell me what to eat, and I will follow your rules. I don’t want to bother with reasons.” God does not do things for us that way. We must put forth our own endeavors. He does not mark our menus for us. It is of great importance that individually we act well our part, and have an intelligent understanding of what we should eat and drink, and how we should live to preserve health.”-Counsels on Diet and Foods, page 34. “Men and women should inform themselves in regard to the philosophy of health. The minds of rational beings seem shrouded in darkness in regard to their own physical structure, and how to preserve it in a~ healthy condition. The present generation have trusted their bodies with the doctors, and their souls with the ministers.” - Counsels on Health, page 37. Certainly both doctors and ministers have their place in human affairs, and a very useful place it is. It was Elbert Hubbard who said: “It is ignorance and sin that furnish the excuse for the existence of the learned professions.” Doctors and ministers should be teachers of the people, and not simply menders of broken pottery. But this alone does not excuse men and women from diligent study of their own physical needs and welfare.

It is well to point out that manna had a most delicious flavor. “The taste of it was like wafers made with honey.” Food should be palatable. It is not necessary to prepare food of unpalatable flavors, food that does not appeal to the unpampered appetite. Food should taste good as well as be healthful. “With a lavish hand God has provided us with rich and varied bounties for our sustenance and enjoyment.” - Counsels on Diet and Foods, page 160. “Who satisfies thy mouth with good things; so that thy youth is renewed like the eagle’s.” Psalm 103:5.

CHAPTER THREE

3. SPIRITUAL REASONS FOR HEALTHFUL LIVING

GOD'S people are not prepared for the loud cry of the third angel. They have a work to do for themselves which they should not leave for God to do for them. He has left this work for them to do. It is an individual work; one cannot do it for another." - Counsels on Diet and Foods, page 32.

"Intemperance lies at the foundation of all the moral evils known to man. Christ began the work of redemption just where the ruin began. The fall of our first parents was caused by the indulgence of appetite. In redemption, the denial of appetite is the first work of Christ."-The Sufferings of Christ, page 12.

"God requires His people to cleanse themselves from all filthiness of the flesh and spirit, perfecting holiness in the fear of the Lord. All those who are indifferent and excuse themselves from this work, waiting for the Lord to do for them that which He requires them to do for themselves, will be found wanting when the meek of the earl, who have wrought His judgments, are hid in the day of the Lord's anger. I was shown that if God's people make no efforts on their part, but wait for the refreshing to come upon them and remove their wrongs and correct their errors; if they depend upon that to cleanse them from filthiness of the flesh and spirit, and fit them to engage in the loud cry of the third angel, they will be found waiting. The refreshing or power of God comes only on those who have prepared themselves for it by doing the work which God bids them, namely, cleansing themselves from all filthiness of the flesh and spirit, perfecting holiness in the fear of God." - Counsels on Diet and Foods, page 33.

No one would dispute the appropriateness of these statements if they applied to such habits as the use of alcohol and tobacco, but that can hardly be their meaning as applied to "God's people." These habits must be abandoned before admission to church fellowship. Perhaps none would say this is misapplied if it referred to gluttonous feasting and the eating of pork, crabs, lobster, and the like, those which the Bible classifies as unclean meats. Yet even this is certainly not Seventh-day Adventists' fare. Moral transgressions are, of course, included in filthiness of the spirit and need no discussion. But is there not something definite to which this does apply, something which urgently needs attention among those who are waiting for the coming of the Lord? What about disease not due to any of the gross sins of eating and drinking or to immoral conduct? The peoples of America and all civilized lands have a host of diseases which lead to infection of highly damaging nature, to degeneration of crippling and disabling proportions, diseases which in their outward appearances are filthy and uncleanly. Abscesses, gangrene, tuberculosis, many skin diseases, and cancer are all too common among us.

TO gain a clearer understanding of this matter, let us turn to other statements regarding the preparation for the coming of the Lord. In order to be fitted for translation, the people of God must know themselves. They must understand in regard to their own physical frames, that they may be able with the psalmist to exclaim, 'I will praise Thee, for I am fearfully and wonderfully made.' They should ever have the appetite in subjection to the moral and intellectual organs. The body should be servant to the mind, and not the mind to the body." - Ibid., page 33. This statement calls for a knowledge of the normal operations of bodily functions and of disease prevention, which is more than freedom from gross physical and moral sins. This is the field upon which the light shines clearly and none need be

ignorant.” Further, “They need to be taught that every practice which destroys the physical, mental, or spiritual energies is sin, and that health is to be secured through obedience to the laws that God has established for the good of all mankind.”-The Ministry of Healing, page 113.

“Christ had been the guide and teacher of ancient Israel, and He taught them that health is the reward of obedience to the laws of God. The Great Physician who healed the sick in Palestine had spoken to His people from the pillar of cloud, telling them what they must do, and what God would do for them. ‘If thou wilt diligently hearken to the voice of the Lord thy God,’ He said, ‘and wilt do that which is right in His sight, and wilt give ear to His commandments, and keep all His statutes, I Will put none of these diseases upon thee, which I have brought upon the Egyptians: for I am the Lord that heals thee.’ Christ gave to Israel definite instruction in regard to their habits of life, and He assured them, ‘The Lord will take away from thee all sickness.’ When they fulfilled the conditions, the promise was verified to them. ‘There was not one feeble person among their tribes.’ ” - The Desire of Ages, page 824.

There are common eating habits among Seventh-day Adventists that lessen or destroy both physical and mental energies and cripple or at least seriously hinder the free exercise of the spiritual energies of the soul. These eating habits are worse than the use of meat, as directly stated in the testimonies. But before we enter upon any comparisons in the relative harmfulness of foods, let us give attention to the direct effects of diet upon disposition, behavior, and character as shown by feeding experiments in animals and in men. If what we eat directly hinders the mental and spiritual faculties in our relationship to others, then we can better understand what is meant by the statement that we are not now ready for the highest endeavors of the spiritual faculties in the time of the latter rain and the loud cry of the third angel’s message.

Behavior Effects of Diet

Since the discovery in 1937-38 of the startling effects of one of the vitamins of the B complex in relieving the insanity of pellagrins, it has become apparent that food has something to do with brain activity as well as with the functions of other organs and tissues. E. L. Thorndike says: “Thinking is as biological as digestion.” The brain-clogging effects of vitamin B, deficiency due to the accumulation of pyruvic acid in the brain is another example of the effects of diet upon mental activity. Both these vitamin deficiencies will therefore be associated, not only with physical disease, but with more or less mental aberration if at all severe, and at least with irritability and difficulty in maintaining patience and composure under provocation.

Burt, in an extensive study of the backward and delinquent child in London, states, “The vast majority of backward children -80 per cent in an area like London-prove to be suffering from minor bodily ailments or from continued ill-health.” He emphasizes a relationship between delinquency and physical deficiency: “Most repeated offenders are far from robust; they are frail, sickly, and infirm. Indeed, so regularly is chronic moral disorder associated with chronic physical disorder that many have contended that crime is a disease, or at least a symptom of disease, needing the doctor more than the magistrate, physic rather than the whip.”

The malnourished brain functions abnormally just as other malnourished organs show dysfunction; and defective and harmful physical foods play a part in wrong behavior.

Beginning first with animal experiments in which civilized man's diet is given to one group and the whole natural foods of aboriginal peoples are given to a control group, there is found a sharp contrast even in animal behavior, in which of course there are no true mental or moral causes to reckon with.

G. T. Wrench, M.D., summarizes certain experiments done by Robert McCarrison, M.D., and in connection with the great variety of diseases due to modern civilized man's food he says: "Considering again the simplicity of the rat and its limitation in things human, the list is, comparatively speaking, almost as complete as the list of contents of a stately textbook of medicine. The diseases of the mind and other very special diseases are omitted. One cannot exactly diagnose neurasthenia, hysteria, and schizophrenia, in the rat.

"Yet even in rats conditions like to these arise from faulty diet. For example, in later experiment, McCarrison gave a set of rats the diet of the poorer classes of England; white bread, margarine, sweetened tea, boiled vegetables, tinned meats and jams of the cheaper sort. On this diet, not only did the rats grow badly, but they developed what one might call rat neurasthenia, and more than neurasthenia. 'They were nervous and apt to bite their attendants; they lived unhappily together, and by the sixteenth day of the experiment they began to kill and eat the weaker ones amongst them.'

"We can add neurasthenia and ferocity to weaker brethren to the list.

"We are left then at the end of these experiments with two vividly contrasted sets of little animals in this small 'universe' of Coonoor-those on good and those on faulty diet; the healthy and the sickly; and certain mental characters, in contrast, the good tempered and live-and-let-live on the one hand, the bad-tempered and cannibalistic on the other." - *The Wheel of Health*, page 38.

In these animals are seen the behavior effects of a diet of meat, tea, refined foods, and sweets as contrasted with the peaceableness of animals on whole natural foods. Of the effects of meat on behavior we have the notable agreement with these experiments of two testimony statements written in 1898 and 1904: "As a general thing, the Lord did not provide His people with flesh meat in the desert, because He knew that the use of this diet would create disease and insubordination. "-*Counsels on Diet and Foods*, page 375. I was instructed that the use of flesh meat has a tendency to animalize the nature, and to rob men and women of the love and sympathy which they should' feel for everyone. "-*Ibid.*, page 390.

Behavior Effects of Meat Eating

"Many wild animals become remarkably tame when deprived of a meat diet. Justus von Liebig noticed in Giessen a young bear that was very tame when no meat was given him, but became wild and unmanageable when again fed upon meat. Tamers of animals, moreover, make use of this fact, simply by bringing up young animals, whenever possible, entirely without flesh food, the animals being thus rendered quite tame, so that they are easily trained.

“To a greater or less degree the same may be observed in man. It is a fact that nations that live upon a vegetable diet, and in particular mainly upon rice, as do the majority of the Chinese, the Hindus, etc., are of a peace loving nature. As an illustration of the converse I would like to cite the interesting example given by Captain Merker of an African tribe, the Masais, a branch of the Semites. As related, in his great work on these interesting people, by Captain Merker, whose premature removal from his scientific labors by death is greatly to be deplored, all the warriors of this brave and warlike tribe live exclusively upon meat, blood, and milk, in companies apart from the rest of the people. The Spartans ate bloody soups and rare meats as a daily food. Liebig states that carnivorous animals are more courageous and savage than the herbivorous ones, which actually become their prey.

“The nations living principally upon vegetables are less prone to engage in warlike enterprises; they like quiet and peace.” Lorand, *Health Through Rational Diet*, page 15.

“The influence of food upon the temperament is of great importance. We have already referred to the fact that nations leading a vegetarian life are of a peaceful nature. Violence, insolent attacks, offenses against the person through passion, occur much more rarely among peoples almost or entirely vegetarian than among those living upon meat. If the main objective point of progress among mankind were peacefulness and quiet, and the life in common-as in Paradise-of wild and tame animals, without mutual annihilation, an exclusively vegetarian diet would be the best way to attain this result. A quieting influence is exerted upon the mind by such a diet, and violent criminals may be subdued by means of it. It is also to be noted that if we regard criminality as a variety of disease, its cure is to be attempted with food of vegetable origin. Such food is actually given in many prisons.” - *Ibid.*, pages 22, 23.

Undoubtedly the deficiency foods greatly exaggerate this effect of meat and tea. Weston A. Price, D.D.S., reveals an experiment on rats in which three groups were fed variations in the vitamin and mineral content of the cereal part of the diet. These rats received the same diet, except for the type of bread. Group 1 received whole-wheat products freshly ground. Group 2 received a white-flour product, and group 3, a bran-and middlings product. The feeding was started after weaning, at about twenty-three days of age. Rats of group 1 were fully developed and reproduced normally at three months of age. They had mild dispositions and one could pick them up by the ear or tail without being in danger of getting bitten. The rats of group 2 on white flour were markedly undersized. Their hair came out in large patches, and they had very ugly dispositions, so ugly that they threatened to spring through the cage wall at us when we came to look at them. These rats had tooth decay, and they were not able to reproduce. The rats of group 3 on bran and middlings did not show tooth decay, but were considerably undersized, and they lacked energy. Here are very definite and different behavior effects of diet-peaceableness, ugly disposition, and the lack of energy.

Bread

Bread has long since ceased to be the staff of life. Modern bread is highly deficient from the standpoint of nutrition. Refined flour, that is, white flour, is seriously lacking in calcium and other minerals. It is deficient in the B vitamins. The wheat germ is

gone and with it the vitamin E content, which has so much to do with reproduction. In looking over genealogies of Andover, Massachusetts, and other New England communities of 1640 and onward for a hundred years, the writer has been impressed with the large families, quite in contrast with the size of modern families. They had no flour mills such as were later developed. Crude stone mills saved all the mineral and vitamin factors which modern scientific research has proved so important for physical health, nerve power, and stability. In order to prevent the spoiling of flour by the growth of weevils and worms, these elements that support life have been milled out by the bolting process. Nutrition and Physical Degeneration, by Weston A. Price, D.D.S., gives a most graphic representation of the importance of these elements. He studied primitive races who were isolated. They were living on native diets in contrast with groups of the same race who were living on refined foods, mostly white flour and white sugar. Not only dental decay occurred, but nervous and even character deterioration were manifest. These studies included such areas as Switzerland, the Gaels of the Outer Hebrides, Eskimos, North American Indians, Melanesians, Malaysians, Polynesians, native Australians, the Maori of New Zealand, South American Indians of the Andes, thirty different African tribes from Mombasa on north through Kenya and Anglo-Egyptian Sudan to Egypt. It is impossible to include here any adequate review of this study accomplished by Dr. Price. Not only dental disease, physical deterioration, facial and bodily deformities, but intellectual, character, and moral degradation follow in the wake of the foods of modern commerce.

White Bread and Epilepsy in Animals

Bleaching of flour is a widespread commercial practice. During the past twenty-five years approximately go per cent of all white wheat flour milled in North America and England has been treated with nitrogen trichloride. The practice is not confined to these countries. When fed to dogs as a major portion of their diet, such bread produces canine epilepsy or canine hysteria, running fits or Bright disease." In The journal of the American Medical Association, November 22, 1947, there appeared an article entitled "White Bread and Epilepsy in Animals," which included the following two quotations: "We feel that the remarkable resemblance of this syndrome to human idiopathic epilepsy, with its irregular grand mal seizures justifies the use of the word 'epilepsy.'" Edward Mellanby proved "that treatment of flour with gaseous nitrogen trichloride rendered that flour convulsant to dogs." Other and later work by several investigators revealed that such abnormal behavior can also be produced in rabbits, rats, cats, ferrets, and monkeys. That article is followed by another entitled, "Role of 'Agenized' Flour in the Production of Running Fits." Although the tests produced running fits in dogs, these did not occur in monkeys or humans. All these investigations specify that the toxic factor is associated with gluten, not with carbohydrate of the flour. Certainly bleaching of flour has no beneficial effect, and dark bread from whole wheat is superior to that made from any white flour.

Bad Diet and Bad Nerves

On December 12, 1939, six white women ranging in age from twenty-one to forty-six years, employed at Rochester State Hospital, were selected by a group of eminent physicians as subjects for an extended test of the effect on body and mind of the absence of

one small factor in the diet, namely, thiamine, or vitamin B,. These women were distinguished for an “absence of physical defects, absence of any history of abnormal nutrition, and quiescence of associated mental illness.” This experiment was carried on for eighty-eight days, or until March 9, 1940.

As the weeks passed, well-defined symptoms developed, such as fatigue, lassitude, and loss of interest in food. This loss of interest in food finally changed “to the point of intolerance for food,” and from that on to “uncontrollable vomiting.” This last condition terminated the experiment.

Quoting further from the report: “The disease induced by the isolated restriction of thiamine resembles minutely that disorder which the discriminating physician commonly would lump together with neurasthenia under such designations as chronic nervous exhaustion or functional neurosis. Thus, neurasthenia, properly defined, may be less of a functional abnormality than has been supposed, and it may depend on improper nutrition of the neurons.” A little further on the report refers to the “irritability” that marked the subjects.

This distressing state resulted from one small abuse of the stomach, a failure to provide the human system with one small substance, thiamine (vitamin B.). All these distressing symptoms vanished from these six subjects as soon as their diet was corrected to include thiamine. (Quoted material is taken from Archives of Internal Medicine, October, 1940, page 786.)

Thiamine and Bad Temper

In their latest study, Williams, Mason, Smith, and Wilder subjected eleven patients to a carefully regulated diet deficient in thiamine. It was their object to study the effect of a less severe deficiency of vitamin B1 than that induced in the first study, since the latter would not be likely to arise in the public at large. Accordingly, instead of a diet containing only 15 milligram of thiamine, as in the first experiment, they provided a menu which would furnish 0.45 milligram. This was calculated to be not much if any below the amount provided by the “poor” diets reported in the Stiebeling-Phipard survey of food purchases by American families.

It was possible to make up a diet of this sort by using foods which commonly appear on American tables: white bread, corn flakes, potatoes, polished rice, sucrose, skimmed milk, beef, cheese, egg white, gelatin, butter, vegetable fat, canned fruits, canned vegetables, coffee, and cocoa. Samples of each food were assayed for thiamine content, and great care was taken to see that the subjects of the experiment ate the calculated amount of each food, with no substitution or extra nourishment. To prevent other vitamin deficiencies from developing during the experiment, the proper amounts of vitamins A, C, and D were fed, as well as the other members of the B complex (as found in autoclaved brewer’s yeast). Supplements of iron, calcium, and phosphorus were also fed. As a further control of the diet, the urine of each patient was analyzed at intervals in order to determine the thiamine content. In most cases this fell to low levels within a month.

The subjects used for this study were all women between twenty-three and forty-six years of age, inmates of an institution for the treatment of psychiatric disorders, who

had been considered as “recovered,” and who had for a considerable period not manifested any evidence of physical or emotional abnormality. Under supervision, they continued to engage in various activities about the ward-housekeeping, laundering, and sewing. The authors do not feel that the experiment is invalidated by making use of this type of patient, since each subject was under careful scrutiny for a long period before the dietary restriction, and each was observed for a long period after the thiamine intake was restored to normal. The subjects did not know when the vitamin was restored to the diet.

After the diet had been restricted for eight to twelve weeks, the most conspicuous early signs observed were gross changes of behavior, marked changes of attitude, diminished inclination to perform accustomed tasks, and progressive decrease of ability to make social adjustments within the group. All became irritable, depressed, quarrelsome, un-co-operative, and apprehensive. Two of the women became agitated, felt that life was no longer worth living, and threatened suicide. All the subjects became inefficient in their work; those engaged in sewing frequently dropped their needles, and those assisting in the kitchen and laboratory with dishwashing broke the crockery and glassware. This loss in manual dexterity was partly explained by weakness, partly by the complaints of numbness in the hands and feet. The marked inefficiency which developed showed itself in an inability to concentrate or to remember instructions, and in a confusion of thoughts. Numerous complaints were voiced by the subjects in the experiment of headache, backache, dysmenorrhea, insomnia, tenseness, sensitivity to noises, and inability to tolerate painful stimuli.

As time went on, the manifestations of deficiency in general tended to become more severe. Vigorous exertion finally became impossible, attacks of weakness, nausea, and vertigo appeared, and vasomotor instability was noted in some.

In eight subjects the period of thiamine deficiency was brought to an end by the injection of 1 milligram of thiamine hydrochloride subcutaneously, followed by the oral administration of 3 milligrams daily for a week, after which the daily intake was 7.5 milligrams orally.

Physical and mental well-being and efficiency gradually returned when the missing vitamin was thus supplied, but the process was not as rapid as in the earlier experiments. In time, all abnormalities in blood-sugar curves, basal metabolic rate, blood pyruvic acid, blood counts, and electrocardiograms disappeared, and the patients reverted once more to their former status.

This group was able to maintain body weight during the deprivation period, but certainly did not maintain good health. The “minimal” daily requirement for thiamine was judged to be between 0.22 and 0.55 milligram for each 1,000 calories in the diet, assuming carbohydrate and fat to be taken in the conventional proportions. The “optimal” intake, however, lay between 1.5 and 1.0 milligram per 1,000 calories. See Archives of Internal Medicine, May, 1942, page 721.

Unstable nerves were one cause of the large volume of rejections in the draft for military service and the still larger percentage of discharges from the armed forces in World War II. Thirteen per cent of those eighteen to thirty-eight years old coming up for induction examinations had a mental or emotional handicap which made them unfit for military service. Forty-five per cent of the medical discharges from our armed forces were

for some neuro-psychiatric condition.

Extensive Use of Refined Foods

H. W. Vollmer, M.D., has gathered the following material (1945), which we are permitted to incorporate into this study:

“Medical science is in harmony with the ‘more sure word of prophecy’ on the subject of the harmful effect of the use of a large amount of sugar. Malnutrition was listed as a menace to workers by Henry Borsook, M.D., noted California Institute of Technology biochemist. He said that war workers in this area are suffering impediment in their work through neglect of vitamin foods in favor of white bread, candy, and refined edibles.

“Dr. Borsook issued a stern warning that eating habits of war workers must change if absence from work due to malnutrition is to be avoided.”

In their research project among war workers here, which has attracted national attention, Dr. Borsook and his fellow scientists found that the chief diet deficiency was in vitamin A, which comes from green and yellow vegetables, carrots, lettuce, and other produce growing abundantly in Southern California.

“Only 3 per cent of the 15,000 workers we tested have a satisfactory diet,” Dr. Borsook declared. “Eleven per cent get a barely adequate vitamin supply, and the diet of 86 per cent is unsatisfactory.”

“The effect of this cause he continued, ‘is shown in the following statistical summary:

“Ten per cent of the workers suffer from a mild form of anemia, 12 per cent complain of being excessively tired by their work, 35 per cent have eye discomfort, 40 per cent have digestive disturbances, and 63 per cent have one or more colds in a period of three months.”

“The White House Conference on Child Health and Protection reports that of 45,000,000 school children of our country, 6,000,000 are suffering from malnutrition, and 2-6 per cent had serious defects. This condition of malnutrition among these millions of our children is not the result of an insufficient amount of food, but of a lack of the proper kind of food.

“Stiebeling and Phipard in their investigation of the diet of the families of employed workers report that out of more than 2,000 workers’ families only 26 per cent could be classified as having good diet. The diet of 45 per cent was fair, and that of 25 per cent was poor.

“From the records of the Bureau of Home Economics, Department of Agriculture, of more than 2,000 families of wage earners, clerical workers, and non relief, non sharing cropper farm families from all sections of the country, it was learned that 43.6 per cent of these families failed to receive a ‘fair’ diet, and 76.2 per cent did not get a ‘good’ diet.

“It will be seen by the following quotations from authorities on the subject that one great reason for the malnutrition that so largely prevails is that so many are

gratifying their appetite by the use of sugar and other refined food at the expense of wholesome and nourishing food. This is especially true among children.

“The following appeared in The Journal of the American Medical Association, November 7, 1942, page 763:

“The consumption of sugar and of other relatively pure carbohydrates has become so great during recent years that it presents a serious obstacle to the improved nutrition of the general public....

“The large per capita annual gross consumption of sugar in the United States increased steadily from about 10 pounds in 1821 to 108 pounds in 1931. Since then this gross consumption has shown little change. The latest available and more accurate estimate, which corrects for industrial non food uses of sugar, and that exported as part of processed fruit, condensed milk, and other foods, places the present annual per capita consumption at about 85 pounds. Even this amount represents 420 calories daily, or from 13 to 17 per cent of the 2,500 to 3,000 calories of an adult average diet.

“Sugar as consumed in recent years, whether it originates from sugar cane or sugar beets, is for the most part highly refined sucrose. What vitamins or minerals may have been present in the cane or the beets are almost completely removed in the processing of crystalline sugar. The finished product is practically chemically pure sucrose. Consumption of molasses, other sirups, and brown sugar, compared to that of white sugar, is relatively small. Some inorganic salts can be found in them, but because of the nature of their preparation their content of thiamine is disappointing. Furthermore, not included in reports of the consumption of sugar are considerable amounts of cornstarch and corn sugar (dextrose). These products are highly purified and as free from vitamins and minerals as crystalline sucrose.

“These circumstances reveal that the increased use of sugar since the middle of the nineteenth century has carried responsibility of almost the same order of magnitude as the roller milling of wheat for the very great lowering of the thiamine content of the average diet. There also undoubtedly has occurred a comparable loss of nicotinic acid (niacin) in diets, although this is more difficult to estimate. Other foods than the cereal grains either contain little thiamine or are not consumed in large enough amounts to contribute importantly to the daily dietary allowances in thiamine; therefore, if the average diet is to be made to provide allowances of thiamine (and niacin?) comparable to those provided by former diets, a point of attack almost as important as roller milled flour is sugar

“Accurate information is not available as to what proportion of the total use of sugar is for use with other foods. However, much sugar is consumed in candies, some prepared desserts, and sweetened beverages, which carry nothing of nutritional significance except sugar. Estimates of the consumption of candy show that it may be as great as sixteen pounds per person each year. Much of this candy is consumed by children and adolescents. Figures are available on sales of sweetened beverages. They indicate that manufacturers of such beverages produced over eighteen billion six-ounce bottles of soft drinks in 1939. It is also admitted that since 1939 the consumption of soft drinks has increased from 20 to 30 per cent. From such data it appears that the per capita consumption of soft drinks must be in the neighborhood of more than three bottles a week per capita. According to data published by the Foodstuffs Division of the US Department of Commerce, the amount of sugar contained

in “beverages, nonalcoholic” during 1939 constituted only 2.4 per cent of that used for all purposes. However, this figure does not include sugar added to beverages at the point of sale; and, on the basis of the data already mentioned concerning sales of sweetened beverages, the amount of sugar thus used figures out at approximately 12 per cent of the total. It seems obvious that, regardless of the method used to estimate the amount of sugar consumed as soft drinks, one obtains a result that is definitely undesirable from the standpoint of the nation’s nutritional welfare

“Physicians presumably will continue to advise against the use of sugar between meals. Such advice should logically apply to the consumption of sweetened beverages as well as to the use of candy. Likewise action may be taken, as has been done with alcoholic drinks, to control the advertising of products, like candy and soft drinks, which tend to be used excessively by many persons to the detriment of health. There is merit in the suggestion of Roberts that attempts be made through school boards to place a zone around school buildings in which the sale of candy and soft drinks would be prohibited.

“Current views as to the exact cause of dental caries are numerous and divergent. Published summaries of findings and conclusions relating to the causes and control of this disease reveal that many investigators attribute harmful effects to the excessive consumption of highly refined carbohydrates. Without question, overuse of sugars and starches will lessen the ingestion of foods which are needed for the maintenance of normal nutrition. Faulty nutrition is not desirable from the standpoint of the teeth or of the other body tissues. It is therefore to be expected that dentists as well as physicians will continue to advise against the excessive use of sugar in the diet.

“The figures given for the per capita annual consumption of sugar, and those for sales of carbonated beverages, are average figures. People, however, do not eat beverages, and diets vary from those containing very little to those containing very much of the item, be it butter, bread, or milk. A disproportionate amount of candy and soft drinks is consumed by children, and the advertising of candy and soft drinks usually makes a play for sales to children. The council has received numerous inquiries from teachers and others asking for guidance in the problem presented by sales of sweetened carbonated beverages in the schools.

The anxiety expressed in such letters has mostly been on the score of the caffeine content of some of these beverages. The use of caffeine by children is not considered wise; but equally undesirable, as the writers of some of the letters have sensed, is the fact that the use of sweetened drinks and candies displaces the use of other foods. The sweetened drinks tend to replace milk, and candies the solid foods-meats, vegetables, fruits, and grain products-that make up a nourishing meal.

“It is obvious that a school lunch suffers gross deterioration when the beverage chosen in place of milk is a solution of sugar in flavored water. It also is generally conceded that excessive sugar eating between meals, or sugar eaten in small amounts within an hour of the regular mealtime, impairs the appetite for food at meals. The council believes it would be in the interest of the public health for all practical means to be taken to limit consumption of sugar in any form in which it fails to be combined with significant proportion of other foods of high nutritive quality.”

Weston A. Price, D.D.S., gave three children with deep cavities near to or

exposing the pulp a special addition to their home meals of a single meal a day of high mineral and vitamin content for five months. In addition to, affirming complete control of the dental cavities he says: "Two different teachers came to me to inquire what had been done to make a particular child change from one of the poorest in the class in capacity to learn to one of the best." This observation reveals clearly that mental energy is definitely influenced by diet.

Now all refined cereals, as well as refined sugar, have somewhat the same effects, for both starch and sugar are changed to glucose in the processes of digestion, though these are somewhat different processes for cane sugar and starches. It is not carbohydrates in their natural state with their full content of vitamins and minerals, as found in fruits, vegetables and whole grains that clog the system. It is not sugar of itself that clogs the living machine, but the fact that it cannot be oxidized when vitamins are absent, for they govern the utilization of the body's fuel, and especially is this true of vitamin B. When vitamin B1 has been taken out of the food, glucose, instead of being oxidized to lactic acid and then reduced again to glucose with a slight loss of fuel (0.2 or 0.16) each time, fails in this cycle of changes, and pyruvic acid accumulates in the tissues. This has been found especially in the brain. It is a toxic substance and affects thinking-intellectual activities, which are the output of brain functioning even as hydrochloric acid, pepsin, and rennin are the output of the functioning of the various gastric glands, and as insulin is of the islands of the pancreas or as thyroxine is of the thyroid gland. The brain is clogged with pyruvic acid as a furnace is clogged with unburned or half-burned fuel. There are also other damaging effects of concentrated sugar in the digestive organs themselves and of milk and sugar together.

I frequently sit down to the tables of the brethren and sisters, and see that they use a great amount of milk and sugar. These clog the system, irritate the digestive organs, and affect the brain. Anything that hinders the active motion of the living machinery, affects the brain very directly. And from the light given me, sugar, when largely used, is more injurious than meat." It is better to let sweet things alone. Let alone those sweet dessert dishes that are placed on the table. You do not need them. You want a clear mind to think after God's order." "Could we know that animals were in perfect health, I would recommend that people eat flesh meats sooner than large quantities of milk and sugar. It would not do the injury that milk and sugar do. Sugar clogs the system. It hinders the working of the living machine." I would prefer a meat diet to the sweet cakes and pastries so generally used." "Let health reformers remember that they may do harm by publishing recipes which do not recommend health reform. Great care is to be shown in furnishing recipes for custards and pastry. If for dessert sweet cake is eaten with milk or cream, fermentation will be created in the stomach, and then the weak points of the human organism will tell the story." "Tar too much sugar is ordinarily used in food. Cakes, sweet puddings, pastries, jams, are active causes of indigestion. Especially harmful are the custards and puddings in which milk, eggs, and sugar are the chief ingredients." - Counsels on Diet and Foods, pages 328, 330, 331, 333-335.

A thorough and prolonged investigation of personality changes associated with restricted intake of B vitamins and animal protein (calcium caseinate) was reported in the American journal of Medical Sciences for April, 1947, pages 213, 488. Since both the full diet and the experimental diet contained more protein of a high biologic value (amino acids) than needed for maintenance, the results must be attributed to the deleterious effects of

vitamin B deficiency. These subjects showed definite changes in personality designated as hypochondriosis, depression, and hysteria; but other categories, including psychasthenia, schizophrenia, hypomania, psychopathic deviate, male-female interest, and paranoia, did not show decisive changes. This corroborates by controlled human experiments the statements in the testimonies.

So these statements in the testimonies are scientifically correct and true to the facts of biologic chemistry. Other abnormalities of the chemistry and functions of the body and brain frequently occur with deficiencies of the diet so that dulled mentality, aberrant and unnatural behavior and disposition, result.

Deficiency of vitamin A may produce actual degeneration of nerve and brain tissue. Especially is this likely to occur in the developmental stages of life, both prenatal and postnatal, giving rise to feeble-mindedness, dullards, morons, and even dementia praecox of adolescence.

Living unhappily with one's neighbors, quarrelsomeness, and ferocity to weaker individuals are more likely to occur when one's body is not functioning normally. He who eats as God intended he should, intelligently and conscientiously with an understanding of the laws of his being, has a distinct aid in the long process of character building and sanctification which are necessary to fit a people for the coming of the Lord.

Contrawise, he who eats merely to satisfy his perverted tastes or to follow fashion and custom is hindered in his striving for wholeness of character and true sanctification.

“Transgression of physical law is transgression of the moral law; for God is as truly the author of physical laws as He is the author of the moral law. His law is written with His own finger upon every nerve, every muscle, every faculty, which has been entrusted to man. And every misuse of any part of our organism is a violation of that law He who remains in willing ignorance of the laws of his physical being, and who violates them through ignorance, is sinning against God.” - Christ's Object Lessons, pages 347, 348.

“Anything that lessens physical strength enfeebles the mind, and makes it less capable of discriminating between right and wrong. We become less capable of choosing the good, and have less strength of will to do that which we know to be right.” Ibid., page 346.

“The body is the only medium through which the mind and the soul are developed for the up building of character.” - The Ministry of Healing, page 130.

“He who cherishes the light which God has given him upon health reform, has an important aid in the work of becoming sanctified through the truth, and fitted for immortality. But if he disregards that light, and lives in violation of natural law, he must pay the penalty; his spiritual powers are benumbed, and how can he perfect holiness in the fear of God?” - Christian Temperance and Bible Hygiene, page 10.

“There are but few as yet who are aroused sufficiently to understand how much their habits of diet have to do with their health, their characters, their usefulness in this world, and their eternal destiny. I saw that it is the duty of those who have received the light from heaven and have realized the benefit of walking in it, to manifest a greater interest for those who are still suffering for want of knowledge. Sabbath keepers who are looking for the soon appearing of their Savior should be the last to manifest a lack of interest in this great

work of reform. Men and women must be instructed, and ministers and people should feel that the burden of the work rests upon them to agitate the subject and urge it home upon others.” - Testimonies, vol. 1, Pages 488, 489.

4. DIVINE LAWS IN LIFE

BEFORE we enter upon a detailed study of the science of nutrition and endeavor to gain a practical knowledge of diet and foods, it would be best to obtain an understanding of certain fundamentals. John Mills, in the introduction to his little book, *Within the Atom*, declares: “Electricity is the only known constituent of the ponderable matter of which our universe is composed.” Whatever substance we may study, whether an apple or a tree, a germ or an elephant, a stone or a star, iron or radium, the ultimate division of any and every particle of matter is a bundle of electricity. Mills further states that physical science no longer studies matter and energy, for “today we know no matter, but only electricity.” This was written in 1923. In 1934 Dr. Robert A. Millikan wrote: “In other words, the two entities, electricity and matter, which the nineteenth century tried to keep distinct, begin to look like different aspects of one and the same thing.” - *Electrons*, page 186. In 1938 Dr. Albert Einstein wrote: “There is no essential distinction between mass and energy.” - *The Evolution of Physics*, page 208.

This is in accord with the statement of the spirit of prophecy as to what went into the making of matter. “In the creation of the earth, God was not indebted to pre-existing matter.” - *The Ministry of Healing*, page 414. Scientific research has discovered that energy is the source of matter, but it can go no further, for “the work of creation cannot be explained by science. What science can explain the mystery of life?”-*Ibid.*, page 414. In the creation of man was manifest the agency of a personal God (*Ibid.*, page 415), not blind unreasoning force or a fortuitous concourse of atoms,” as some would have us believe. There is a difference between something which is merely fortuitous or fortunate—a sort of lucky chance—and something which is by design; that is, by personal intelligence for a predetermined purpose. An inventor has first of all in mind a purpose, a use he wishes to make of his invention. The use or function of every part of the human body was predetermined, and the structure of each organ or part was created accordingly; that is, to serve that particular use. So function preceded and determined anatomy. Each was by personal, that is, intelligent, design. “Our substance was not hid from Him when we were made in secret; His eyes saw our substance, yet being imperfect, and in His book all our members were written, when as yet there were none of them.”-*Ibid.*, page 415. Men of research in physiology are so certain of this intelligent purposeful design that they will spend long years or a life time in patient, careful study in order to discover this design. And so certain are they that these designs, these plans and laws governing them, will not change from one year to the next that they can safely build upon what was learned in 1930 to help them in the discovery of another manifestation of physiological action they wish to investigate in 1940.

In spite of this, men, in their finite limitation, are prone to think of the universe and the manifestations of energy as they think of a clock which, when wound up, will sometime run down and be dead and still. We hear astronomers talk of new and old stars, and we read of speculations as to how long it may be before our sun will cool off and leave its planets sunless and dead. How unfortunate and purposeless would all such be, how

contrary to the infinite manifestation, of purposeful design, whether we consider stars or atoms or plants or animals. We see intelligent reasoning and beneficent design wherever we look.

“It is not by inherent power that year by year the earth yields its bounties, and continues its march around the sun. The hand of the Infinite One is perpetually at work guiding this planet. It is God’s power continually exercised that keeps the earth in position in its rotation. It is God who causes the sun to rise in the heavens. He opens the windows of heaven and gives rain. It is by His power that vegetation is caused to flourish, that every leaf appears, every flower blooms, every fruit develops.” -Ibid., page 416.

So it is also with the human body. It is not as the result of a mechanism, which, once set in motion, continues its work, that the pulse beats, and breath follows breath. In God “we live, and move, and have our being.” The beating heart, the throbbing pulse, every nerve and muscle in the living organism, is kept in order and activity by the power of an ever-present God.”-Ibid., page 417. How God upholds “all things by the word of His power” we do not know, nor can we ever fathom His methods. “Great things doeth He, which we cannot comprehend.” Job 37:5. “The mechanism of the human body cannot be fully understood; it presents mysteries that baffle the most intelligent.” -The Ministry of Healing, page 417. He ever works according to the laws which He Himself has established. “God is constantly employed in upholding and using as His servants the things that He has made. He works through the laws of nature, using them as His instruments. They are not self-acting.”-Ibid., page 416.

In 1930, Professor John Garstang and Sir Charles Marston investigated the site of the Jericho of Joshua’s conquest, locating it with certainty and discovering conditions and occurrences such as are described in the book of Joshua. By well-authenticated methods they determined within a probable range of twenty-five years the time of its destruction. Digging under its fallen walls and in the adjoining Jordan Valley revealed unmistakable evidence of an earthquake as the agency of the overthrow of its walls. One zealous individual when told of this evidence at once denied its possibility, for, said he: “Does not the Bible say that God overthrew the walls of Jericho?” What strange and often times childish notions we sometimes get, as if the forces of nature were not within the control of Him who made all things or that He would not work by them for His own purpose. “The Lord hath His way in the whirlwind.” Nahum 1:3. He who sent Noah to preach regarding the Flood, did not He make that Flood by those very powers of nature which He had created? “Whatsoever the Lord pleased, that did He in heaven, and in earth, in the seas, and all deep places.” Psalm 135:6. “For all are Thy servants.” Psalm 119:91. Directly to the point are the statements made in, Job 37:11-13, in which are clearly revealed that God commands and directs the forces of nature to His own purposes-which purposes may be different at different times. “He scatters His bright cloud: and it is turned round about by His counsels: that they may do whatsoever He commands them upon the face of the world in the earth. He causes it to come, whether for correction, or for His land, or for mercy.”

Having seen that God works by laws which He has established, we are better prepared to understand one of the fundamental facts of the biochemistry of nutrition; namely, that the life of plants, animals, and man is maintained by a constantly acting agency multiple in its manifestations. Also that when that agency is cut off, either by God or when man cuts himself off from the field of activity of that agency, then he begins the process, be it slow or

rapid, which we call death. In order to possess an endless existence, man must continue to partake of the tree of life. Deprived of this, his vitality would gradually diminish until life should become extinct. “-Patriarchs and Prophets, page 60. “Dying thou shall die.” Genesis 2:-17, margin.

When Adam and Eve transgressed God’s command, the Lord God said: “Now, lest he put forth his hand, and take also of the tree of life, and eat, and live forever: therefore the Lord God sent him forth from the Garden of Eden, . and He placed at the east of the Garden of Eden cherubims, and a flaming sword which turned every way, to keep the way of the tree of life.” Genesis 3:22-24. This tree of life and its properties are as literal as Adam and as historical as sin. It is no more parabolical or allegorical than the creation of man or the Garden of Eden.

Why God saw fit to make the tree of life the agency by which He imparted endless life to man is not a question for us to answer nor a problem for our solution. Sufficient for us is the fact that He did. God did not change its life-giving properties after Adam sinned. He prevented man’s access to it. But with this prevention, man still had access to the fruits of the earth, which God had ordained for his nutrition and in which He had placed those subtle elements which govern the reproduction, development, growth, structure, and function of every tissue and organ of the body. If men continued to partake of these as God gave them, the life which He has given them would be greatly prolonged. If men were to choose food which God had not given to them and so work contrary to the laws He has established in their being, life would be greatly shortened. Attempts at improvement on God’s plan of nutrition could only result in disaster, for God’s way is the best way. It always has been and always will be. To choose our own way is to cut ourselves off from the life sustaining forces ordained by our Creator.

These are the fundamental principles of biochemistry as scientific research is discovering them. The scientist is continually using the terms “nature,” “natural”, and is working with and depending upon “nature’s evident intent,” “nature’s method.” With these we should have no quarrel, but in and through all our studies of “intelligent design” we acknowledge the Designer, the omniscient and omnipotent Creator, the God of nature.

We begin the study of the principles of nutrition, of diet and foods, with those elements which most obviously manifest the Creator’s sustaining and controlling power in the working of the human mechanism. From time to time we shall need to consult the counsels sent to us to make sure we are not wrongly interpreting incomplete facts or spending precious time on side issues or misinterpreted phenomena.

The Vitamins

For many years the proteins were considered to be of first and main importance in nutrition, as the name given them by Mulder, the Dutch chemist, indicated. They are indeed fundamental in all life processes. But while every element of nutrition is important, yet there are elements-vitamins-which seem to be equally as essential, if not even more so, to the health and harmonious working of the body functions as the proteins. At least, their deficiency produces disease much more quickly and sometimes of a more serious nature than deficiency of proteins.

The first studies of food and nutrition were concerned solely with building and fuel materials. As the utilization of both these classes of food elements in the body was found to be accompanied by the production of heat, research drifted into the field of the estimation of the caloric, or heat, value of foods. The building materials are the proteins and minerals; the fuel elements are the starches, sugars, and fats. However, when these elements were obtained in chemically pure form and fed mixed in the proportions occurring in natural foods, it was soon discovered that animal life could not be sustained by them. In a short time growth ceased, development was arrested, and one or more functions failed. Some animals living on such purified foodstuffs succumbed to infections. As the science of bacteriology had made its advent some twenty-five years before this, attaining many most notable triumphs, there was a tendency to attribute numerous obscure diseases to as yet undiscovered infections. Several diseases which are now known to be the result of dietary deficiencies were at first thought to be infections. Nor was this without appearance of verity as malnourished tissue loses its resistance to infection and readily succumbs to invasion or, more physiologically speaking, invites such invasion.

It is now coming to be recognized that one of the principal predisposing causes of some infections is deficiency of vitamins and minerals. Certainly in some cases this deficiency is the determining factor. Biological research of large extent is revealing a most remarkable resistance to infection in animals receiving larger vitamin rations. Two vitamins play a special role in the resistance to invasion of bacteria, or in their destruction and counteraction or neutralization of their toxins. Vitamin A to a very large extent controls the resistance of the skin and mucous membranes to the entrance of bacteria, while vitamin C displays a marvelous power of counteracting poisons produced by infections which have already gained entrance to the body tissues or blood stream. How extensive such protection may be is not known, but it is known to apply to a number of the more common infections. There is a growing tendency among medical research men to attribute the occurrence of some of the baffling epidemics to latent vitamin and mineral deficiencies. Some have pointed out the evidences that individual resistance to influenza, infantile paralysis, encephalitis, and some other epidemic diseases may lie in the fuller nutrition attained by man and animals in their original natural environment before human arts had produced so many refined and denatured foods and while food plants were grown on fertile, mineral-rich soil.

Albert Szent-Gyorgyi, M.D., professor of medical and organic chemistry in Szeged, wrote: "After twenty years of medico-chemical experiment and reasoning, I am convinced that the human body is not nearly so susceptible as it would seem to be with its thousand different diseases. Nature does not build such weak structures, because anything as weak as this would long ago have died out. I am convinced that many human illnesses are not due to the insufficiencies of our bodies, but are due to the fact that we are living in a manner and in an environment which was never meant for our bodies." Translated from *Deutsche Medizinische Wochenschrift*, 63:1789, Nov. 26, 1937.

Scientific facts are compelling us to recognize and respect such pronouncements, and, to the Christian physician who must always look beyond nature to nature's God and beyond the "manner" and "environment" of life, to the laws and commandments of the Creator, there dawns a new consciousness of the scientific bearing of those God-given commandments which Moses was instructed to reiterate in the hearing of the stubborn and rebellious Hebrews just before he laid down his leadership. "Wherefore it

shall come to pass, if ye hearken to these judgments, and keep, and do them, that the Lord thy God shall keep unto thee the covenant and the mercy which He swore unto thy fathers: and He will love thee, and bless thee, and multiply thee: He will also bless the fruit of thy womb, and the fruit of thy land, thy corn, and thy wine, and your oil, the increase of thy cows, and the flocks of thy sheep, in the land which He swore unto thy fathers to give thee. Thou shall be blessed above all people: there shall not be male or female barren among you, or among your cattle. And the Lord will take away from thee all sickness, and will put none of the evil diseases of Egypt, which thou knew, upon thee.” Deuteronomy 7:12-15.

The commandments given to the Israelites through Moses cover a wide range. They were not only moral and religious precepts and laws, but whole codes pertaining to the economic, commercial, social, hygienic, agricultural, and pastoral affairs of community and national life. The laws of justice and equity were quite replete, and much of English common law is based upon the laws of Moses. The laws of health, in so far as nutrition is concerned, pertained largely to the prohibition of unclean meats.

As we proceed with the study of nutrition we shall have occasion to point out some of the biological agencies by which the Creator has chosen to make good these promises of blessing, health, and prosperity when we obey the laws He has ordained to govern our bodies.

In order to be fitted for translation, the people of God must know themselves. They must understand in regard to their own physical frames.” - Counsels on Diet and Foods, page 33. This indicates the necessity of a study of physiology and especially nutritional physiology in such a form as to give a practical knowledge of how to cat for physical health, mental attainment, and spiritual welfare. These studies are not so much to obtain a technical knowledge of nutrition as to ascertain the importance of a complete, well-balanced, and adequate diet for development of these faculties in their highest attainment.

In relation to the fuels of the human mechanism, the vitamins have been compared to the ignition spark of the gasoline engine. They make available the energy value of these fuel elements of the food. Especially are oxidative functions controlled by the various vitamins of the B complex.

Fuel Economy. When a muscle contracts, the energy for that contraction comes from the oxidation of glucose. In this burning process lactic and other acids are formed. These are harmless substances in small amounts; but, if they accumulate in the muscles, they produce fatigue. If a little time is allowed to elapse, about two minutes, the fatigue disappears and the muscle is able to work again with almost the total original energy. This recovery is due to the effect of the oxidation-reduction vitamins upon the acid fatigue substances, the lactic, pyruvic, and other acids, changing them back to glucose. A full tissue saturation with these (water-soluble) vitamins is necessary for such quick recovery. Also, of course, a good circulation carrying plenty of fresh oxygen is needed. In this way the fatigue producer becomes an energy producer, so the body fuel is used over and over again with a loss of only one fifth or one sixth in each cycle. There is no machine or internal-combustion engine devised by human ingenuity that uses its fuel over and over again with so little loss. Gasoline or oil burns but once and must be entirely replaced.

Proteins and minerals are the lumber, hardware, lime, cement, chemicals, and fabrics of which this living machine is constructed. Vitamins are the electricians and

engineers which direct the activities of this living machine. In the language of chemical science, they are the enzymes; that is, they produce chemical changes without themselves entering permanently into the resulting chemicals produced.

Repair Economy. In the matter of repairs the body mechanism enjoys a unique pre-eminence. Engines usually require repairs in proportion to the amount of work done-an automobile in proportion to the distance it runs. Not so with the body. It requires repairs only in proportion to its size, and that in a fixed amount daily, regardless of the amount of physical work done. A day laborer with pick and shovel requires no more repair material for his body each day than the bookkeeper at his desk or the teacher before his pupils. Physical labor breaks down no more muscle tissue than does brain work. It does, however, require more fuel material, as does any machine, in proportion to the work done. Men of average height and weight require daily for tissue repair only about forty-five grams of repair foods. This does not increase with hard physical labor nor decrease with sedentary or brain work.

Although this fact is well known to physiologists and students of nutrition, its dietary significance is but poorly understood, and to many physicians it is either unknown or ignored. It is almost totally unknown to the laity, and it is consequently overlooked by the great majority of otherwise intelligent people.

Harm From Excess of Repair Foods

What difference does it make whether or not we know this requirement for repair foods? It makes a great deal of difference, chiefly because the eating of repair foods in excess of the body's needs for repairs leaves "cinders and clinkers," waste substances, which produce friction and fatigue, thereby damaging the vital working parts of the human machine.

Certainly we are all familiar with the difference between fuel and repairs for such a machine as an automobile, and we know where to put each. The fuel goes into the gasoline tank, and repairs are put where needed. We make no mistakes in this. I wonder if we are all equally familiar with the difference between fuel and repairs for the human engine.

When you go to the table three times a day do you know the difference between fuel foods and repair foods, and the proportion of each that you are eating? The fuel foods either burn up quite completely, leaving no ash or cinders, or else they form lactic acid, which may be used over again. On the other hand, repair foods are not fully consumed. So while the body can use repair foods for fuel, they leave waste substances which lessen the working capacity, increase fatigue, and damage the vital parts of the working mechanism of the body-the blood vessels, liver, kidneys, and, finally, the heart.

What are the fuel foods, and which the repair foods? The starches, sugars, fats, and oils constitute the fuel of the body. From these the body derives its energy for heat and work. Protein is the repair material for the body. This substance is found in lean meat, white of eggs, gluten of wheat, and casein of milk. Beans and nuts also contain a high percentage of protein. Fruits and most vegetables contain a small percentage of protein.

About 65 per cent of the food should be fuel material. Though somewhat interchangeable, about 65 parts of this should be made up of starches and sugars, and 25 parts of fats and oils. Only 10 per cent of the daily ration should be protein, the minimum for a

person of average weight being about 45 grams by weight. Former dietary standards set this at 118 to 120 grams daily (30 grams to the ounce, therefore four ounces).

Food Uses

Fuel (for light muscular work) 90 per cent

Carbohydrates (starch and sugar) 65 per cent

Fats and oils 25 per cent

Repairs-Protein, 40 to 50 grams, or 10 per cent

Food Needs

Repair foods-according to weight of body (weight of active tissues).

Fuel foods-according to physical work done and heat requirements, which is dependent on weather and climate.

The supposed need of the body for protein was decided upon after studies of the dietary habits of different peoples German chemists studied the habits of the German people, and on tabulating and analyzing the foods they were found to be eating, it was ascertained that they were using 100 to 120 grams of protein daily. This was regarded as their physiologic need. Voit, a German chemist, set the amount at 118 grams.

However, the process was nothing more than the tabulation of dietary habits. With equal logic it might have been said that two steins of beer should be included in the daily ration, merely because the people were found to be consuming that beverage and in that amount. German chemists were not the only ones to fall into this error; the English chemists did the same thing, and our American chemists likewise. Professor W. A. Atwater set the daily need for protein at 120 grams, or four ounces every twenty-four hours.

Appetite and Instinct Not Infallible

It was assumed that appetite and instinct were safe guides to the physiological needs of the body. These standards were derived through studies of the actual consumption of food by families in various walks of life. Those who accepted them as the amounts of the various food components which the body requires under specific conditions, accepted the view that man, when in a position to select his food from a suitable variety such as exists in times of relative plenty and moderate values, would take under the guidance of the appetite such amounts of food as are best suited to his bodily needs.”-E. V. McCollum and Nina Simmonds, *The Newer Knowledge of Nutrition*, 3d ed., 1925, page 54.

However, appetite has never proved to be such an infallible guide. In fact, it is not only fickle and fantastic in its demands, but often proves dangerous. Nevertheless, this standard is found in all the older works on physiology and nutrition, and such is the force of

tradition that it is still often dogmatically stated as the body need, though now proved false by oft-repeated experiments.

While only a small amount of protein is the body's actual need, it is next to impossible by the use of whole natural foods without extracts or concentrates to reduce the protein below about fifty grams and at the same time secure the optimal amounts of the vitamins and minerals from the protective foods of fruit, vegetables, and milk. With these optimal amounts of vitamins and minerals, the wastes from the slight excess of the repair foods will be neutralized in their harmful effects by these same protective elements. Such menus will inevitably contain about sixty-five grams of protein, more or less. This is in fact the statement made by Henry C. Sherman that "when the supply of staple foods is such as to ensure excellence of mineral content and vitamin values, the protein supply will be provided with even greater relative abundance."

The vitamins of the food are much like the hormones or chemical messengers produced by the ductless glands of the body, such as thyroxine of the thyroid glands, insulin of the islands of the pancreas, adrenalin and cortin of the adrenal glands, the various hormones of the pituitary and sex glands, parathyroid hormone, and so forth.

Even more than this, they also exercise' control over the reproduction, development, growth, and structure of all the body tissues and organs. More prominently than any other, this control is manifest by vitamin A. During the drought of the "dust bowl" years in the Middle West, some animals were born deformed, blind, or eyeless, with cleft palate, harelip, or clubfeet, and underdeveloped nervous system. Yet when these blind or eyeless animals were given vitamin A from fresh growing plants and grasses, previous to conception, they reproduced animals with normal organs and parts.

Not all parts of any particular tissue suffer equally from vitamin deficiencies. The damage in development of parts and organs is usually patchy, normal and abnormal parts existing side by side. One eye may be undeveloped, blind, or absent, while the other is normal. There may be missing or supernumerary digits or limbs on one side of the body, while the other side is normal. The same patchy distribution of disease after full development and growth are attained occurs in adults subsisting on deficiency diets. Normal and diseased epithelial cells, gland cells, or other tissues may exist side by side. Part of an organ or structure may be normal and healthy while another part is diseased.

The malnutrition occasioned by the persistent vomiting of pregnancy results in vitamin deficiencies in the mother. In the offspring it may cause lasting damage in development, with ductless gland diseases; that is, hormone deficiencies, which become most manifest only at periods of special development or stress, such as rapid growth in childhood, puberty, adolescence, during the menstrual cycle, or during pregnancy and labor.

Reproduction and development are also profoundly influenced by the pituitary and thyroid glands, yet the control of vitamins and hormones over these processes is specifically different.

Hormones and vitamins differ in origin. Hormones are produced within the body by the glands of internal secretion. Vitamins are produced by plants and reach the body by way of the food. Vitamins are formed for the most part by green plants in or associated with that part of the plant, the chlorophyll, where active photosynthesis is occurring. The

only one which can be developed wholly within the body is also a product of the external stimulus of ultraviolet light, in this case upon certain sterols of the body (vitamin D).

Vitamin A comes from the green and yellow vegetables as the pro-vitamin carotene and is converted in the body (probably in the liver) to vitamin A itself.

Both hormones and vitamins must be present in adequate amounts and proper proportions in order to produce and maintain normal tissues and normal functions. In the case of hormones, departure from these normal amounts and proportions by either excess or deficiency results in disease. From natural food sources, harmful excess of vitamins is not known to occur and is probably not possible. Relative and even slight deficiency of vitamins in time produces serious disease. For this reason, our ancestors of one hundred fifty years ago, who lived before food refining processes were discovered and when they could have fruits and vegetables fresh, were far less subject to many of the ills which afflict mankind today.

Each vitamin presides over a specific body function not governed by any other. In the main, each vitamin manifests these activities in a certain tissue, class of tissue, or substance of the body. Similar specificity is manifest by all the hormones, so that the term "chemical messengers" is a most appropriate one in order to distinguish from brain and nerve control.

Some vitamins are linked together in biochemical processes with each other or with the hormones. The production and maintenance of some hormones has been shown to be dependent upon an ample supply of vitamins. Conversely, at least some vitamin activity is dependent upon a fully normal production of hormones. In the goat, carotene, the pro-vitamin A secured from green and yellow vegetables, is not converted into vitamin A itself if the animal has been deprived of its thyroid. As deficient thyroid secretion is a common human ailment, this dependence of vitamin nutrition upon a hormone may account for some of the unexplained symptoms manifested by those with a definitely low basal metabolism and their relief by full thyroid medication, which raises the metabolism to normal.

One of the pituitary secretions or an ovarian secretion has a definite bearing upon the acid-base balance of the body. An imbalance on the acid side is often an accompaniment of the premenstrual period of from one to several days in those who have headaches and nervousness at this time. In some extreme cases this imbalance can even be detected by the alkali reserve of the blood and is remarkably bettered by an extra large supply of alkaline-ash protective foods with naturally occurring carbohydrate, such as orange juice. The same, but usually far more complete, relief is obtained by oral or hypodermic use of ovarian or similar extracts.

The oxidative functions of the body are dependent upon thyroxine, -a pituitary hormone, -insulin, vitamin C, the vitamin B complex, and, for the complete cycle of oxidation and reduction, possibly also upon other vitamins.

Normal, infection-resistant tissues may be dependent upon two or more vitamins or two or more hormones and vitamins. Of special known importance in resistance to infections are vitamins A, B, C, and D, and thyroxine.

For the development of healthy tooth structure vitamins A, C, and D are required, as well as normal thyroid function. Nearly every structure in the eye is dependent upon vitamin A. The epithelial tissues all over the body are governed by vitamin A. These tissues are

widely distributed and of large importance in the internal organs and in all ductless glands. The intercellular cement substances are controlled by vitamins C and D. The nerve tissues are more largely dependent upon vitamin A for their development and upon the B complex for healthy action.

One of the vitamins may occur largely alone in a given natural food, yet they are found mostly associated together in two groups—the fat-soluble and the water-soluble vitamins. In the former group are A, D, E, and K; in the latter, the C group and the B complex. This grouping undoubtedly has great practical importance, as is evident from the natural occurrence in such grouping.

Causes of Vitamin Deficiency

Deficiency of vitamins occurs from a variety of causes. Among these are, first, the use of foods which have been “refined” so that they have lost many of their original food elements. But deficiency may also occur because of digestive defects, incomplete absorption, habitual use of cathartics, or destruction by cooking or by such chemicals as baking soda, so widely used as a household remedy and in cooking. Mineral oil and charcoal in the digestive tract also produce serious vitamin deficiency states by dissolving or absorbing vitamin A or D and thereby preventing their absorption into the body. Vitamins are also destroyed or used up in excessive degree by the use of alcoholic beverages, by other intoxications, and by infections. Excessive nerve strain, depleting illnesses, accidents, and surgical operations may demand more vitamin content than a full diet can furnish. Loss of appetite, physical inactivity, and old age are definite factors in causing vitamin deficiency. Hormone deficiency or excess may also occasion vitamin deficiency. It has been especially noted that toxic goiter causes vitamin deficiency.

Deficiency diets and the eating of many refined foods may in time produce a variety of peculiar sensations. The most common of these is a burning sensation. This may be and often is in the region of the stomach, so it is interpreted by the afflicted individual as excess of acid, or acid indigestion. Such sensations may be present without any increase in the hydrochloric acid, with a decrease of acid, or with no acid at all. Because of this general belief in over acidity, by common custom soda or some other mineral alkali is taken. Once begun, such self-medication is continued and resorted to with increasing frequency. As soda destroys the vitamins, a deficiency, especially of the various parts of the B complex, of progressive severity is made almost certain. Burning sensations due to lack of one or more of the B vitamins are not confined to the region of the stomach, but may occur anywhere in the body, the head, face, neck, back, or limbs and are often located about the mouth, throat, or other mucous membrane orifices of the body. These deficiency symptoms may also be associated with redness and swelling of the lips, tongue, mouth, gums, or throat and confirm the person in his belief in the acidity idea. Besides these are fissures, cracks, redness, and scaling about the corners of the mouth or various rashes on the skin. Itching or dryness and burning of the eyelids may occur.

A great variety of other disturbances comes from deficiencies of the various fractions of the B complex. Among these are nervousness, insomnia, cramping pains in the abdomen, weakness, muscle rigidity, tremors, roaring sensations in the ears or head, fullness in the head, flushing of the neck and face, dizziness, swimming sensations, or the indefinite

distress designated by some people as “a misery.” These body sensations when accompanied by mental, temperamental, and abnormal behavior disturbances are indicative of the more severe types of deficiency disease. Rarely are they due to the lack of one vitamin, being almost always from multiple deficiencies.

Of recent discovery are the mental, temperamental, and dispositional effects of deficiencies of various parts of the B complex, so that the individual does not behave normally or loses the elements of self-control in which the human differs so widely from the animal organism. Hypochondria, melancholia, irritability, hypersensitiveness to internal and external stimuli, emotionalism, hallucinations, and even insanity occur from the use of deficiency diets. Many persons with such ailments have been relieved in a most spectacular manner by oral or hypodermic medication with vitamin concentrates in two to four days or even in a few hours or minutes in certain instances.

The dispositional effects of refined foods is seen even in animals. Those on a complete well-balanced diet are placid and peaceable, while those on deficient diets are of ugly disposition.

5. REFINED FOODS AND DISEASE

THERE have been numerous reports of “epidemics” of strange diseases occurring among groups of men living for a time beyond the reach of their accustomed foods and subsisting without fresh milk, fruits, or vegetables. Not all of these have been scurvy or typical beriberi, but one of the most notable occurred in the crew of the cruiser “Kronprinz Wilhelm.”

Since this account is quoted from *The Science of Eating*, by Alfred W. McCann, it is given without alteration. However, some of his conclusions are not correct. Especially is this true of his diagnosis of acidosis. It will also be readily seen that the treatment he advised carried a concentrate of thiamine and other vitamins of the B complex, which of course accounts for the recovery of the men who had beriberi. My conclusions are given on page 67 in the paragraph after the material in quotations and agree with the diagnosis of the physicians who examined these men. The same is true of the quoted statements by Alfred McCann concerning the Madeira-Mamore tragedy.

“April 11th, 1915, the converted cruiser ‘Kronprinz Wilhelm’ was discovered lying at anchor in the James River, off Newport News, to which port she had followed her raiding predecessor the Prinz Eitel (Attila) Friedrich.”

“After sinking fourteen French and British merchantmen, she had successfully run the gantlet that brought her to her safe retreat in American waters

“When she put into Newport News she was stricken with a disease the doctors called ‘beriberi.’

“One hundred and ten of her crew of five hundred were prostrated. The others were on the verge.”

“Government experts, state experts, specialists in private practice, and great numbers of eminent health officers and physicians, hastened to the ship to hold consultations over the curious disease....

“After leaving Hoboken, August 3rd, 1914, the German cruiser roamed the seas for two hundred and fifty-five days, subsisting on supplies taken from French and British merchantmen before she bombed them. During this period of two hundred and fifty-five days she touched at no port, depending entirely for coal and provisions on her raiding ability and her speed in escaping French and British warships.

“The cruiser’s troubles began September 4th, 1914, when she sank the British steamer ‘Indian Prince,’ bound from Bahia to New York, after seizing all her coal, meat, white flour, oleomargarine, canned vegetables, coffee, and soda crackers. Her own supply of fresh meat was nearly exhausted when the ‘Indian Prince’ crawled into view. The white flour was looked upon as manna from heaven. A month passed.

“October 7th, 1914, the British refrigerator steamer ‘La Correntina,’ bound from Argentina to London with 5,600,000 pounds of fresh beef, was sighted. The Germans ran her down and took from her enough fresh meat to supply her needs for several years. She crammed her own spacious refrigerators with hind quarters and ribs. She corned 150,000 pounds of rounds in addition to her supply of the chilled and frozen quarters.

“She stowed enough meat to give each member of her crew as much as three pounds a day for an entire year. She also seized all the ‘La Correntina’s’ butter, white flour, tea, biscuits, sweet crackers, potatoes, canned vegetables, and her meager supply of fresh vegetables before blowing her up. Six weeks passed.

“November 21st, 1914, she captured the French bark ‘Anne De Bretagne’ on her way from Fredrickstad to Sydney. This boat, before she was blown up, surrendered all her coal, white flour, butter, potatoes, canned vegetables, champagne, and dried peas. The rest of her provisions went to the bottom.

“The Germans had all the meat and bread and oleomargarine they could eat. With their twenty-six knots an hour they knew they could continue to scour the seas until the end of the war....

“Fresh meat, bread, and oleo, and boiled potatoes are generally assumed to be life-sustaining foods. The Germans unwittingly had commenced to explode that theory.

“December’4th, 1914, after she had been out four months, she sank the British steamer ‘Bellevue,’ bound from Liverpool to South America. From this ship she secured four thousand tons of coal and an immense shipment of sweet biscuit with all the white flour, butter, and canned vegetables the Englishman carried.

“The subtle, slow-moving influence of their refined and demineralized diet had not yet broken the sturdy Germans. They had no suspicion that the fruits of their raids were actually eating into their lives

“The pallor of her crew and the dilation of the pupils of their eyes and marked shortness of breath here and there were observed by the ship’s surgeon but were not considered significant and the men went on devouring their typical American meals, so highly rated by the advertising geniuses of the refined food industry.

“February 5th, 1915, she sank the Norwegian bark ‘Samentha,’ from Linton to Falmouth, loaded with a cargo of wheat -whole wheat. The germ and bran of that wheat would have been worth more to the rapidly succumbing Germans than its weight in gold and

precious stones, but the Germans did not know they were sick. They did not know how badly they needed that whole wheat with its alkaline calcium and potassium salts.

“They did not know that within a few weeks a hundred of them would pass just one inch beyond the limit of toleration and then fall without warning, paralyzed, to the deck. In consequence of their faith in fresh meat, white flour, oleo, boiled potatoes, and coffee, those thousands of bushels of whole wheat with their priceless salts were sent to the bottom. Not a bushel was transferred to the German ship.

“February 23rd, 1915, she sank the French passenger steamer Guadeloupe from Buenos Aires to Bordeaux. There was more red meat aboard and plenty of ham, butter, white flour, and canned vegetables. She seized it all. Some of her crew were complaining of swollen ankles and pains in the nerves of the legs below the knees. Otherwise they seemed able to eat, sleep, and work, and apparently no plague was in sight, for there still remained to them plenty of meat, lots of potatoes, and enough white bread and butter to last seemingly forever....

“Alarming conditions began to develop. Typical symptoms of paralysis, dilated heart, atrophy of muscles, and pain on pressure over nerves, with anemia, were marked. Fifty of the men could not stand on their feet. They were dropping at the rate of two a day. It seemed that a curse had descended upon the cruiser, and it was plain that the whole crew was rapidly going to pieces.

“The ‘Kronprinz Wilhelm’ would either be manned by five hundred dead bodies in a few more weeks or she would have to make a run for it to the nearest port. Her wireless told her that Newport News had given harbor to the Prinz Eitel (Attila) Friedrich.’ She would take a desperate chance against the enemy and make a dash. April 11th, 1915, having been out 255 days, she made that dash

“Here was a crew of men living in the open air, eating the staple articles of diet for which the American scientists claim so much. Fresh meat, all the fat and cheese they could eat, boiled potatoes, canned vegetables, condensed milk, sugar, tons of fancy cakes, biscuits and white bread, and all the coffee and tea they could drink constituted their diet

“On the ‘Kronprinz Wilhelm’ the intensity of the cause determined the gravity of the effect. There was no outside assistance in the form of offsetting fresh vegetables and fruits or whole-grain foods to lessen that intensity. The canned vegetables consumed, although theoretically contributing base-forming elements, were consumed in comparatively small quantities

“The lesson of the ‘Kronprinz Wilhelm’ is this: She has proved almost conclusively the inadequacies of the very foods on which America relies so heavily for the protection of her troops, as well as the protection of her so-called middle- and lower-class civilians.

“No prolonged experiments had ever been conducted to determine the evil result of living exclusively on such foods. The ‘Kronprinz Wilhelm’ furnished that experiment.

“There can be no greater or more picturesque proof of the folly of unbalancing food by refinement, of the folly of ignoring the meaning of the salts, colloids, and vitamins natural to all unprocessed foods; of the folly of claiming for high caloric foods the absurd

virtues they do not possess.” - Pages 193-205.

Alfred McCann managed to board the cruiser, much to the disgust of the medical consultants, and, gaining the confidence of the chief surgeon, Dr. E. Perrenon, he left a suggestive program of dietary treatment.

“To one hundred pounds of wheat bran add two hundred pounds water. Leach for twelve hours at one hundred and twenty degrees Fahrenheit. Drain off liquor. Give each man eight ounces each morning.

“Give each man one teaspoonful wheat bran, morning and night, until contraindicated by loose stools.

“Boil cabbage, carrots, parsnips, spinach, onions, turnips, together two hours. Drain off liquor. Discard residue. Feed liquor as soup in generous quantities with unbuttered whole wheat bread.

“Wash and peel potatoes. Discard potatoes. Retain the skins. Boil skins and give liquor to men to drink four ounces a day.

“Give to each man yolks of four eggs a day in fresh, sweet, unskimmed milk, one yolk every three hours, with as much milk as he will drink by sipping.

“At noon, with dry whole-wheat bread, give one ounce fresh roast beef, for the psychological effect upon the men who have been taught to believe that without meat they cannot live.

“One hour before drinking milk give juice of ripe oranges or lemon juice, diluted with water without sugar, to each man.

“Keep, apples or applesauce within reach of men all the time.

“At end of first week let the men eat solids of vegetable soup as well as liquor.”

At the end of two hundred and fifty-five days here was a disease of mysterious origin. The treatment consisted of supplying concentrates of various nutritive elements, vitamins and minerals, mostly in broth or other liquid form. The subsequent course of this mysterious disease McCann states as follows:

“Ten days had passed, and forty seven men were so far advanced toward recovery that Dr. Perrenon said: ‘We can safely say they are cured.’ The phenomenon was so striking that I had again journeyed to the vessel to be an eyewitness of it.

“Dr. Perrenon escorted me on the tenth day to one of the worst cases, that of a sailor who spoke English well. He was the second man aboard to collapse, going down in January, 1915. After a diet from the officers’ table he recovered until February 23, when he again went down.

“When I visited the ship for the first time, Dr. Perrenon thought the man might die. When I saw him on the tenth day, he said: ‘I have had three days without pain. I am now hoping to be well.’

I examined him with Dr. Perrenon. The swelling of his legs had subsided, but the pain still existed when pressure was applied. His condition was indeed pathetic.

‘You know you owe this to white bread and meat,’ I said to him. ‘Yes,’ he answered, ‘my case is the worst, but the other cases are bad enough. We all owe it to white bread and meat, but there will be no more such food in the German navy when they know what happened to us. They will profit by this, all of them.’ .

“Summing up the experience of the ‘Kronprinz Wilhelm’ prior to her appearance in the James River, Dr. Perrenon said: ‘We had many cases of pneumonia, pleurisy, and rheumatism among the men. They seemed to lose all resistance long before the epidemic broke out. We had superficial wounds, cuts, to deal with. They usually refused to heal for a long time. We had much hemorrhage. There were a number of accidents aboard, fractures, and dislocations. The broken bones were slow to mend. Nature was not doing her duty. Food is indeed the cause of much disease. In nine months we can learn much that is not to be found in the textbooks.” - Ibid., pages 206-213.

While Alfred McCann attributed this mysterious disease largely to mineral deficiency, we now know that it was due in an even greater measure to vitamin deficiency. Both vitamin and mineral deficiencies were concerned.

The Madeira-Mamore Case

One more case is here given as recorded by Alfred W. McCann in *The Science of Eating*.

“The Madeira-Mamore Railway Company in 1914 went into the hands of a receiver, after constructing a single track two hundred and thirty-two miles long connecting Bolivia with Brazil.

“The first mile of this railway was laid just ten years ago, its object being to exploit the rubber industry of South America, not to advertise the dietetic virtues of ripe fruits, or fruit juices, or the deficiencies of American diet.

“In the construction of its two hundred and thirty-two miles of track four thousand men were literally starved to death “The laborers, of whom there were originally six thousand, consisted of Russians, Greeks, Turks, Italians, Germans, English, Japanese, Hindus, French, Jamaicans, Barbadians, and Brazilians. The officers, engineers, and physicians were chiefly British and American

“White bread constituted the chief foodstuff of the men. It was baked in the camp from patent flour imported from the United States in thousand-barrel lots, and was furnished by wholesale grocers in New York City under the most highly advertised brands on the market....

“For breakfast the laborers ate white crackers and white bread with plenty of black coffee, sweetened with sugar. As they had to pay for their own meals, and pay heavily for them, they economized as much as possible, believing, as most others believe, that bread is the staff of life, and in itself sufficient to maintain strength, energy, and health.

“At noon they ate white bread, white crackers, and xarque, with more coffee and sugar. Occasionally dried codfish, ham, or bacon was substituted for the xarque. Xarque is dried beef, which looks like leather. It is packed in slabs or layers weighing fifty pounds

each. Each slab is several inches thick, and as dry and hard as wood. Before cooking, the xarque was soaked overnight in water and then boiled.

“In the evening the men ate more white bread, crackers, and xarque, and occasionally indulged themselves in a can of sauerkraut, a can of pork and beans, or a can of jam.

“The French, Jamaicans, and Barbadians grouped together, and every day made what the others called ‘sinkers,’ a sort of heavy doughnut composed of white flour, sugar, and water, fried in lard....

“The first symptoms observed among the laborers and officers affected were manifested in a tendency to stub their toes while walking along smooth roads. The foot would seem to drag. After that a slight swelling appeared in the ankles, which gradually extended upward to the knees with loss of sensation. When this swelling was at its height, a dent in the flesh made by pressure of the finger would remain for a long time.

“Shortness of breath and palpitation of the heart, with tremor of the nerves were the next symptoms, after which the men began to walk as though they were suffering from locomotorataxia, with the halting, hesitating, uncontrolled stride characteristic of that disease.

“As the cases advanced, the swelling subsided, and the leg gradually wasted away, until prior to death nothing remained apparently but the bone and skin.

“Before death all the men were completely prostrated and helpless. None of the drugs with which the physicians were provided had any effect. Finally the doctors ordered ‘no more rice.’ They thought that rice was the bugaboo because they had been reading of the relationship between rice and ‘beriberi.’

“The death of the four thousand railway laborers who built those two hundred and thirty-two miles of railway that run by the Candelaria Graveyard represent not only preventable loss of life, due to ignorance of the laws of nutrition, but they also represent tremendous financial losses sustained by the builders of the railway, who, handicapped by sickness and inefficiency, poured more money into the construction of the project-a hundredfold more-than would have been necessary had the diet of their men been properly safeguarded and less false economy invoked.”-Ibid., pages 169-176.

Again we should remember that it was not acidosis but chiefly vitamin B deficiency that produced these weaknesses and paralyses of these men. Nor is it alone a matter of vitamin B, deficiency but basically a multiple vitamin deficiency, involving probably the several fractions of the B complex as well as the fat soluble vitamins A, D, and E, and at least some deficiency of vitamin C.

Interesting as are the functions of the several different vitamins and their relation to normal nutrition and health and their intimate relation to the balance of minerals and the acid-base balance of the body, there is that which everyone should know and which is not after all such an involved matter as to require a college education for its acquirement.

6. FAULTY FOOD HABITS AND DISEASE

THE universal laws of cause and effect apply to disease, yet man has largely disregarded this inevitable relationship. He is willingly ignorant of the presence of great light on this subject.

“The violation of physical law, with its consequent suffering and premature death, has so long prevailed that these results are regarded as the appointed lot of humanity; but God did not create the race in such a feeble condition. This state of things is not the work of Providence, but of man. It has been brought about by wrong habits, by violating the laws that God has made to govern man’s existence.”

“The strange absence of principle which characterizes this generation, and which is shown in their disregard of the laws of life and health, is astonishing. Ignorance prevails upon this subject, while light is shining all round them.”

“Disease never comes without a cause. The way is prepared, and disease invited, by disregard of the laws of health.” -Counsels on Diet and Foods, pages 118, 119, 122.

Note the epitome of the science of nutrition as stated on page 126 of the same work: “Those foods should be chosen that best supply the elements needed for building up the body.” Appetite, habits, or customs are not proper guides in the choice of food, although these, rather than reason, are often allowed to determine what is eaten. Others have recognized this irrational attitude. One has said, “Eating has a great vogue as an amusement,” and another, “Eating is the great American pastime.”

In 1905 E. G. White stated: “The disease and suffering that everywhere prevail are largely due to popular errors in regard to diet.” - The Ministry of Healing, page 295. Her statement may have seemed wildly extravagant at the time it was made, for the scientific knowledge of food, diet, and nutrition was then in its infancy, and the bacterial causes of disease dominated the medical horizon. How largely is improper eating responsible for human disease? This is a question upon which science can now shed much light.

“Impounded rats, eating perforce what they are furnished, may thrive and grow vigorous. Reasoning man, with laboratory knowledge at his disposal, remains a slave to dietary habits, sacrificing his health, and sometimes even his life.”-Victor G. Heiser, M.D., “We Are What We Eat,” The Reader’s Digest, March, 1938.

Ulcer and Cancer

Concerning the work carried on at Coonoor, India, by Robert McCarrison, M.D., we read in the same article:

“Diet can be the cause of many diseases. For example, the stomachs and intestines of many of the inhabitants of southern India are riddled with ulcers. Bad as is the condition in Madras, it is much worse in adjacent Travancore, where the natives consume large quantities of pure starch as found in their tapioca root. The laboratory men put two groups of rats on the respective diets of these two provinces. Over a quarter of those eating Travancorian food and 10 per cent of those on the Madrasi diet presently developed gastric

or intestinal ulcers; these figures correspond almost exactly with the incidence of the disease among the two peoples. No ulcers occurred in the control rats fed on balanced rations.

“The Japanese in turn discovered that if diets producing ulcers in rats were continued for more than 180 days, the ulcers turned into cancers and were incurable; if the diets were reversed within that time, they disappeared.”

Stones in Urinary Organs

Upon the frequency of stones in urinary organs, Dr. Heiser has this to say:

“Half the 12,000,000 inhabitants of Sind in northern India suffer from painful stones in the bladder. Dr. McCarrison fed the Sind diet to healthy rats; with dramatic suddenness 50 per cent developed stones, again paralleling the incidence of the disease in the human population. No stones, however, formed in a group of rats fed this same diet with the simple addition of a daily teaspoonful of milk. It is probable that the same result could be repeated and millions could be saved from pain if every day they could drink just one pint of milk.”-Ibid. See also “The Causation of Stone,” British Medical Journal, June 13, 1931.

Tuberculosis

“In this country [England] the per capita consumption of milk provides an excellent index to tuberculosis. The more milk drunk, the fewer the cases. During the World War, in food lacking Germany and Austria, the tuberculosis rate rose rapidly. In the first few years after the war, despite overcrowding in sunless, unsanitary houses, the incidence came down quickly; the populace were once more being supplied with milk, fats, and other food essentials.”-Ibid. See also G. T. Wrench, M.D., The Wheel of Health, pages 70-82.

Tooth Decay

“Before the American brought his highly milled flour, cereals, and other foods to Hawaii, strong, sound teeth flashed from dark Hawaiian faces, but no sooner had American diet been substituted for taro, the native tuber from which poi is made, than an 80 per cent tooth decay developed, a high figure, identical with that in the United States. Four years ago 1,000 Hawaiian children were shifted back to the diet of their forefathers. In the very first year tooth decay dropped to 40 per cent, and now it appears to be about eight, an extraordinary decrease.” - Ibid. See also F. LeGros Clark, National Fitness.

Pellagra

“The person who lacks health may often lack only some essential food property. ‘Hog and hominy’ with sorghum for sugar has long been the diet in parts of our own South. Resultpellagra. Remedy-an ordinary vegetable garden.”-Ibid.

Diseases Due to Unbalanced Diet

Space does not permit the quotation of other statements, but to show the widest range in the least possible space we quote from *The Wheel of Health*, by G. T. Wrench, M.D. Dr. Wrench makes a comparison of the experimental use in animals of the complete and excellently balanced diets of the Hunza, Sikh, and Pathan peoples of northern India with the faulty, unbalanced diets of the other peoples of India.

These native diets of the northern Indian tribes, from which Dr. McCarrison fed the rats, consist of whole-wheat flour, unleavened bread (chapatties) lightly smeared with fresh butter, sprouted Bengal gram (legume), fresh raw carrots and cabbage ad libitum, unboiled whole milk, a small ration of raw meat with bones once a week, and abundance of water, both for drinking and for washing purposes.

It will be noted that Dr. McCarrison does not include fruit in the experimental diet of these rats. He makes no explanation for this omission. Over a period of two and a quarter years he found in the rats no disease at all.

“The only thing, therefore, that was common to rat and man in this first experiment was the diet. Here in the great cleft of Hunza was a little oasis of a few thousand beings of almost perfect health, and here in the cages of Coonoor was a little oasis of a thousand and more albino rats also in perfect health. The only link connection between these two otherwise dissimilar sets of living things was a similar kind of diet.

“McCarrison now linked up other batches of rats in the same constant conditions of cleanliness and comfort with other peoples of India by their diets. He was in a most enviable position for trying out diets as a whole. The Indian subcontinent provides so many different races and different habits and diets. Hence McCarrison was able to sit in his sanctum at Coonoor and connect up his rats with teeming peoples near and far, and in the mirror of the rats read the dietetic fates of the peoples.

“He took the customary diets of the poorer peoples of Bengal and Madras, consisting of rice, pulses, vegetables, condiments, perhaps a little milk. He gave these to rats. Now, this diet immediately opened the lid of Pandora’s box for the rats of Coonoor, and diseases and miseries of many kinds flew forth. McCarrison made a list of them as found by him in 2,243 rats fed on faulty Indian diets. Here it is given by him at the Royal College of Surgeons in, necessarily, technical language: .

“Diseases of the nose and accessory sinuses: sinusitis.

“Diseases of the ear: otitis media, or pus in the middle ear.

“Diseases of the upper respiratory passages: adenoid growths.

“Diseases of the eye: conjunctivitis, corneal ulceration, keratomalacia, panophthalmitis.

“Gastrointestinal diseases: dilated stomach, gastric ulcer, epithelial new growths in the stomach, cancer of the stomach (in two cases only), duodenitis, enteritis, gastrointestinal dystrophy, stasis.

“Diseases of the urinary tract: pyonephrosis, hydronephrosis, pyclitis, renal calculus, ureteral calculus, dilated ureters, vesical calculus, cystitis, incrustrated cystitis.

“Diseases of the reproductive system: inflammation of the uterus, ovaritis, death of the fetus in utero, premature birth, uterine hemorrhage, hydrops testis.

“Diseases of the skin: loss of hair, dermatitis, abscesses, gangrene of the tail, gangrene of the feet, subcutaneous edema.

“Diseases of the blood: anemia, a “pernicious” type of anemia, Bartonella muris anemia.

“Diseases of the lymph and other glands: cysts in the submaxillary glands and accessory glands in the base of the tongue, abscesses in the same, and occasionally also in the inguinal glands, enlarged adrenal glands, atrophy of the thymus, enlarged mesenteric, bronchial, and other lymph glands.

“Diseases of the endocrine system: lymph-adenoid goiter, and, very occasionally, hemorrhage into the pancreas.

“Diseases of the nervous system: polyneuritis.

“Diseases of the heart: cardiac atrophy, occasionally cardiac hypertrophy, myocarditis, pericarditis, and hydropericardium.

“Edema.’

“That is the complete list. Freeing it of its technical dressing, in plain English it means that the rats, which were fed on the diets eaten by millions of Indians of Bengal and Madras, got diseases of every organ they possessed, namely eyes, noses, ears, lungs hearts, stomachs, intestines, kidneys, bladders, reproductive organs, blood, ordinary glands, special glands, and nerves. The liver and the brain, it may be noted, do not occur in the list. The liver was, as a fact, found to be diseased in conjunction with the diseases of the gastrointestinal tract. The examination of the brain requires a careful opening of the small bony brain case of the rat and adds greatly to the time needed for post-mortem examinations.

“This list denotes a pretty comprehensive lot of troubles to be owed on to simple little creatures like rats as a result of eating faulty Indian diets. In a list given five years later in the Cantor Lectures, McCarrison adds a few further diseases, such as general weakness, lassitude, irritability, loss of hair, ulcers, boils, bad teeth, crooked spines, distorted vertebrae, and so on.

“Considering again the simplicity of the rat and its limitation in things human, the list is, comparatively speaking, almost as complete as the list of contents of a stately textbook of medicine.” - G. T. Wrench, M.D., *The Wheel of Health*, pages 36-38. See also “Some Surgical Aspects of Faulty Nutrition,” *British Medical Journal*, June 6, 1931.

A classified summary reveals in the white rat sixty-one diseases in fourteen different parts, organs, or systems of the body, all due solely to defective diet, with ten more diseases in other animals on a defective diet. The diseases of this list are among the most prominent and common of human ailments. Among them are diseases in which we have hitherto considered the causes as mechanical, infectious, congenital, or hereditary. New growths or tumors, ductless-gland disorders, and heart disease might also be included. To all of these there have been no definitely assigned causes.

Dr. McCarrison states: "Rats are not the only animals I use; guinea pigs, rabbits, pigeons, and monkeys are also employed. In them I have found many of the above-mentioned diseases, and some others besides. Of the latter I may mention the following: prescorbutic states, scurvy, and duodenal ulcer in guinea pigs, hyperplastic goiter in rabbits, epithelioma contagiosum, P0b neuritis, and true beriberi in pigeons, and ulcerative colitis in monkeys." I may add that of all the faulty diets I have used, that composed of margarine, tea, sugar, jam, preserved meat, and scanty, overcooked vegetables-a diet in common use by people of this country (England)-proved to be one of the worst, and most likely to be associated in rats with many of the morbid states I have mentioned, especially diseases of the lungs and of the gastrointestinal tract.

In every species,-pigeons, rats, guinea pigs, rabbits, and monkeys, I have found the same thing: properly fed animals remain remarkably free from disease; improperly fed animals are remarkably subject to it. It is reasonable, therefore, to assume that the human species is no exception to this rule, and that many of the ailments to which man is erroneously supposed to be heir are the outcome of his improper feeding."

Coincident with these observations regarding the disease producing qualities of civilized man's diet, it should be noted that the American Indian, in adopting the white man's diet, became at once subject to the dental decay, gum diseases, bone diseases, and tuberculosis of the white man. The Alaskan Eskimo shows dental and gum disease in the very year his diet changes to the white man's food, and this is most notable in children. Archie N. Tong, M.D., writes regarding health conditions in Portuguese West Africa: It is a rare thing for a native African to have any of the gastrointestinal conditions that are so common in so-called civilized countries. I have seen but two cases of appendicitis in the African native, and these two men were chiefs who tried to live like the white man, subsisting principally upon meat and refined foods. Malignancies [cancers] are unheard of."

It seemed from these experiments that the diets of the English people resulted in a great preponderance of the common diseases of the respiratory and gastrointestinal tracts. Among these respiratory diseases are many that are recognized as due to infections, that is, of germ origin, such as pus in the sinuses and the middle ear, bronchitis, pneumonia, bronchio-pneumonia, and other infections such as boils and abscesses. Regarding the occurrence of pneumonia as related to diet, Alexis Carrel, M.D., says:

"The frequency of pneumonia may also be modified by food. The mice belonging to one of the strains kept in the mouse center of the Rockefeller Institute died of pneumonia in the proportion of 52 per cent while subjected to the standard diet. Several groups of these animals were given different diets. The mortality from pneumonia fell to 32, per cent, 14 per cent, and even zero, according to the food." - *Man, the Unknown*, page 207.

From voluminous research it is now known that susceptibility to pneumonia is partly due to lack of vitamin A, with consequent failure in the maintenance of the normal structure and function of the respiratory mucous membranes, which prevent the entrance of germs into the tissues, and the further failure of the internal protective efforts of vitamin C, and possibly other dietary factors, in neutralizing the toxins or destroying the germ. A definite relationship of the dietary lack of vitamin C to rheumatic fever has recently been discovered. Nearly all dietary deficiencies, and many dietary excesses, prepare the body for

infections. Sometimes they are the real determining factor, as shown by susceptibility and so-called natural immunity.

Relation of Diet to Disposition

“Against every transgression of the laws of life, nature will utter her protest. She bears abuse as long as she can; but finally the retribution comes, and it falls upon the mental as well as the physical powers.”

“Many spoil their dispositions by eating improperly It is possible for one to spoil his spiritual experience by an ill use of the stomach.”-Counsels on Diet and Foods, pages 120, 126.

That improper diet and eating have much to do with the disposition as well as with gross physical disease is not unknown to experimental science, even though animals cannot be used to demonstrate the production of mental disorders. Concerning the wide range of diseases produced by faulty diet, Dr. Wrench says:

“The list is, comparatively speaking, almost as complete as the list of contents of a stately textbook of medicine. The diseases of the mind and other very special diseases are omitted. One cannot exactly diagnose neurasthenia, hysteria, and schizophrenia, in the rat.

“Yet even in rats, conditions like to these arise from faulty diet. For example, in later experiment, McCarrison gave a set of rats the diet of the poorer classes of England; white bread, margarine, sweetened tea, boiled vegetables, tinned meats and jams of the cheaper sort. On this diet, not only did the rats grow badly, but they developed what one might call rat neurasthenia, and more than neurasthenia. They were nervous and apt to bite their attendants; they lived unhappily together, and by the sixteenth day of the experiment they began to kill and eat the weaker ones among them....

“We are left, then, at the end of these experiments with two vividly contrasted sets of little animals in this small ‘universe’ of Coonoor-those on good and those on faulty diet; the healthy and the sickly; and certain mental characters in contrast, the good-tempered and live-and-let-live on the one hand, the badtempered and cannibalistic on the other.”-The Wheel of Health, page 38.

Speaking of his personal visit to Dr. McCarrison’s experimental station at Coonoor, Dr. Victor G. Heiser makes this interesting observation:

“As I approached the first cage, a heavy, stocky rat lunged viciously at me. His hair was rough, his whiskers bristled threateningly. He was ready to fight at the drop of a hat. From the time he had been weaned he had been fed on white bread and jam, boiled beef, boiled mutton, boiled fish, boiled vegetable-, boiled tea-the English workman’s daily fare. It was apparent that he and his fellows partook of the nature of the Britons, and never, never would be slaves.

“Next to them, pink eyes round and placid, were rats brought up on the Sikh and Pathan diet. They were as large as the British rats, but their fur lay sleek and smooth; they were gently disposed.”-The Reader’s Digest, March, 1938.

That even insanity occurs in the deficiency disease, pellagra, has been known for many years. Recent experiments with a newly identified fraction of the vitamin B complex in the treatment of insane pellagrins have produced complete mental restoration in four to six days. See *The Journal of the American Medical Association*, May 14, 1938, p. 1665; June 18, 1938, Page 2065; August 13, 1938, Page 584.

To the dietary production of all this great variety of disease one might add the effects in detail of the total or relative lack of each of the various food elements which regulate the growth, structure, and function of the numerous tissues, organs, and systems of the body. These regulative substances are the vitamins, minerals, and certain amino acids. The known distinct fractions of the vitamins or essentially separate vitamins are at least twelve main ones and several others less perfectly known. It is this field of research which is revealing the causes of many diseases of hitherto obscure causation.

A brief scanning of literature at hand shows a large number of these diseases and disorders in which a deficient or unbalanced diet is wholly or largely the cause. Among them are night blindness, colds, acne, dental cavities, pyorrhea, gingivitis, trench mouth, spinal cord degeneration, nerve degenerations, loss of appetite, constipation, stunted growth, degenerations and other disorders of the ductless glands (pancreas, thyroid, adrenals, testes, ovaries, pituitary, thymus), scurvy, purpura haemorrhagica, rickets, failure of callus formation after fractures, tetany, congenital pyloric hypertrophy and stenosis, malformations of the teeth and jaws, cataract, psoriasis, pruritis (certain types), eczemas (certain types), secondary anemias, and pernicious anemia.,

Dietary excesses of protein, acid ash, or animal fats play an even larger part than do dietary deficiencies in causing some diseases such as Bright's disease, arteriosclerosis, high blood pressure, cardiac hypertrophies, apoplexy, cirrhosis of the liver, and some skin diseases such as psoriasis, general pruritis, and certain eczemas.

Influence of Diet on Heredity

Many years ago Sir William Osler said: "Ninety per cent of all conditions outside of acute infections and traumatisms are directly traceable to diet." Now the predisposing and really determining cause of many infections has been found to be dietetic. By far the larger proportion of degenerative diseases, such as those of the liver, heart, blood vessels, and kidneys, are also directly traceable to the "current customs" and "popular errors in regard to diet." We cannot say what the whole truth might reveal, but from what is now known (and without any further attempt to say what proportion), the statement, "The disease and suffering that everywhere prevail are largely due to popular errors in regard to diet," would seem conservative.

The statements in regard to the hereditary transmission of disease originally due to transgressions of parents and their faulty diet (*Counsels on Diet and Foods*, pages 117-120), deserve more consideration than can be given here. The statements concerning effects of transgression of natural law influencing longevity find striking scientific confirmation by Henry C. Sherman in regard to the single factor of diet. His statement refers to the addition of the second pint of milk.

“Calcium was found to account for a large part of the nutritional improvement which had resulted from increasing the proportion of protective food in an already-adequate diet. In an extended series of experiments with diets differing in their calcium contents only to the same extent as in the above-mentioned mixtures of natural food materials (Sherman and Campbell, 1935, 1937) this moderate increase of calcium intake resulted in slightly more rapid)growth, more efficient utilization of food value whether computed in terms of calories or of protein, slightly earlier maturity, better success in reproduction and lactation, and some increase in the average length of adult life. Here the gain in longevity by the males was undoubtedly significant, while that by the females was less, and if it stood alone would not be statistically convincing. But the females receiving more calcium had borne and reared more young. That they invested their extra calcium in more and better offspring and did not inherently lack the ability to profit in the same way as the males, is shown by the results of two subsequent series of experiments, as follows: (1) It was found that the above-described increment of calcium intake did increase the longevity of unmated females. (2) When the increase in the calcium content of the diet was more liberal, there resulted both increased success in reproduction and lactation and the attainment of greater longevity by the same individual females (Campbell, Pearson, and Sherman, 1943).”-Henry C. Sherman, *Chemistry of Food and Nutrition*, 7th ed., pp. 601, 602.

The degenerative diseases are particularly related to longevity, for they cut the thread of life prematurely in a most notable and often tragic manner. Specifically, concerning hereditary kidney disease due to meat eating, Louis H. Newburgh, M.D., of the University of Michigan reports some enlightening experiments showing the deceptive effects of external appearances while internal organs are fatally injured. M. Hindhede, M.D., of Denmark gives other facts of undeniable significance in connection with the degenerative diseases and longevity. See George K. Abbott, M.D., *High Blood Pressure*, pages 67, 84-86. Also, arteriosclerosis in its first stages has been found in young children and even in infants. See Edmund V. Cowdry, M.D., *Arteriosclerosis*, page 13.

In connection with this subject a further statement is made which all of us should heed. “Many suffer in consequence of the transgression of their parents. While they are not responsible for what their parents have done, it is nevertheless their duty to ascertain what are and what are not violations of the laws of health.”-*Counsels on Diet and Foods*, page 122. In view of this, we can see the importance of including health subjects in the curriculum of every academic and college course in our denominational schools.

As notable as the work of Robert McCarrison is that of Weston A. Price, D.D.S., the latter centering in dental health and hereditary tooth perfection. It has, however, been criticized as biased by a preconceived idea. More recent research regarding hereditary tooth disease in animals began with another concept, also a preconceived idea. This was that hard, coarse food particles produced dental caries, cavities, and imperfect dentition by mechanical injury essentially traumatic. This has now been proved false, as revealed by extensive research by Reidar F. Sognaes of the Harvard School of Dental Medicine. It fully agrees with the extensive survey of human dental health made by Weston A. Price.

In the following quotation it should be remembered that sucrose is cane sugar, a highly refined product, and not a natural carbohydrate as is dextrin:

“There is a much greater cariogenic effect of sucrose than of dextrine when a change from one to the other is made posteruptively. The great difference in caries in the two generations lends further support for a mechanism operating before tooth eruption and resulting in an increase in caries with the length of time of maternal maintenance on the purified ration. For our present purpose it is evident that, during such a period of non function of the teeth, the mechanism of masticatory or traumatic injury of the enamel can have no conceivable direct bearing upon the initiation of caries. From the above experiments it may therefore be concluded that mechanical injury is a minor factor, if any, in the production of experimental rat caries of the nature reported by the writer in this and in the other most recent experiments with the purified ration.

“Binocular examination of the carious molars reveals a low degree of attrition, presence of undermining cavities, and absence of fractures of the cavity walls and cusps.... In contrast to lesions produced by coarse diets, initial lesions in the enamel produced by the purified ration occur without fractures. Even on the lateral wall of the cusps, where fractures are very unlikely, regardless of the ration, there is evidence of early invasion of the enamel. In the described type of lesions the dentine in the bottom of the cavities is usually very soft, more or less pigmented, and invaded by microorganisms. Following the dental tubuli and their branches, the process eventually spreads laterally, causing large decayed clefts in the dentine. Under oil immersion, Gram-stained sections reveal a spheroidal type of microorganism, both in the enamel and in the furthest extension of the lesions into the dentine.

“If the described lesions are compared with caries in man, the great similarity is obvious. Undermining cavities, soft pigmented dentine, lateral spread and cleft formation, invasion of the enamel as well as the dentinal tubuli by microorganisms with ‘pioneer bacteria’ invading the deepest layers, can be regularly demonstrated in the rat caries produced on the purified ration. Counterparts of the above description of the experimental lesions, as well as the accompanying illustrations, can be found in most textbooks on the histopathology of human caries

“Evidence has been presented that a purified ration, adequate in known nutrients, is conducive to rat caries independently of the presence of coarse particles and the impact of mastication. Demonstration of a caries-producing mechanism operating before tooth eruption, the absence of enamel fractures and attrition, and the persistence of weakly supported overhanging enamel walls surrounding undermining caries, all tend to indicate that the described lesions are not caused by mechanical injury of the teeth. No difference can be found between the histopathology of the rat caries here presented and presently established findings in man.” - Reidar Fauske Sognaes, *The Journal of Nutrition*, Volume 36, Number I, July 10, 1948, pp. 8-13.

7. PERFECT DIET-PERFECT HEALTH

THE matter of greatest practical importance is that we shall learn which are whole natural foods and which are not. It may seem strange that anyone today should need such instruction. Unfortunately food is now purchased at a store, mostly canned and packaged goods, instead of being gathered directly from the farm, orchard, garden, and the dairy. Preserving of food is done on a wholesale scale, much of it outside the home. Harmful

chemicals are used in some of these processes, unknown to the consumer. Only after many years has it become known that the most important nutritional elements in food have thereby been destroyed or discarded. Very little of this knowledge, essential as it is, seems to have filtered through from research laboratories to the rank and file of the people. Some of the otherwise most highly educated appear to know the least about these necessary health facts, or if they know them, they disregard them entirely. The searching out of the role in nutrition of individual vitamins or mineral factors is a complicated biological and biochemical matter difficult for any but the initiated to grasp or apply. However, the essential facts necessary for individual use can be, and have been, put in understandable form.

It is not common to see whole crews of men prostrated in a few months. These are the most extreme examples. That which we see every day and so think nothing about are the common diseases of civilized man that are caused by the quantitatively minor-if minor in importance it may be called-deficiencies of these vital life-giving elements of the food, the vitamins and minerals.

The most notable of these facts regarding the supreme importance of the vitamins and mineral elements in whole natural foods, unrefined has been shown by Robert McCarrison, M.D. His statements, based on medical observation of the health of the various native tribes of northern India as compared with the health and diseases of his countrymen of England, are outstanding as to the prime importance of these whole foods in the maintenance of a healthy organism free from disease.

Among these native tribes three are notable for their fine physique, their strength, endurance, freedom from disease, and their longevity. These peoples are the Hunzas, the Pathans, and the Sikhs, but of these three the Hunzas surpass. Travelers have given with one voice testimony to the superb physique and great endurance of the Hunza people.

“For example, that illustrious traveler and savant, Sir Aurel Stein, when on the way to the ‘sand-buried ruins of Khotan’ (1903), was amazed on the morning of June 25th to see a returning messenger who had been sent by the Mir to the political Munshi of Tashkurghan to prepare him for Stein’s impending arrival. The messenger had started on the 18th. It was just seven complete days between his start and his return, and in that time he had traveled two hundred and eighty miles on foot, speeding along a track mostly two to four feet wide, sometimes only supported on stakes let into the cliff wall, and twice crossing the Mintaka Pass, which is the height of Mont Blanc [nearly 16,000 feet]. The messenger was quite fresh and undisturbed, and did not consider that what he had done was unusual.

“Nor was it, not even its speed. To pass along mountain tracks, of course, is the only way the people can get out of their strip of green country between river and mountain. But that does not make their going up and down and across the faces of precipices easy going. Yet ‘it is quite a usual thing for a Hunza man to walk the sixty miles to Gilgit at one stretch, do his business, and return direct,’ says Colonel R. C. F. Schomberg, who for eight years had occasion to visit the Gilgit Agency and saw much of the Hunza.

“They are a peculiar people, almost like the mountain ibex which they hunt, in the ease of their gait. When they traverse these huge distances they have such a quick, light way of passing over the ground that they can be detected at great distances from other peoples on a mountain track. ‘How can you tell at such distance that those laden coolies are

Hunza?’ asked Schomberg of his native companions. ‘By the way they walk, was the reply.’- G. T. Wrench, *The Wheel of Health*, page 13.

In Dr. McCarrison’s Mellon Lecture in Pittsburgh in 1922 he reports his interesting observations among these various peoples of northern India.

“For some nine years of my professional life my duties lay in a remote part of the Himalayas, where there are located several isolated races far removed from the refinements of civilization. Certain of these races are of magnificent physique, preserving until late in life the characters of youth; they are unusually fertile and long-lived, and endowed with nervous systems of notable stability. Their longevity and fertility were, in the case of one of them, matters of such concern to the ruling chief that he took me to task for what he considered to be my ridiculous eagerness to prolong the lives of the ancients of his people, among whom were many of my patients.

“Among another of these races, the custom which required an eldest son on pain of death to carry in a conical basket his aged and decrepit parents to the top of a high rock from which to hurl them to destruction, has died out only within recent years under the protective influence of British rule; and the proverb, ‘Every man’s basket for his son,’ still survives the custom.

“During the period of my association with these peoples I never saw a case of asthenic dyspepsia, of gastric or duodenal ulcer, of appendicitis, of mucous colitis, of cancer.”

Buoyant Health

Indeed, their buoyant abdominal health has, since my return to the West, provided a remarkable contrast with the dyspeptic and colonic lamentations of our highly civilized communities. Searching for an explanation of this difference in incidence of gastrointestinal disease in the two peoples, I find it, in the main, in four circumstances:

“1. Infants are reared as nature intended them to be reared at the breast. If this source of nourishment fails, they die; and at least they are spared the future gastrointestinal miseries which so often have their origin in the first bottle.

“2. The people live on the unsophisticated foods of nature, milk, eggs, grains, fruit, and vegetables. I don’t suppose that a chocolate, or a patent infant food, nor that as much sugar is imported into their country in a year as is used in a moderately sized hotel of this city in a single day.

“3. Their religion prohibits alcohol, and although they do not always lead in this respect a strictly religious life, nevertheless they are eminently a teetotal race.

“4. Their manner of life requires the vigorous exercise of their bodies.

“Let us now for a moment contrast the habits of those primitive people in respect to food with those of our more highly civilized communities. The former are content with natural foods, milk, eggs, grains, fruits, and leafy vegetables; or, if their state of mind be not precisely one of contentment, they can at least not better their lot nor worsen it. These natural foods, ‘the protective foods,’ as McCollum has named them-provide in proper quality

and proportion the proximate principles and vitamins necessary for nutritional harmony, and the proper vegetable residues for the healthy evacuation of the bowels.

Foods “Preserved, Purified, Polished, Pickled, and Canned.”

“But the case is different with civilized man. No longer is he content with the unsophisticated foods made in nature’s laboratory, with ‘herbs bearing seed’ and with ‘every tree, in which is the fruit of a tree yielding seed.’ To him these are ‘still for meat,’ but preserved, purified, polished, pickled, and canned. Some he extracts and distills with the object of procuring concentrates agreeable to his taste. His animal food he heats, dries, freezes, thaws, and stores. One way or another by desiccation, by chemicals, by heating, by freezing and thawing, by oxidation and decomposition, by milling and polishing, he applies the principles of his civilization—the elimination of the natural and the substitution of the artificial—to the food he eats and the fluids he drinks. With such skill does he do so that he often converts his food into a dead fuel mass, devoid of those vitamins which are to it as the magneto’s spark to the fuel mixture of a petrol-driven engine. Unmindful, too, or more often ignorant, of the composition of the fuel mixture with which he charges his human machine, he joins deficiencies of some essentials with excesses of others, heedless that the smooth running of his bodily functions bears intimate relation to the ordered balance of these essentials.

I am not at the moment concerned with the circumstances of his civilization—expediency, penury, prejudice, ignorance, or habit—which have compelled man into this dangerous course. It is sufficient for my purpose that these circumstances exist, and that, in consequence of the food habits they have fostered, normal bodily function cannot be sustained, and gastrointestinal function is one of the first to suffer.

“Let me emphasize this point: ‘Gastrointestinal function is one of the first to suffer.’ This truth is made manifest by the clinical evidences of disease that are first to appear in wild monkeys fed on deficient and ill-balanced food: loss of appetite, depraved appetite, vomiting, diarrhea, dysentery, anemia, unhealthy skin, asthenia, and loss of body weight. If the faulty food be persisted in, other symptoms manifest themselves later, due in the main to malnutrition of the central nervous system; but it is the gastrointestinal tract, the functions of digestion, absorption, and assimilation, that are among the first to fail in consequence of faulty food. These are the signs that our ship is running upon the rocks, and as good pilots, we must be aware of them. I often think that we are apt to assume more readily the office of savors of wrecks than of pilots whose function it is to prevent them.”

8. OVERLOADING THE HUMAN MACHINE

THERE is much misunderstanding of the causes of overeating. Certain classes of food, because of stimulating qualities, tempt to overeating and result in perverted appetite. These foods contain nutritional elements which are required in only minimal amounts, and which produce harm when taken in amounts above what “the living machinery requires,” and especially if taken in “double the quantity” the “system requires.” - *Counsels on Diet and Foods*, pages 132, 137. Among such foods are grain products (breads and cereals), eggs, cheese, and meats; also heavy protein legumes, such as beans and peanuts. The stimulating

quality of these foods is in the protein. In the science of nutrition, this stimulating quality is spoken of as a specific dynamic effect. It is in proportion to the quantity of the protein as related to, that is, above, the protein requirements of the body.

Meats have a greater stimulating effect than have other high protein foods. For example, Moore of Harvard found that a single meat meal such as a cat would eat called forth extra heart work equivalent to three or four additional hours in twenty-four. The common practice of eating the higher protein food in" amounts above what the body needs for growth (building material) and for maintenance (repair material) is not a precaution of wisdom, but a factor productive of degeneration.

From the minimal body needs Of 45 grams (for a man of 154 pounds) up to 60 grams (the Chittenden standard) or a little above, there is no evidence of harm if the diet is maintained in alkaline balance and is 75 per cent to 80 percent made up of fruit, vegetables, and milk. In acid-ash preponderance, fatigue and slowly accumulating nitrogen, sulfur, and phosphorus wastes produce various degenerative changes if the protein intake is in excess of minimal body needs.

Mary Swartz Rose makes a significant comment on this subject: "When protein is used as fuel, the nitrogen it contain is not an asset, but a liability, to be got rid of as speedily possible. There is thus a maintenance requirement for protein- which continues throughout life and is independent of muscular activity." - *The Foundations of Nutrition*, 1938 ed., p. 127.

When Protein Becomes a Liability

Any protein above the amount the body can use for growth and repair is used as fuel; that is, burned, with nitrogen, sulfur, and phosphorus wastes resulting. These wastes in the blood stream above a certain amount result in ultimate damage, with temporary disabilities occurring, such as fatigue and lessened working capacity and endurance. The statement regarding protein's being "not an asset, but a liability" when used as fuel, is an accurate scientific parallel to the spirit of prophecy statements concerning eating "more ... than the living machinery requires" and "double the quantity ... your system requires," coupled with the results specified as hindering "it in its work." These statements are certainly applicable to a protein intake above 70 grams, and especially up to 120 grams, which is actually "double the quantity . your system requires." Such an intake is not an uncommon practice with large numbers of individuals among civilized peoples.

Eggs are to quite an extent similar in amino acid composition to meat and are also of high protein content. They must be used with moderation. Cheese is likewise a food heavy in protein, of which one should not eat freely. A further reason for the need of much limitation in these foods of animal origin is explained by the researches of Newburgh and Marsh, H. B. Lewis, and A. C. Curtis, who have shown that of twelve common amino acids, two in large dosage were mildly harmful, and five produced serious kidney damage. They state that single doses of some amino acids, too small to give microscopic evidence of injury, would cause the appearance of abnormal urine if repeated only a few times, and that it requires about twice as much to give unequivocal microscopic evidence of kidney damage as is needed to produce casts in the urine.

The fuel foods-starches and sugars-may also be eaten to excess. The foods in these classes are spoken of by E. G. White as “rich and luxurious,” “the tempting dessert,” “every stimulating kind of food,” “Meat, highly seasoned gravies, and various kinds of rich cakes and preserves.”-Counsels on Diet and Foods, pages 138, 134, 188, 190.

As to the quantity of even good foods, this is said: It is possible to eat immoderately, even of wholesome food Nearly all the members of the human family eat more than the system requires.” Grain products are perfectly wholesome; yet even of whole-wheat bread or other whole-grain foods, such as oatmeal or corn bread, it is not only possible to overeat, but it is a rather common habit with some persons to partake of as high as nine slices of bread a day. Such large quantities of bread, cereals, and other grain products require an amount of fruits and vegetables for acid-ash neutralization that it is impossible to consume. The physical results of overeating are described by such phrases as “clogs the living machine,” “hinders it in its work,” “weakened and crippled,” “tired and weary feeling faintness or languor.” -Ibid., pages 131, 132, 134.

Research Has Demonstrated Results

In order to appreciate the great practical importance of the statements made in regard to the results of overeating, let us turn to the researches which have demonstrated the various results specified.

The weakening effects of protein in the diet in excess, hindering the body in its work, were shown by the researches of Russell H. Chittenden of the Sheffield Scientific School of Yale University, with his professional, soldier, and athlete groups on both high and low protein rations. The fatiguing effects of this diet, with lessened endurance, have been shown by numerous long- distance running, walking, and swimming contests, which have frequently been won by vegetarians. Irving Fisher of Yale University, working with tests such as the ergograph and horizontal arm holding, also showed the great superiority of vegetarians over meat eaters in endurance and foot-pounds of work done.

The fatiguing effects upon the heart muscle have been shown by Dr. Alexis Carrel of the Rockefeller Institute, who worked with the chicken-embryo heart. Accumulated wastes produced conditions like senility; washing out the wastes rejuvenated to active life at once. Though the work was done for an entirely different purpose, yet this informational by-product was so startling as to occasion emphasis by Carrel himself and also by Fisher and Fisk as a chief physiological lesson of crucial health importance. In human physiology, this progressive accumulation of wastes is so widespread as to be noted by Jay E. Shamberg as a rule of life arithmetical in progression with the advancing years. It is due not to the years as such, but to overeating of proteins with consequent accumulation of their wastes.

The acid-ash wastes from excess protein foods-sulfur and phosphorus-have weakening and fatiguing results more or less in common with the nitrogen wastes, and in practice they are inseparable.

The clogging, tissue-damaging, disease-producing effects of confections, cakes, rich desserts, and puddings have been shown. They are deficient in certain vitamins needed for the healthy action of the nervous system and alert mental grasp. It should be said that vitamins B, and B2 and niacin have been shown to have specific nerve function effects.

These are not alone valuable in the prevention of beriberi and pellagra, but are useful in the prevention of neurasthenia, neuroses, mental depression, and, melancholia.

Thus, overeating of both heavy protein foods and carbohydrates in the form of confections and rich desserts, produces end results which are properly described by the terms “weakened,” “tired,” “weary,” “languor.” Technically, the expression, “clogs the living machine,” applies to both classes in a definite scientific sense.

There is a remedy for overeating among intelligent and Christian people. It is plainly stated: “Were all men acquainted with the living, human machinery, they would not be guilty of doing this.”-Ibid., page 131. This means that we, as intelligent men and women, should become acquainted with the nutritional requirements of the body. To avoid overeating, we must know what damage results from eating food in excess of our requirements, and how much is excessive.

There are certain other classes of food of which there is little or no danger of overeating. They do not produce perversions of appetite. Their bulky nature, with a low protein, large water component, and soft cellulose structure, are non stimulating, and they are not at all likely to do harm by any excess one could eat. These are protective foods-fruit, vegetables, and milk-that contain the larger amounts of the regulatory and protective substances. Vitamins and minerals are more largely found in this class.

On the contrary, some of these vitamins in amounts of twenty to one hundred times the supposed body requirements give unusual protection against disease, infections, and various poisons. In some diseases several thousand times the requirement of vitamins for the normal person produces spectacular recoveries. Among those vitamins are certain fractions of the B complex and vitamin C. Among minerals, calcium serves a unique purpose. Double the supposed body requirements for health and normalcy gives increased longevity and improves health and efficiency.

Daily Nutritional Needs

Fasting for short periods is physically beneficial and health promoting for those who overeat. Were it not for overeating, fasting would be largely unnecessary, and entire abstinence from food would be harmful. The foods of which people overeat do not contain enough alkaline ash to neutralize and hasten the elimination of their nitrogen and acid wastes. Also, the activities of the body and its chemical changes constantly produce acid wastes, and these require alkaline-ash foods for neutralization and elimination.

Hence, a scanty diet often results in so-called acidosis. Shopper’s headache occurring before a late noon meal is an example. Headaches in general are often due to overeating of heavy protein, acid-ash foods, and sweet desserts; or, they may be due to a coffee-and-toast breakfast, or no breakfast at all, or a scanty or late noon lunch. Thus, in the latter case, the person lives on his own tissues-a meat diet.

Faddists are frequently encountered who are ardent advocates of long fasts. They make absurd promises of cures or improvements in health, and extravagant claims of marvels performed by fasting. They even undertake to fast clients by mail, fees to be paid in advance. In the practice of medicine, persons are occasionally met who have done themselves irreparable harm by following such spurious advice. The absolute fast for a

period of days or weeks is generally inadvisable, and is to be undertaken only under the specific care of a competent physician.

Counsels on Diet and Foods states: “The true fasting which should be recommended to all, is abstinence from every stimulating kind of food, and the proper use of wholesome, simple food, which God has provided in abundance.”-Page 188. On the next page, a fruit diet for a few days, is suggested as a proper fast. Such a diet supplies the needed vitamins and the necessary carbohydrate to maintain tissue metabolism. It adds only an insignificant amount of protein, while it greatly aids and hastens the elimination of accumulated excess protein wastes-nitrogen, sulfur, and phosphorus-by means of its alkaline-ash constituents.

If fruit and low protein vegetables were freely used a few days by those who have for years overeaten of heavy protein and other rich foods, much benefit would result, and no harm would need be feared. That no harm could result was shown in 1928 at the Mayo Foundation when a man was kept for sixty three days on a diet entirely devoid of nitrogen (protein free), but with all other elements supplied. No noticeable physiological disturbances resulted.

Certainly if this nutritive procedure, entirely free from protein, could be prolonged more than two months without harm, no one need fear a prompt nutritive debacle from a few days’ fast in which vegetables and fruit were abundantly supplied. Although such fasting is highly beneficial physically and mentally to those who overeat, it need find but little place in the life of those Christians whose daily habit is a well-balanced dietary. When a regular meal is omitted for a religious fast, it is best to use fruit in its place as suggested. By maintaining a physiological balance, the free use of fruits and vegetables aids mental reactions. On the other hand, overeating of high protein, acid-ash foods, or of sweet desserts, is one of the physical causes of inability to appreciate intellectual and spiritual themes.

What Constitutes the True Fast

“The true fasting which should be recommended to all, is abstinence from every stimulating kind of food, and the proper use of wholesome, simple food, which God has provided in abundance.” - Ibid., page 90.

This is a significant statement, indicating that the daily use of simple, wholesome food in proper amount and abstaining from unhealthful and stimulating food are regarded by God as the true physical fast.

“All the fasting in the world will not take the place of simple trust in the word of God. ‘Ask,’ He says, ‘and ye shall receive.’ You are not called upon to fast forty days. The Lord bore that fast for you in the wilderness of temptation. There would be no virtue in such a fast; but there is virtue in the blood of Christ.” “The spirit of true fasting and prayer is the spirit which yields mind, heart, and will to God.”-Ibid., page 189.

A careful reading of Isaiah 58 (addressed to the Jews, to whom a “fast” had come to mean the height of religious ceremony) makes it clear that God requires no rigorous doing of penance.

“The true fast is no mere formal service. The Scripture describes the fast that God has chosen, ‘to loose the bands of wickedness, to undo the heavy burdens, and to let the oppressed go free, and that ye break every yoke;’ to ‘draw out thy soul to the hungry, and satisfy the afflicted soul.’ Isaiah 58:6, 10. Here is set forth the very spirit and character of the work of Christ. His whole life was a sacrifice of Himself for the saving of the world. Whether fasting in the wilderness of temptation or eating with the publicans at Matthew’s feast, He was giving His life for the redemption of the lost. Not in idle mourning, in mere bodily humiliation and multitudinous sacrifices, is the true spirit of devotion manifested, but it is shown in the surrender of self in willing service to God and man.”-The Desire of Ages, page 278.

9. REGULARITY IN EATING

THERE are no more commonly disregarded laws of physiology than those upon which the statements and advice given in this section are based. The first of these, concerning the necessary time between meals, is a matter of common knowledge to every physician who makes X-ray examinations or is even casually acquainted with them. In a normal individual four and a half or five hours are required for the stomach to empty completely after each meal. Food put into the stomach before it has entirely emptied from the previous meal, causes that meal to be further held in the stomach, often several hours longer than it should be. This allows the mixed and partially digested food to undergo decomposition, fermentation, and even putrefaction. The delicate structures and mechanisms of the stomach and other organs are injured. The glandular secretions are altered, and in time the muscle tone of the stomach is impaired. Abnormal chemical products of this decomposition disorder the nerve mechanism, blood vessel action, and many other functions. Headaches, sour stomach, morning-after depressions, excess or deficiency of hydrochloric acid, and impairment of digestive activity often result. These are only a few of the direct results. Many other indirect effects of a disturbing and disease-producing nature occur.

The popular custom of evening dinners, banquets, and late suppers impairs the appetite for breakfast and makes people believe that the no-breakfast plan is better for them. “This is reversing the natural order.”-Counsels on Diet and Foods, page 181. The truly physiological requirement is for a substantial breakfast, a larger midday dinner mostly of vegetables, and a light supper. For sedentary workers two meals only, or two meals and a light supper, are best. With the addition of physical labor “the objection to the third meal is to a great extent removed.”-Ibid., page 178. The reason for this, as we now know it, is not that physical labor requires more protein food, but more fuel food, that is, more calories, which should come largely from the natural unrefined carbohydrates of vegetables, fruit, milk, and whole-grain breads and cereals.

Few realize the great amount of harm which comes from nibbling at confections, peanuts, ice cream, sandwiches, or other food between meals. People are often advised to take milk between meals as a means of improving nutrition. But even this is not advisable. In the Berkeley, California, schools one group of children was given a glass of milk between meals and another group a glass of orange juice. It was found that those having the fruit juice did much better and had a keener appetite for their regular meals than those who were given the milk between meals. The reason is plain. Fruit juices require no stomach

digestion and pass on into the intestine almost immediately. On the contrary, the milk must be curdled by the rennin of the gastric juice and so is a solid food requiring stomach digestion the same as cheese. Fruit juices are often better taken before or between meals so as not to lessen stomach capacity for the meal itself. Instead of interfering with the appetite for the regular meal, they improve it.

X-Ray Evidence

By means of X-ray examinations of the stomach it is possible to determine how long the emptying time of the stomach after a regular meal is delayed by food taken between meals. The outlines below are from two groups of such experiments. In the first a breakfast of cereal and cream, bread and butter, cooked fruit and an egg, was given. The stomach was empty, or nearly so, in four hours. On other days this same meal was repeated, but with various other foods eaten two hours later. The results in prolonging the stay of the food in the stomach are given below.

Food Two Hours After Breakfast Break fast Left in Stomach

An ice-cream cone . A residue remained at 6 hours.

Nut butter sandwich A large residue at 9 hours.

Pumpkin pie and glass of milk . A residue at 9 hours.

A banana A residue at 8 hours.

In another series of experiments (Life and Health. September, 1931) where an ordinary normal breakfast was eaten, the stomach was completely empty in 4.5 hours. After breakfast, on another day, every hour and a half a slice of bread and butter was eaten, but no dinner. Half of the breakfast remained in the stomach at nine hours. No further X-ray examinations were made, so complete emptying time was not known.

After breakfast of the same foods, every hour and a half a five-cent milk chocolate bar was taken. Half of the breakfast remained in the stomach at nine hours.

Again breakfast was eaten at 8 AM; dinner at noon; supper at 5:30 PM. Twice in the forenoon and twice in the afternoon chocolate candy was eaten. At 9:30 PM more than half the breakfast was still in the stomach - 13.5 hours after breakfast was taken.

A ten-cent bag of peanuts was carried in the pocket and a few eaten at irregular intervals. Eleven hours later a large amount of the breakfast was still in the stomach. In another individual the stomach after breakfast was empty in six hours. A slice of bread and butter was taken halfway between breakfast and dinner. A small amount of the breakfast remained in the stomach eight hours after it was eaten.

“If all would eat at regular periods, not tasting anything between meals, they would be ready for their meals, and would find a pleasure in eating that would repay them for their effort.” Counsels on Diet and Foods, page 179. Besides this pleasure of a keen appetite and relish for food many distresses and even serious disabilities would be avoided.

10. NARROW VIEWS AND DEFICIENT DIETS

THE history of Christianity is filled with extremes, both fantastic and fanatical. Those who do not reject the word of God may go to such inconsistencies that the truths of God's word appear ridiculous to those of good judgment. Most of these inconsistencies are based upon some text taken by itself or out of its logical setting without comparing it with other equally plain statements or with the only logical conclusions one can possibly draw from the blended divine mercy and justice of the Creator and the whole background of the great sacrifice made on Calvary for the human race.

Besides these extremes it is easy enough to find apparently contradictory statements in the Bible, if one is looking for them. One text says, "Answer not a fool according to his folly;" but the next verse says, "Answer a fool according to his folly." As in the Bible so in the testimonies there are some things hard to understand. As we cannot "by searching find out God," so there will always be some things we cannot fathom either in this world or in the next. "Thy word is a lamp unto my feet, and a light unto my path." If any man will do His will, he shall know of the doctrine."

We should seriously question those pronouncements which accept the spirit of prophecy with reservations, rather than with analytical study, sanctified judgment, and due comparison of all statements made on a given subject.

A young physician, when asked about certain statements in the Testimonies on health, replied: "You must remember that they were written before the days of science." Men another person, after stating the spiritual benefit derived from *The Desire of Ages*, asked a minister about something not understood in the Testimonies on health, he replied: I am glad that you

find *The Desire of Ages* so helpful. Forget about the other." This situation of disbelief on the one hand and of fanatical, though zealous, extremes on the other, had to be dealt with years ago. Inasmuch as it still exists, it is profitable to give this subject of extremes in diet most careful and detailed study. "When those who advocate hygienic reform carry the matter to extremes, people are not to blame if they become disgusted. These extremists do more harm in a few months than they can undo in a lifetime." -*Counsels on Diet and Foods*, pages 195, 196. As stated in the context of that quotation, such extremists can be divided into two classes. First, those who "adopted the reform because someone else did. They did not obtain a clear understanding of its principles for themselves." Second, "the other class take wrong views of the reform. They adopt too meager a diet. They subsist upon a poor quality of food, prepared without reference to the nourishment of the system. It is important that food be prepared with care, so that the appetite, when not perverted, can relish it."-*Ibid.*, page 196. It is difficult to say which is the larger class. The second gather the more fanatical extremists, while attracting few who wish food to appeal to the taste. In the first class are those who do not study for themselves, those who follow blindly. Like the blind who lead the blind, both fall into the ditch either of ill-health or of apostasy, being carried about by every wind of doctrine.

Those who have difficulty with certain foods or combinations, and who urge upon others the supposed principles of their own limitations, are next considered, but with

the admonition: “No one should think himself a criterion for all. Not all can eat the same things. Foods that are palatable and wholesome to one person may be distasteful, and even harmful, to another.”-Ibid., page 198. This writer cannot eat strawberries without annoying and painful results, but this is not because strawberries are unwholesome; it is merely his own personal peculiarity, or “idiosyncrasy,” as it is called.

Some wish to set down rigid rules which they say all must adhere to. This is narrow, unscientific, and contrary to the counsel of the spirit of prophecy. It is impossible to make an unvarying rule to regulate everyone’s habits.”-Ibid., page 198.

Healthful living does not consist mainly in prohibitions and restrictions, or in leaving something out of the diet; but it consists chiefly in partaking freely of the bountiful supply of wholesome foods which God has provided. Too meager a diet, too limited a variety, poorly prepared or unappetizing food, are not health reform.

Fruits and Vegetables Together

One of these restrictions which is necessary for some sick persons many have taken as a rigid, unalterable rule for everyone, sick and well alike, though it is impossible to find in agreement any two who take such a stand. They make various exceptions, no two alike. This food disagreement is the matter of combining fruit and vegetables at the same meal. It is plainly stated in one place that this is a bad combination “if the digestion is feeble.”-The Ministry of Healing, page 299. In another place where this difficulty is mentioned the admonition is directed definitely to a sick man to whom an experienced physician said: I took notice of your diet. You eat too great a variety at one meal.”-Counsels on Diet and Foods, page 113. There are some supposedly well persons who must refrain from eating coarse vegetables with the readily fermentable fruits and fruit juices. Of sick people there are many who have abdominal distress because of the gas which forms when such combinations are made. These are mostly those who have irritable colons (so-called colitis), no acid in the stomach, or who have much gas and stomach distress because of gall-bladder disease, the gas and distress of which occurs regardless of what is eaten, but which may be made worse by certain foods or combinations of food. These foods or combinations productive of gas are extremely variable with different individuals, so that no hard and fast rule can be applied to all. These colonic lamentations often result in leaving off one article after another until extreme deficiency disease and real colitis exist, and in some cases these unreasonable prohibitions have been the first cause of the lamentations of the colon.

The majority of well people have no difficulty with the use of fruit as dessert with the vegetable meal and find even less abdominal distress than when cakes, puddings, and other sweet desserts are used, as is the common American custom. Fruit is nature’s dessert. Let each one make his own individual application, since avoiding this combination is definitely stated as desirable if the digestion is feeble.

Cheese and Its Relation to Disease

“Hundreds of millions of pounds of cheese are produced annually in the United States; the per capita consumption is placed conservatively at more than seven pounds per person per year; its wholesomeness depends on the quality of the milk from which the

cheese is made and the sanitary conditions from the farm to consumption. Important factors are the health and environment of the milk-producing animals and the human beings who participate in the production and distribution of cheese. Apparently public health agencies have given insufficient attention to the sanitary safeguards necessary to insure a safe product. F. W. Fabian has compiled a list of fifty-nine epidemics of disease traced to cheese since 1883. These epidemics caused 2,904 cases of illness and 117 deaths. Probably still more outbreaks occurred, as a thorough search of the foreign literature has not been made. The most frequently reported disease was food poisoning, which accounted for 61 per cent of the epidemics; typhoid fever accounted for 27 per cent of the epidemics and for 97.4 per cent of the total number of deaths, or 1 death for approximately 12 cases of typhoid. In contrast to the high mortality for typhoid, none of the 1,389 cases of food poisoning was fatal, indicating that the pathogenic organisms did not remain viable in cheese long enough to produce enough toxin to cause death. The most recent typhoid epidemic in Fabian's list occurred early in 1946 at Cornwall, Ontario, Canada. Nineteen cases in this outbreak were traced to cheese from a factory which obtained milk from a farm on which a typhoid carrier lived. A study of these epidemics showed that the cheese generally was made from raw milk and that it had been sold too soon after manufacture. Experiments on the longevity of bacteria in cheese showed that the pathogens die out more quickly when the cheese is aged at high rather than at low temperature. Fabian concludes that if all milk and cream used in the manufacture of cheese were pasteurized and the cheese aged at the higher temperatures, epidemics of infectious diseases resulting from the consumption of cheese would not occur. Epidemics have not been traced to Swiss cheese, the manufacture of which requires heating the milk to a higher temperature than in making Cheddar cheese; however, Swiss cheese apparently cannot be prepared from pasteurized milk. While efforts toward requiring pasteurization in making cheese have been made for many years, Fabian says that cheese makers have resisted pasteurization because it requires a somewhat different technique. The Dairy Division of the U. S. Department of Agriculture has demonstrated, however, that it is possible to make high-quality cheese more uniform in flavor from pasteurized milk; also that by using a good grade of pasteurized milk and cream and adding a starter, it is possible to age the cheese at a much higher temperature and thus reduce the aging period by at least 50 per cent. The pasteurized milk method, when properly used, will kill all asporogenic bacteria which have been responsible for epidemics. Likewise, a higher temperature for the ripening process will help kill pathogens that have escaped pasteurization or got into the cheese after pasteurization. The organisms most commonly associated with cheese-borne infection are members of the Salmonella group, the Staphylococci, the Brucella group, and the Clostridium botulinum. Only seven states-Alabama, California, Colorado, Illinois, Indiana, New Jersey, and New York-and Canada require that cheese be made from pasteurized milk and cream or be held in storage for periods varying from sixty to one hundred and twenty days in lieu of pasteurization. The sixty-day holding period is considered too short, especially if cheese is held at a temperature of 40' to 50' F. A ninety-day holding period is preferable, and one of one hundred and twenty days is still better." - The Journal of the American Medical Association, Volume 135, Number 11, November 15, 1947, Page 718.

Milk and Eggs

The discarding of all dairy products and eggs is another extreme which a few overzealous persons have 'in the past advocated. Fortunately, the large majority of Adventists have used good sense and moderation. Milk and butter from diseased animals readily transmit infections, some of a very serious nature. This is one side of the matter and a very important one. It is recognized by all that inspection of dairy animals and government restrictions are necessary and legitimate. With the increase of knowledge regarding the transmission of infectious diseases by milk and dairy products the matter has assumed large proportions. Streptococcus infections of quite a variety, tuberculosis, undulant fever, scarlet fever, and other infections are communicated, sometimes in epidemics of considerable extent. Edward C. Rosenow, M.D., found in one Army camp during World War I a large epidemic of mumps which he traced directly through a shipment of cheese to a certain cheese factory and dairy where there were cows with an udder infection. The epidemic stopped promptly when the food involved was destroyed and the source cleaned up.

The increase of disease among animals makes pasteurization or boiling of milk a necessity unless frequent and thorough inspection is carried out. This increase of disease is spoken of in the testimonies on diet. "The time will come when we may have to discard some of the articles of diet we now use, such as milk and cream and eggs; but my message is that you must not bring yourself to a time of trouble beforehand, and thus afflict yourself with death. Wait till the Lord prepares the way before you." -Counsels on Diet and Foods, page 206. See also page 208 and Testimonies, Volume 9, p. 162. The expression in this statement, "and thus afflict yourself with death," is one that will bear some study. Is it really a serious health matter to discard all dairy products and eggs? In the case referred to it led to a most serious blood deficiency disease at that time invariably fatal, but which was relieved with return to health when the instruction given was followed. Part of this instruction is most interesting from the standpoint of food research which was done nearly 30 years after the time it was first written. The testimonies on diet and foods were nearly all written long before the days of the scientific research which has verified their truthfulness and accuracy; but it has verified them, and in no case has a single statement been proved false.

This was the instruction given in 1901: "You must not deprive yourself of that class of food which makes good blood. When you see that you are becoming weak physically, it is essential for you to make changes, and at once. Put into your diet something you have left out. It is your duty to do this. Get eggs of healthy fowls. Use these eggs cooked or raw. Drop them uncooked into the best unfermented wine you can find. This will supply that which is necessary to your system." -Counsels on Diet and Foods, page 204.

The disease in question, pernicious anemia, has been found to be due to a deficiency in the diet, in stomach function, or in liver function. The liver is the largest storehouse of vitamins of any organ of the body. Both animal and fish livers contain vitamins A, D, and G in large amounts and all, or nearly all, parts of the B complex which accompany vitamin G or B2. These vitamins are also found in good supply in eggs. It is known that normal liver contains something which has to do with blood formation, preventive of both pernicious and secondary anemias.

Why eggs should have been advised both cooked and raw in this case may not be entirely clear, but it is significant that a certain degree of heat separates riboflavin (formerly known as lactoflavin, or vitamin B2 or G) from vitamin B, because it is resistant to heat, while B, (thiamine chloride) is destroyed by a high degree of heat. The raw white-of-egg contains a substance called "avidin." It is injurious when used in any free or large amount because it neutralizes or binds biotin, one of the vitamins of the B complex. Nevertheless the bacteria-destroying power of mucus which resides in a digestive enzyme called "lysozyme" is dependent upon this complex of avidin-biotin for its activity. This may be the scientific explanation for the use of eggnog made with raw as well as cooked egg. See Nutrition Reviews, Volume 3, Number 2, February, 1945, Pages 36, 37; Meyer, Science, 99:391 (1944); Lawrence, Ibid., 99:392 (1944). It is also known that several parts of the B complex, of which there are six or more fractions, are often associated in deficiency diseases, and these parts are found abundantly in the foods which prevent these diseases. Vitamins A, B, G, and E are found in good quantities in milk, and vitamins A, B, D, and G are found in eggs in, large measure. Two parts of these instructions are significant as revealing nutritional facts entirely unknown to science at the time they were written in 1901, though they may not both have direct application to the blood disease under consideration. The first of these statements reads: "Eggs contain properties that are remedial agencies in counteracting certain poisons."-Counsels on Diet and Foods, page 2-07. In addition to the more commonly known effects of vitamin A in controlling the reproduction, development, growth, structure, and function of all the epithelial tissues of the body, another one was discovered by Mellari by. This effect is stated briefly in a review on vitamins appearing in The Journal of the American Medical Association in 1932, (June 10 and later reprinted in book form, "The experimental researches of Mellari by have shown that diets containing a large amount of cereals and deficient in vitamin A or carotene, when fed to young puppies caused degeneration of the spinal cord in the form of demyelination of the nerve fibers. Moreover, it was definitely established experimentally that the effect of the neurotoxin of ergot and cereals is neutralized by this vitamin." Embryologically the spinal cord is derived from epithelium, hence the relationship of vitamin A to it. This spinal cord degeneration is especially notable when vitamin A is withdrawn at the time of weaning. Now vitamins are not considered antidotes to poisons; they are related to disease by deficiency or absence. Here, however, is an effect scarcely distinguishable from that of a neutralizing or counteracting agent.

Not only does this property of eggs (vitamin A) neutralize or counteract the effect of the nerve poison of ergot (smut on grain), but it also counteracts the nerve poison of a diet high in good cereals. This main effect of vitamin A in unbalanced diets was later confirmed also by Hughes of the Kansas Agricultural Experiment Station (1928), Elvehjern and Neu of the University of Wisconsin 1932), Krauss of the Ohio Agricultural Experiment Station 1932), and by Zimmerman and Cowgill of the School of Medicine of Yale University 1933).

Vitamin A is one property of eggs, vitamin D is another, and relative to this we have another counteracting effect on the poisons of a diet excessive in cereals. "Soon after Mellari by's original announcement of the discovery of the dietary cause of rickets, he made a second startling statement to the effect that cereals, especially oatmeal, not only do not contain vitamin D but do contain some definite anti calcifying substance. Continuing his work on dogs, he found that a diet which was deficient in vitamin D, when other dietary and environmental factors remained the same, doubling the amount of cereal, made the rickets

distinctly worse.”-The Journal of the American Medical Association, July 23, 1932. This particular counteracting agency may or may not have a direct effect on the blood disease in question, but here again is a poison found in perfectly wholesome cereals which is counteracted in its harmful effects by vitamin D, a nutritional property of egg yolk. Calcium has a far wider effect in the system than just that upon bones or in preventing rickets, and two of the most notable of these effects are in relation to the nervous system and the muscles, especially the automatic rhythmicity of the heart muscle.

Elaborating upon this research by Mellariby, is the further investigation into the nature and source of the poison which is neutralized by vitamin D, which vitamin controls the metabolism of calcium throughout the body and particularly the absorption and elimination of calcium and phosphate.

“Recently Mervish, by methods similar to those of Mellariby, has obtained from oatmeal an extract which will lower the blood calcium of rabbits 30 per cent in from twenty-four to forty-eight hours after intraperitoneal injection, with a return to normal in approximately seventy-two hours.” A further fact showing that this property of eggs-vitamin D, whether from eggs or other sources-counteracts certain poisons is found also in the work of Mellariby. “Mellanby himself was the first to show that the anti calcifying effects of cereals or cereal extracts may be completely nullified by supplementing the diet with adequate amounts of vitamin D in the form of cod-liver oil, egg yolk, or irradiated fats, or by irradiating the animal, or even the cereal itself. One immediately calls to mind the fact that whole races of people, notably the Highland Scotch and many peoples of the Orient, have lived for generations on diets consisting largely of cereals. The Highland Scotch, particularly, have been a sturdy race, noted for their fine physical development. Their diet has, however, been well calculated to overcome the deficiencies of the cereal, since it contained an abundance of milk and fish. In tropical countries the sunlight undoubtedly performs the same function.” - The Vitamins, 1932 ed., p. 151.

We have, therefore, at least two properties of eggs which counteract certain poisons found in wholesome food-the grains: oats, corn, barley, rye, rice, and wheat. Breads and cereals constitute a large part of the diet of vegetarians not using dairy products and eggs. So these acid poisons are present in large proportions, and with no milk, cream, butter, cheese, or eggs in the diet, there is deficiency of vitamin A and none of vitamin D in the diet, leading to serious malnutrition. Moreover, in a country of fog and smoke not much could be expected from the ultraviolet of sunlight to help in forming vitamin D in the body itself. With absence of these fats (butter fat and the fat of egg yolk) even the carotene of green and yellow vegetables and yellow fruits could not be adequately absorbed, so vitamin A made in the liver from plant food sources is also deficient. “Wilson, Das Gupta, and Ahmad studied the influence of the fat content of the diet in relation to the absorption of the carotene of raw carrots or of cooked spinach in an adult human subject. They found that only about 50 per cent of the carotene was absorbed when the diet was devoid of fat, whereas, from 80 to 90 per cent was absorbed when the diet contained moderate amounts of fat.” - The Vitamins, 1939 ed., p. 113.

In this connection it is also interesting to note the testimony statement in regard to the use of milk in the preparation of food. “Do not remove milk from the table or forbid its being used in the cooking of food.” - Counsels on Diet and Foods, page 203. “Vegetables should be made palatable with a little milk or cream, or something equivalent.” -

Ibid., page 207, or Testimonies, Volume 9, p. 169. In the case of cooked spinach it is customary to serve it with a little butter and hard-boiled egg. The fats of milk, cream, butter, and egg yolk provide the element needed to get the full value by absorption of even the provitamin A (the carotene of plants), and besides this, the supply of the preformed vitamin A itself was entirely lacking because it is not found in plants. This means that a vegetarian not using milk, dairy products, or eggs would be without the preformed vitamin A and would get only about half the value of the provitamin A from plant sources. A deficiency therefore would result.

Still another element in this instruction, namely, to use eggs raw in unfermented wine, has definite nutritional importance. It is not merely a palatable way of eating raw eggs. The unfermented grape juice has biochemical effects not generally known, and these effects are also especially needed to counteract the effects of a large amount of bread and cereals in the diet. Grape juice is not an acid-ash food but an alkaline-ash food, while cereals are all acid in ash. Grape juice is, nevertheless, acid in the digestive tract from the standpoint of true acidity; that is, hydrogen ion concentration. "The true acidity exerts its effect principally on absorption from the intestinal tract. On the acid side the absorption of calcium and phosphorus is facilitated; on the alkaline side the absorption is retarded or inhibited." - *The Vitamins*, 1939 Edition, Page 468. This means that grape juice facilitates the absorption of calcium and phosphorus, while such alkaline as baking soda, so extensively used for "sour stomach" and for gas on the stomach, retard or prevent the absorption of calcium and phosphorus. Grape juice, therefore, helps vitamin D in its work with calcium and phosphorus, in so far as the absorption of these elements from the food is concerned. But this is not all its function. "Foods which are potentially alkaline tend toward diminished excretion and hence to a greater retention of calcium and phosphorus in the body." This means that grape juice also helps by conserving the supply of calcium and phosphorus already in the body. On the contrary, such acid-ash foods as cereals cause losses of this supply. "Acid foods, meaning those which have an excess of the acid elements, increase the excretion of calcium and phosphorus." "The total effect is, therefore, the resultant of the true and the potential acidity of the food."-Ibid., page 468.

"An advance has recently been made by Hamilton and Schwartz, who were able to separate and combine the effects of diet on absorption and metabolism. By the use of a diet which provided an excess of organic acid and an alkaline ash, they facilitated both absorption and retention of calcium and phosphorus.... These workers were able to convert rachitogenic diets into normal diets by the addition of organic acids and alkaline ash. The diets contained additions of tartaric acid and sodium tartrate. Shohl found that these effects were not entirely due to the acid-base properties of the diet, but were due also to a specific organic acid effect, in which the tartrates were involved. The citrate ion showed even more pronounced effects. Additions of citric acid plus alkaline residue to rachitogenic diets were found to prevent or cure rickets. This result was obtained not with a single type of diet but with several widely different combinations of calcium and phosphorus." - Ibid., pages 466-469. This is also the effect of vitamin D; namely, to correct the rachitogenic effects of a high cereal diet with even widely varying proportions of calcium and phosphorus. "There is no reason to believe that vitamin D acts directly on bone cells to promote calcification." - Ibid., page 462. "The main action of vitamin D is to increase the absorption of calcium and phosphorus or to diminish their intestinal excretion." - Ibid., page 474.

Grape juice and orange juice in their end effects and even in their manner of effect act precisely as does vitamin D upon calcium and phosphorus in correcting the harmfulness of a diet unbalanced by an excess of cereal food.

. In connection with the effects of fruit acids upon calcium and phosphate metabolism, it should be pointed out that the use of lemon juice on spinach, various other greens, lettuce, and on all salads is a most highly beneficial practice. It makes a maximal calcium ration available to the body from vegetables by increasing its absorption from these sources, and, of course, decreasing also the excretion of calcium by the kidneys and intestinal mucosa, as has been shown by Schwartz and Hamilton, and especially by Shohl for the citrate ion. Hitherto it has been considered that an adequate calcium ration could be obtained only or principally from milk, of which many adults take but little. This action of the acid organic salts of fruits, -similar to that of vitamin D, if carried out by the free use of salads with lemon juice, would provide the larger calcium ration which could otherwise be obtained only from an entire quart of milk daily. There is also another important feature of the free daily use of salads served with olive oil, mayonnaise made with olive oil or other oils and lemon juice, or the use of butter and lemon juice on cooked greens. It is providing for a much larger absorption of carotene the plant provitamin A which has to do with the healthy action of vastly more functions of the body than does any other nutritional element. As pointed out previously, a moderate amount of fats and oils increases the absorption of carotene from only 50 per cent where there are no fats in the diet up to a maximum of 80 or 90 per cent if this element is present with the plant food consumed.

Lastly, the work of Sherman on calcium should be borne in mind. His earlier work on calcium derived from milk, and the later work of Sherman and Campbell, demonstrated by the addition of pure calcium carbonate that it is the calcium itself and not any other constituent of the milk that adds so notably a whole group of benefits. After Sherman had kept rats thriving in the twenty-seventh generation on a uniform diet, he added to their diet an amount of calcium equivalent to that in the second pint of milk. He then reported, in 1931, "an improvement in the general nutritional condition as shown by a whole series of criteria, such as more rapid and efficient growth, lower death rates and higher vitality at all ages, an increase of 10 per cent in the average longevity of adults, and greater extension of the prime of life, in that maturity is expedited and senility deferred in the same individual."-The Journal of the American Medical Association, Nov. 14, 1931. At the same time he stated: "My associates and I are now engaged in working out the role of individual chemical factors in this improvement of an already normal nutritional condition." In 1935 the report on these individual chemical factors appeared. Mary Swartz Rose gives this summary: "Shennan and Campbell have observed the effects of two diets differing only in calcium content through several generations. The first diet consisted of five-sixths ground whole wheat and one-sixth dried whole milk with added common salt, and distilled water to drink. On this diet rat families have prospered for as many as forty generations, hence there is no doubt that it is an adequate diet. The second diet differed from the first only in the addition of calcium carbonate to make the calcium intake equal to a quart of milk instead of a pint. On this calcium-enriched diet, growth was somewhat more rapid and average size at a given age somewhat greater, as shown by growth curves for each sex. The appearances and behavior of the adult animals indicated that the more liberal calcium intake resulted in a higher vitality and its maintenance over a longer time. The females matured somewhat earlier, showed a longer period of ability to bear young, and reared a higher percentage of them. The males,

not having the strains of maternity, manifested their greater vigor by longer life and a longer period between the attainment of maturity and the onset of senility. Thus, improved growth, greater adult vitality, lowered death rates, and increased length of life show that increased calcium improved the nutritive value of a diet which by all ordinary signs would be judged adequate.

‘In human nutrition’ Sherman points out, ‘the enrichment of the diet in calcium should normally be accomplished, not by the use of calcium salts as such, but rather by increasing the consumption of calcium-rich food, especially milk, which contains along with its abundant calcium content, such proportions also of phosphorus and other mineral elements as to ensure improvement of the dietary in its mineral content as a whole.’ - *The Foundations of Nutrition*, 1938 ed., p. 171.

After speaking of the necessity of a liberal supply of calcium for the bones and teeth, Mary Swartz Rose says: “Not so readily apparent, but of even greater significance, is the part played by this element in the regulation of body processes. Some of the ways in which its functions have already been mentioned in discussing the general effects of minerals; namely, the control of the contractility of muscles, and particularly the rhythmic beat of the heart; the preservation of the normal response of nervous tissue to stimuli; and the coagulating power of the blood. In addition to these very important functions, calcium is a kind of coordinator among the mineral elements. As has already been said, these must be nicely balanced in order that all parts of the body may function successfully; if sodium, or potassium, or magnesium, for instance, should tend to be too much in the ascendancy, calcium is capable of correcting the disturbance which they might make, whether it be in the direction of increased or decreased irritability. Altogether, it is highly important that the organism have at all times an adequate supply of this element.”-*Ibid.*, pages 163, 164.

How many of all these effects may have had a direct application to the particular condition of blood disease in question cannot be stated with certainty. In addition to the properties of eggs which counteract certain poisons, we have also in grape juice certain chemical properties which counteract the poisons of a diet excessive in cereals. As there are other vitamins in eggs, such as B, and riboflavin, which have profound effects, we can only point out that all these vital elements are necessary for the perfect functioning of the human mechanism and the instruction, “Put into your diet something you have left out” (*Counsels on Diet and Foods*, page 204), is most highly scientific. Though given in simple language and in terms only of well-known foods, these instructions are found to be based upon a whole group of profound biochemical laws, which were wholly unknown to any scientist or research worker in nutrition when they were given to correct the disease resulting from certain extremes in diet. Some of these principles, which apply also to many other deficiency states, are even now but little emphasized in the science of nutrition, though of the greatest practical health importance. Thus it is more clearly seen how important it is to avoid all these extremes.

“Those who understand the laws of health, and who are governed by principle, will shun the extremes, both of indulgence and of restrictions. Their diet is chosen, not for the mere gratification of appetite, but for the up building of the body. They seek to preserve every power in the best condition for highest service to God and man. The appetite is under the control of reason and conscience, and they are rewarded with health of body and mind.” - *Counsels on Diet and Foods*, page 198.

Further Research Regarding Milk and Eggs in Nutrition

In studying the testimonies on health or medical practice, it to be noted that they tell ultimate effects or end results of certain errors in diet, of wrong habits of eating, or of drugs. They but rarely give the mode of action in disease production or of improvement in health by diet or treatment. The same is true of methods of treatment of disease which are spoken of as approved of God or as God's plan. These latter are said to be in harmony with the laws of physiology which the Creator has established in the body. Consequently physicians and all people are urged to study the laws of physiology, of nutrition ' and of nature's means of combating disease or of disease prevention and disease

treatment.

A single sentence may cover in one mere affirmation that which takes many steps in research and years of time and projected analytic experimentation to demonstrate. Secondary, qualifying, or contributing factors in a given end result are not usually included. Such factors may be discovered by different scientists and be years apart. Quantitative considerations are not always elucidated, such as that some foods are necessary and health-producing in small or moderate amounts while harmful in large amounts or proportions. However, these are given in a few cases. One is regarding the free use of eggs, another regarding the proportion of nuts in nut foods. We speak of these as balance in the diet. In some cases, time, national custom, or fashion, methods of production, processing, or marketing, may radically change the diet of people generally in this matter of balance.

Concerning the harmfulness of meat eating, it is principally emphasized as life-shortening. How this is brought about, no intimation is given. But voluminous research by many workers has not only demonstrated its correctness, but also in great detail the mode of action by which such diseases are produced that shorten man's life. In the case of one who had discarded milk and custard from his diet and suffered from pernicious anemia as a result, the statement was made: "Eggs contain properties that are remedial agencies in counteracting certain poisons." - Testimonies, Volume 9, p. 162. About twenty years after I read this testimony and thirty years after it was written, Mellari by and Mervish published researches revealing that vitamins A and D do neutralize certain chemical substances in cereal grains which unneutralized or not counteracted produce harmful effects, disordering nutritional processes. By its absence in the diet one of these in animals experimented upon led to a spinal cord degeneration like that which complicates pernicious anemia. In this testimony no explanation was given concerning the reasons for nutritional need of milk in the diet of adults. However, these same vitamins A and D are found in connection with butterfat as well as in egg yolk. Even this research by Mellari by and that by Mervish did not explain the matter of blood formation and the maintenance of normal blood quality, though they did explain, as far as they went, the counteracting or balancing of certain chemical elements in a diet composed so largely of cereal grain products.

Recently several researches in animals and man have directly connected with blood formation and the correction of particular forms of anemia a nutritional element derived from milk. In 1901 E. G. White specified milk and eggs as necessary for normal blood formation in a certain man having this type of anemia. See Counsels on Diet and

Foods, pages 202-206. It was by returning to the use of milk and eggs in obedience to this testimony that he recovered and was still living at the time of this writing.

One of these human experiments on six persons with pernicious anemia (The journal of the American Medical Association, Aug. 10. 1946, p. 1201) revealed another dietary or nutritional factor which had previously been called "the liver or intrinsic factor" and more recently partially identified as vitamin B₁₂ and as lactobacillus casei factor or folic acid. The treatment in these six persons was by synthetic (laboratory made) folic acid.

This acid is naturally present in both the white and the yolk of eggs and in milk. In some animals it may be produced in the caecum.

"Mitchell and Isbell have reported that the intestinal flora of the rat supply about 70 per cent of the animal's estimated folic acid requirement.... This is influenced by the type and quantity of intestinal flora, which in turn may be influenced by relatively small changes in diet. Taylor, Pennington, and Thacker have adduced additional data to indicate that the caecum of the rat makes a contribution to the animal's supply of folic acid, among other vitamins. On a Purina ration, diluted with sucrose and deficient in several of the B vitamins, caecetomized rats were severely affected, while the unoperated controls remained in good health. Folic acid excretion was reduced over 60 per cent."

"A. aerogenes has been found to produce large amounts of folic acid when grown aerobically in a medium of hydrolyzed casein, glucose, and salts." Also reported by the same experimenter is the bacterial synthesis of folic acid by various bacilli.

"Wright and Skeggs have reported that when xanthopterin was added to cultures of A. aerogenes only small amounts of folic acid were synthesized by the organism."

Of the need for folic acid and stimulation of the growth of certain bacteria, Hutchings says: "Growth of [bacilli] was not stimulated, but in every case these organisms had synthesized significant amounts of the factor. The ability of the latter group of organisms (and others in all probability) to synthesize the vitamin indicates the importance of intestinal synthesis in considering nutritional studies of the factor."

Yogurt derives much of its beneficial action from the presence of such bacteria, while meat eating produces putrefactive changes in the intestines, with harmful results.

Sulfonamides have been shown to cause deficiencies of the L. casei factor (folic acid), probably by interference with bacterial production of vitamin factors. Twelve investigations regarding the toxic effects of the sulfonamides are given in the Present Status of the Lactobacillus Casei Factor by Samuel Wieder of Lederle Laboratories, Inc. Penicillin now used in throat lozenges also causes deficiencies of folic acid and all the other vitamins of the B complex by interference with the intestinal bacterial production of these vitamins from milk, since much of the penicillin is certain to be swallowed.

A certain type of macrocytic anemia of dietary origin in monkeys was relieved by autolyzed yeast preparation. Investigators found the active material in brewer's yeast and in wheat germ.

Milk is important, not only in the bacterial production of folic acid, and therefore definitely a preventive of pernicious anemia, but it has been found to be a strong

factor in the prevention of pellagra, though milk itself is poor in niacin. The inclusion of disordering nutritional processes. By its absence in the diet one of these in animals experimented upon led to a spinal cord degeneration like that which complicates pernicious anemia. In this testimony no explanation was given concerning the reasons for nutritional need of milk in the diet of adults. However, these same vitamins A and D are found in connection with butterfat as well as in egg yolk. Even this research by Mellariby and that by Mervish did not explain the matter of blood formation and the maintenance of normal blood quality, though they did explain, as far as they went, the counteracting or balancing of certain chemical elements in a diet composed so largely of cereal grain products.

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Milk is important, not only in the bacterial production of folic acid, and therefore definitely a preventive of pernicious anemia, but it has been found to be a strong factor in the prevention of pellagra, though milk itself is poor in niacin. The inclusion of a large proportion of corn in the diet of rats yields intestinal contents which are incapable of supporting the growth of niacin synthesizing bacteria. But the addition of tryptophan (an amino acid) promotes the growth of niacin-producing organisms. Casein is poor in niacin but rich in tryptophan, in which corn is deficient, thus providing for the bacterial synthesis of niacin.

A similar interaction might be necessary for the bacterial production of folic acid. That is, certain amino acids might be needed to sustain and promote the life of certain bacteria and their synthesis of folic acid. It would seem from the research that casein is needed for this bacterial synthesis, which may be dependent upon tryptophan or certain other amino acids.

Folic acid is present in a number of different plants used for food by man and animals, such as spinach and joint grass. With such foods why should there occur a macrocytic hyperchromic anemia, such as in the case already cited of a vegetarian who used no milk or eggs? The only reason stated in the instruction given him and by which he recovered was: "Eggs contain properties that are remedial agencies in counteracting certain poisons." Testimonies, Volume 9, p. 162. Such an effect, or at least a similar effect, in counteracting the acid poisons of a diet largely of cereals has been demonstrated by Mellari by and by Mervish to reside in vitamins A and D. The poisons they counteract were found to occur in cereal grains and could be neutralized by these vitamins, each in a different way. In the case of a diet heavy in cereals Mellari by demonstrated that a deficiency of vitamin A produced a spinal cord degeneration similar to that in pernicious anemia.

This situation of a diet heavy in cereal grain products without eggs (or milk) which contain colorless or preformed vitamin A would be liable to occur in strict vegetarians. Such a diet might block the action of folic acid in the red bone marrow. If such is the case, this might be the explanation for this type of anemia occurring with such a dietary even in the presence of a large supply of folic acid. This means that the acid ash of such a diet blocks the action of even the large amount of folic acid which is present in green vegetables. This is a fruitful field for further definite research and promises a more complete demonstration of the causes for nutritional macrocytic hyperchromic anemia.

The expression in the testimony, "You must not deprive yourself of that class of food which makes good blood" (Counsels on Diet and Foods, page 204), clearly

designates such scientific facts demonstrated by research thirty years, and now forty-five years, after this statement was written in explanation of the necessity for milk and eggs in the diet. It is however also clearly stated: "The time will come when we may have to discard some of the articles of diet we now use, such as milk and cream and eggs; but it is not necessary to bring upon ourselves perplexity by premature and extreme restrictions. Wait until the circumstances demand it, and the Lord prepares the way for it." - Testimonies, Volume 9, p. 162. As infections increase in animals, these restrictions might become necessary. The demand of circumstances is clearly something that men can and must become aware of. "Demand" is a strong word and as used here indicates forcible conviction of mind based on well-demonstrated and well-known facts. How "the Lord prepares the way for it" we may not now know. It could be by increased scientific knowledge of where and how to find substitutes adequate to make "good blood." These recent researches may lead up to such knowledge.

While folic acid (*Lactobacillus casei* factor) is found in a number of different foods,* it is present in varying amounts, and in most of these not in sufficient amounts to be effective in maintaining normal blood quality as it is in milk and eggs. So far as present experimentation has been carried on, only liver extract, stomach extract, and folic acid have produced relief in these types of anemia.

Experience with folic acid thus far has shown correction of the abnormal blood condition in pernicious anemia, but it does not prevent the spinal cord degeneration of this disease. Liver extract is necessary to prevent this nerve degeneration. The identity of this nutritional element in liver has not as yet been determined. It might be vitamins A and D, as suggested by the researches of Mellariby and Mervish (see pages 107-109), or it may be related to some amino acid deficiency.

*Other foods containing folic acid are soybean meal, oats, fish meal, alfalfa meal, yeast, rice bran, linseed meal, bone marrow, meat scraps, wheat, polished rice, ground yellow corn.

The research work of Carlson and Hoelzel is highly significant as to inadequacy of a purely vegetable diet in the matter of growth and reproduction. Only their conclusions can be quoted here: "Rats on vegetarian self-selection diets including corn (whole kernels), wheat (whole grains), pearl barley, rolled oats, sunflower seeds, peanuts, soybeans, green peas, corn germ meal, wheat germ meal, brewer's yeast, alfalfa leaf meal, salt (NaCl), lettuce, and celery cabbage, were found to be generally fertile, but raised less than 25 per cent of their offspring. They raised none in winter. The growth of these young was also subnormal, and severe rickets commonly developed."-The Journal of Nutrition, Volume 35, Number 1, January 10, 1948, Page 55. This is in sharp contrast with the experience of Sherman with rats and later that of Sherman and Campbell (see pages 112, 113 of this book) in which it was well proved that the great improvement in a diet already adequate was in the calcium of the "second pint" of milk. A further identification of calcium as the crucial element is found in a research by Schroeder, Cahill, and Smith, from which we quote only the summary: "The utilization of the calcium in three foods and one pure chemical compound was studied in adult human subjects. The supplementary calcium consumed ranged from 319 to 795 mg. per day. The average per cent utilization of the calcium in evaporated milk was found to be 29.1; in calcium sulfate, 23.7; in soybean 'milk,' 22.6; whole cooked soybeans, 10.4." - Ibid., Volume 32, Number 4, October 10, 1946, P.

421. Here again we see the great superiority of milk as an available source of calcium from which the system appropriates far more than from any other source, of which purely vegetable sources are considerably deficient. Not only is milk necessary for calcium, severe rickets appearing without it, but it is also an absolute necessity for reproduction and for the raising and the welfare of the young.

Economy of Feed and Food

“First, milk represents the most economical and efficient transformation of animal feeding stuffs into human food; and, second, it is the outstanding source of the specific nutrients in which it is most important to enrich our dietaries.

“As officially stated in the Yearbook of the United States Department of Agriculture, for the amount of food eaten, a dairy cow returns more than three times as much digestible protein as does a beef animal, and more than twice as much energy in edible products.

“This statement is well within the average findings of further investigations. It is also true that the average dairy cow is more than three times as efficient a producer of human food protein as is any kind of meat animal; and, except for the fat calories of the fattened hog, milk furnishes from two to seven times as much human food energy at a given feed cost as does any other class of farm animal. Armsby and T. B. Wood independently put this at about a fivefold higher return through milk than through meat; and Jordan found the advantage of milk over meat in the efficiency of use of food-production resources to be equally great. Further investigations in the United States Department of Agriculture indicated that the same food-production resources yield five times more human food calories and four times more digestible food protein through milk than through beef. The poultry enterprise, counting both eggs and poultry meat produced, was intermediate in efficiency between milk and beef production, with respect both to calories and to protein. Leitch and Godden (1941) found milk about three times more efficient than meat with respect to protein and about twice to about four times as efficient with respect to energy.

“More recently Jennings (1943) and also R. P. Christensen of the United States Department of Agriculture have estimated the return through milk to be about sevenfold higher both in calories and in protein than that through either beef cattle or sheep. Dairy cattle were found to yield two to three times more food energy and protein per hundred man-hours of labor consumed in producing feed and in caring for the animals than did either beef cattle or sheep. Figured on either basis, the returns of riboflavin by milk cows were five to seven times as high as in pork and six to twenty times as high as in beef or lamb. Several facts contribute to the variability of the precise figures. Normal physiological variations among animals would, in any case, be a factor causing deviations in the precise quantitative findings as to the higher efficiency of the milk-production over the meat production process.

“Hence it would be unwise to tie one’s thinking too closely to the precise numerical findings of any one investigation, or to attempt to draw an exact average of numerical findings. It is more scientific to say that the feeding of milk cows is more than twice as economical of energy as is the feeding of beef cattle or sheep; more than three times as efficient in the transformation of protein as is meat production; and that the greater

efficiency of the milk cow over the meat animal is manifested in still higher degree if the comparison is extended to include riboflavin, as it should be now that we know how important the riboflavin content of our food is to the nutritional well-being of our bodies and to the efficiency of our life processes. Riboflavin is a large factor in our nutritional building of higher health and longer life; so that the economy of use of food-production resources should take account of the efficiency of the transformation of riboflavin as much as of protein. This latter fact is, of course, only beginning to be adequately recognized. Even without it, the greater efficiency of milk production over meat production is very important and far-reaching." - Henry C. Sherman, *Foods: Their Values and Management*, pages 93, 94.

The motion-picture film "Folic Acid" by the Lederle Laboratories gives pictures of the diseases due to the lack of those foods that make good blood. It explains the action of this vitamin on the red bone marrow in blood cell production.

We still have some overzealous persons who advocate the total nonuse of milk and eggs at this time, claiming that the time has come to discard them. Such persons fail to read carefully the messages that bear upon this subject. Apparently they do not discern that the testimonies distinctly state that their unhealthfulness lies in diseases of the animals from which these products come and the increase in such disease rather than that milk and eggs are intrinsically harmful. Second, that outstanding circumstances must demand giving up all animal products (milk and eggs). And, third, that a way must be made whereby the place of these foods may be supplied, as indicated by the expression "and the Lord prepares the way for it." Both the testimonies and

scientific research indicate that milk and eggs are an important aid in the formation of a normal quality blood, and serious results follow if these foods are left off.

Many read with preconceived ideas and notions in their own minds instead of trying to get the meaning and import of what the author or writer says. This is not alone the fault of the unlettered and unlearned. It is more or less characteristic of many people, even those of much learning. Berger Evans in *The Atlantic Monthly* (April, 1946, page 74), speaking of the popular mind, says: It generalizes from exceptions, and from a mass of experience selects only those elements that confirm its preconceptions-without the faintest awareness of what it is doing. Most of what is called thinking-even up to and including much of what goes on in the brains of college faculties-is actually seeking for confirmation of previous convictions."

When God speaks to us through His servant in the spirit of prophecy, our ears should be open to hear what He says. We are altogether too ready to volunteer our personal interpretations, as if God were unable through His chosen mouthpiece to use human language plainly enough to make Himself understood. "No prophecy of the Scripture is of any private interpretation." 2 Peter 1:20. It should be taken as it reads.

However, today there seems to be more ignorance of the testimonies than there is outright disbelief. I fear our children and youth are not as thoroughly instructed in these testimonies on health as they were forty or fifty years ago; at least they have become mere traditions to many, to be accepted in general, but taken with considerable allowance for the passage of time and increase in scientific knowledge.

This attitude of course ignores their divine source, taking account only of the human agent and implying that the message or revelation is so colored by this agency as to

render it essentially a human opinion and therefore subject to the imperfections of previous years, before the age of scientific research.

We need a renewed interest in the writings of the spirit of prophecy. They should be studied with our children. Let them see also that we consider it important to put these principles into practice in our eating and in every habit and activity of life.

11. THE USE OF DAIRY PRODUCTS

by ARTHUR L. WHITE

QUITE apart from the counsels given in regard to the use of flesh as food have been the uniform spirit of prophecy utterances relative to the use of dairy products: milk, cream, butter, and eggs. While we are counseled, "In countries where there are fruits, grains, and nuts in abundance, flesh food is not the right food for God's people" (Testimonies, Volume 9, p. 59), the same pen writes, "Vegetables should be made palatable with a little milk or cream, or something equivalent" (Ibid., Volume 9, p. 162); and we are admonished that "milk, eggs, and butter should not be classed with flesh meat" (Ibid., Volume 7, P. 135). True, there are warnings against the excessive use of dairy foods, and cautions are given regarding the danger of their use if secured from uncertain sources or improperly cared for; yet with the possible exception of butter, these foods were ever considered by Mrs. G. White as a proper part of the diet of God's people.

It was in the summer of 1863 that, through the visions given to Mrs. White, the attention of Seventh-day Adventists was called to the importance of reforms in diet and the care of the sick. In their endeavor to find a rational application of the great health principles thus revealed, the leading denominational workers turned to such hygienists as Sylvester Graham and Drs. J. C. Jackson and R. T. Trall, who were advocating in their writings and exemplifying in their work the application of health reform principles. These men who were forging ahead in experimental lines were greatly admired for their aggressive work and their rational views.

As the years advanced, some of these prominent men to whom Seventh-day Adventists had looked as pioneers in reform were inclined to go to extremes. This was especially true of R. T. Trall, whose published works were widely read by Seventh-day Adventists and who was a frequent contributor to the denomination's health journal, *The Health Reformer*. It was but natural that those who at the beirmina had found Dr. Trall's views so rational, should be led to follow him in his opinions as they took on an extreme hue, and thus not a few of our own ranks were led to untenable positions in regard to what constitutes a proper diet. By not a few all dairy products were discarded, as were also salt and sugar; and strong editorials and selected articles appeared for a time in almost every number of *The Health Reformer* condemning these common articles of diet.

Mrs. White's attitude and teachings during this wave of extremism are significant. Moving forward cautiously, guided by definite revelations on certain phases of

the diet question, and observing on the other hand the results of extreme teaching, without scientific or spirit of prophecy support, she avoided extremes both in practice and teaching, and she continued the use of milk and eggs and salt and sugar in her own home. We are fortunate in having from the pens of both James and Ellen White clear-cut statements during this perplexing period (circa 1870-1873). In 1870 Mrs. White stated in a letter of counsel to an inquiring sister:

“We place no butter upon our table. Our vegetables are generally cooked with milk or cream and made very palatable.... We think a moderate amount of milk from a healthy cow not objectionable. We seldom prepare our food with butter. When we cannot obtain milk, we use a very trifle in some articles of vegetables

“We have but one cow. She gives but a very little milk. We have made this little do the cooking and table use for a company of from twelve to twenty.... We cannot obtain cream to use, but we should use more of it could we get it to use. I greatly object to an impoverished diet

“If you have eggs, use them as your judgment shall dictate. Yet I would say for children of strong animal passions, they are positively injurious. The same may be said of adults. [See Testimonies, Volume 2, Pages 362, 400 for similar caution.] ...

“I would not advise you to set aside milk or a moderate use of eggs [or a moderate use of sugar.”-E. G. White, Letter 5, 1870.

A little later in this same year Elder James White published in the Review and Herald an article reviewing their recent experience in practicing and teaching the health reform principles, in which he makes reference to Mrs. White’s attitude toward the use of dairy foods, and alludes to such phases of this question on which she had received definite light:

It may be well here to state, however, that while she [Mrs. White] does not regard milk, taken in large quantities, as customarily eaten with bread, the best article of food, her mind, as yet, has only been called to the importance of the best and most healthy condition possible of the cow, whose milk is used as an article of food. She cannot unite in circulating publications broadcast which take an extreme position on the important question of milk, with her present light upon the subject.” - James White, in Review and Herald, November 8, 1870. Also in Counsels on Diet and Foods, page 497. (Italics mine.)

Three years later Mrs. White in a letter again alludes to the practice in the White home relative to the use of dairy foods.

“We have always used a little milk and some sugar. This we have never denounced, either in our writings or in our preaching. We believe cattle will become so much diseased that these things will yet be discarded, but the time has not yet come for sugar and milk to be wholly abolished from our tables.” - Counsels on Diet and Foods, page 356.

It is interesting to note that in all these statements relating to Mrs. White’s viewpoint on the question of the use of dairy foods, she never looked upon the matter as did the contemporary writers of the articles appearing in The Health Reformer, who freely denounced all animal products because of their animal origin. She spoke of them as useful articles of diet which must be carefully safeguarded because of disease in the animal kingdom. She ever pointed out the care which must be taken to see that these foods were

derived from safe sources. Her attitude was a consistent one, held through the years. We find these significant words from her pen in *Christian Temperance and Bible Hygiene*, published in 1890, indicating that there was no prohibition to the use of milk and cream, but that they constituted an important part of the healthful diet:

“God has furnished man with abundant means for the gratification of an unperverted appetite. He has spread before him the products of the Earth—a bountiful variety of food that is palatable to the taste and nutritious to the system. Of these our benevolent heavenly Father says we may freely eat. Fruits, grains, and vegetables, prepared in a simple way, free from spice and grease of all kinds, made, with milk or cream, the most healthful diet. They impart nourishment to the body, and give a power of endurance and a vigor of intellect that are not produced by a stimulating diet.”—*Christian Temperance and Bible Hygiene*, page 47; *Counsels on Health*, pages 114, 115. See also *Counsels on Diet and Foods*, page 355.

Changed Conditions Foreseen

It was near the turn of the century that a number of statements were made by Mrs. White, calling attention to the increase of disease in the animal kingdom, which, at some future time when conditions became acute, would result in an adjustment of the dietary program. We list here a cluster of statements on this point, together with the dates when they were made:

“There is no safety in the eating of the flesh of dead animals, and in a short time the milk of the cows will also be excluded from the diet of God’s commandment-keeping people. In a short time it will not be safe to use anything that comes from the animal creation.” - *Counsels on Diet and Foods*, page 411.

“The light given me is that it will not be very long before we shall have to give up using any animal food. Even milk will have to be discarded. Disease is accumulating rapidly. The curse of God is upon the earth, because man has cursed it.”—*Australasian Union Conference Record*, July 28, 1899.

“Its [the health food business] purpose is to supply the people with food which will take the place of flesh meat, and also milk and butter, which, on account of the diseases of cattle, are becoming more and more objectionable.” - *Ibid.*, January 1, 1900.

“Let the diet reform be progressive. Let the people be taught how to prepare food without the use of milk or butter. Tell them that the time will soon come when there will be no safety in using eggs, milk, cream, or butter, because disease in animals is increasing in proportion to the increase of wickedness among men. The time is near when, because of the iniquity of the fallen race, the whole animal creation will groan under the diseases that curse our earth.” - *Testimonies*, Volume 7, Page 135 (1902).

“The time may come when it will not be safe to use milk. But if the cows are healthy and the milk thoroughly cooked, there is no necessity of creating a time of trouble beforehand.” - *Counsels on Diet and Foods*, page 357.

Premature Action

No doubt statements of this character made by Mrs. White confirmed some of our medical workers in their conviction that all food products of animal derivation should be discarded from the diet. Such an attitude was maintained by a number of the physicians in Battle Creek and those who had formerly been associated with them, who were now scattered to various parts of the world field engaged in medical missionary work. One such was D. H. Kress, M.D., who writes freely of his experience in this matter.

An inadequate diet resulted in his succumbing to pernicious anemia which threatened to cut his life short at the age of forty years. But in vision Mrs. White was instructed that he should use eggs with grape juice, and it would save his life. He was counseled also to provide for himself an adequate diet comprised partly of dairy products. She also pointed out in this connection that the doctor was not justified in taking such an extreme position in regard to his diet, and she stated positively:

“I say that milk and eggs should be included in your diet. These things cannot at present be dispensed with, and the doctrine of dispensing with them should not be taught.”-Ibid., page 204.

Following the timely counsel, Dr. Kress broadened his diet to include milk, cream, and eggs, and made a full recovery. He is still [in 1948] laboring in the cause of God at the ripe age of eighty-five. Appended to this document will be found his statement, written January 6, 1944, relative to this experience, in which he quotes freely from the testimony addressed to him.

Again in 1909 the caution was repeated: “Milk, eggs, and butter should not be classed with flesh meat. In some cases the use of eggs is beneficial. The time has not come to say that the use of milk and eggs should be wholly discarded.” - Testimonies, Volume 7, Page 135.

In 1909 she admonished: ‘Wait until the circumstances demand it, and the Lord prepares the way for it.’-Testimonies, Volume 9, page 162.

As an Emergency Measure

It would seem from an examination of all the statements which bear upon this subject that the time spoken of, when dairy products may have to be laid aside, is brought to view as an emergency issue, and is not set forth as an advanced position in health reform living. There may be some significance in the varied wording in speaking of such a time yet to come: “The time will soon come;” “The time may come.” Might conditions in the animal kingdom vary, resulting in a varying adjustment to the problem? The whole situation is clearly based upon the increase of disease in the animal kingdom, and, therefore, dependent upon that emergency factor.

Those who in 1870 took extreme positions and discarded not only meat but also all dairy products from their diet, did not take an advanced step in health reform, but ran into extremes. In 1901, when some were advocating that the time had come to lay aside these articles of diet, warning was given that they were in danger of turning “health reform” into “health deform,” and it was a mistaken idea on their part which led to these extreme

positions. Counsel was given that “the time has not come” and we were to “wait till the Lord prepares the way.” - E. G. White, Letters 151, 37, 1901.

How May We Know When Dairy Products Should Be Discarded?

With the prediction that the time may or will come when, because of the increase of disease in the animal kingdom, dairy foods must be laid aside, the logical question arises: How may we know when such a time is reached? In connection with some of the cautions which have been sounded, we have been given definite assurances regarding a knowledge of that time. Note carefully the following:

“As I preach the gospel to the poor, I am instructed to tell them to eat that food which is most nourishing. I cannot say to them: ‘You must not eat eggs or milk or cream. You must use no butter in the preparation of food.’ The gospel must be preached to the poor, and the time has not yet come to prescribe the strictest diet

“But I wish to say that when the time comes that it is no longer safe to use milk, cream, butter, and eggs, God will reveal this. No extremes in health reform are to be advocated. The question of using milk and butter and eggs will work out its own problem. At present we have no burden on this line. Let your moderation be known unto all men.”- Counsels on Diet and Foods, page 353.

From the message sent to Dr. Kress in 1901, we take the following guiding counsel:

“The time will come when we may have to discard some of the articles of diet we now use, such as milk and cream and eggs, but my message is that you must not bring yourself to a time of trouble beforehand, and thus afflict yourself with death. Wait till the Lord prepares the way before you.

“I assure you that your ideas in regard to diet for the sick are not advisable. The change is too great. While I would discard flesh meat as injurious, something less objectionable may be used, and this is found in eggs. Do not remove milk from the table or forbid its being used in the cooking of food. The milk should be procured from healthy cows and should be sterilized.” -Ibid., page 358.

Writing a few months later, she reiterated the assurance that God will make it clear to His people when the emergency step must be taken, discarding dairy products from the diet:

“We see that cattle are becoming greatly diseased, the earth itself is corrupted, and we know that the time will come when it will not be best to use milk and eggs. But that time has not yet come. We know that when it does come, the Lord will provide. In all parts of the world provision will be made to supply the place of milk and eggs. And the Lord will let us know when the time comes to give up these articles.”-Ibid., page 359.

Counsels Repeated in 1909

As Mrs. White stood before the General Conference of 1909, she reviewed the broad principles of health reform and again cautioned against premature action in regard to

our attitude toward the use of articles of animal derivation which would lead to perplexity:

“The time will come when we may have to discard some of the articles of diet we now use, such as milk and cream and eggs; but it is not necessary to bring upon ourselves perplexity by premature and extreme restrictions. Wait until the circumstances demand it, and the Lord prepares the way for it.” - Testimonies, Volume 9, p. 162.

Safeguarding the Use of Animal Products

While Mrs. White pointed out consistently that it was proper that dairy products should appear on our tables, she earnestly urged that adequate safeguards be observed to assure a safe supply of such foods. Thus to Dr. Kress she wrote:

“When you see that you are becoming weak physically, it is essential for you to make changes, and at once. Put into your diet something you have left out. It is your duty to do this. Get eggs of healthy fowls. Use these eggs cooked or raw. Drop them uncooked into the best unfermented wine you can find. This will supply that which is necessary to your system. Do not for a moment suppose that it will not be right to do this.” -Counsels on Diet and Foods, pages 366, 367.

In *The Ministry of Healing*, published in 1905, we read: “In the case of persons whose blood-making organs are feeble, especially if other foods to supply the needed elements cannot be obtained, milk and eggs should not be wholly discarded. Great care should be taken, however, to obtain milk from healthy cows, and eggs from healthy fowls, that are well fed and well cared for; and the eggs should be so cooked as to be most easily digested.” - Pages 320, 321.

“If milk is used, it should be thoroughly sterilized; with this precaution, there is less danger of contracting disease from its use.”-Ibid., page 302.

Phrases in statements previously quoted will come to mind:

“We think a moderate amount of milk from a healthy cow not objectionable.”-E. G. White, Letter 5, 1870.

“Her mind, as yet, has only been called to the importance of the best and most healthy condition possible of the cow, whose milk is used as an article of food.”-Counsels on Diet and Foods, page 497.

“If the cows are healthy and the milk thoroughly cooked, there is no necessity of creating a time of trouble beforehand.” -Ibid., page 357.

“Milk should be procured from healthy cows, and should be sterilized.”-Ibid., page 358.

Cautions Regarding Premature Moves

In presenting true health reform, certain guarding principles were laid down in early days. Note the significance of this statement published in 1872:

If we should allow the people as much time as we have required to come up to the present advanced state in reform, we would be very patient with them, and allow them to

advance step by step, as we have done, until their feet are firmly established upon the health reform platform. But we should be very cautious not to advance too fast, lest we be obliged to retrace our steps. In reforms, we would better come one step short of the mark than to go one step beyond it. And if there is error at all, let it be on the side next to the people.”- Testimonies, Volume 3, pp- 20, 21.

Again in 1902 the same principles were set forth in these words: In teaching health reform, as in all other gospel work, we are to meet the people where they are. Until we can teach them how to prepare health reform foods that are palatable, nourishing, and yet inexpensive, we are not at liberty to present the most advanced propositions regarding health reform diet.” Ibid, Volume 7, Page 135.

True reforms will recommend themselves as being consistent, sensible, and practical.

“Do not go to extremes in regard to the health reform. Some of our people are very careless in regard to health reform. But because some are far behind, you must not, in order to be an example to them, be an extremist. You must not deprive yourself of that class of food which makes good blood. Your devotion to true principles is leading you to submit yourself to a diet which is giving you an experience that will not recommend health reform.”- Counsels on Diet and Foods, page 366.

A Balanced Program Which Will Recommend Itself

The very appearance of those advocating health reform is a large factor in gaining adherents to the better way of healthful living:

“There is danger that in presenting the principles of health reform some will be in favor of bringing in changes that would be for the worse instead of for the better. Health reform must not be urged in a radical manner. As the situation now is, we cannot say that milk and eggs and butter should be entirely discarded.

“We must be careful to make no innovations, because under the influence of extreme teaching there are conscientious souls who will surely go to extremes. - Their physical appearance will injure the cause of health reform; for few know how to properly supply the place of that which they discard.”-Ibid., page 352.

In 1909 a warning was again sounded against a course of action which would hinder true reform:

“While warnings have been given regarding the dangers of disease through butter, and the evil of the free use of eggs by small children, yet we should not consider it a violation of principle to use eggs from hens that are well cared for and suitably fed. Eggs contain properties that are remedial agencies in counteracting certain poisons.

“Some, in abstaining from milk, eggs, and butter, have failed to supply the system with proper nourishment, and as a consequence have become weak and unable to work. Thus health reform is brought into disrepute. The work that we have tried to build up solidly is confused with strange things that God has not required, and the energies of the church are crippled. But God will interfere to prevent the results of these too strenuous ideas. The gospel is to harmonize the sinful race. It is to bring the rich and poor together at the feet

of Jesus.” - Testimonies, Volume 9, p. 162.

Tolerance of the Views of Others

On some of the minor points of the diet of the individual, Mrs. White advocated that there should be a wide latitude of tolerance, recognizing that some could use some articles of food which others could not. The principles set forth in the following statement, exemplified in Mrs. White’s experience and work, are worthy of careful study.

“We must remember that there are a great many different minds in the world, and we cannot expect everyone to see exactly as we do in regard to all questions of diet. Minds do not run in exactly the same channel. I do not eat butter, but there are members of my family who do. It is not placed on my table; but I make no disturbance because some members of my family choose to eat it occasionally. Many of our conscientious brethren have butter on their tables, and I feel under no obligation to force them to do otherwise. These things should never be allowed to cause disturbance among brethren. I cannot see the need of butter where there is abundance of fruit and of sterilized cream.

“Those who love and serve God should be allowed to follow their own convictions. We may not feel justified in doing as they do, but we should not allow differences of opinion to create disunion.” - Counsels on Diet and Foods, pages 351, 352.

“There is a wide difference in constitutions and temperaments, and the demands of the system differ greatly in different persons. What would be food for one, might be poison for another; so precise rules cannot be laid down to fit every case. I cannot eat beans, for they are poison to me. But for me to say that for this reason no one must eat them would be simply ridiculous. I cannot eat a spoonful of milk gravy, or milk toast, without suffering in consequence; but other members of my family can eat these things, and realize no such effect; therefore I take that which suits my stomach best, and they do the same. We have no words, no contention; all moves along harmoniously in my large family, for I do not attempt to dictate what they shall or shall not eat.”-Ibid., page 494.

A Summary

We find, then, in our study of this question that-

1. Milk, cream, butter, and eggs are not subject to the same condemnation as flesh meat and should not be classed with it.
2. Mrs. White never received instruction that these dairy products should be eliminated from the diet.
3. In the White home milk, cream, and eggs, and at times butter, were used.
4. Dairy products furnish a part of an appetizing, nourishing diet.
5. The spirit of prophecy counsels urged that dairy products be secured from safe sources and be handled properly.
6. Because of the increase of disease in the animal kingdom, the time might or would come when it would be necessary to discard dairy products from our tables-an

emergency for which we should prepare.

7. The people should be taught how to furnish a wholesome diet without the use of these articles of food.

8. Our health food factories had been established to make healthful, inexpensive foods to take the place of meat and also of dairy products.

9. In 1870, 1901, and 1902, and again in 1909, Mrs. White specified that the time had not yet come to say that dairy products should be discarded.

10. Eggs contain remedial properties and constitute one substitute for meat in our sanitariums.

11. We must guard against extremes in health reform teaching and living, especially in advocating prematurely the discarding of dairy foods.

12. The cause of health reform must not be brought into disrepute and retarded by radical teachings leading to extremes and resulting in a group of people whose strength and physical appearance would injure the cause of health reform.

13. Strange things are not required of God to be introduced.

14. We are to wait until circumstances demand our dropping these foods and the Lord prepares the way for such a move. 15. "When the time comes that it is no longer safe to use milk, cream, butter, and eggs, God will reveal this."-Counsels on Diet and Foods, page 353.

"The Lord will let us know when the time comes to give up these articles."-Ibid., page 359.

16. It is not necessary to bring upon ourselves perplexity by premature and extreme restrictions." - Testimonies, Volume 9, p. 162.

17. "The question of using milk and butter and eggs will work out its own problem."-Counsels on Diet and Foods, page 353.

18. When the time "does come, the Lord will provide." Ibid., page 359.

19. We should not consider it a violation of principle to use dairy products from safe sources.

20. "Those who love and serve God should be allowed to follow their own convictions" on these minor points of diet. See Medical Ministry, page 269; Counsels on Diet and Foods, page 352.

The opinion is held among our earnest physicians and dietitians that when the time spoken of by Mrs. White comes-that it will no longer be safe to use animal products-the evidences in the animal kingdom will be such as to make this very clear. Unquestionably, the testing of dairy herds and the slaughtering of infected cattle, the pasteurization of dairy products, and the refrigeration and speedy delivery and marketing of these articles of diet have maintained a degree of safety in their use which would not have obtained had not these more modern methods of handling perishable foods been brought into use.

Is it not possible too, that, as with the seven last plagues, the worsening conditions in the animal kingdom, of which she speaks, may be universal? They may be

more acute in some places than in others. Be that as it may, we have the definite cautions in regard to dropping these from our diet that we are to wait until the circumstances demand it and the Lord lets us know when the time comes.

Unquestionably, it is in the providence of God that experimental work is being done in the discovery and manufacture of healthful, appetizing vegetable foods which can well take the place of milk and butter. We are urged to prepare for the issues.

In connection with this discussion we present two statements written by physicians of long experience in our work. (The one by Dr. Abbott precedes, Dr. Kress's experience follows.) These will be read with interest. Attention of the reader is also called to Counsels on Diet and Foods, section II, "Extremes in Diet," pages 195-213; section 21, "Fats," part 1, "Butter," pages 349-353, part 3, "Milk and Cream," pages 355-359; and section 22, "Proteins," part 2, "Eggs," pages 365-368.

Let us move forward in health reform, living consistently and carefully, guarding against extreme positions, following a course which will recommend true health reform to all about us.

12. THE TESTIMONIES AND A BALANCED DIET

BY D. H. KRESS, MD

SOME honest souls have taken an extreme position in regard to some of the statements made by Mrs. E. G. White regarding the use of animal food products, especially milk and eggs. These extreme views were advocated in Battle Creek by J. H. Kellogg, M.D., and his associates, including myself. When I went to England I advocated strenuously the doctrine of dispensing with butter, milk, and eggs, and later I did the same in Australia. I aimed to practice what I taught. It was difficult for me to get suitable foods in traveling from place to place, and as a result my food was lacking in some essential elements. I ran down in health almost to the point of death, suffering from pernicious anemia, which was then regarded as incurable.

Mrs. White saw me in vision and wrote me several letters (portions of these-letters are found in Counsels on Diet and Foods, pages 202-207), pointing out the cause of my condition and urging me to make a change in my dietetic habits. She said: "Your devotion to true principles is leading you to submit yourself to a diet which is giving you an experience that will not recommend health reform. Because some are far behind, you must not, in order to be an example to them, be an extremist."

This instruction I aimed to carry out.

She then added: "When you see that you are becoming weak physically, it is essential for you to make changes, and at once. Put into your diet something you have left out. It is your duty to do this. Get eggs of healthy fowls. Use these eggs cooked or raw. Drop them --cooked into the best unfermented wine [grape juice] you can find. This will supply that which is necessary to your system. Do not for a moment suppose that it will not be right

to do this We appreciate your experience as a physician, and yet I say that milk and eggs should be included in your diet. These things cannot at present be dispensed with, and the doctrine of dispensing with them should not be taught.”

This letter came to me in Australia, and was dated May 29, 1901. She added: “The time will come when milk cannot be used as freely as it is now used; but the present is not the time to discard it; and eggs contain properties which are remedial agencies in counteracting poisons.... We should not consider it a denial of principle to use eggs of hens which are well cared for and suitably fed.” “While I would discard flesh meat as injurious, something less objectionable may be used, and this is found in eggs. Do not remove milk from the table or forbid its being used in the cooking of food. The milk used should be procured from healthy cows, and should be sterilized.... I use some salt, and always have, because from the light given me by God, this article, in the place of being deleterious, is actually essential for the blood. The whys and wherefores of this I know not, but I give you the instruction as it is given me.”

“This that I now send you was opened distinctly before me last night. The reason for Dr. Kress’s poor health is his overdrawing on his bank stock of health and then failing to replace the amount drawn out by wholesome, nutritious, palatable food. MY brother, devote your whole life to Him who was crucified for you, but do not tie yourself down to a meager diet, for thus you misrepresent health reform.... We are to be brought into connection with the masses. Should health reform be taught them in its most extreme form, harm would be done. We ask them to leave off eating meat and drinking tea and coffee. This is well. But some say that milk also should be given up. This is a subject that needs to be carefully handled. There are poor families whose diet consists of bread and milk, and, if they can get it, a little fruit. All flesh food should be discarded, but vegetables should be made palatable with a little milk or cream or something equivalent. The poor say, when health reform is presented to them, ‘What shall we eat? We cannot afford to buy the nut foods.’ As I preach the gospel to the poor, I am instructed to tell them to eat that food which is most nourishing. I cannot say to them: You must not eat eggs, or milk, or cream; you must use no butter in the preparation of food. The gospel must be preached to the poor, and the time has not yet come to prescribe the strictest diet. The time will come when we may have to discard some of the articles of diet we now use, such as milk and cream and eggs; but my message is that you must not bring yourself to a time of trouble beforehand, and thus afflict yourself with death. Wait till the Lord prepares the way before you.... I wish to say that when the time comes that it is no longer safe to use milk, cream, butter, and eggs, God will reveal this. No extremes in health reform are to be advocated. The question of using milk and butter and eggs will work out its own problem.”

After receiving this message, I at once began making reforms by using eggs as directed, and milk; and with God’s blessing I made a good recovery. She also begged of me to call for the elders of the church and have them anoint me with oil, claiming the promise that God would raise me up and pardon my sins.

This was more than forty years ago. I have now about reached my eighty-second year of life, and am still able to spend three hours daily in my office at the sanitarium. For the health so graciously granted me, I am indebted to the messages that came to me at a time when a recovery seemed hopeless from a human standpoint. I still follow out the instruction by using milk and eggs, and when I feel the need I use them with grape juice as

directed.

I think the position we should take is that the situation will be an emergency condition rather than a moral one. Dairy products, from a safe source, will to my mind, always be allowable to the end of our sojourn in this world. Milk and eggs were designed as food from the beginning, before sin entered the world. They contain all the elements of nutrition, including the vitamins, to sustain the creatures for which they were originally designed. This was not true of meat. Meat was not designed as a God never planned that one creature should kill and feed upon another. Meat eating was introduced as a result of sin. It was wholly an emergency diet, and its use was justifiable only in the absence of the original or natural foods. Meat cannot be classed in any way with milk and eggs. Had sin not entered the world, eggs and milk would have been utilized as food for the creatures for which they were designed. It is no sin for man to use them if he desires, since both contain the elements of nutrition.

I think I have made my position clear in this letter, and am pleased to do this, recognizing this as a God-given opportunity to undo in a measure what my teaching in the past may have done. It is late, but I felt that possibly God can enable me to help others who are inclined to take an extreme view, as did I, on the question of diet.

13. HELPFUL COUNSEL ON DIET

BY M. E. CADY

I HAD been president of Healdsburg College only one year, having begun my work there in 1899. For me it was a new line of educational work, and I found Mrs. E. G. White very helpful to me as I counseled with her and she with me with reference to the solution of some serious and difficult problems that arose from time to time. She visited the college quite frequently, sometimes staying for two or three days. At one time she stayed about a week, bringing with her two or three of her secretaries to carry on her work while there. During that time she occupied a seven-room cottage, where she continued her work and spent some time visiting the school.

I felt free to talk with Mrs. White in regard to problems, and she always was very sympathetic in her attitude. I remember speaking to her about the dissatisfaction of some of the young men regarding the diet. Some of the young men sixteen to eighteen years of age were not Seventh-day Adventists, although their parents were members of the church. They had been sent to school by their parents with the hope that the children would become Seventh-day Adventists. These young men were used to eating all kinds of food. Meat, pepper, tea, coffee, were things that they had used before coming to school, and they were quite dissatisfied not to have access to these things that they were used to eating. They told me that the food served in our dining room tasted like sawdust, and they wanted the privilege of going down to the restaurant in the city and having a good square meal.

I asked Mrs. White what I should do in cases of this kind where the young men were not Adventists and were used to eating food of the kind that we did not serve. She

replied: “You should be very sympathetic and kind to them. It is a hard situation and a very trying one to the boys. They are to be pitied. We should love them and, if possible, lead them into the truth. This their parents are praying for, and we should do all we can to help their prayers to be answered.”

I was a little surprised at her reply. It was so sympathetic and kind. But she gave a little further counsel: “Of course, we could not allow them to go down to the restaurants and eat, but the food in our dining room should be very palatable, and they should have all the good food that we can supply them; plenty of butter, milk, eggs, and vegetables, so that there will be no lack of good food.”

To her suggestion I replied that we did not serve butter in the college, and she was greatly surprised. In fact, we did not serve eggs very liberally. The board had taken action two or three years before to eliminate from the diet butter and eggs, as Mrs. White had given instruction in her writings indicating that the time would come when butter, milk, and eggs could not be used, because of animals being so diseased. To this she replied: “The board has run away ahead of the Lord. I have stated in my writings that the time would come when animals would be so diseased that it would not be safe to use their flesh as food, but that time has not yet come. Butter, cream, milk, and eggs are still to be served, and we are to serve them until we find substitutes to take their place.”

I had made an effort the year before to have butter and eggs served, but the board did not yield. They spoke of the time coming to do away with these foods produced by animals, and were not willing to reverse their action, for they felt that that would be a step backward.

Mrs. White then strongly affirmed that we should have these foods on the table, and it was not long before they were there. She was able to bring about the change which was very much appreciated by the students, and a much better spirit came into the school and much more co-operation on the part of these young men that were dissatisfied.

14. DOES MILK “MAKE MUCUS”?

“WHEN dietary instructions are given patients, the physician is not infrequently faced with this statement: ‘Doctor, I haven’t been drinking milk because it makes mucus in my throat.’

“A few years ago, to test the extent of this feeling among patients, I asked two hundred consecutive adult patients this question: ‘Does milk make mucus for you?’ The answer was Yes in 25 per cent of the cases.

“The belief is widespread that milk is the cause of the disturbing postnasal mucus. Is there any factual basis for such a belief? Are patients mistaken?

“As is well known, a thin layer of mucus is normally present as a protective film for the nose and throat, and causes no sensation. However, when the mucus becomes excessive or mucopus develops, then the patient is annoyed.

“Also, as has been pointed out by Proetz [Arthur W. Proetz, Vostriasal Drip,

the Current Nightmare, The Annals of Otolaryngology, Rhinology, and Laryngology, 54:739 (December), 1945, the patient complains of discharge in the nasopharynx if the mucus becomes abnormally viscous, abnormally fluid, irritating, odorous, or obstructive.

Vroetz listed eighteen different agents he considered capable of causing the 'Postnasal drip,' but did not mention milk as a possible factor. Yet milk is what many patients believe is responsible, and consequently many of them omit milk from the diet.

"Cultists and a few reputable physicians take milk away from patients because they, too, believe that milk 'makes mucus.' Milk should not be taken from patients without good reason because, in the words of James C. McLester: 'Milk is the most important of all foods. The amount of milk consumed by the adult has an important bearing on the health of the community and on its wealth.'"

"It seemed important, therefore, to make nose and throat examinations of patients drinking milk and those not doing so to see which group had the most mucus in the throats; and at the same time to obtain statements from the patients of each group as to the presence or absence of disturbance from postnasal mucus.

Procedure for Collecting Data

"Histories were obtained from 1,047 consecutive adult eye, ear, nose, and throat patients observed during the past three years.

Information was recorded at the first visit relative to the number of glasses of milk consumed each week, whether the patient was or was not ordinarily bothered with mucus in the throat, or had a cold, sore throat, sinus trouble, or history of allergic disturbances. Of the 1,047 patients, 400 were excluded because of active upper respiratory disease. This left 647 patients with normal-appearing noses and throats, from whom the data were obtained, largely patients with eye disease.

"Table 1. Reports From 647 Patients as to Complaints of Postnasal Mucus

Milk, Glasses Consumed per Week Number Per Cent	Complaint of Mucus		Not Bothered With Mucus	
	Patients in Group	Cases Number	Per Cent	Cases
0-5	310	141 45	169	54
6-9	94	47 50	47	50
10 or more	337	155 46	182	54

“The 647 patients were divided into three groups according to their habits of drinking milk; for each group the individual complaint of mucus is summarized in Table i.

It is thus evident that the percentage of persons who complain of postnasal mucus is practically the same among those who drink milk as among those who do not.

It was further observed that of the scores of non-milk drinking patients who began to drink milk, none made a voluntary complaint of mucus, and there was no tendency for more mucus to be found in their throats on examination

Quantity of Postnasal Mucus Found on Examination

“Nose and throat examinations were made on 157 patients with no history of colds or other upper respiratory disease to see if the milk-drinking patients were actually secreting an increased quantity of mucus. Excess mucus was considered to be present if on the pharynx or in the nasopharynx an accumulation of mucus in excess of 0.5 inch in diameter or a string of mucus over one inch long was observed. In the nose any accumulation of mucus, excluding slender strings of ‘mucus bridges,’ was considered excess mucus. Research reveals findings seeming to establish that there is no difference in the prevalence of excess mucus between the milk-drinking and non-milk-drinking groups.

Summary

“Of 647 adult patients with apparently normal noses and throats, nearly one half complained of being bothered with postnasal mucus. The percentage of patients making this complaint was practically the same among those who drank milk as among those who did not drink milk. From nose and throat examinations it was found that the percentage of those patients with excess mucus was also practically the same among both milk drinking and non-milk-drinking groups.

Conclusions

“Reports from over 600 patients have indicated that milk is not the cause of annoying postnasal mucus. The cause of this common disturbance needs further investigation. Milk is too valuable a food to be omitted from the diet because of the popular belief that ‘milk makes mucus.’ - Ray M. Moore, M.D., in California Medicine, Volume 68, No. 1, January, 1948, pp. 31-32.

15. SHORTENED HUMAN LIFE

THE people who lived before the Flood ate animal food. After the Flood the people ate largely of animal food. And He permitted that long-lived race to eat animal food to shorten their sinful lives. Soon after the Flood the race began to rapidly decrease in size, and in length of years.” Counsels On Diet and Foods, page 373 (1864).

“Many die of diseases wholly due to meat eating, when the real cause is

scarcely suspected by themselves or others. Some do not immediately feel its effects, but this is no evidence that it does not hurt them.”-Ibid., page 391.

The principal life-shortening diseases today are the group of high blood pressure degenerative diseases of the heart, blood vessels, and kidneys. Mortality from hypertensive cardiovascular renal disease has now reached an all-time high in America. For the last sixty years there has been a steady progressive increase in deaths from this one group of diseases. For the decade 1931-1940 there was an additional increase of nearly 20 per cent. For the last year of that decade the mortality from this group constituted 62 per cent of deaths for ages sixty-five and over, and 44 per cent of deaths for all ages.

Animal experiments and other research work have shown a relationship between meat eating and high blood pressure, heart, blood vessel, and kidney diseases. From my own personal study of this research I have listed more than thirty prominent research workers whose investigations and experiments have revealed one or more phases of the causes of this class of diseases. There are many more whose work has thrown illuminating side lights upon this subject. The following are selected from these researches. The chemical elements of cholesterol, nitrogen and acid-ash wastes, and various high protein diets (of which meat is the principal one), along with alcohol and tobacco, are ultimate factors in the pathogenesis of these degenerative, life-shortening diseases. For the last century or so there has been the added factor of refined food, chiefly sugar and white flour. When it is considered how large a factor of susceptibility to infections as well as degenerations is provided by refined food, and how conducive is the eating of meat to convey infections, one might appropriately say that meats and sweetmeats rank highest as dietary causes of disease and death. These are the popular dietary practices of today which modern scientific research has shown to be unhealthful. In the words of the testimonies: “The disease and suffering that everywhere prevail are largely due to popular errors in regard to diet.”-The Ministry of Healing, page 295.

We shall see from the research work that such high protein foods as meat, cheese, cereal grains, and ripe (mature) legumes, when used largely in the diet, produce high blood pressure, accumulation of nitrogen wastes, and nephritis. These, with the exception of beans, cause arteriosclerosis also. Besides this, all flesh foods and such foods of animal origin as butter, other animal fats, and eggs contain cholesterol-the chemical substance involved in the production of arteriosclerosis. The contributing causes which force this substance into the artery walls are shown to be high blood pressure, overweight, high protein diets, acid-ash diets, tea, coffee, alcohol, and tobacco. Experimental work by Russian physiologists and by Dr. Leary of Boston were with cholesterol alone (0.5 gm. daily for each rabbit) without any secondary causes.

Hardening of the Arteries - Causes and Production

“Actually arteriosclerosis is not a normal sequel of aging and therefore as inescapable as gray hair and wrinkles.”-Editorial, The journal of the American Medical Association, November 4, 1944, p. 642.

In 1944 Major A. J. French and William Dock, M.D., reported one hundred fatal cases of coronary artery disease in soldiers from twenty to thirty-six years of age. These

were all arteriosclerotic disease, and there were arteriosclerotic plaques in more than one coronary branch in 84 per cent. Thrombosis (blood clot) was demonstrated in 36 per cent of the cases. All these facts prove arteriosclerosis to be a disease as definite as rheumatic fever or peptic ulcer and not due to aging. It is a chronic disease of slow insidious onset, giving little or no warning of its occurrence until the end, which in the cases of coronary disease comes with a crash.

J. H. Musser, M.D., professor of medicine, Tulane University School of Medicine, New Orleans, Louisiana, in an address delivered before the California Academy of Medicine, December 12, 1936, said: "This disease, coronary occlusion, has been frequently referred to as the doctor's disease. Certainly among the medical profession there is no one condition, disorder, or disease which takes away so many active members of the medical profession as coronary occlusion. I have seen at times as many as one third of the deaths in the obituary columns of The journal of the American Medical Association attributed to coronary disease. I would like to stress that these men who died from this condition for the most part were men in the most vigorous and most active period of their professional life."

Dublin and Spiegelman from the statistical bureau of the Metropolitan Life Insurance Company say, concerning mortality of American physicians: "Far outstanding on the list are diseases of the heart and coronary arteries, with 40.7 per cent of the total deaths."- The Journal of the American Medical Association, Volume 134, Number 15, August 9, 1947, P. 1212.

"During the last few years the editor of The journal has reported more than one in five physicians' deaths as due to coronary disease, which killed more than twice as many as cancer. Similar ratios probably exist among businessmen, lawyers, the clergy, and those engaged in teaching, clerical, and supervisory work."-Ibid., Volume 131, Number 11, July 13, 1946, p. 875.

Timothy Leary, M.D., of Boston, in a paper entitled "The Most Important Professional Disease-Coronary Sclerosis," also read before the California Academy of Medicine, said: "That atherosclerosis is not a disease of old age is indicated by high-grade coronary sclerosis as early as 12 to 15 years and coronary deaths in my series at 24, 25, 26, 28, 29, 30, years.

"The widespread belief that arteriosclerosis is merely a manifestation of old age does not tally with the actual facts." "It is not a mere 'infirmity' of old age; but rather a disease of the vessels manifesting itself mainly during senescence-in short, it is a 4 malady' or an 'affliction' of old age." - Ludwig Aschoff, in Arteriosclerosis, edited by Edmund V. Cowdry, pages 1, 5, 6. While it is chiefly a disease of middle-aged and elderly persons, yet young men, mere boys under twenty years of age, not infrequently show thickening of the arteries, and old men may not show it. The writer attended a boy of thirteen who had attacks of periodic acidosis without diabetes, who had arteries noticeably sclerotic.

"No disease other than arteriosclerosis, to which man is heir, is apt to lead so frequently to dangerous conditions or to cut off the thread of life without warning." - Ibid., page 14. On the other hand, the disease plays a large part in sickness and death not primarily due to it. United States mortality statistics for 1925 give it as associated with forty other diseases and conditions stated in death certificates, only seven or eight of which are directly due to hardened arteries. Yet there can be no question but that this is far short of the total.

The nearest approach to the full story of the prevalence of the disease is revealed in large “samplings” done by insurance companies. Edgar Sydenstricker, in Arteriosclerosis, page 135, gives a report of examinations of male policyholders at the head office of the Life Extension Institute, of which the following is a portion:

Age Group	Slight	Moderate or Marked
20-24	10.5	0.9
25-29	10.9	1.9
30-34	14.4	2.0
35-39	18.9	3.0
40-44	24.0	3.7
45-49	30.6	5.7
50-54	35.9	8.0
55-59	36.8	12.8
60-64	38.4	18.6

From German autopsy records during World War 1 arteriosclerosis was found with great frequency in those of military service age, that is, the young and the middle-aged. The summary appears as follows:

1. Before 33 many have arteriosclerosis.
2. At 33 years, 97 to 98 per cent have changes in their arteries.
3. From 33-40 years there seems to be a stationary or non progressive period.
4. From 40 years on it progresses, and at 45 years everyone has it to some degree.

American soldier deaths (1942 to 1946) reported by the Army Institute of Pathology show “approximately 1,000 sudden non accidental, non combat deaths of apparently healthy soldiers aged 18 to 40. Pathologic examination of between 700 and 800 of these, reviewed by Moritz and Zamcheck, reveals that approximately 350 of the deaths were caused by previously unrecognized heart disease, almost 300 of which were due to coronary arteriosclerosis. The post-mortem examinations disclosed severe atherosclerosis of one or both coronary arteries, and thrombotic occlusion was recognized in approximately 2-5 per cent.”-The Journal of the American Medical Association, Volume 133, No. 51 February 1, 1947, Page 325. Original report from Alan R. Moritz and Norman Zarncheck: Sudden and Unexpected Deaths of Young Soldiers: Diseases Responsible for Such Deaths During World War II, Archives of Pathology, 421:459, November, 1946.

Obesity and Atherosclerosis

“Various relations of diet to atherosclerosis have been described recently (Nutrition Reviews 6:99, 1948). A survey by S. L. Wilens (Archives of Internal Medicine, 79:129, 1947) on the relation of obesity to the incidence of atherosclerosis is of importance to nutrition workers because of the methods used and for the resulting data. The observations reported in this paper were based on 1,250 autopsies performed at Bellevue Hospital, New York. Of these, 1,000 were consecutive, unselected autopsies of persons thirty-five years of age and over at the time of death. Because an insufficient number of obese persons was included in this selection, the series was enlarged by including the next consecutive 250 autopsies of obese persons in the same age range. The autopsies were performed by pathologists who were not concerned with development of a survey on the relation of obesity to atherosclerosis. The data were obtained by examination and classification of information recorded in the individual protocols. Evaluation of the extent of obesity at time of death was based on the pathologist’s expression of the bodily condition and on descriptions and measurements of fat deposits in various parts of the body. The patients of each group (obese, average, and poor) were classified, according to degree of atherosclerosis present, into the following categories: (1) those with no atherosclerotic lesions or only slight ones; (2) those with a moderate degree; and (3) those with severe widespread lesions

“Wilens’s classification of the individuals into what he termed -nutritional groups’ (obese, average, and poor) inferred that obesity is a measure of ‘good’ nutrition and that lack of depot fat constitutes evidence of ‘poor’ nutrition. Actually, obesity does occur in cases of poor nutrition and is principally a measure of caloric intake and excessive appetite and is not a measure of adequate nutrition achieved through consumption of normal amounts of a balanced diet. The correlation between obesity and atherosclerosis is an important one, but cannot be considered as a correlation with ‘nutritional status’ as interpreted by Wilens. Throughout the original article the reader should distinguish between good nutrition, which signified a balanced intake of nutrients, and obesity, which may reflect sufficient or excessive calories, but frequently poor nutrition. On the other hand, this method of collecting data had the virtue of having been recorded with complete detachment from any possible relations between atherosclerosis and fat stores.

“The occurrence of general atherosclerosis and of coronary atherosclerosis in this series of persons was directly proportional to the amount of adipose tissue deposited throughout the body. In obese men the incidence of severe, general atherosclerosis was two and one-half times as great as in poorly nourished men. In obese women the incidence of severe, general atherosclerosis was almost twice as high as in poorly nourished women. For both men and women with average fat stores the incidence of general atherosclerosis was intermediate to that in obese and lean groups. Obesity in men appeared to be a more important factor in increasing the incidence of coronary atherosclerosis than in women, as the incidence of this category of lesions was twice as high in obese men as in obese women.

“When the relation of depot fat to the incidence of general atherosclerosis was classified according to decades of age, the same relation was observed in each age group as had been recorded above for the entire series. The incidence of severe atherosclerosis among the obese individuals of any decade of life was always greater than among the persons with little storage fat of the succeeding age group.

“To determine whether the relation between fat stores and atherosclerosis was influenced by inclusion of a large percentage of persons with hypertensive vascular disease in the obese group, the cases deemed to be free of hypertension were considered alone. The major observation was again confirmed with an additional interesting relation being noted in this group. Up to the age of sixty-five in men and fifty-four in women the incidence of atherosclerosis in non-hypertensive groups with average and with low depot fat stores was practically the same, while over these ages individuals of average nutritional status had a higher incidence. When hypertensive cases were considered alone, the findings supported the conclusion of a general relation between

obesity and atherosclerosis and also suggested that hypertension accelerated the development of atherosclerosis in obese and average groups more than in those with little storage fat....

“The data in these surveys indicate strongly that there is a relation between bodily condition and fat deposits at autopsy and the incidence and severity of atherosclerosis of the aorta and main branches of the coronary arteries.”-Nutrition Reviews, June, 1948, pages 176-179.

The weakening effects due to hardened and inelastic arteries are large factors in the severity and prolongation of acute infections such as influenza and pneumonia, and in the failure to recover from operations and accidents.

Cholesterol

Beginning in 1908 and perfected from 1912 onward by Russian investigators of whom Anitschikow was a prominent leader, it has been demonstrated that cholesterol, not excess protein or acidosis, is the materies morbi of atherosclerosis, the arterial disease which constitutes 95 per cent of human arteriosclerosis. A high protein and high acid-ash diet supplies the forces which cause the impregnation of the blood vessel wall with cholesterol, the chemical material of the disease. Since cholesterol is found only in animal fats and animal tissues, meat, which is the principal high protein food in use, furnishes all the factors and materials of the disease. However, it should be noted with emphasis that ovo-lacto-vegetarians also have atherosclerosis, and not without reason, as the customary large use of breads and cereal preparations, eggs, and butter, as well as the high protein and high acid-ash factors, furnishes cholesterol in excess.

These now nearly completed links in the chain of evidence regarding the causes of arteriosclerosis have been gathered together and correlated, with funds supplied by the Josiah Macy, Jr., Foundation, in the book Arteriosclerosis, edited by Edmund

V. Cowdry, and published by the MacMillan Company in 1933. Quotations in this section, unless otherwise credited, are from the contributors to this volume. Timothy Leary, pathologist of the Boston City Hospital, aided by a grant from the Committee on Scientific Research of the American Medical Association, conducted a pathological and experimental research on coronary atherosclerosis which has also served to correlate the processes of disease with the causes in the human. Leary's first contribution from this research was published in 1934 in the Archives of Pathology.

The Disease Process

Atherosclerosis begins as a fatty infiltration of the lining of the blood vessels, usually the larger vessels first, and is more distinct and extensive in the aorta just beyond the aortic semi-lunar valves. This process is seen as “small round grayish or yellowish spots, measuring a few millimeters in diameter They exhibit a marked tendency to fuse and form larger, rounded or irregular plaques.... In the course of time the surface of many of these latter becomes milky white by the development of fibrous tissue, while the fatty parts in the depth of the lesions break down and form the mushy material from which the condition originally received its descriptive name. The Greek word *athere* is translated “mushed.”

“From this point on further change may take place in two directions: Either the surface is permanently scaled by the development of a calcareous plate [lime soap] or the degenerative process in the depth gradually extends to the surface through the fibrous covering. When the softening eventually reaches the inner surface the atheromatous masses are partly washed away by the blood stream. In this manner there are established ragged ulcerative defects at the bottom of which there always remain considerable remnants of necrotic [dead] material. These ulcers may then be partly or completely covered with thrombi [blood clots].”-W. Ophuls, in *Arteriosclerosis*, page 253. These fatty changes are at first confined to the lining of the blood vessels, but later the inner layers of the muscle cells are also filled with minute fat droplets. This so-called fatty material is chemically cholesterol, often with numerous cholesterol crystals from the splitting off of fatty acids, which latter may be saponified and absorbed, or unite with calcium to form an insoluble debris.

The early formation of fibrous tissue, as Leary shows, appears as the reaction of youth, while the formation of the large, deep, or projecting collections of soft, mushy cholesterol which break through to the surface with the formation of a blood clot in the vessel, is the reaction of age.

Unbalanced Diet

These are the forms of arteriosclerosis found by Newburgh in rabbits fed on muscle meats and liver; and by Nuzum and Sansum on rabbits fed liver or oat- as a large part of the food. They supposed these factors of high protein and acid ash were the direct and sole cause of the disease, but further research has revealed other factors which cannot be overlooked.

“A relatively unbalanced diet, however, in certain species of animals leads to changes in the blood vessels similar to those of human arteriosclerosis. Ignatowski (1909) observed that adult rabbits kept on a meat diet usually died within five or six days of what he considered ‘acid intoxication.’ When vegetables were added to the meat the ‘toxic effect of the diet’ was less pronounced and death occurred only after two or three weeks. Curiously as enough, these animals exhibited kidney changes described as nephritis. Even so small an amount as one or two grams of meat ingested daily produced a ‘toxic’ effect.... Ignatowski observed that animals which survived for a long time on a diet containing meat exhibited, in addition to the changes in the kidneys, a considerable degree of sclerosis of the aorta.”-Soma Weiss and George R. Minot, in *Ibid.*, page 234.

“Stuckey (1912) observed that of various diets composed of milk, meat juice,

egg yolk and egg albumen, the one containing cow's milk and egg yolk was best suited to the production of marked arteriosclerosis in rabbits. Stuckey (1912) and Saltykow (1908-1914), believed that the cholesterol rather than the proteins in this and similar diets is the potent and primary factor in the production of the arterial changes." - Ibid., page 235. Chalutow and Anitschkow then fed rabbits cholesterol dissolved in sunflower-seed oil. After a few weeks, they observed fatty infiltration of the aorta and other organs. Wacker and Jueck produced arteriosclerosis by feeding rabbits daily amounts of 1.5 grams of cholesterol mixed with oats for 120 days. Pure cholesterol alone, except in enormous doses (fifty grams daily) kept up for months, produced no sclerosis, while such small amounts as 0.3 grams fed with milk, eggs, and greens produced marked arteriosclerosis, as did the cholesterol dissolved in vegetable oils.

Complete Viewpoint

Newburgh and Clarkson in further extensive research modified their earlier stated views. As given by Weiss and Minot, their conclusions are as follows:

In this study they compared the effects of protein and of cholesterol feeding and found excess of either capable of producing arteriosclerosis, but that relatively less excess protein than cholesterol was necessary to obtain the same degree of atheromatous change in the aorta. They pointed out that the experimental rabbits whose nitrogen intake from protein food was about 1.1 gram per kilogram of body weight, which is about four times the normal requirement, developed arteriosclerosis in six months to a year; whereas rabbits ingesting practically no cholesterol in their natural diet, required 250 mg. of cholesterol in capsules daily to develop arteriosclerosis. It is significant, however, that Clarkson and Newburgh observed a high cholesterol content of the blood following a high protein diet. They claim that this increased amount of blood cholesterol is not due to cholesterol absorbed from the digestive tract, but attribute it to metabolic disturbances directly referable to the excess of protein in the diet. They also point out the considerable variation in the degree of arteriosclerosis in individual rabbits on the same diet, and the lack of any close relationship between the level of the blood cholesterol and the degree of arteriosclerosis."-Ibid., page 236. While Newburgh and Clarkson showed that a high protein diet raises the level of the blood cholesterol, Steinbiss attributes the cholesterol disease of the blood vessels to metabolic (chemical) disturbances produced by the animal food rather than to the direct increase of cholesterol in the blood from the food itself. Anitschkow and many others have now produced the disease by feeding varying amounts of cholesterol dissolved in various vegetable oils, with no other additions to the usual herbivorous diet of rabbits. This was also Leary's method, who has shown the almost exact parallelism of human atherosclerosis (of the coronary artery) with that produced experimentally in rabbits, and, further, that sclerosis due to cholesterol infiltration is the reaction of youth in both rabbits and humans, while large, mushy cholesterol "abscesses" is the reaction of age in both the animal and the human, and so there is no species difference.

These high cholesterol feedings show that excessive ingestion of cholesterol-containing foods is a definite factor in the production of the arterial disease even in the absence of such factors as a high level of blood cholesterol or of high protein and high acid-ash intake.

Fatty Food

This is of importance, as repeated estimations of human blood cholesterol have failed to show any uniform level or excess even where manifest arteriosclerosis was present. Research workers and pathologists agree that the deposits of cholesterol are not due to so-called fatty degeneration, but to infiltration.

In 1935, Rosenthal of Chicago published an extensive treatise (in Archives of Pathology) based on chemical estimates of fat in the aorta of 500 persons with varying degrees of atherosclerosis. It confirms and adds certainty to other researches, and, together with an extensive correlation and analysis of other investigations, it makes doubly certain the importance of all the factors and especially the secondary. "Although each school of thought at its inception believed the evidence which it presented was the primary and sole cause of the atherosclerosis, in the later development all in turn have conceded that the secondary factors were of utmost importance."

Leading backward from effect to cause is the fact that "the total amount of extractable fat in the aorta" is "directly proportional to the degree of atherosclerosis. These differences are as follows, using only the cases of white male individuals:

Atherosclerosis		Smooth Aortas	Slight and Moderate	Moderate
and Severe	Age	Grams of Fat	Grams of Fat	Grams of Fat
	25-30	0.077	0	0
	31-40	0.081	0.213	0.696
	41-50	0.139	0.340	1.308
	51-60	0.152	0.440	1.082
	61-70	0.181	0.497	1.277
	71-100	0	0.575	1.486

"In other parts of the body, for example, degenerative processes, fibrosis, and hyalinization are not accompanied by a corresponding deposit of fat." In the aorta, "moreover, the liquid (fat) was mainly composed of free cholesterol and its ester, and in atherosclerotic aortas the relationship between these elements was constant; namely, 25 and 57 per cent, respectively." "Atherosclerosis of the aorta as it occurs in man is never found in animals which are fed a diet devoid of cholesterol, and which must synthesize their own sterol." In no race for which a high cholesterol intake (in the form of eggs, butter, and milk) and fat intake are recorded is atherosclerosis absent (America, United Kingdom, Central

Europe, South America, Mongolia). Where a high protein diet is consumed, which naturally contains small quantities of cholesterol, but where the neutral fat intake is low, atherosclerosis is not prevalent. Thus, in the Japanese race, by which a diet rich in protein but low in neutral fat (4.9 per cent, compared with 11.4 per cent in the Western diets) is consumed, the incidence of atherosclerosis is much lower than it is in the United States (3.1 to 21 per cent, respectively). Similarly, the Eskimos, who, contrary to current opinion, eat very little neutral fat (as the oils extracted from the liver, etc., are used for heating, lighting, and cooking) have a low incidence of atherosclerosis, although their diet consists mainly of red meat. The neutral fat paves the way for cholesterol absorption. Diets high in cholesterol and low in neutral fat may result in a much lower blood cholesterol than a diet high in neutral fat and low in cholesterol. Aschoff traces the marked decrease of atherosclerosis in Central Europe following the war to the low intake of fat.”

“Of interest is the report of Ismail in Egypt, who has communicated that among his private patients, whose diet is similar to that of the Europeans, the incidence of atherosclerosis is high, while in his hospital practice, composed mainly of natives, who subsist largely on a carbohydrate diet, the incidence of atherosclerosis is low.”

“Saile compared monks living on an absolute vegetarian diet (without meat, eggs, or butter) with another group of monks who were non-vegetarian, subsisting on a diet similar to that of the average European. Unfortunately, his results dealt mainly with blood pressure; he showed that only 25.4 per cent of the vegetarians had a systolic blood pressure over 120 mm. of Mercury. In comparison, 70.4 per cent of the non-vegetarians had a blood pressure over that amount. He inferred a similar relationship to arterial changes. It must be stressed at this point that the vegetarians usually considered in the literature abstain from meat but consume eggs, milk, and butter to a high degree. This diet, high in cholesterol and neutral fat, may account for contradictory opinions.” In determining what part the diet plays in atherosclerosis, it must be borne in mind that important factors are the amounts of cholesterol and of neutral fats consumed.”-Sol Roy Rosenthal, “Studies in Atherosclerosis: Chemical, Experimental, and Morphologic,” *Archives of Pathology*, October, November, December, 1934.

Pressure Factors

Anitschkow has also presented definite evidence that mechanical stresses determine to a great extent both the occurrence and localization of these infiltration deposits. They are present, most numerous, intensive, and extensive where there is excess force to the blood stream or in arteries where sharp bends or narrowing occur. This is notable just beyond the aortic valves in the aorta, where branch arteries occur in the descending aorta, in the coronary at the sharp bend of the left coronary, and in other arteries where muscular contractions narrow the channels with the blood stream at high pressure. Leary further elaborates some of these, especially the preponderance of coronary occlusion at and beyond the bend of the left coronary artery. He also points out the factor of increased blood pressure in occasioning atherosclerosis and the combination of this with acidosis in diabetic patients, in whom arteriosclerosis is most extreme.

In animal experiments there is a great variation in the occurrence of arteriosclerosis in cholesterol-feeding experiments even when conditions and dosage are as

nearly uniform as can be secured.

Daily Cholesterol Content of a Commonly Used Diet of 50 or 75 Years Ago

Food	Ounces	Grams	Grams	
			Grams	Cholesterol
Bacon	1	30		0.0324
Eggs, 2	3.33	100		0.49
Milk, 3 glasses	24	720		0.216
Cream	2	60		0.198
Lard (for cooking)	2	60		0.198
Butter	1.3	40		0.088
Cheese	0.66	20		0.0176
Beefsteak	3.33	100		0.076
Fish or chicken	3.33	100		0.076
Total		.		1.392

This variable "susceptibility" is not difficult to understand when all these variables in causative influences are taken into account. The same may be said also of the infinite and puzzling variability of occurrence in the human.

In rabbits notable damage occurs in a month by the daily addition of a half gram of cholesterol to the food, and in three or four months full-blown fatty changes occur in the arteries. Much smaller amounts of cholesterol given for a longer time produce the same results.

Even if some fruit and vegetables are added to this menu, it is proportionately higher still in protein and acid in ash, so that such diets are remarkably conducive to arteriosclerosis.

Liver and other cellular organs, as brain, sweetbreads, and kidney, contain ten times as much cholesterol as lard, suet, and butter, and forty times as much as beef.

Cholesterol Content of Foods

Foods	Per Cent	Per Cent
	Maximum	Minimum

Brain, cattle	3.7	2.7
Liver	3.4	0.3
Kidney, mutton	3.4	0.24
Pancreas, calf	3.12	
Thymus, calf	2.3	
Roe, salmon	2.2	
Egg, yolk	2.15	1.34
Chicken	0.527	0.059
Meat, chicken	0.108	0.059
Lard, suet	0.35	0.10
Butter	0.22	0.185
Blood, beef	0.194	
Rabbit, whole	0.117	
Bacon, fat	0.108	
Meat, veal, beef, pork	0.088	0.046
Milk, cows	0.03	0.013

The above table, published in The Journal of the American Medical Association, December 9, 1933, page 1845, gives the averages of many estimates.

Acidosis Factor and Diabetes

Some years ago, when a high-fat and high-meat diet were in vogue in the treatment of diabetes, hardening of the arteries, with resulting gangrene of the feet, was much more common and more serious than it is since the advent of insulin and the now greater use of vegetables.

“The disturbed metabolism of fat in the depancreatized animal is indicated by the accumulation of the ketone bodies in the blood and by the excretion of excessive amounts in the urine. The ketosis in a fat dog is greater than in a lean, but this species is characterized by its efficiency in metabolizing fats, without ketosis. The loss of body fat is rapid but the ketosis may be so severe, even in this species, that the animal dies in coma before the fat reserves are depleted.

“B-hydroxy-butyric and aceto-acctic acids and others derived from tissue breakdown appropriate base and thus when the available reserve of base is depleted may produce an acidosis. In acidosis the respiratory center is stimulated and ‘air hunger’ and coma are produced. The exact mechanism of coma production in diabetes is not known.

Some observers believe that aceto-acetic acid is particularly toxic. This acid is oxidized in the bladder and lungs to form acetone, which is excreted in the urine and expired air.

“The neutral fat content of the blood increases due probably to the increased rate of mobilization of depot fat and there is also a rise in cholesterol esters and the phospholipid.”

In the depancreatized animal insulin decreases the lipernia and cholesterolemia and prevents the deposition of the large amounts of excess fat which accumulate in the liver in the untreated animal. The level of the ketone bodies in the blood is restored to normal. This effect may be due to a diversion of metabolism from fat to carbohydrate. The formation of fat from carbohydrate is increased under the influence of insulin. It has been shown that insulin in the presence of fructose fumarate or lactate inhibits the formation of ketone bodies in liver slices of diabetic cats.”-Charles Herbert Best and Norman Burke Taylor, *The Physiological Basis of Medical Practice*, 4th ed., 1945, Pages 574, 579, 580.

These scientifically determined facts are the basis for the idea that, as fat is burned in the body only in a bright flame of burning carbohydrate, the lack of both insulin and carbohydrate, which is restricted in the diabetic diet, produces imperfect buffling of fat; that fats thus poorly oxidized form highly toxic acids, and that these acids, as well as the increased cholesterol, cause extreme and extensive arteriosclerosis. As vegetables furnish an alkaline ash, their lack in the diet caused further accumulation of the unneutralized acid ash of meats, eggs, and gluten breads.

Coronary Occlusion

While all are acquainted with the relationship of hardening of the arteries of the brain and accompanying high blood pressure to the occurrence of apoplexy and its resulting stroke of paralysis, many are quite unfamiliar with the relationship of hard arteries to sudden heart deaths. The three following abbreviated case histories are taken from Dr. Leary's autopsy records at the Boston City Hospital as given in his paper of 1934, already cited.

“Case 1. A man aged twenty-five, an athlete, who had had no previous illness save one attack of indigestion two weeks before his death, was playing baseball as usual on Sunday, the day of his death. He made a hit, ran to second base, and collapsed.... The conditions found were: high-grade sclerosis of the left coronary artery, with thrombosis at a higher level.”

“Case 2. A man twenty-six years of age, a chauffeur, had an occasional attack of acute indigestion. He was removing a wheel from an automobile when he collapsed, and within a few minutes, when a doctor was found, was pronounced dead. The heart ... presented a high-grade sclerosis, with thrombosis of the descending branch of the left coronary artery.”

“Case 3. A retired businessman sixty-one years of age, with no record of illness, collapsed on the street. The coronary arteries showed regions of narrowing almost to occlusion, notably of the descending branch of the left coronary artery.”

These three cases are given together because though the sudden death of one sixty years of age does not startle us, the others at twenty-five and twenty-six years of age are not so common; yet the cause of death is one and the same disease-atherosclerosis of the coronary artery, with thrombosis (clotting) of the blood in this artery and the consequent cutting off of the heart's life line. Even if survival occurs, the affected portion of the heart wall from which blood supply is cut off, softens, and healing by the production of fibrous tissue requires months, and its muscle power is permanently damaged thereby. The slightest exertion or excitement causes decompensation and circulatory deficiency and may at any time be inimical to life. Angina pectoris may also be associated with coronary sclerosis and prove a most painful, disabling, and even dangerous affliction.

Quantitative Factor

While there is clear evidence that there are at least three other major factors-protein, acid ash, hypertension, and other mechanical stresses-in the production of arteriosclerosis, yet the quantitative factor of animal fats and cholesterol should not be overlooked, and it has been shown to be, along with these other forces, of determining importance.

“Any metabolic agent capable of producing atherosclerosis must have been an article of diet from early times, since atherosclerosis has been found in mummies. The substance is a necessary part of every animal cell, forming, from Starling's concept, the stable groundwork of the cell. The most urgent demands for it come at times of most rapid cell formation. Egg yolk is intended for the embryo. Milk is intended for the infant. The high blood cholesterol found in pregnant women marks the mobilization of this substance for the need of the fetus in utero. Man is the only animal that ingests eggs and milk throughout its lifetime. Man is also the only animal ... which dies in early life from coronary sclerosis, and which acquires atherosclerosis almost universally in advanced life.”-Timothy Leary, in *Archives of Pathology*, April, 1934.

Timothy Leary, M.D., after most extensive research, gives the following account of the causes and processes in atherosclerosis:

“Atherosclerosis, whether human or experimental, cannot occur without visible cholesterol. Cholesterol is a necessary part of all animal cells. It is present in the cells in a combined invisible form. Visible cholesterol (polariscope) occurs normally in the adrenal cortex, in myelin sheaths, in the interstitial cells of the testicle, and sometimes in corpora lutea. Apart from these tissues visible cholesterol is associated with disease. It is literally excess cholesterol. Excess cholesterol in adequate dosage over long periods will produce in rabbits cirrhosis of the liver, enlargement of the spleen, and chronic nephritis-a triad of lesions corresponding to those produced by Gye and Purdy by intravenous injections of silica sol over long periods in rabbits. Excess cholesterol is therefore a chronic irritant. Like silica it provokes a growth of connective tissue.

“There are two types of lesions of arteries associated with the presence of cholesterol. The first type, atheroma, is a reversible process in youth, responsible for the aortic deposits in nurslings and at puberty, and in general for superficial lipid deposits in the arteries of the young. The cholesterol esters appear in foam cells in the subendothelial layer

of the intima as in true atherosclerosis. The excess cholesterol, however, is removed from the lesions by cells which have the character of fibroblasts. In these the cholesterol esters are split, the excess cholesterol is dissolved and disappears from the lesion. The stay of the excess cholesterol, with its chronic irritant properties, is not long enough to provoke true atherosclerosis. As the body ages, the power to remove excess cholesterol from the arteries is lost, except in the ascending aorta, where the power may persist into old age.”

“Experimental atherosclerosis in the rabbit is produced by feeding cholesterol. In rabbits so fed there is a latent period of several weeks following the beginning of feeding before lesions appear in the aorta. By killing animals at critical intervals during this period I have been able to show that the ingested cholesterol is brought to the liver and esterified; that the esters collect in excess in the liver cells and the adrenals; that Kupffer cells in the liver and similar cells in the adrenals engulf the excess esters as particulate matter; that these ameboid cells, now become foam cells, escape from the organs through the blood and lymph streams, pass the so-called filter of the lungs with ease, and invade the aortic intima. In this way atherosclerosis is produced.”

“Atherosclerosis belongs with diabetes, obesity, and gout, a group of diseases due to inadequate metabolism of food substances and favored by excessive ingestion. There is a close linkage between diabetes and atherosclerosis. An inadequate carbohydrate metabolism seems to be accompanied by an inadequate cholesterol metabolism. Atherosclerosis in the diabetecic does not differ from standard atherosclerosis in the method of its production or in the pathology of the lesions. It does tend to occur more frequently in youth, to develop more rapidly, and to be more serious in character in general. As in diabetes, atherosclerosis may be a familial disease.” - Modern Concepts of Cardiovascular Disease, by American Heart Association, Volume 11, Number 11, October, 1942.

“Cholesterol is one of the most complex substances found in the animal body. It is metabolized apparently with difficulty. Because of its stability Starling believed that it served as the skeleton-like structure of the cell body in the interstices of which more labile substances underwent metabolism. It is synthesized in the human body. The excess is probably ingested. Egg yolk, milk, and animal fats are the dietary sources.”

“The tissue content of cholesterol increases with age, and the needs for it grow less.”

“Vegetable oils, whose sterols are not absorbed through the animal intestine, can be substituted for animal fats. The cholesterol stored in the tissues as the individual ages, and synthesis of the substance, should care for the body’s needs on a cholesterol free diet.” - Ibid., Volume 11, No. 11, November, 1942.

Concerning the source of cholesterol, the effects of excess, and the body’s means of protection against such excess,-in short, the metabolism of cholesterol,-Thannhouser says:

“Herbivorous animals cannot excrete cholesterol in noticeable amounts, although they are able to absorb animal cholesterol experimentally added to their plant food.”

“Cholesterol is the only animal sterol which undergoes absorption from the intestines. It is excreted in the bowels and reabsorbed to a large extent.”

“The fact that cholesterol is synthesized in the metabolism prevents a

deficiency in the organism due to an unsatisfactory absorption. In regard to excretion, however, diseases may originate from an accumulation of cholesterol due to an unsatisfactory discharge.”

“Summing up, it may be said that the synthesis of the sterol skeleton in animals is evident, but the destruction of the sterol molecule in the metabolism is not proved.”

“Hypercholesteremia, whether due to cholesterol (ester) or to free cholesterol, is a symptom which indicates that the excretion of cholesterol does not keep pace with the endogenous and exogenous supply. Simultaneously with the symptoms of hypercholesteremia, cells appear in different organs filled with lipides which are mainly sterols. These cells, which are called foam cells, according to their appearance, or xanthoma cells according to their content, may after some time give up their cholesterol to the blood. There remains a granulomatous scar tissue consisting of giant cells, lymphocytes, and connective tissue.”-E. J. Thannhouser, “Cholesterol Metabolism and the Different Groups of Xanthomatous Diseases,” Proceedings of the California Academy of Medicine, 1937-38, Pages 99, 101, 103.

On the same subject Timothy Leary also gives an excellent summary discussion:

Summary

“Evidence is presented:

“That atherosclerosis in man and in the experimental rabbit is due to the presence of excess cholesterol esters with phagocytic cells, which first appear in the intima of the arterial wall.

“That cholesterol is esterified in the liver as directly observed in the experimental rabbit.

“That cholesterol when fed in excess to rabbits is deposited in the form of esters in the cells of the liver and adrenals.

“That the esters as they accumulate in excess become a burden and are removed from these organs by Kupffer cells in the liver and their analogues in the adrenals.

“That the cholesterol esters are engulfed as particulate matter by these cells.

“That these cells, now lipid cells, escape from the liver and adrenals through the blood and lymph systems and may produce obstruction in the lymph sinuses.

“That lipid cells, having entered the blood stream, pass through the lung filter and selectively invade the arterial intima. This invasion is favored by stresses, but is apparently dependent on a positive chemotaxis of the arterial wall for cells carrying cholesterol esters.

“That the latent period after the beginning of cholesterol feeding in the rabbit and before aortic lesions appear is dependent on the production of esters in excess and their transport, as indicated in paragraphs 21 to 7 inclusive.

“That lipid cells possess the power to split cholesterol esters and bring the substance into solution in an excess of fatty acids.

“That excess cholesterol esters are akin to silica in their irritant character. Both are difficult of metabolism, tend to stay long in tissues, and stimulate growth of connective tissue.

“That intravenous silica and cholesterol esters, practically alone among particulate matters, tend to cause in rabbits cirrhosis of the liver, enlargement of the spleen, and changes in the kidneys resembling those of chronic ‘interstitial’ nephritis.”

“It is evident that atherosclerosis is a lipoidosis which, probably because of limited and intermittent excess dosage in man, tends to be restricted largely to the arteries. Only in unusual persons, in whom tolerance for the substance may be lower, is the lipoidosis more general; e.g., xanthoma formation. The great excess and the continuous dosage in the experimental rabbit result more frequently in a wider distribution of cholesterol.”

“Macrophages in man and in experimental animals in which a great variety of forms of particulate matter have been engulfed, including silica and silicates, carbon, magnesium dioxide, lapis lazuli, mercuric sulfide, colloidal dyes, bacteria, blood pigment, and other agents, exhibit no tendency to invade the arterial walls.” -Timothy Leary, M.D., “The Genesis of Atherosclerosis,” Archives of Pathology, Volume 32, Number 4, October, 1941, Pages 554, 555, 540, 534, 535.

The following diseases are listed by these investigations: Gaucher’s disease; Niemann-Pick’s disease; diabetes (pancreatic disease); cirrhosis of liver; fatty degeneration of liver; adrenal diseases; interstitial nephritis; xanthomatosis of skin, eyelids, tendons, joints, bony prominences, palms of hands, soles of feet; skin creases on and about nipples, axilla, and groins; deposits of urates within bones and cartilages.

“This discussion of atherosclerosis, dealing as it does with the harmful effects of cholesterol over dosage, cannot be closed without calling to attention the fact that cholesterol is an important food substance as necessary as the carbohydrates, fats,

protein, and mineral elements of the dietary. All the cholesterol needed by the cells of the human body is ingested.... Milk and eggs are wholesome foods, which are necessary sources of cholesterol. As one advances in years, the needs for the substance appear to grow less. In general ... it is the abuse, the overeating of these foods, as is true in the case of other food substances, that is likely to produce disease.” - Timothy Leary, in The journal of the American Medical Association, Aug. 17, 1935.

It should be noted that Dr. Leary in 1935 says that all the cholesterol needed by the cells of the body is ingested. E. J. Tharmhouser in 1937 and others in 1942 specify that cholesterol is synthesized in the animal organism. The research on cholesterol synthesis was done by aid of grants from Josiah Macy, Jr. Foundation and the Rockefeller Foundation. The former also gave aid in the research on cholesterol pathology by Edmund V. Cowdry, Ph.D.

Block and Rittenberg (see Konrad Block and D. Rittenberg, “On the Utilization of Acetic Acid for Cholesterol Formation,” journal Biological Chemistry, 145:625, October, 1942) have demonstrated that cholesterol can be synthesized from acetoacetate in the animal organism. They determined this by feeding sodium deuterioacetate

to mice and rats. Acetic acid has been demonstrated to be an antecedent of a number of different substances not present in food but necessary for the body mechanism. Acetoacetate is an intermediate product of combustion and so could be very readily seized upon for the synthesis of cholesterol. See The journal of the American Medical Association, Volume 136, No. 11, March 13, 1948, Page 771. This rules out any nutritional necessity for foods of high cholesterol content in so far as preformed cholesterol in the diet is concerned, with the possible exception of milk for the newborn. In milk the cholesterol content is only about three one-hundredths of i per cent. Moreover, it becomes evident that cholesterol disease is in the main due to ingested, that is, dietary, cholesterol. Milk may be used freely, a quart a day, but butter and eggs must be used moderately. Meat of all kinds, and animal fats having no essential uses not supplied by other foods, should be omitted. Evidence has been presented by research that pantothenic acid functions in the metabolism of acetate. Other research supports this concept and that certain intestinal bacteria of harmless and beneficial use function in the utilization of acetate in the formation of fatty acids and sterols.

“F. Lipmann and N. O. Kaplan (Nutrition Reviews, 5:331, 1947) have presented evidence which suggests that pantothenic acid functions in the metabolism of acetate. This concept is supported by an experiment by Shive and co-workers using *L. arabinosus*, which is believed to utilize acetate in the formation of fatty acids and sterols.” - Nutrition Reviews, Volume 6, Number 5, May, 1948, Page 155.

In the application of these principles of balance, and avoidance of an excess of cholesterol even when liver and other cellular organs are excluded from use as food, it certainly appears necessary to see that the foods next highest in cholesterol—eggs and butter—are held to moderate use. Of eggs, probably two or three a week, in addition to a limited use in cooking, are about all that one should allow. With the use of milk and cream there is no necessity for any but a moderate use of butter. As butter ranks with lard and suet in its cholesterol content, it is next to liver and the cellular organs in quantitative importance. In the present state of our knowledge we cannot advise interdiction of milk and cream, as milk carries the largest content of calcium of any food. To secure the necessary lime entirely from other foods does not seem possible.

The best information available indicates a present great increase in the amount of animal fats in the American diet. Sansurn and Hare (Normal Diet and Healthful Living, 1936) say that diets today contain a greater proportion of fat than they did fifty years ago. They state that not more than fifty-six grams were taken then, while home and hotel fares now contain as high as one hundred fifty grams of fat. This comes about by the increased use of cream in pastries and sweet desserts. The nation-wide consumption of ice cream is enormous. Feeding processes give meats more fat today than they did formerly.

Vegetable oils have likewise a tremendous vogue. Cooking oils and salad dressings are made from corn, cotton seed, peanuts, olives, coconuts, and soybeans. The phenomenal increase of commercial salad dressings is an outstanding factor in this increase of fats in the American diet. Even the wider use of olives and avocados contributes somewhat to this increase.

Excess of Vegetable Oils

It is not only excess of animal fats which is directly responsible for arteriosclerosis by means of their cholesterol content, but vegetable oils in excess are also harmful as they act as solvents for the cholesterol of other foods and cause it to impregnate the arterial walls in far greater amounts.

By reference to quoted experiments, it will be noted that pure cholesterol unaccompanied by fats does not produce arteriosclerosis except in enormous dosage so large as to be impossible of ingestion from natural animal foods. But dissolved in vegetable oils, the same arterial damage occurs as when cholesterol is taken in the form of animal fats. How much this modern increase of animal and vegetable fats is responsible for the apparent increase of arterial degeneration, and especially the coronary disease, it is difficult to say with certainty. That excess fat is extremely harmful cannot be reasonably questioned in the light of the experimental work done.

The usual estimate that fats need not constitute more than 25 per cent of the total food calories would make it about 14 or 15 per cent by weight of all energy-yielding foods, as fat yields double the number of calories given by either protein or carbohydrates. Sansum and Hare allow one part of fat to three or four parts of carbohydrates as an ideal ratio. This is a liberal allowance, and certainly where the protective foods with their natural unrefined carbohydrates are adequate in the diet, but a small proportion of fat is needed.

Summary of Other Factors

In the diet experiments of Nuzurn and Sansum, atherosclerosis was not present in any of the control rabbits on a 10 per cent protein diet from vegetable sources (herbivorous diet), which is an alkalizing diet. It was not present in any of the twelve animals on a soybean diet, a strongly alkalizing diet.

It was present in seven of ten rabbits kept upon a liver diet (acidifying) from three to eleven months, though not present in three which had the diet less than three months. It was present in seven of eleven animals on an oat diet (acidifying) for two years.

A high protein diet from liver makes a decidedly acid urine with reduction in the alkali reserve of the blood. The acid of the urine from the group is from 2.2 times to 223.8 times the acid of normal blood, while the acid of the blood was increased as shown by the reduced alkalinity of the blood (CO₂ combining power) below that of the control group on a normal herbivorous diet.

A high protein diet from oats makes an acid urine, with reduction in the alkali reserve of the blood. The acid of the urine from the oat protein group was from 3.5 times to 22.3 times the acid of normal blood, and the acid of the blood increased as shown by the reduced alkalinity of the blood, which was somewhat lower on an average than in the liver diet group. A high protein diet from soybeans makes a strongly alkaline urine, with increase in the alkali reserve of the blood.

The atherosclerosis of the arteries was present only in the rabbits on the acidifying diets of liver and oats, being absent in those on the alkalizing diet of soybeans, though all three diets produced kidney disease and an increase in blood pressure. The blood

pressure increased earliest (within six weeks) in the liver diet group, and attained the highest final level. The increase in blood pressure was slowest in appearance (six months) in the oat diet group, but attained a high level, though not so high a final level as the liver diet group. The increase in blood pressure occurred within four months in the soybean diet group, but did not reach so high a point as with either of the other groups.

Relative to the hypertension factor, Rosenthal concludes: "That hypertension predisposes to atherosclerosis is granted, but that the two conditions are not synonymous and may exist independently." Also: "Hypertension without atherosclerosis can occur-in the cases studied, to the extent of 7 per cent. Atherosclerosis, however, can develop without increased blood pressure-to the extent of about 48 per cent in the series examined." "It follows that factors other than increased blood pressure must be present to incite the development of atherosclerosis." As an example of such other factors, Rosenthal cites a rather notable example of a complicated interplay of the effect of diet on hypertension and of the two factors in turn on atherosclerosis. "Within the folds of the white race, the so-called normal blood pressure may in reality be abnormal. Saile has clearly shown that monks who live under different environments and diets have marked variations in their blood pressure. In one group who were strict vegetarians and spoke little, the average blood pressure rarely went over 120 mm. of mercury (24 per cent), while in other monks who lived on an average diet, going among their parishioners, the blood pressure was practically always -in 70 per cent of the cases examined) over 120. The 'normal' blood pressure of the white race in late adult life borders on hypertension and may partly account for the high incidence of aorta changes."

From these differences it may be safely inferred that the determining factors in the production of arteriosclerosis and of high blood pressure are not exactly the same, even so far as the diet is concerned. But to prevent both, the diet must be both low in protein and alkaline in ash, as well as restricted in animal fats and cholesterol.

In addition to this it becomes increasingly apparent that even a vegetarian diet must be selected with some care to avoid a preponderance of acid ash, such as was present in the food of the oat diet group of rabbits. All grains and cereal preparations give an acid ash. No one has intimated that they are at all harmful per se. But these researches do give undeniable evidence that they must be well balanced, if not indeed overbalanced, by base-forming or alkalizing foods. The grains are not so highly acid in ash as are flesh foods and eggs. Nevertheless they require a large amount of base-forming food to neutralize them and maintain the normal alkalinity of the blood and the body fluids.

Whether or not diabetic acidosis is a large factor in blood vessel disease in persons with diabetes, at least there is a high incidence of arteriosclerosis in such persons. Joslin (See The journal of the American Medical Association, Volume 134, No. 16,

Aug. 16, 1947, Page 1289. Original by E. P. Joslin, Insulin's Twenty-Fifth Anniversary," Diabetes Abst. 5:37, April, 1946.) "found evidence of vascular damage in 70 per cent Of 250 juvenile patients despite twenty years of treatment." There is also a rise in cholesterol esters (See Charles Herbert Best and Norman Burke Taylor, The Physiological Basis of Medical Practice, 4th ed., 1945, P. 574) which occurs with lipoid cell transport of this substance, so that cause and effect in arteriosclerosis is certain.

Importance of Fruits and Vegetables

Fruits and vegetables are strongly base-forming, and must therefore form the bulk of the diet. Grains and cereal preparations must be used only moderately. Some nuts are acid and some alkaline. They contain complete proteins, and may be used but sparingly because of the high protein and high fat content. Beans and peas are strongly alkaline, but other food legumes, as lentils and peanuts, are acid in ash. All legumes are high in protein, and for this reason they must be used very sparingly. The same caution applies to cheese of all sorts. Milk is alkaline, and it may be, and should be, used to the extent of three glasses daily.

Tobacco

In an editorial in The journal of the American Medical Association (January 30, 1909) this statement is made:

“Not only can aortic atheroma (softening with scar formation) be produced experimentally in rabbits by injecting either nicotine or infusions of tobacco, or by inhalation of smoke, but not a few cases have been observed in man in which there seems to have been no evident cause for an extensive arteriosclerosis other than excessive smoking.”

Zebrowski, a Russian investigator, in 1908 (*Russkii Vratch*, Volume 7, No. 13), reported experiments upon rabbits in which, by means of an ingenious device, he administered tobacco in a manner similar to that in which it is used by human beings. In this apparatus the rabbits inhaled tobacco smoke from cigarettes artificially smoked for a period of six to eight hours daily. Within two months two of the rabbits died. These showed changes in the nerve ganglia of the heart. Those killed at the end of five months showed atherosclerosis, that is, a degenerative hardening of the blood vessels.

Fisher and Berry, in a series of careful tests, found the following physical efficiency results of smoking:

“1. Cigarette smoking caused an increase in the heart rate.

“2. Cigarette smoking maintained a blood pressure which, under the circumstances of the experiment, would otherwise have dropped.

“3. Cigar smoking caused a considerable increase in heart rate and blood pressure.

“4. In a number of instances, in the cigar test, the heart was unable to maintain, with the vertical position of the subject, the increased blood pressure found in the horizontal position, showing a disturbance of the control of the blood vessels. This latter effect was more pronounced in tests made of nonsmokers.” - Irving Fisher and Eugene L. Fisk, *How to Live*, 18th ed., pp. 401,402.

Cannon, Aub, and Binger have shown that nicotine in small amounts stimulates adrenal activity. The secretion of this ductless gland raises blood pressure, but the effect scarcely outlasts the increased secretion. Experiments by John, at Dortmund, indicate that-

“The smoking of two ‘medium’ cigars evokes the characteristic alterations in

arterial pressure in typical cases; even during the act of smoking there may be evidence of undeniable rise in diastolic pressure, and the effect may persist for as long as two hours....

“Despite the interfering complications attributable to pressor and depressor influences, which enter in diverse ways into the daily routine, the smoking of from eight to ten cigars, or from twenty-five to thirty cigarettes, during the course of the day is by no means negligible, if we may believe the statements made by John. The widely current impression, based in part on experimental investigations, that nicotine can produce vascular alterations in the sense of sclerotic changes, is thus confirmed.” -Editorial, The journal of the American Medical Association, February 7, 1914.

Lee of Cambridge University, from a series of observations on the effects of tobacco smoke, found that-

“The effect of smoking on the blood pressure in man was very striking in the case of novices, an initial rise of pressure being followed by a very severe and sudden fall (from 128 mm. to 78 mm. in one case) at a time when the patient presented the familiar condition of ‘intense pallor of skin, cold sweat on forehead, feeling faint and weak. Cigar three-quarters finished; stopped smoking.’”

“Even the habitual smokers showed a slight rise of blood pressure when smoking, although the rest of the description did not apply to them. The action, then, of tobacco smoke on man is exactly what might be expected, from a knowledge of the action of nicotine; while the stimulation stage lasts, the blood pressure is raised, then as the nerve cells are depressed, the blood pressure falls, this fall being perhaps augmented by the depressive action of the pyridine bases.”-Editorial, The journal of the American Medical Association, January 30, 1909.

Lee also found that the extract of a gram of Virginia tobacco injected into a cat caused a rise in blood pressure of 56 mm. The same amount of tobacco in cigarette form produced a rise of 42.4 mm.

It thus becomes evident that tobacco smoke inhaled or nicotine injected causes cholesterol to impregnate the artery walls by increased blood pressure, by direct chemical action, or by both, and that this is most notable in the coronary artery. Even in the rabbit which eats no food containing cholesterol, the same effect is -Produced from a normal blood content of this substance.

Summary

Conclusions from all this experimental work leave positive evidence that there are various factors and contributing causes in the production (pathogenesis) of arteriosclerosis (and other life shortening diseases mediated by cholesterol). Exactly how or why an acid-ash diet with no ingested cholesterol, as in the case of one group of Sansum’s rabbits, should produce arteriosclerosis, may not be known. However, the end result (pathology of the disease) is the same as when there is an increased ingestion of cholesterol. The same or some other unknown mechanism may be present in the case of caffeine drinks, tobacco, and even syphilis. The dietary factor of cholesterol and all the known secondary or contributing causes are given in the following outline.

Causes of Arteriosclerosis

1. Cholesterol-the materia peccans of the disease-always the agent in producing atherosclerosis.
2. Other chemical factors:
 - a. High protein diet.
 - b. Acid-ash diet.
 - c. Coffee, tea, and cola drinks.
 - d. Tobacco, alcohol, lead.
 - e. Chronic diseases of metabolism, such as gout, diabetes, gallstones, asthma, Bright's disease, obesity.
3. Stresses and strains of life.
 - a. Competitive athletics.
 - b. High blood pressure.
 - c. Nervous strain of high-pressure life.
4. Syphilis. Some of the worst and most extensive forms of arteriosclerosis are due to this disease.

There is no evidence that other infections, acute or chronic, play any particular part in arteriosclerosis.

16. BRIGHT'S DISEASE AND ARTERIOSCLEROSIS

IN 1920 Newburgh and Squier of the University of Michigan reported the occurrence of arteriosclerosis in eleven rabbits fed on high protein diets. In 1922 Newburgh and Clarkson reported on two series of rabbits fed a high protein diet. One group was given equal parts of lean beef, wheat flour, and bran, with protein content of 36 per cent. The other was the same, except for one part of beef to two of flour and bran, and contained 2-7 per cent protein. Both were fed greens once or twice a week.

There were twenty-four animals in the 36 per cent protein group. Of ten living four to eight weeks, two showed early disease of the blood vessel lining. Of six living ten to sixteen weeks, four showed early disease of the blood vessel lining. Of eight animals on the aiet eighteen to thirty-six weeks, all showed marked and extensive arteriosclerosis.

There were fifty-one animals in the 27 per cent protein group. None of these showed disease of the aorta under six months. Eight out of eleven that lived more than six months showed true arteriosclerosis of the aorta, and in seven of these it was advanced and extensive. In the eighth, that lived only six months, there was an early but widespread distributed disease process.

It is evident that animals which ate the diet containing 36 per cent of protein showed arteriosclerosis sooner than the rabbits that received only 27 per cent of protein, and that the occurrence and extent of the arteriosclerosis is roughly proportional to the duration of the feeding. Nineteen rabbits on an ordinary diet showed no arteriosclerosis. Of 116 supposedly normal rabbits, four, or 3.5 per cent, showed small wart like lesions of the upper aorta. Steinbiss found no aortic disease in 500 normal rabbits. Loeb found none in 483 control rabbits. It must therefore be concluded that spontaneous disease of the blood vessels is a negligible factor in rabbits, while degeneration is the rule following high protein diets.

Kidney Injury

Eight rabbits of the 1919 experiments on 36 per cent protein showed albumin and casts in six weeks in every rabbit. These animals were of healthy appearance, with a glossy coat, and were playful, but without exception they developed sudden death or the rapid onset of serious symptoms. One rabbit that lived five months on the diet showed both liver and kidney damage, as did also another that lived seven months on the diet. These results were confirmed in the 1922 experiments. Of the rabbits on 27 per cent protein, none showed kidney injury if on the diet less than twenty-four weeks. Of those which lived on the diet from twenty-four to fifty-nine weeks, 75 per cent revealed chronic disease of the kidneys. Only one out of eleven controls on a stock diet showed kidney disease.

One female on 27 per cent protein gave birth to a litter of four, sired by a male on the same diet. The mother was on the diet four months. The young rabbits were weaned after thirty three days, one dying the same day of bronchopneumonia. The remaining, three took to the high protein diet kindly and gained weight rapidly. Their general condition was good, they were plump, with a shiny coat and bright eyes, and were playful up to the day of death. They were found dead in from six to seven weeks, but in no case had the general appearance of the animal on the day preceding death indicated any difference from a healthy young rabbit. No disease was found in any organ except the kidneys. In one there was stoppage of kidney function, and in two the urine contained much albumin, many casts, and red blood cells. The kidney substance was damaged in all.

Carnivorous Animals

Several observers have taken exception to the use of herbivorous animals for high protein diet experiments, insisting that omnivorous or carnivorous animals should be used, as the diet of these corresponds more closely with that of man. Among these was Dr. McCollum of Johns Hopkins.

“Polvogt, Mccollum, and Simmonds (1923) reported studies on rats which had been fed for periods varying from 250 to 400 days on diets containing 31 to 41.3 per cent of protein. They made a special point of having their diets satisfactory in their composition with

respect to factors other than protein [roughage, vitamins, mineral salts, and alkalizing qualities]. All the animals had lesions of the kidneys of considerable severity. Even comparatively young animals of the fifth generation of a family confined to a high protein diet showed lesions. There was intense congestion and the formation of hyaline casts in large numbers.” -The Newer Knowledge of Nutrition, page 126.

Dr. McCollum concludes:

“The diets, as will be seen by an inspection of these charts, induced good growth and high fertility. The infant mortality was very low, and succeeding generations did not deteriorate in a noticeable degree.

“Notwithstanding the fact that the rats apparently did so well on these diets, they showed marked kidney damage without exception. There is apparently no cause other than the excretion of excessive amounts of the end products of protein metabolism, to which we can ascribe this renal damage.

“Our data do not permit of the possible criticism that defects in the diet other than protein may have been partially or indeed solely responsible for the kidney lesions observed.”-Johns Hopkins Hospital Bulletin, Number 367, Pages 171, 172.

With this acknowledgment from Dr. McCollum must subside any legitimate objection to the evidence from animal experiments that a high protein diet damages the kidneys of all animals, whether herbivorous or carnivorous, and hence that this evidence applies to man as legitimately as does other experimental work on animals.

Dr. Newburgh, in replying to discussion relative to the effects of a meat diet, says:

“Dr. Fox of Philadelphia has examined all the animals that have died in the Philadelphia Zoological Gardens. His conclusions are of interest in this connection. He pointed out that the carnivore had chronic vascular and renal lesions, and that they were practically the only ones that had such lesions. I wrote to Dr. Fox, asking him whether I was justified in assuming that a definite relationship existed between the carnivorous diets and these chronic lesions of the arteries and kidneys. In his reply he stated that this certainly was true, that the meat-eating animals showed a high incidence of chronic disease of the arteries and the kidneys as compared with all the other animals on which he had performed necropsies.”-The Journal of the American Medical Association, September 30, 1922.

Osborne and Mendel of Yale University, in brief experiments (100 days); Miller of Harvard University, in very brief experiments (mostly nine weeks); Addis, McKay, and McKay of Stanford University, in experiments of one year; Reader and Drummond of University College, London, in experiments of four months; and Jackson of Harvard University, in experiments of eight to fourteen months; all found kidney enlargement to result from high protein diets. They found no nephritis or Bright’s disease.

Later, Osborne, Mendel, Park, and Winternitz of Yale University found kidney enlargement to occur in the surprisingly brief time of eight days. Animals on 40 per cent protein, and especially those on the very high per cent of protein, if continued 400 days or more, showed definite kidney damage (nephritis).

Moise and Smith of Yale University, experimenting with high protein diets on

rats after removal of one kidney, invariably found kidney enlargement greater with high protein diets than with normal diets, and this overgrowth increased in direct proportion to the increase in the per cent of protein in the diet. In these rats with one kidney carrying the load of two, the remaining kidney showed definite and often extreme damage when on the high protein diet ninety days or more. This was accompanied by large quantities of albumin and casts in the urine.

In 1925 Evans and Risley of Loma Linda, California, reported another series of high protein diet experiments upon the omnivorous rat. They fed white rats on such high protein foods as casein, meat, nut meal, peanuts, soybeans, and wheat gluten, with greens for vitamins, mineral salts, and roughage. The foods, exclusive of water, contained of protein respectively, 75, 58, 55.5, 27, 39, and 44 per cent. The duration of these diets varied from six to fifteen months, and without exception the kidneys showed pronounced disease varying with the kind and per cent of protein used.

Newburgh and Marsh in 1925 reported experiments upon rabbits and dogs as to the effects of normal digestive products of protein upon the kidneys. Their experiments were with twelve amino acids, which are normally produced in the digestion of protein. Of these, five were harmless in the dosage used, two were mildly harmful, and five others produced serious kidney damage.

“The intravenous administration of alanine, leucine, glycine, phenylalanine, and glutamic acid gave us no evidence of renal injury in doses as large as 2 gm. per kilogram. Arginine and aspartic acid are mildly nephrotoxic, while serious kidney damage was produced by lysine, histidine, tyrosine, tryptophan, and cystine.”

H. B. Lewis observed serious kidney damage in rabbits after the ingestion of cystine. A. C. Curtis found kidney damage in rats after the addition of cystine to standard diets. Folin and Berglund found that uric acid causes serious kidney disease.

They state also that single doses of some amino acids, too small to give evidence of injury, would cause the appearance of abnormal urine if repeated only a few times, and that it requires about twice as much amino acids to give unequivocal microscopic evidence of kidney damage as is needed to produce casts in the urine.

In 1925 and 1926 Drs. W. D. Sansum and F. R. Nuzum of the Potter Memorial Clinic, Santa Barbara, California, reported observations extending over a period of nearly three years. They experimented on rabbits. These were divided into four groups of twelve each. Three of these were given a high protein diet over a period of twenty-one months. The first, or control, group were kept upon a diet normal in protein.

Control Group. This group was fed a mixed diet of oats, alfalfa, and greens. The blood pressures ranged from 72 to 81 mm. of mercury, averaging 74, which is normal for a rabbit. The urines gave no evidence of kidney damage. The protein wastes of the blood remained normal.

Liver Protein Group. The second group of twelve normal rabbits, after a period of three months' observation, during which it was ascertained that the blood pressures, urine, and protein wastes of the blood were normal in every way, was placed upon a 40 per cent protein diet, chiefly from liver. The diet was made up as follows:

Food Type	Per Cent
Wheat	30
Maize	20
Casein	20
Liver	20
Navy beans	5.5
NaCl	1
CaCO ₃	1.5
Cod-liver oil	2

Amounts of tomato were also given.

The twelve animals were kept upon this diet over a period of two years, which represents approximately one third the life of a rabbit. After six weeks the blood pressures were elevated, without exception, and continued so. At the end of one year these pressures averaged 99 mm. of mercury. The protein wastes of the blood increased in amount, and the urines contained casts and albumin after six weeks, and were acid.

Oat Protein Group. The third group of twelve normal rabbits was fed a diet containing 16 per cent protein from oats. In six months the blood pressures were elevated and continued so. The range for the first year was 82 to 99 mm. of mercury. The urines contained albumin and casts by the fourth and fifth months. The protein wastes of the blood increased in amount. The urines were acid.

Soybean Protein Group. The fourth group of twelve normal rabbits was fed a diet containing 38 per cent protein, chiefly from soybeans. Within four months, elevation of blood pressure occurred, the range for the first year being 78 to 94 mm. of mercury. Albumin was not found regularly in the urines until almost a year after the high protein feeding was begun. Increase of the protein wastes of the blood was noted in the ninth month. The urines remained alkaline.

Hardening of the Arteries

In seven out of ten rabbits kept upon the liver diet for three to eleven months, extensive arteriosclerosis was found in the aorta. Three rabbits on this diet for a period of less than three months presented no evidence of blood vessel change. The early blood vessel damage showed as raised yellow-white areas of the lining, which in some cases involved the entire circumference of the vessel. The later changes were marked thickening (sclerosis), with deposit of lime soap in considerable amounts. In seven out of eleven animals kept on an oat diet for two years, there was also marked arteriosclerosis. This was of the type beginning in the lining of the vessels as yellow patches of softening, and in three of these there was also sclerosis of the middle or muscle coat, consisting of death of the muscle fibers and deposit of

calcium. The most marked arteriosclerosis was found in the animals that had been longest on the grain diet, and it was these animals that had the greatest increase of blood pressure, the highest ranging between 90 and 100 mm. of mercury.

Not one of the group of twelve animals on the soybean diet presented true arteriosclerosis (softening of the lining, with later hardening and deposit of lime), but three showed spontaneous sclerosis (degeneration of muscle coat, with later deposit of lime). None of the control group presented arterial disease.

Of those animals on the liver diet, eight out of nine showed kidney disease of a type like that found in Bright's disease in man. In nine out of twelve on the oat diet, kidney disease occurred, and in eight out of ten of those on the soybean diet. The kidney damage was worst and most extensive in the liver diet group, less in the grain diet group, and least in the soybean group. None of the control group showed kidney damage. It is notable that the kidney disease was most marked in those that had the greatest increase in blood pressure and the most strongly acid urine; namely the liver diet group.

Summary

Three groups of rabbits, placed upon high protein diets, each group on a different type of protein, developed an increased blood pressure. This appeared earliest in those on a liver protein diet, later in those on a grain protein diet, both of which produce an acid urine, and still later in those on a vegetable (soybean) protein diet, which kept the urine alkaline. The protein wastes of the blood showed increase in the same order, as did also the appearance of albumin and casts in the urine, evidencing kidney irritation. The meat and grain protein diets contributed to acidosis, that is, increased acids in the blood. This was not true of the vegetable protein diet. The acidifying diets, meat and cereal resulted in hardening of the arteries, while the alkalizing diet did not.

Kidney damage occurred in all three groups on the high protein diet, whether with acid or alkaline urine, and was in proportion to the height of the blood pressures and the acidifying factor.

Later Research

Returning again to the protein content of the food, let us first consider what amounts of protein and kinds of protein have been shown to damage the kidneys in previously healthy animals, for we are considering, not high blood pressure alone, but all phases of the degenerative disease group (cardiovascular-renal).

The later researches of Dr. Newburgh and his associates (University of Michigan) give some definite facts along this line. They fed white rats varying percentages of protein for from 240 to 480 days. The protein was from milk (casein), grains, legumes, beef, and liver. From the accompanying table it is manifest that the urine shows no definite evidence of kidney damage on 12, or 18 per cent of protein; but when 25 per cent is reached, definite evidence of renal injury is present when the diets are prolonged more than one year.

Table 1.

Relation Between the Amount of Dietary Protein and the Number of Casts and Per Cent of Albumin in the Urine

Days	Per Cent		240 Days			480
	Dietary Protein Number	Of Albumin, Casts,	Animals, Number Per Cent	Albumin, Per Cent	Casts, Number	
12 4	3		0	0	5	0.2
18 4	11		0	3	10	0
25 83	8		0	0	6	0.6
32 351	7		0	44	12	0.8
39 652	9		0.2	52	10	0.4
75 4,705	15		0.3	1,412	4	1.4

[Only two animals in this group were alive at 480 days. The averages recorded in the table were obtained from counts made on the 410th day.]

Meat Protein More Harmful

Concerning the degree of injury with different kinds of protein, the second and third tables reveal a marked increase of kidney damage on beef muscle and still more on liver. Newburgh says:

“These two tables bring out the fact that the nature of the protein fed is at least as important a factor as the amount of protein in both the production of injury and the degree of injury. This statement derives further support from the course of events in the case of the

rats that received the liver diet. These five animals, all of which showed the heavy albuminuria and the great numbers of casts, were unable to survive the diet a year. Four of them lived eight months, and the fifth one, eleven and one-half months. Their early failure seemed the more significant, since they grew up more rapidly and reached a greater weight than any other group studied. And further, that the damage caused by casein (75 per cent for more than one year) is confined to the tubules, while beef muscle (31 per cent for fifteen months) causes more severe tubular damage and injures the glomeruli (blood vessel tufts at the beginning of each tubule), and later a fibrosis (scar tissue deposit).”

Table 2.

Relation Between the Type of Protein and the Degree of Renal Injury When the Protein Is One Third of the Diet

	240 Days		450 Days	
	Albumin, Per Cent	Casts, Number	Albumin, Per Cent	Casts, Number
Casein	0.1	37	0.1	312
Beef muscle	0.3	60	1.1	1,444

Table 3.

Relation Between the Type of Protein and the Degree of Renal Injury When the Protein Is Three Fourths of the Diet

	240 Days		450 Days	
	Albumin, Per Cent	Casts, Number	Albumin, Per Cent	Casts, Number
Casein	0.2	783	0.5	992
Beef muscle	0.5	2,130	1.5	5,900
Liver	3	8,900		

The kidneys of even the omnivorous rat are damaged by a meat diet. Of the external appearance of rabbits on such a diet, of which it is often said they are not used to a meat diet, and by inference that they would not thrive on such a diet, Dr. Newburgh says:

“Nothing we ever fed rabbits was so pleasing to them. As a result they grew to

be abnormally large and gave the appearance of great vigor. Visitors to the laboratory were impressed by the fine appearance of these animals.” - Proceedings of the Third Race Betterment Conference, page 408.

Factors Other Than Diet

It must not be supposed that diet is the only factor contributing to high blood pressure and degenerative changes in the blood vessels and kidneys. Several other items are known to have very decided effects. Among these are obesity, diabetes, toxic goiter, focal and other infections, constipation, and lastly, but not least, the strenuous life, fear, and worry.

Of poisons taken into the system from outside sources, none is more harmful than alcohol, whether as beer, wine, or distilled liquors. Since the repeal of prohibition the use of alcoholic beverages has increased by leaps and bounds, and today exceeds by far even pre-prohibition heights. Bright's disease is much on the increase, and physicians are seeing a large number of cases in which alcohol appears to be the chief cause of the disease.

Tobacco is another prolific factor in hardening of the arteries especially since its use has spread so extensively among both men and women since World War 1. Lead and some other industrial poisons are occasional causes of blood vessel, liver, or kidney disease.

Objections Considered

M. W. Lyon, Jr., M.D., in discussing Newburgh's experiments on rabbits in regard to the effects of a high protein diet in producing arteriosclerosis, said:

“I think anatomic and zoological investigations in human beings would establish the fact that men have had a rather high protein diet for many generations, and have become accustomed to it.”-The journal of the American Medical Association, September 30, 1922.

The idea that man or any animal may become accustomed to an unbalanced diet or any unhygienic habit, and therefore suffer no harm, is entirely unsupported by either experiment or experience. No one thinks of producing such an excuse for the continuance of unbalanced conditions in other things, except where appetite and personal desires play so large a part. It is chiefly in relation to such habits as the use of intoxicating liquors and tobacco, and the desire for flesh meats and the milder stimulants, such as tea and coffee, that we continually meet with fanciful and unscientific arguments to excuse the cravings of an abnormal appetite or the continuance of a harmful practice. The idea of immunity by long continuance of a cause is borrowed from the science of bacteriology, but it does not apply to diet. Neither time, habits, nor customs alter the laws of physiology or biochemistry.

Dr. Lyon suggested the experimental use of the hog, which, he said, “has a diet much more like that of human beings than the rabbit.” This idea that omnivorous animals can use a high protein diet without damage, was entirely disproved by McCGLum's experiments on the omnivorous rat. The idea that there is any essential difference in the kidneys of carnivores and herbivores or their susceptibility to an excess of protein, is further dispelled by Dr. Newburgh's citation of Dr. Fox's observations on the animals of the Philadelphia Zoological Gardens. “He pointed out that the carnivores had chronic vascular

(blood vessel) and renal (kidney) lesions (disease), and that they were practically the only ones that had such lesions.”

It has already been shown that there are several phases of the degenerative process—high blood pressure, arteriosclerosis, and chronic kidney disease. These do not necessarily all exist together, nor do they run entirely parallel with each other. Any one of them may exist almost alone, for a time at least. The same may be said of the several heart conditions which are degenerative in nature, and which arise from high blood pressure, protein end products, and tobacco.

Mosenthal has relied almost entirely upon such negative arguments for his denial of the harmful effects of a high protein diet. The same may be said of Strouse and Kelman, who fed high protein diets to persons with high blood pressure and got no increase in the pressure. These negative and non conclusive figures are on a par with the general statement that kidney disease is not common among the Eskimos, who subsist almost wholly upon a flesh diet. The observation is too general, and lacks the exactness of mortality statistics or of post-mortem findings.

M. Hindhede, the Danish nutritionist, gives the facts, which are entirely contrary to these bald statements:

“Studies in Greenland and in Denmark show that for Eskimos the death rate at the prime of life is for men four times, for women three times, higher than for the Danes. The Eskimos cannot therefore be used, or misused, as proof of the harmlessness of a meat diet. They may appear strong and healthy, but the internal organs are probably ruined at an early age.

“Comparing the death rates of Denmark and Iceland seventy years ago, when the Icelanders were living largely on animal foods, the death rate was 50 to 100 per cent higher in Iceland than in Denmark; but since the importation of cereals has increased, the difference in the death rate has dropped to 11 per cent.”

The more recently quoted experience of Vilhjalmur Stefansson, the arctic explorer, who lived almost nine years upon a diet largely of meat, with no apparent health impairment, is likewise lacking in conclusive findings. It is well known that meat eaters are often of a ruddy complexion, and are full of life and energy. The same observation was made by Newburgh in his rabbit experiments, where no manifest ill health or lack of playfulness was shown almost to the day of sudden death.

It is also well recognized that a vigorous out-of-door life balances, to some extent at least, many bad habits. This is seen in the not infrequent longevity of the early Eastern and Western pioneers, who have always lived an out-of-door life, and who have also smoked for almost a whole lifetime. Longevity is not, however, a crowning feature of the tobacco habit in anyone, much less in those of the indoor, sedentary habits of today.

Climate and Body Functions

A cold climate is a most profound stimulant to body functions, and especially to oxidation, that is, the burning of foods in the body. This same effect is seen from all sorts of cold stimulating agencies, such as the application of tonic cold baths. Winternitz, “the

father of hydrotherapy," years ago demonstrated the profound effects of cold baths in increasing the metabolism (oxidation and other chemical changes) of protein foods and hastening their elimination. He and others (Strasser and Kuthy) have also shown that cold baths, with a vigorous reaction, increase the alkalinity of the blood and decrease the acidity of the urine. These researches cannot be quoted here in detail, but those who are interested may find them in the original (Lehrbuch der Hydrotherapie, von Dr. B. Buxbaum, page 39), or in the author's work, The Principles and Practice of Hydrotherapy for Students and Practitioners of Medicine, pages 106, 107.

Such effects of a cold climate in oxidizing (burning up) protein wastes and acid poisons and hastening their elimination must lessen greatly the harmfulness of a meat diet. In general, this effect of climate is not unknown, it being well recognized that meat eating cannot with impunity be indulged in to the same extent in a warm climate that it can in a cold climate. If the conclusions of Sansum are correct, the acid ash of a meat or grain diet is a large factor in arteriosclerosis and in high blood pressure, and hence in apoplexy. A cold climate, with much out-of-door life and physical activity, would therefore lessen to a considerable extent the acidosis of an otherwise much more harmful diet.

Of interest is the general observation that national degeneracy comes with material prosperity and luxurious living. All history attests this fact in a general way. Somewhat more specific as regards degenerative disease is the comparison made by Dr. Hindhede between the mortality rates in the United States and in Denmark for the diseases nephritis, cirrhosis of the liver, and apoplexy.

Death Rate in America and Denmark Compared Rate per 100,000 Living

Disease	America	Denmark
Nephritis	82	24
Cirrhosis of liver	11	2
Apoplexy	69	34

Still more to the point are the figures from the well to do and the poor in Bremen for a ten-year period.

Bremen 1901-1910 Death Rate per 10,000 Living

Disease	Well to Do	The Poor
Brain disease (apoplexy)	68	45
Heart disease	132	86
Kidney disease	18	5

From the health standpoint, at least as regards these diseases, it pays to be poor.

The most practical and conclusive demonstration of the damaging effects of a high protein diet upon the kidneys and blood vessels of human beings and the great benefit to be derived from the low-protein diet comes to us from the experiences of Denmark during World War I. In 1917 war blockade and drought brought about a serious situation. Denmark had only one third the amount of cereal to which it was accustomed. Dr. Hindhede became food dictator, put the Danes upon a strict ration, and took control of food consumption by animals in order to conserve that needed for the people. His previous practical diet experiments covering many years gave him the knowledge necessary to handle this serious situation, regarding which he says:

“It seemed desperate, but the solution was nevertheless extremely simple. The fact merely was that both people and pigs could not live. In Germany the pigs were allowed to live, and therefore the people died. In Denmark we killed our pigs, and lived directly on the pigs’ food-their barley and potatoes. We took all the wheat bran from the cows and put it in our whole-rye bread. The half of our bread consisted of bran. Moreover, we took the grains from the distillers, which left us without brandy and whisky, while the English deprived us of our coffee. Some doctors were angry and wrote that Hindhede put the people on pig food, and hen food.

“Yes, I did. It was my intention to put my people on pig food, a natural diet, to show how foolish we humans have lived.

“The whole country was placed on a low protein diet. Believers in high protein suggested that the resistance against disease would decrease. My expectations were to the contrary. Who won? Well, the result was a great victory for the low protein diet. The state of health improved as never before. The doctors lost their business. The death rate went down during this period of rationing-October 1, 1917, to October 1, 1918-to 10.4 Per 1,1000, the lowest known death rate of any European country at any time.” - Proceedings of the Third Race Betterment Conference, pages 391, 392.

While Denmark was on this reduced ration, the death rate from all causes per 100,000 living persons between the ages of twenty-five and sixty-five, decreased 34 per cent among the women. Note also the direct effect upon the death rate for apoplexy and diseases of the kidneys, as shown in the graphs on page 193.

To the candid observer the facts presented must be conclusive. No other explanation than that given is possible. The diet experiment in the human carried out on a scale of national extent as done by Dr. Hindhede fully answers the last quibble of those who persist in claiming for man some intangible immunity to the harmful effects of an unbalanced ration.

The notable damage produced by a plentiful supply of food and prevented by restriction of food may seem paradoxical, but the fact nevertheless remains. The damage is definitely associated with, and much of it dependent upon, the arteriosclerosis off the arteries of the kidney. It is from this condition that excessive and incurable high blood pressure occurs. It has been shown by experimental work on animals that this is due to the element of

restriction of oxygen carried to the kidneys. The only avenue of approach is by education regarding diet and those factors in the diet which prevent arteriosclerosis, keeping the blood vessels supple, elastic, and free from invasion by lipoid cells carrying cholesterol. This education should be carried on in the high school and college grades. Its simplest statement is that the protective foods-fruit, vegetables, and milk-should make up three out of four, or four out of five, servings of food for the day. See The journal of the American Medical Association, Volume 118, Number 11, March 14, 1942, p. 899; California and Western Medicine, Volume 56, No. 2, February, 1942, Pages 66-69.

NOTE: Kempner reported excellent results in high blood pressure by the use of a diet consisting largely of rice, fruit, and fruit juices. But it was known at that time that rice of itself had no beneficial effects on high blood pressure. The results were due to the large content of fruit juices and to the low protein content of the diet from low protein vegetables which could lower blood pressure before arteriosclerosis had occurred in the kidneys.

17. LIVER AND KIDNEY DAMAGE BY DIET

THE liver is necessary for maintenance of the sugar of the blood. Jaundice develops when the liver is removed or extremely degenerated. The liver splits off nitrogen, sulfur, and phosphorus from all protein food in excess of body requirements. Many other metabolic processes are entirely dependent upon the liver.

“Yet no other organ has such a wide margin of safety from disease, since experiments show that more than 50 per cent of the liver can be removed from animals without demonstrable impairment of these functions.

“Regeneration of the liver occurs rapidly after its partial removal or destruction by toxic substances.

“Small doses of carbon tetrachloride by inhalation or by stomach tube cause acute necrosis of liver tissue. Jaundice occurs the second day, and stupor deepens until death. Extensive death of liver tissue and fatty changes occur. If the animal survives beyond three or four days, complete recovery usually occurs, complete repair within about two weeks, and the liver appears almost normal microscopically.

“Repeated administration of carbon tetrachloride at intervals of less than two weeks produces chronic liver disease similar to portal cirrhosis.

Unbalanced Diet

“Continued use of an unbalanced diet produces large changes in glycogen, fat, and water content of the liver, depending upon the excess or deficiency of carbohydrate, fat, or protein of the diet. But even then ordinary functioning capacity of the liver is not notably disturbed until most extreme conditions prevail. When additional stress is placed on the liver by repeated administration of carbon tetrachloride, differences in function become apparent.

“Experiment on sixteen dogs, each receiving 10 c.c. of carbon tetrachloride by mouth daily for the duration of the experiment.

“Four on a diet of 90 per cent carbohydrate.

“Four on a diet 50 per cent carbohydrate and 25 per cent each of protein and fat.

“Four on a diet of lean meat only.

“Four on a diet of 50 per cent fat and 10 per cent each of carbohydrate and protein.

“At the end of three weeks all four of the fat-fed animals were dead. They all showed jaundice, and the liver was enlarged and fatty, and had numerous areas of degeneration.

“At the end of one month, one of the meat-fed animals had marked ascites and died two weeks later. Within three months another died with marked ascites and the other two had definite ascites but appeared otherwise in good condition.

“In the same period the other eight dogs remained in good condition with no signs of ascites.

“Biopsy of the liver of the meat-fed animals at the end of three months showed more extensive liver injury than was present in the other animals, although all showed some evidence of early cirrhosis. In six to eight months the liver disease of the other animals appeared about the same as those of the meat-fed animals at three months.

“Alcohol produced less clearly defined evidence of cirrhosis. Alcohol was given to the stage of definite intoxication to dogs twice daily for more than two years. Those animals on a well balanced diet showed no gross or microscopic abnormalities; but when food was withheld or when fat predominated with the alcohol, the liver rapidly became fatty. With a fat diet that would produce fatty livers in dogs in six to eight weeks, the addition of alcohol causes the liver to become fatty in two or three days. Liver disease does not appear to be very detrimental to animals under ordinary conditions, but will cause it [sic] to fail rapidly following a surgical operation which would be of no consequence to a normal animal. Following operation these animals are markedly lacking in resistance, and extensive degeneration occurs in the previously injured liver. Intoxication with alcohol may be produced in dogs with fatty livers by half the amount required to produce the same degree of intoxication in normal animals. Anesthesia with various barbiturate derivatives is produced with about half the amount necessary for normal animals.

“The preventive value of diets containing large amounts of carbohydrate is evident and they are of definite value in combating the damaging effects of toxic drugs. We have not been able to produce cirrhosis in dogs by administration of carbon tetrachloride to the extent that ultimate symptomatic (and in part anatomic) recovery was impossible when the drug was discontinued. If administration of the drug is discontinued when dogs have such extreme symptoms as jaundice, emaciation, and rapid accumulation of ascitic fluid, and when many tests considered indicative of extreme damage to the liver are positive, the animals give evidence of definite improvement within a few weeks. Within two to six months after the drug is discontinued, and under maintenance on a diet rich in carbohydrate, all symptoms of cirrhosis disappear, the only evidence of previous liver injury that persists being the collateral circulation and the appearance of gross and microscopic distortion of the liver lobules. With all tests that we have used which are considered as being tests of liver function, the reaction

to such tests has approached that of the normal animal.” - Jessie L. Bollman, “Some Experimental Observations Pertinent to the Treatment of Hepatic Disease,” abstract in the Mayo Clinic volume for 1938, page 2.8.

Here in animal experiments it is shown that two highly toxic substances, alcohol and carbon tetrachloride, produce severe liver damage from which the animals may recover and show no functional disability, though there may be evident gross and microscopic damage. This recovery occurs provided the diets are high in carbohydrates. On the contrary, diets high in fat or protein determine death when these toxic substances are fed to dogs. Evidently the liver has a most resistant structure and can withstand some of the most highly toxic substances. Recently similar experiments have been conducted with various sulfa drugs and diets high in carbohydrates or high in protein or fat. The results were in the main the same as with alcohol and carbon tetra-chloride. The conclusions are inescapable. In so far as the liver is concerned, diets high in either protein or fat are far more harmful than outright toxic chemicals. However, it must be admitted that these diets were so extreme in the proportion of fats and protein that they seldom would occur in the human. Do lesser extremes of excess protein and fat produce liver damage with or without the ingestion of toxic substances, as alcohol or industrial poisons? To answer this question it would be necessary to examine human livers in those dying of accidents. Such a- opportunity offered itself in World War I.

Here many of the finest specimens of humanity were killed suddenly or died in a few hours or days after war injuries. They were picked men-all weaklings and diseased having been, of course, weeded out by draft boards. The remainder were physically fit for military service.

In the eighth volume of Dr. William Keen’s Surgery are given the results of the post-mortem examination of the bodies of fifty-seven such men. In young men of nineteen and twenty years of age, mere boys, there were 40 per cent who showed beginning degeneration-hardening of the liver. In the age group twenty-one to thirty years, 45 per cent showed beginning degeneration of the liver, while in 10 per cent this hardening was confirmed. In the age group thirty-one to forty years, 50 per cent showed beginning hardening of the liver, while in 40 per cent it had become confirmed.

The findings in the kidney examination were much the same, except that they were worse in the age groups of the third and fourth decades of life, reaching 57.5 per cent of beginning sclerosis in the ages twenty-one to thirty, and 50 per cent of confirmed hardening in the fourth decade. In brief, 40 per cent of the cream of the male population show beginning degeneration of the liver and kidneys at twenty years, and only 10 per cent remain normal at forty years.

Percentages of Liver and Kidney Degeneration in Fifty-seven Soldiers

Age	Liver Sclerosis			Kidney
	Normal	Beginning	Confirmed	
Beginning	Confirmed	Both		Normal

19-20	60 40	40	0	60	40	0
21-30	45 20	45	10	32.5	57.5	10
31-40	10 10	50	40	10	40	50

In brief, 40 per cent of the cream of the male population show beginning degeneration of the liver and kidneys at twenty years of age, and only 10 per cent remain normal at forty years of age.

Dietary Protection of Liver and Kidneys

Numerous researches show the value of a high carbohydrate diet in protecting the liver from damage by various toxic drugs and chemicals, and in recovering from the effects upon the liver from such chemicals or of diets high in fat or protein. A high carbohydrate diet also protects the kidneys.

Drury has shown that in disease of the liver, cell regeneration is definitely retarded by a high fat diet in contrast with a normally high carbohydrate diet.

Effects of a High Fat Diet on Regenerative Process

Days of Regeneration	Diet	Weight Per Cent	Cell Regeneration
2	Control	71.4	55.2
2	Fat	54	37.1
3	Control	76.2	68.6
3	Fat	70.4	47.9
4	Control	81.5	72
4	Fat	96.7	51

Drury has also demonstrated that the production of ketone bodies on a ketogenic diet occurs in the liver, not in the muscles. "The highest ketone excretion actually occurred on a day when the subject remained in bed for the entire twenty-four hours. The concentration of ketone bodies in the blood was maximum on this day." "The activity of the liver is very definitely influenced by carbohydrate metabolism of the individual. Increased utilization of sugar by the subject leads promptly to a diminished production of ketone bodies

by the liver.” “Here again we have a very definite reason for the administration of carbohydrates.... to cases that might be threatened with ketosis and its baneful results-acidosis and dehydration.”-Drury, “Liver and Carbohydrate Metabolism,” in California and Western Medicine, Volume 45, No. 1, July, 1936.

In discussing this presentation of experimental work on antagonism between high fat and high carbohydrate diets on liver function, Dr. Fred Kruse closes with this statement: It may be pertinent to mention here, also, that conditions which produce anoxemia-such as congestive heart failure, pulmonary infarcts, severe anemia, pulmonary consolidation (lobar pneumonia), and other conditions-produce liver damage by lowering the glycogen stores and increasing the fat accumulations, and require increased carbohydrate therapy.”

Diet and Kidney Damage

Smadel and Farr at the Rockefeller Institute for Medical Research studied the effects of high protein diets and high carbohydrate diets on experimental nephritis produced by Masugi’s organ-specific nephrotoxic serum. Forty-eight animals were divided into three groups of sixteen each after severe nephritis was produced by this toxic serum.

	Carbohydrate	Protein	Fat
Diet 1	64%	5%	37%
Diet 2	51%	180%	27%
Diet 3	29%	40%	27%

“The rate of growth of the rats on Diet i was never as great as in rats on the intermediary or high protein diets. During the first month the course of the experimental nephritis was the same in all three dietary groups. Severe albuminuria and cylindruria appeared and persisted in all animals, anasarca was present for from a few days to several weeks, and plasma protein values were temporarily depressed. Neither blood urea nor urea clearance was significantly altered except in the single animal of each group which died during the first month from renal insufficiency.

“During the second month nephritic symptoms diminished greatly or disappeared completely in all but two of the animals on Diet 1. Eight and a half months after injection of the nephrotoxic serum only one of the thirteen surviving rats on this low protein diet had urinary abnormalities. At this time five of these apparently fully recovered rats were changed to Diet 3. During the ensuing two months, three of the five rats developed albuminuria with casts. Every animal fed on Diet 3 from the time of injection of the nephrotoxic serum developed progressive nephritis. Only two of these animals were still alive at the end of eleven months. Both of these surviving rats were then in the terminal phase of Bright’s disease. Rats fed from the time of the nephrotoxic serum injection on Diet z had symptoms intermediate between those on Diets i and 3.

“The experiment ended at the end of eleven months. Microscopic studies of

the tissues showed intense renal scarring in all rats fed on Diet 3. Vascular lesions with degenerative changes were demonstrated in the hearts of most of these animals. Rats on Diet 1 showed only a trace of renal damage, represented by old scarring.

“From this investigation on experimental Bright’s disease, Farr and Smadel conclude that in rats a ‘progressive chronic nephritis may follow a single toxic insult to the kidney’ and that the severity and course of the resulting nephritis is markedly influenced by diet.” - Editorial, The Journal of the American Medical Association, October 9, 1937, Page 1202.

Of these three diets, No. 1 of carbohydrate 64 per cent and protein 5 per cent gave the highest degree of protection to the kidney against Masugi’s toxic serum.

Much important additional experimental work on liver physiology and liver disease was reported by Frank C. Mann in the Mayo Clinic volume for 1943, pages 38 to 45:

“One of the first observations made which appear to indicate that diet might bear a relation to the development of pathologic lesions in the liver was made in studies of the effect of the hepatotoxin, chloroform, on young animals, puppies. Chloroform produces central necrosis of the lobules of the liver. It was observed that puppies were more resistant than adult dogs to the production of such lesions by the administration of chloroform. One of the outstanding differences found between the livers of young and adult animals was the content of glycogen, it being much higher in the livers of the young than of the adult animals. It was also found that a high carbohydrate diet not only increased the glycogen content of the liver of the adult animal, but also made such livers more resistant to the action of chloroform.

“Many years ago my associates and I attempted to produce chronic hepatic insufficiency in animals by various means, for the purpose of making an experimental study in regard to the value of certain liver function tests. The hepatic lesion which can be produced experimentally, and which simulates most clearly the lesion seen clinically, is cirrhosis. Typical hepatic cirrhosis had been produced experimentally by the administration of the hepatotoxin, carbon tetrachloride. This appeared to be the method of choice. In order to produce the chronic lesion of the organ, it is essential to produce repeated acute lesions by repeated administration of the hepatotoxin. We found considerable variability in the effect of the substance on different individual animals, and not a few succumbed to amounts of carbon tetrachloride which appeared to be necessary to cause the acute lesion which on repetition produced the chronic lesion, cirrhosis. Acting on the observations that had been made in regard to chloroform and supported by a recently discovered fact that the maintenance of the glucose content of the blood is a vital function of the liver, we placed some of our animals, previous to the administration of carbon tetrachloride, on a diet consisting of a simple protein (skimmed milk) and a high carbohydrate (syrup and bread) content. Animals maintained on this diet proved to be much more resistant to the effect of carbon tetrachloride than animals that were not on a high carbohydrate diet.

“In all of our experimental work, carbohydrate in the diet has proved to be of value in protecting the liver from injury by the hepatotoxins we have used. An abstract of some of the investigations illustrating this statement is given as follows:

“Four dogs were maintained on a diet of skimmed milk, bread, and syrup; four on a mixed diet containing about 25 per cent meat protein, 50 per cent carbohydrate, and 2.5

per cent fat; four other dogs received as much meat as they desired. All of these animals received daily doses of 10 c.c. of carbon tetrachloride by mouth. Within three months, ascites developed in all the animals that were fed an exclusive meat diet, and two had died. In the same period, the other eight dogs remained in good condition and did not give any signs of ascites. Biopsy revealed that the livers of the animals that had been fed meat had more extensive injury than was present in the other animals, although all had definitely cirrhotic-appearing lesions.

“Similar results have been obtained in rats in our laboratory by Dr. Bollman. He used male white rats weighing approximately 200 grams each. They were each fed a basic diet which consisted of 44 parts lean meat, 44 parts cracker meal, 8 parts lard, and 4 parts salt mixture and vitamin supplement. The rats were kept in individual cages, and the uneaten portion of the food was reweighed each day. The mixed diet was fed in 20 gm. amounts; the carbohydrate diet consisted of 10 gm. of the mixed diet and 7 gm. of cracker meal; the protein was 10 gm. of the mixed diet and 10 gm. of lean meat; the fat diet was 10 gm. of the mixed diet and 3 gm. of lard. The amounts thus fed were isocaloric. All animals were given the experimental diet for five to seven days prior to exposure to carbon tetrachloride.

“The animals were placed in a closed chamber and exposed to carbon tetrachloride vapor for thirty minutes three times each week as long as they survived. The concentration of carbon tetrachloride vapor was uniformly maintained by vaporizing 1 c.c. of carbon tetrachloride in 10 liters of air passed through the chamber each minute. This experimental procedure ensured the production of extensive hepatic injury in all animals. A marked decrease of the glycogen content of the liver and hepatic necrosis were observed in all the rats. The hepatic necrosis appeared greatest with the fat diet and least with the carbohydrate diet, while regenerative changes were most marked in the protein-fed animals.

“In a second investigation, using the same diets as before and administering the carbon tetrachloride in the same manner, Dr. Bollman not only studied the hepatic injury produced, but also noted the length of life of each animal. Considering the duration of life of the rats on the mixed diet as representing a protective value of the diet of 100, the following protective values were obtained: carbohydrate 146, protein 100, fat 91.

“In a third investigation, three fourths of the mixed diet was replaced with isocaloric values of carbohydrate, protein, and fat. With the protective values of the same mixed diet as 100, the following protective values were obtained: carbohydrate 205, protein 104, and fat 58. All of the diets used were adequate to maintain normal animals.

“The high carbohydrate diet has been of value not only in regard to the acute effects of the hepatotoxin, but also in supporting the functions of the liver that has been seriously impaired. During the past twenty years we have studied in our laboratory a large number of dogs in which various degrees of hepatic injury had been produced. The hepatic tissue in some of these animals had been reduced to an estimated 15 per cent of the normal amount. Other animals had very marked cirrhosis of the organ. Some of the animals that had severely injured livers have been studied for a period of several years. These animals were maintained in good condition on the foregoing diet of high carbohydrate, moderate protein, and low fat. Placing such animals on a meat or high fat diet was usually followed by death in a short time. We have maintained dogs that had complete biliary obstruction on a diet of milk, bread, and syrup for six to twelve months and have repeatedly observed the rapidly

fatal effects of diet composed entirely of meat or high in fat content. After biliary obstruction for three months, no dog has survived on a diet entirely of meat for more than a few days.

“Not only has diet been of value in protecting the liver from injurious agents and aiding in the maintenance of functions of the impaired organ, but it has also been helpful in some of the conditions associated with hepatic insufficiency. Ascites is a good example.

“Ascites develops spontaneously in animals that have very extensive cirrhosis, and also after obstructive jaundice of long duration. Under both of these conditions we have been able to produce and remove ascitic fluid by dietary measures. Animals that had obstructive jaundice were maintained for three or four months on a diet of milk, bread, and syrup and did not show any evidence of ascites. They were then fed meat for three or four days. In most animals, within twenty-four hours after the feeding of meat had been instituted, the presence of ascites could be determined by inspection of the abdomen. It was fairly common for the abdominal circumference of an animal weighing 5 to 7 kilograms to increase from an original measurement of about 35 cm. to more than 50 centimeters, and from 1 to 3 liters of fluid could be aspirated from the peritoneal cavity. In many animals this process was repeated several times. Certain animals appeared more resistant than others, but in all cases ascites developed within four days of the initiation of repeated feeding of meat. Most of the animals that were refractory to formation of ascitic fluid became less so as the interval after complete biliary obstruction increased, and with repetition of the regimen of meat feeding. As the process was repeated more and more, ascitic fluid could be formed with smaller and smaller intake of meat. Experimental cirrhosis must be very extensive before ascites can be produced in this way, but if the cirrhosis is extensive enough, feeding of meat will produce ascites.

“The active substance which produces ascites in these animals is probably not protein. Proteins of milk do not favor the production of ascites. The active principle appears to be in the water soluble extractives of meat. The feeding of meat extract which is free from protein and fat produces results which are even more striking than those produced by the feeding of meat. Within four to six hours after 25 gm. of meat extract has been fed to animals that have obstructive jaundice of long duration or extensive cirrhosis, marked abdominal distention is evident and 2 or 3 liters of newly formed ascitic fluid can be withdrawn. Control experiments with the addition of salt to the diet have produced entirely negative results.

“The ascites disappeared in most instances when the meat or the meat extract was withdrawn from the diet. The substitution of large amounts of carbohydrate to the diet seemed to aid in the removal of the fluid; the fluid disappeared more rapidly than when all food was withheld. With repetition of the formation and removal of ascitic fluid, the animals became more susceptible to accumulation of fluid, and the time of disappearance of the fluid with the feeding of glucose became greater and greater.

In our experiments animals that had fatty livers caused by dietary means were observed to be more susceptible to some substances that injure the liver than animals in which the glycogen content of the liver was high. The results of experiments with alcohol and carbon tetrachloride illustrate this point. We have given alcohol to the stage of definite intoxication to dogs twice daily for more than two years. Those animals which took a wellbalanced diet during this time did not show any gross or microscopic hepatic lesions. In animals receiving carbon tetrachloride and alcohol, acute hepatic lesions developed rapidly

and cirrhosis was produced with less carbon tetrachloride than was necessary without alcohol. Alcohol in the presence of an adequate diet did not produce any demonstrable effect on the liver; but when food was withheld or when diets predominantly fat were given with the alcohol, the liver rapidly became fatty. With a fat diet that would produce fatty livers in dogs in six to eight weeks, the addition of alcohol caused the liver to become fatty in two to three weeks.

“The acute action of alcohol is also affected by diet, as illustrated by the following investigation. Three series of animals were used. One series was given a diet that maintained the usual normal content of both glycogen and fat in the liver; a second series was given a diet increased in carbohydrate until the normal glycogen content of the liver was about doubled; the third series was placed on a high fat diet until the fat content of the liver was about 50 per cent and glycogen 0.1 per cent. Ethyl alcohol was injected intravenously into each animal. It was found that the animals on the normal diet became intoxicated for a period of about thirty minutes on the equivalent of 2 c.c. of 95 per cent alcohol per kilogram of body weight; the animals on the high carbohydrate diet gave evidence of only momentary intoxication after the injection of 2 c.c. per kilogram, while the animals on the high fat diet went into coma or died after the injection of 1.5 c.c. per kilogram.

“The synthesis of fat from other food materials appears to occur in this organ in the presence of specific vitamins. Vitamins are also affected by injury to the liver, as indicated by an increase of their excretion after the administration of a hepatotoxin.

“Injury to the liver may also decrease or abolish the action of a vitamin.

“Lesions of the liver occur in some vitamin deficiencies. Fatty degeneration of the liver has been produced in the guinea pig and the rabbit by diets devoid of vitamin C but otherwise adequate. Fibrotic livers have been noted in rabbits on diets deficient in the B complex.

“An interesting investigation in this connection has recently been concluded by my colleague Dr. Higgins and his associates. The primary purpose of their research was to study the effect of feeding human diets, to which had been added certain vitamins, to laboratory rats. Briefly their investigation and results in relation to the liver are as follows:

“A basal human diet, composed of foods which are consumed by large portions of our industrial populations, as learned by extensive surveys of food purchases in several large industrial centers, was selected. Five diets, which differed from one another only in the flour from which the bread component was made, were prepared for rat consumption. In the basal diet, the bread was made of patent white flour. In the second diet thiamine was added to the white flour in amounts sufficient to equal that found in whole wheat flour. In the third diet thiamine and riboflavin were added to the patent flour. In the fourth diet, thiamine, riboflavin, and niacin were added to the white flour, in such amounts as to conform to the government recommendations. In the fifth diet, the bread was made of whole wheat flour.

“These five diets were fed to five groups of rats for fourteen weeks. Growth curves were plotted. At the end of this time all animals were killed and sections of the liver were prepared.

“In the animals eating the basal diet, low in thiamine and riboflavin,

pathologic changes were marked. There was extensive peripheral necrosis. The cells were extremely vacuolated and in many of them the cytoplasm appeared greatly injured, only the isolated nuclei persisting. Only a narrow margin of normal parenchyma remained around the central vein.

“In the animals eating the diet containing added amounts of thiamine, no improvement in the condition of the liver was noted. The addition of thiamine and riboflavin to the diet improved the condition of the liver somewhat, for the normal appearing zones around the central veins were larger than in the animals eating the basal diet, but peripheral necrosis still persisted.

“The addition of thiamine, riboflavin and nicotinic acid to the diet protected the liver against any damage. The cells of all lobules were normal and one could not detect any difference between the livers of these animals and those of animals eating the standard rat ration. Furthermore, the animals which ate the human diet in which the bread was made of whole wheat flour had normal hepatic patterns.

“Briefly the study showed that a pathologic condition of the liver will develop in rats eating a diet in which the three fractions of vitamin B are low. The addition of all three fractions to the diet appeared necessary to maintain normal hepatic tissue.

“The hepatic activities in regard to protein appear to be difficult and costly for the hepatic cell to perform and since the protein in the diet not needed for use as body protein is eventually utilized mainly as carbohydrate, it would appear that the excess protein causes an added work load on hepatic cells which may be injured. Furthermore many protein foods, such as meat, contain substances which appear to be deleterious to the functioning of injured hepatic cells.

“Carbohydrate, in the form of glycogen in the hepatic cell, appears to be the food that is most readily available and most easily utilized by the body. Its presence in the liver insures a quickly mobilizee and physiologically inexpensive, source of fuel that can be easily metabolized by the body. It appears to protect the hepatic tissue mainly by conserving the protein content of the organ.”

Causes of Liver Disease

Another review of facts regarding liver disease is given by Captain Albert M. Snell (MC) USNR, in *California and Western Medicine*, volume 63, No. 2, August, 1945, pages 74, 75:

“The relationship of alcoholism to cirrhosis is well known; yet cirrhosis develops in only a small percentage of cases of chronic alcoholism, and the disease cannot be reproduced experimentally in dogs who are given alcohol continuously in large quantities. Connor suggested years ago that an inadequate intake of food might explain the susceptibility of some human beings to liver damage by alcohol, a point on which all students of the subject now agree. Patek and others, noting that alcoholic beriberi and pellagra resembled in all respects the endemic forms of these diseases, conceived the idea that the correlation between alcoholism and cirrhosis might likewise depend on nutritional deficiencies. There is now ample clinical evidence to support this view. An inquiry into the dietary habits of many chronic alcoholics with liver disease will reveal that their intake of food is deficient in many

respects. It is not remarkable that such patients also may have a variety of associated vitamin deficiency states which may be due not only to poor diet but to failure of absorption, storage, and intermediate metabolism of vitamins because of associated liver damage.

“In certain parts of the world cirrhosis is endemic; this possibly is due to nutritional disturbances. Snapper, in commenting on the great frequency of cirrhosis in north China, stated that malnutrition is certainly one of the principal factors in the development of the disease. Hardiker and Gopal Rao recently have reported a high incidence of cirrhosis of the liver in southeastern India where rice is the principal ingredient of the diet and have commented on the fact that in parts of India where jowar and wheat constitute the staple diet, liver disease is relatively rare. Among South African negroes who subsist chiefly on a meager diet of corn and fermented cow’s milk, the incidence of both deficiency disease and cirrhosis is high. Gilbert and Gillman have noted this fact and have shown that cirrhosis developed in rats fed the natives’ diet.

“Experimental evidence supporting the deficiency theory of the etiology of cirrhosis is abundant. Gyorgy and Goldblatt noted that parenchymatous and fatty degeneration, necrosis, and sometimes fibrosis developed in the livers of rats maintained on a diet deficient in the vitamin B complex. These changes were prevented by the addition of yeast or yeast extract to the diet. Rich and Hamilton have shown that a diet adequate in respect to all its essential constituents and containing adequate amounts of thiamine chloride, nicotinic acid, riboflavin, and vitamin B6 was capable of producing marked hepatic cirrhosis in rabbits. Animals, fed exactly the same diet but with yeast substituted for the various individual components of the B complex, did not develop hepatic lesions. Various other workers have shown that riboflavin or thiamine deficiency alone will under certain circumstances produce fatty change in the liver. Hepatic functional disturbances also have been produced by somewhat similar types of experimentally deficient diets.”

These researches into liver disease produced by excess of fatty food in the diet have a direct connection with disease of the kidneys and adrenal glands, and with atherosclerosis and its sequellae-apoplexy, coronary heart disease, and diabetic and arteriosclerotic gangrene of the extremities.

“Feeding cholesterol is one of the most certain means of producing excessive deposition of neutral fat in liver. Under these circumstances there is also a large accumulation of cholesterol esters.”-Best and Taylor, *The Physiological Basis of Medical Practice*, 1937 Edition, Page 948; 4th Edition, 1945, Page 599. The details of this process were shown by Timothy Leary, M.D., in research published in 1941 (“The Genesis of Atherosclerosis,” *Archives of Pathology*, Volume 32, Number 4, October, 1940. The steps in the process are stated in another report by Dr. Leary as follows:

- A. “The esterification of ingested cholesterol in the liver.”
- B. “The deposit of esters in liver cells in massive amounts.”
- C. “The phagocytosis of ester cholesterol as particulate matter the Kupffer cells, which thus become foam or lipid cells.”
- D. “The freeing of the Kupffer cells from the walls of the liver sinusoids and their delivery into the blood stream or their invasion of the lymphatics.”
- E. “The passage of the foam cells through the right side of the heart and the

lungs.”

F. “The invasion by these cells of the subendothelial layer of the aortic (arterial) intima and the initiation. of atherosclerotic lesions.” Hirsch states that “human fat normally becomes saturated with 4 per cent of cholesterol but can dissolve up to 13 per cent after the addition of fatty acids.” - Archives of Pathology, 25:34, 1938.

The association of cholesterol in the causation of arteriosclerosis with damage to other parts is further stated by Dr. Leary: “It is of interest that chronic cholesterol poisoning in the experimental rabbit should tend to be associated with cirrhosis of the liver, enlargement of the spleen, and renal changes resembling those of ‘chronic interstitial nephritis.’” - Timothy Leary, Archives of Pathology, 32:4 October, 1941.

In these extensive researches there is seen a definite scientific background for the Biblical prohibition of animal fat as food. It produces life-shortening diseases of the vital organs-the liver, the kidneys, and the blood vessels. It is also to these effects of meat eating in general that the spirit of prophecy points in the statements quoted regarding its life-shortening results.

Simplified, these demonstrated facts mean that an excessive amount of fat in the diet is deposited in the liver where certain cells of the liver (Kupffer cells) take on this combined cholesterol and fatty acid (cholesterol esters) as foreign or particulate matter. They are thus “obese” cells distended with fat. The blood stream carries these lipoid cells from the liver through the right side of the heart, through the lungs and the left side of the heart. From the blood stream they invade the artery walls through the lining membrane (intima). This fat-softened artery ruptures easily in the brain (apoplexy) and in other localities. If this fatty material remains long, it starts the hardening process, which is initiated by fibroid cells.

Research Confirms Messages

These researches reveal the various factors in the shortening of human life brought about by meat eating. The testimony statements written in 1864 have been explained by research, all of which has been done since 1900. The Creator who made the human body and ordained its proper diet and nourishment knew what foods would best sustain life and health, and what foods would bring disease and death. In three short sentences is told what it has required experimental work of nearly thirty years to demonstrate. The first of which began in 1908, forty-four years after this testimony was written. The latest research by Dr. Leary on arteriosclerosis was published in 1941, seventy-seven years after the first of these statements regarding the effects of meat eating were made in messages addressed to the remnant church.

[After all this presentation of the importance of a diet high in carbohydrates and vitamins in protecting the liver and kidneys from damage, it is significant that the boy of eleven years of age referred to in the fore part of this book, under “Advance Information,” who would eat no fruit or vegetables and developed purpura hemorrhagica as a consequence, also had nephritis and was so diagnosed in both the San Francisco hospitals where he was taken in 1936. In the draft for World War II he was rejected because of nephritis.]

Meat contains cholesterol, is a high protein food, with acid ash and excessive

nitrogen wastes. As commonly used, it is the principal dietary factor in producing the chronic degenerative type of nephritis (Bright's disease), as shown by the animal experiments done by many different experimenters. As commonly used, it provides all the factors which produce arteriosclerosis, including a higher than normal blood pressure, arteriosclerosis of the kidneys and of the coronary artery of the heart, with its heart crippling or sudden death. Arteriosclerosis of the kidneys or other forms of nephritis (Bright's disease) end in permanent, incurable high blood pressure. It should also be known that the first stage of arteriosclerosis is softening of the artery wall (atheroma), not hardening. This is the condition in the arteries of the brain which, with increase in blood pressure, results in apoplexy, commonly called "a stroke of paralysis." The same rupture of blood vessels may occur elsewhere in the body. The writer has seen sudden death occur from internal hemorrhage from such softened arteries as the pulmonary artery, with fatal bleeding into the pleural cavity. In another case the rupture of a small branch of the iliac artery caused pain in that region, but it took a whole month for the blood to burrow out into the peritoneal cavity, with resulting sudden death. These arteries were soft like grease-soaked tissue paper. The hardening or sclerosing process did not occur. No fibrous tissue formed, and no calcium was deposited, as is the usual final stage of this disease process.

Research on High Blood Pressure

Incurable high blood pressure is today one of the most common causes of death. This study would not be complete without some reference to the research work done to determine the mechanism of this disease. Coldblatt's experimentation, first published in 1934, has led the way to the explanation of at least many such cases. Restricted circulation of blood through the kidney, by arteriosclerosis of the renal arteries or the arteries in the kidney itself, or by any disease of the kidney which prevents the free flow of blood through these organs, was shown to elevate the blood pressure. It seems that the ischemic kidney produces a substance which causes contraction of the blood vessels all over the body. This partly proved, but still considerably theoretical, substance was called "renin" because it originates in the kidney. It was also called "angiotonin" because it causes general contraction of the blood vessels of the body, thus raising blood pressure. A large volume of experimental and research work has been done by many workers. While not the full explanation of all cases of incurable hypertension, it at least does explain some, and probably many, of such conditions. See H. Goldblatt, J. Lynch, R. F. Hanzel, and W. W. Summerville, "Studies on Experimental Hypertension; the Production of Persistent Elevation of Systolic Blood Pressure by Means of Renal Ischemia," in *Journal of Experimental Medicine*, 59:347, March, 1934.

In the light of these researches another much-misunderstood testimonies statement is fully explained in every item. It is this: "We bear positive testimony against tobacco, spirituous liquors, snuff, tea, coffee, flesh meats, butter, spices, rich cakes, mince pies, a large amount of salt, and all exciting substances used as articles of food." - Testimonies, Volume 3, Page 21. This list includes all the factors in the production of the degenerative diseases, except the large use of eggs. It was difficult to understand the inclusion of butter in this list with tea, coffee, alcohol, and tobacco. Butter in moderation would give only a small content of cholesterol. But at the time this testimony statement was made (1872), butter was largely used not only on the table, but in cooking, especially in frying. The large use of eggs, even though an essential food, is harmful for the same reason-

its content of cholesterol as well as the fact that it is a high protein food. The use of three eggs a week as given by Sherman may be safely considered as harmless and necessary. The Biblical prohibition of animal fats and blood has the same scientific basis. It shall be a perpetual statute for your generations throughout all your dwellings, that ye eat neither fat nor blood.” Leviticus 3: 17.

It is apparently difficult for some minds to grasp both sides of a question. Especially is this true of the fact that some foods which are wholesome and healthful when used in small or moderate amounts and proportions, and staple foods necessary for a complete, well-balanced diet, are harmful when used in large amounts and proportions. This is true also of grain products breads and cereals-in this case because of higher protein and acid ash. Vegetarians as well as others seem to have difficulty in understanding this matter. It is fully explained by the researches given in the preceding studies. These degenerative diseases are made more common and more rapid in progress by the large present-day use of refined foods, deficient in vitamins and mineral elements, and by the often almost entire absence of the protective foods fruits, vegetables, and milk. In this connection another testimonies statement is worthy of special emphasis. “Flesh meats and rich food, and an impoverished diet, will produce the same results.”-Testimonies, Volume 2, Page 368 (1870).

Not alone in connection with life-shortening diseases produced by meat eating, nor alone in relation to patience and tranquility under trying conditions of life or life together in peace and harmony, is this last statement true; but also has it been shown to be literally, actually correct in physical power and endurance. The presence of waste substance in meat (and coffee) and the lack of thiamine in refined white flour produce the same loss of physical strength and endurance.

Meat contains extractives known as purines. Some purines, the constituents of nucleic acids of certain nucleoproteins, are definitely required for adequate bodily maintenance. There are wastes like uric acid, however, which are also purines. Caffeine and theine belong to this group. These are stimulating in their first effect, but later their influence produces premature and extreme fatigue, as shown by the tracing of muscle contractions.

Cola drinks are caffeine beverages, and of them it has been said:

“All cola beverages are unsuitable for children, both because of high sugar content (in common with other soft drinks) and because of their appreciable caffeine content. It is not believed that they are harmful to adults if used in moderation. If used in large quantities, they may have harmful effects, being fortified with chemical caffeine, which is considered to be about twice as toxic as the caffeine occurring naturally in coffee.

“The following table from Consumers’ Digest gives comparative analyses, made in 1941, of four popular cold drinks and two samples of coffee:

Brand Name	Caffeine	Caffeine
	Per Cent	Grains
		per 12 oz.
Royal Crown Cola	0.0152	0.833

Pepsi-Cola	0.0337	1.845
Double Cola	0.0271	1.484
Coca-Cola	0.0271	1.484
Restaurant coffee (1)	0.0289	1.584
Restaurant coffee (2)	0.0359	1.970

Consumers' Research Annual Cumulative Bulletin, 1941, Page 187, Column 363.

These substances in meat, tea, and coffee have their part in the brief primary stimulating effect and their more notable and more prolonged fatiguing effects. The interval required until this fatigue disappears and the contractions can be repeated with the first power and endurance is two minutes with vegetarians, but for meat eaters it averages ten minutes. This is because uric acid and other wastes cannot be converted and must be carried away by the circulation and excreted by the kidneys. Hence the remnant fatigue lasts five times as long with those who eat meat and drink coffee as with vegetarians who use neither.

All these facts concerning foods and nutrition are important in health, physical and mental superiority, and longevity. A critical study of the testimonies in the light of the newer knowledge of nutrition as revealed by scientific research shows complete harmony.

“As a general thing, the Lord did not provide His people with flesh meat in the desert, because He knew that the use of this diet would create disease and insubordination. In order to modify the disposition, and bring the higher powers of the mind into active exercise, He removed from them the flesh of dead animals. He -gave them angels' food, manna from heaven.” - Counsels on Diet and Foods. Page 375.

“Those who have received instruction regarding the evils of the use of flesh foods, tea, and coffee, and rich and unhealthful food preparations, and who are determined to make a covenant with God by sacrifice, will not continue to indulge their appetite for food that they know to be unhealthful. God demands that the appetite be cleansed, and that self-denial be practiced in regard to those things which are not good. This is a work that will have to be done before His people can stand before Him a perfected people.” - Ibid., Page 381; Testimonies, Volume 9, Pages 153, 154 (1909).

“Among those who are waiting for the coming of the Lord, meat eating will eventually be done away; flesh will cease to form a part of their diet. We should ever keep this end in view, and endeavor to work steadily toward it.”-Ibid., pages 380, 381; Christian Temperance and Bible Hygiene, page 119 (1890).

“The Lord intends to bring His people back to live upon simple fruits, vegetables, and grains. He led the children of Israel into the wilderness where they could not get a flesh diet; and He gave them the bread of heaven. ‘Man did eat angels' food.’ But they craved the fleshpots of Egypt, and mourned and cried for flesh, notwithstanding the promise of the Lord that if they would submit to His will, He would carry them into the land of Canaan, and establish them there, a pure, holy, happy people, and that there should not be a feeble one in all their tribes; for He would take away all sickness from among them. The

Lord would have given them flesh had it been essential for their health, but He who had created and redeemed them led them through that long journey in the wilderness to educate, discipline, and train them in correct habits. The Lord understood what influence flesh eating has upon the-human system. He would have a people that would, in their physical appearance, bear the divine credentials, notwithstanding their long journey.” - *Healthful Living*, pages 96, 97.

“God is working in behalf of His people. He does not desire them to be without resources. He is bringing them back to the diet originally given to man. Their diet is to consist of the foods made from the materials He has provided. The materials principally used in these foods will be fruits and grains and nuts, but various roots will also be used.” - *Testimonies*, Volume 7, Page 125, 126.

“If we could be benefited by indulging the desire for flesh foods, I would not make this appeal to you; but I know we cannot. Flesh foods are injurious to the physical well-being, and we should learn to do without them. Those who are in a position where it is possible to secure a vegetarian diet, but who choose to follow their own preferences in this matter, eating and drinking as they please, will gradually grow careless of the instruction the Lord has given regarding other phases of the present truth, and will lose their perception of what is truth; they will surely reap as they have sown.” - *Ibid.*, Volume 9, Page 156.

18. OPTIMAL PROTEIN

WE have seen that diets high in protein and animal fats, and acid in ash, when continued over some time, produce high blood pressure, hardening of the arteries, Bright’s disease, and heart disease, largely coronary artery sclerosis. Meat contributes to all of these factors, but other diets involving similar factors also produce the same diseases. It is further shown that liver degeneration occurs with high fat or high protein diets and that such diets render the liver more susceptible to damage by alcohol and other toxic chemicals.

Research has given clear ideas of the functions of protein and the amount needed for such functions. These amounts have been found to be much smaller than previously believed necessary. By tests of strength and endurance the optimal protein ration comes much nearer the minimal necessities of the body than anything even approaching popular beliefs and practices, whether of past decades or centuries or of today.

McCay of Cornell University reported that keeping animals lean after attaining their adult growth resulted in greatly increasing longevity. He kept them lean by either reducing the total calories of their food or by exercise. When I finally obtained his detailed reports, I found that the rations he used were generous in all nutritional elements—vitamins, minerals, and 40 per cent protein. He called these greatly increased amounts optimal, though the total calories of the rations were considerably reduced. His claims for prolonged life were apparently sustained, for the average duration of life was more than had been reported by Sherman or others. More careful study of his detailed reports, however, showed that McCay rats had a prolonged senility and various degenerative diseases, whereas in the experiments done by Sherman and Campbell, in which first milk and then calcium alone were doubled over the previous rations, there was a definite prolongation of the prime of life with senility deferred.

“Among the recent findings of nutrition experiments, carried through successive generations of such laboratory animals, is the fact that starting with a dietary already adequate according to current standards, we may, by enrichment of the diet in certain of its chemical factors through increase in the proportion of protective food, induce a higher degree of health and vigor, and a longer adult life expectation.

“In the writer’s laboratory certain families of experimental rats are still thriving in the fiftieth generation on a diet of which dried whole milk constitutes one sixth and ground whole wheat five sixths of the food mixture. Although this diet (Diet A) is thus unquestionably adequate, an increase in the proportion of milk, from one sixth to one third of the solids of the food mixture (Diet B), results in a marked improvement in nutritional wellbeing and positive health. Growth is more rapid and more efficient, death rates are lower and evidences of vitality higher at all ages; in addition to the increase in the average length of life by the diminution of early deaths, there is also a well-marked increase in the average length of adult life; and the period of the prime of life is extended in greater proportion than the life cycle itself.

“Each of these advances in health through improvement of nutrition has been measured on large numbers of cases in which inheritance and all the factors of the environment except the feed were exactly the same.

“Special interest has attached to the influence of this improvement of food supply upon the adult life expectation. This is partly because in the great advance made during the past two or three generations in the life expectation at birth, there had been practically no advance in the life expectation of the adult. The diminution of death rates had been practically confined to the early ages. And, moreover, studies on longevity had succeeded only in correlating it with heredity. Hence the present experimental correlation of length of adult life with an improvement in an already adequate food supply was a finding unexpected to those to whom we had previously owed our chief knowledge in this field; and it is optimistic and constructive where the previous view had been pessimistic and fatalistic.

“Another reason for special interest in these findings is that here the same improvement, induced by a more scientific quantitative proportioning of everyday articles of food, has both expedited growth and development and advanced the vitality and life expectation of the adult; so that longer life here means not a longer old age, but a longer ‘period of the prime,’ and the life ‘cycle’ or course, is not only longer, but is lived on a higher level of positive or buoyant health throughout.”-Henry C. Sherman, *Chemistry of Food and Nutrition*, pages 5 17, 5 18.

This remarkable improvement in health and longevity did not involve increase in protein, but in protective food.

The Nutritional Function of Protein

Protein food is primarily for the construction of body tissue (growth) and for tissue repair, that is, the replacing of what Sherman and others have called the “wear and tear” of tissues. Protein makes poor and uneconomical fuel material as a source of energy. Carbohydrates and fats are fuel foods, the source of heat and energy. Concerning protein metabolism we give the following quotation from *The Physiological Basis of Medical*

Practice (first edition, 1937) by Best and Taylor of the University of Toronto:

“The great proportion of the nitrogen released by the catabolism of the amino acids appears in the urine of man, mammals, amphibian, and fish as urea.”-Page 876.

“On an ordinary mixed diet from 80 to 90 per cent of the urinary nitrogen is urea-nitrogen. The urea-nitrogen varies with the protein content of the diet. Upon a low protein diet the output may be as low as 2 grams and on a diet rich in protein over 25 grams. The value of urea-N is therefore taken as an index of the magnitude of the catabolism of food protein (exogenous metabolism)

“It has long been known that the liver is an important site of urea formation. In dogs urea formation is exclusively an hepatic function. After complete removal of the liver, the formation of urea ceases. If the kidneys as well as the liver are excised, there is no accumulation of urea in the blood, but the latter’s amino acid content rises.” - Page 878,

Creatinine

“The daily output of creatinine in the urine is constant for the individual, amounting to from 1.5 to 2 grams for men and from 0.8 to 1.5 grams for women. Unlike the excretion of urea, which is derived largely from exogenous sources, the creatinine output is practically independent of the protein level of the food. The creatinine excretion is therefore considered to be an index of the magnitude of the metabolism of the tissues and especially of muscle. The daily output of creatinine is extraordinarily constant for the individual; it is not influenced by ordinary exercise or by the urine volume.”-Page 882.

Nitrogen Balances

“The healthy adult requires protein to replace the inevitable loss of tissue protein. When given a sufficient amount of protein to repair this so-called ‘wear and tear’ his output and intake of nitrogen will balance, i.e., he will be in nitrogen equilibrium. If his diet contains protein in excess of this amount, the nitrogen not employed for repair is excreted and nitrogen equilibrium maintained. In children, in adults recovering from wasting diseases or undergoing muscular training, and in pregnant women, the body, if the protein intake is liberal, does not excrete as much nitrogen as it receives. Nitrogen is retained for the manufacture of new tissue....

“The quantity of protein required to establish nitrogen equilibrium depends very greatly upon the content of the diet in the other two food principles-fats and carbohydrates. It is impossible, for example, to establish nitrogen equilibrium in man upon an exclusively protein diet; the excretion of nitrogen always exceeds the intake even though the individual ingests protein to his full capacity. The reason for this is that man cannot consume and digest sufficient amounts of protein to satisfy his energy requirements. Under such circumstances he draws upon his stores of carbohydrates and fats, but after these have been exhausted the protein elements of his tissues are disrupted.” - Pages 886, 887.

“In the fourth edition of Sherman’s book (1945), the same statements appear with slight changes of wording. See pages 546-553. “The experiments seem to prove conclusively that the intake and outgo of nitrogen-the important element of protcid-tend to run in exactly

parallel lines; that is to say, that 'increase of protein income is followed at once by an increase in the metabolism of protein with a corresponding outgo of nitrogen.'

"A meal rich in protein leads at once-within a few hours to an excretion of urea equivalent to full 50 per cent of the nitrogen of the ingested protein, while a few hours later finds practically all the nitrogen of the intake eliminated from the body. Further, it is to be remembered that in a general way this occurs no matter what the condition of the body may be at the time and no matter how large or small the amount of protein consumed." - Goodwin Brown, *Scientific Nutrition Simplified*, pages 82, 83.

The actual elimination of nitrogen in the form of urea from protein food above the actual needs of the protein tissues for repair of wear and tear has received an interesting corroboration from experiments on the effects of heat and cold by hydrotherapy and other physical therapy measures on nitrogenous metabolism.

"The earlier experiments done by the Winternitz school indicated a rather notable increase in the completeness of absorption of nitrogenous food and the hastening of nitrogenous catabolism, as shown by the lessening of nitrogen in the feces on days when tonic cold baths were given and an increase in the per cent -of nitrogen in the urine at the same time. On these treatment days the excretion of urea was increased about 20 percent and the Uric acid about 30 per cent. The excretion of ammonia was increased as much as 50 per cent, and the alkaline phosphates 25 to 30 per cent. After the bath period the more completely burned nitrogenous extractives of the urine sank as low as 0.5 or 1 per cent of the total nitrogen excreted, whereas the extractives usually make up from 3 to 4 per cent of the total nitrogen. With hot treatment these changes were very slight unless it was much prolonged or frequently repeated. As these experiments were done in Austria years ago on men subsisting upon a high protein diet, a question was later raised regarding the effects when a low protein diet was used. Later controlled experiments by Dr. E. H. Risley at the suggestion of one of us (C. K. A.), under conditions of a Chittenden standard of protein, produced no such marked changes. This seems to indicate that there was little or no excess of nitrogen above body needs, and that this necessary amount was not subject to any but slight metabolic change from thermal stimuli.

"Some observations have also been made on protein metabolism by Graham and Poulton (1912), who found that a rise of rectal temperature to 40.2° C. induced by exposure to warm, moist air did not necessarily produce any increased breakdown of body proteins; if a diet of high caloric value were taken, the increased energy production set up by this high temperature was taken care of without change in protein metabolism, but if the diet also contained a large protein excess, then protein might also take a small share in the increased energy production.' (H. C. Bazett, *Physiological Responses to Heat*.)" - Abbott, Moor, and Nelson, *Physical Therapy in Nursing Care*, pages 50, 51. These experiments reveal that any added absorption of protein above the minimal or actual body needs is treated as so much waste and quickly excreted, serving no known useful function whatever.

"Within rather wide limits, the greater the amount of carbohydrates and fats eaten, the smaller will be the amount of protein metabolized as indicated by the nitrogen output. And, naturally, still lower nitrogen outputs result if there is no attempt at equilibrium and the protein intake is drastically reduced while a liberal intake of total calories is maintained.

"Hence under ordinary dietary conditions, the higher the total energy value of

the diet, the less protein it need contain. The ability of the body to use over again some of the amino acids or even the products of their intermediary metabolism may also play a part in the ability of relatively simple nitrogen compounds to replace a part of the protein in the feeding of farm animals....

“Moreover, both the above processes of protein ‘sparing’ or ‘replacing’ by simpler nitrogen compounds may be active at the same time.

“Deuel (1928) lived continuously for fifty-four days upon a diet nearly free from protein, consisting of starch, sugar, orange juice clarified by centrifugation, lettuce, cod-liver oil, and definite amounts of pure salts. This diet contained usually from 0.24 to 0.32 gram (and never more than 0.51 gram) of total nitrogen per day, and not all of this was in the form of protein. The energy value was about 1800 calories per day, chiefly derived from carbohydrate. On this diet the urinary output of nitrogen fell rapidly from nearly ten grams on the first day to less than four grams per day at the end of a week, and about two grams per day at the end of a month. Throughout the month, however, the output of creatinine nitrogen remained nearly constant, beginning at 0.60 gram and ending at 0.56 gram per day.

“At the end of a month on this nearly protein-free diet and when the total urinary nitrogen output had become nearly constant at about two grams per day, thyroxine was administered and resulted in a temporary increase in the nitrogen excretion to a maximum of 6.12 grams on the eighth day of this thyroxine period. Thereafter this nitrogen output decreased in the course of four days to about three grains per day and remained at this low rate notwithstanding the administration of sufficient thyroxine to maintain the increased rate of energy metabolism. The increased nitrogen excreted under the influence of thyroxine appeared almost wholly as urea, creatinine excretion remaining essentially constant. This result was taken as confirming the view that even under these conditions the extra protein metabolized was ‘dispensable’ rather than ‘body tissue’ protein.

“In discussing these results, Lusk remarked that, ‘The protein reserves of the body are relatively enormous,’ and estimated that, with carbohydrate to supply the needed energy, a man starting from an ordinary condition of nutrition could probably live for more than a year without any protein whatever in his food.” - Henry C. Sherman, *Chemistry of Food and Nutrition*, 7th ed., pages 206-208.

Practically applied, these facts mean that, to prevent excessive “wear and tear” on the protein tissues of the body, the diet must be high in (natural) carbohydrates-the starches and sugars of fruit and vegetables. It is not high protein that protects the protein of the tissues from wear and tear or high protein that can repair this wear and tear. The moderate excess of protein in a diet high in fruit, vegetables, and milk (as specified by Sherman for fulfilling the requirements of the newer knowledge of nutrition) is even more than enough to supply the extra protein for a plus nitrogen balance during pregnancy, growth, athletic training, and recovery from wasting diseases or starvation. This excess above the wear and tear repair needs of the body is the difference between 45 grams and 60 to nearly 70 grams per 70 kilograms of body weight.

On the other hand, in weight reduction in cases of obesity there is nearly always a blood pressure above normal, and often greatly so. Also the non protein nitrogen of the blood is above normal. These two conditions-high blood pressure and increased protein wastes in the blood-are also present in obesity with diabetes. Neither in obesity alone or

obesity with diabetes should a high protein diet be given, for the simple reason that it does not correct these conditions (increase of nitrogen wastes and high blood pressure); but actually makes them worse, with resulting damage to the arteries and kidneys. These applied facts and principles have been discovered by observation on many hundreds of cases of these diseases, and they fully agree with the experimental facts as stated by Best and Taylor, and Goodwin Brown.

The prevalent custom of giving a high protein diet in obesity on the supposition that the specific dynamic effects of protein will result in more oxidation of the protein tissues of the body is a fallacy not supported by any experimental work and wholly contrary to actual clinical experience. It causes more damage to the kidneys, blood vessels, and heart than is obviated by the weight reduction. Moreover, weight reduction can be secured without a high protein diet.

A high protein diet does not increase the metabolism of endogenous protein, but only that of exogenous protein, which is revealed by the constancy of the excretion of creatinine under all conditions of diet, while the urea varies directly with the amount of protein food ingested. Moreover, notice the statement quoted from Best and Taylor that only after the body stores of carbohydrates and fats have been exhausted are the protein elements of the tissues disrupted. Furthermore, Goodwin Brown definitely states: "The intake and outgo of nitrogen—the important element of protein—tend to run in exactly parallel lines; that is to say, that 'increase of protein income is followed at once by an increase in the metabolism of protein with a corresponding outgo of nitrogen.'"

The subject of specific dynamic effects of protein has received further scientific inquiry by Forbes in a series of six animal experiments. From the last one four conclusions are stated:

"The idea that the dynamic effects of normal diets are in harmony with their protein contents depends primarily on two misconceptions, (1) that specific dynamic effects of nutrients determined at planes of nutrition involving the catabolism of body substance apply to super maintenance planes of nutrition, and (2) that the specific dynamic effects of individual nutrients, determined by any procedure, are true of these nutrients when combined as in the diets of normal nutrition."

"Further, Forbes, Bratzler, and associates (39), Ring (42), and Forbes and Swift (44) have conducted experiments showing that the dynamic effects of protein, carbohydrate and fat as individually determined are not true of these nutrients variously combined."

"Results are presented of a study of the heat production of growing albino rats in relation to the protein contents of equicaloric diets containing approximately 10 per cent, 25 per cent, and 45 per cent of protein; and general conclusions are drawn from six similar studies, including the present experiment, on the same subject."

"The metabolizable energy and the heat production diminished at about the same slight rate throughout the entire range of increase in the protein contents of the equal caloric diets, thus showing that it was the metabolizable energy, and not the protein content of these diets, which dominated the production of heat."

Can specific dynamic effects of protein be utilized? "The greatest specific

dynamic action is exerted by protein food. When protein is fed alone to a fasting animal, in an amount possessing a heat value equivalent to the animal's basal metabolism, the heat production is raised 30 per cent or more above the basal level. Carbohydrate causes a rise of about 6 per cent, and fat of 4 per cent. If a quantity of protein, carbohydrate, or fat having an energy value of 100 calories be fed separately to an animal whose basal metabolism is 100 calories daily, its actual heat production will be 130, 106, or 104 calories respectively. "The extra heat resulting from protein food cannot be employed for the production of mechanical or other forms of energy. It is waste heat and is simply added to the heat produced by the muscular exertion.

"A diet very rich in protein is therefore unsuited to heavy muscular work." -
The Journal of Nutrition, Volume 28, Number 3, September, 1944, Page 890.

It should be noted that the specific dynamic heat of protein, 30 per cent, compared with that of carbohydrates of 6 per cent and fat of 4 per cent, is based on equal quantities of each fed separately. This is a proper scientific comparison, but it is not in the physiological proportion of protein to the total calories of a normal diet, which is 10 per cent while carbohydrates should be about 65 per cent or even more, and fat 25 per cent or less. This means that the specific dynamic effect of protein becomes a matter of practical importance only when it is definitely and considerably above such fairly normal proportions. It is then that it is a matter of waste and detriment to physical energy and damage to the body in causing degenerative diseases.

An interesting example of this wasted energy from excess of protein food and its life-shortening effects when used daily throughout life is found in the following summary of an experiment done in Harvard Medical School.

An investigation was conducted by Dr. Robert Moore in the laboratories of physiology and reported in the American Journal of Physiology, August, 1929. It concerns the great excess of work thrown upon the heart by a meat diet. He used cats in which the heart nerves had all been severed, also the sympathetic nerves to the adrenal glands and liver. The heart in such cats "beat at a slow, steady rate when at rest, and this rate is not significantly altered by extreme emotional excitement or by periods of active muscular exertion." Yet when such a cat is fed "a moderate or even a small meal of protein food, such as lean beef," the increase in the heart rate is "of surprising magnitude and duration."

In one animal so prepared and fed, "although violent struggling failed to elevate the heart rate more than nine beats per minute, the protein meal caused a progressive acceleration which reached a maximum of thirty-seven beats per minute—a 35 per cent rise over the fasting level—at four hours after the feeding." The increased rate does not return to normal until fourteen to nineteen hours after feeding.

Even the average results when calculated for one day show a surprisingly large amount of extra work required of the heart by a meat diet, which was never shown by other food elements. "Such a calculation shows that the protein meals caused accelerations ranging from 13,400 to 22,400 extra beats. At the rate of 90 beats per minute a heart beats 13,500 times in two and a half hours, or 16,200 times in three hours." "Protein foods invariably bring about an acceleration of surprising magnitude and duration. After a meal of meat, the increase in heart rate regularly amounts to a 25 to 50 per cent rise above the fasting level, and persists for fifteen to twenty hours to reach a total of 13,000 to 22,000 extra beats.

In other words, a protein meal throws an extra burden of work upon the heart, which is comparable in extent to the heart's total performance during three or four hours under fasting conditions. Obviously a high protein diet is incompatible with cardiac [heart] rest."

If two meat meals were eaten daily, the heart rate would never be at a physiological or normal resting rate. Even when only one meat meal is eaten, the extra work thrown on the heart amounts to three hours. This is one eighth of the day's work. Such an overburdened heart must of necessity become degenerated and diseased much earlier than is at all normal. Putting together these scientifically demonstrated fatiguing and damaging effects of a meat diet upon the working capacity of the body, upon the endurance of the muscles, upon the heart and its muscle walls, upon the blood vessels and kidneys, and in the production of high blood pressure, no other facts are needed to see that life's span of years must inevitably be shortened.

The practical application of these physiological facts of the protein ration to human nutrition were tested by Russell H. Chittenden of the Sheffield Scientific School of Yale University.

This scientist began to experiment upon himself and other laboratory workers, and by gradual reduction of protein a level of 40 grams daily was reached in one subject. Even at this lowered intake only 35 grams daily were actually being used by the body. The same subject at another time consumed only 36 grams daily, of which the body used only 31 grams. Another subject of heavier weight consumed 51 grams daily, of which his body utilized only 40 grams. After a time these men found themselves working with greater ease, and with the absence of certain minor ailments and discomforts.

For periods of nine and seven months, respectively, during which these subjects (five professors and instructors) were under daily experiment, they kept in this improved state of health and efficiency, and this was continued into the years following. "The improved condition of health, freedom from minor ailments that formerly caused inconvenience and discomfort, and the greater ability to work without fatigue," had all combined to place the new habit on a firm basis from which there was no desire to change.

"Chittenden, however, did not change to an absolute vegetable diet, but, as he says, 'a simple introduction of physiological economy.' The result was that 'at first, this change to a smaller amount of food daily was attended with some discomfort, but this soon passed away, and the writer's interest in the subject was augmented by the discovery that he was unquestionably in improved physical condition. A rheumatic trouble, which had persisted for a year and a half and which had only partially responded to treatment, entirely disappeared (and has never recurred since). Minor troubles, such as "sick headaches" and bilious attacks, no longer appeared periodically as before. There was greater appreciation of such food as was eaten; a keener appetite, and a more thorough liking for simple foods.' .

"Finally," said he, the writer in summing up his own experience is inclined to say that while he entered upon this experiment simply with a view to studying the question from a purely scientific and physiological standpoint, he has become so deeply impressed with the great gain to the body by this practice of physiological economy, and his system has become so accustomed to the new level of nutrition, that there is no desire to return to the more liberal dietetic habits of former years.' - J. L. Buttner, M.D., *A Fleshless Diet*, pages 21-23.

Soldier Group

Following this experiment, eleven volunteers from the hospital corps of the United States Army were chosen for experiment. These men were accustomed to live upon a diet high in protein, as must be where beef is used so liberally.

“The amount of protein food was gradually reduced, three weeks being taken to bring the amount down to a level somewhat commensurate with the estimated needs of the body. This naturally resulted in diminishing largely the intake of meat, though by no means excluding it. Effort was constantly made to introduce as much variety as was possible with simple foods, though the main problem with this group of men was to keep the volume of the food up to such a point as would dispel any notion that they were not having enough to eat. A second problem, which at first threatened trouble, was the fear of the men, as they saw the proportion of meat gradually drop off, that they were destined to lose their strength....

“A little later their personal experience opened their eyes to possible advantages which quickly drove away all further thought of danger, and made them quite content to continue the experiment

“The grand average, i.e., the average daily output of nitrogen of all the men for the five months period, amounted to 7.8 grams per man, corresponding to an average daily catabolism of 48.75 grams of protein.

In this group, we have a body of men doing a reasonable amount of physical work, who lived without discomfort for five consecutive months on a daily consumption of protein food not much, if any, greater than one third the amount called for by common usage, and the average fuel value of which certainly did not exceed 3,000 calories per day.

Plus Nitrogen Balance

“With one exception, all of the men were plainly having more protein food than was necessary to maintain the body in nitrogen equilibrium, the plus nitrogen balance in most cases being fairly large. It is only necessary to remember that a gain to the body of 1 gram of nitrogen means a laying by of 6.2-5 grams of protein, and with such a gain per day it is apparent that the men were really being supplied with an excess of protein food....

“A daily intake of 8.5 grams of nitrogen means the consumption of 53 grams of protein. Under these conditions of diet, the average daily amount of nitrogen metabolized was 6.45 grams, corresponding to 40.3 grams of protein....

“General health is equally well maintained, and with suggestions of improvement that are frequently so marked as to challenge attention. Most conspicuous, however, though something that was entirely unlooked for, was the effect observed on the muscular strength of the various subjects....

Soldier Group-Figures Represent Total Strength

Soldier	October	April
Broyles	2,560	5,530
Coffran	2,835	6,269
Cohn	2,210	4,002
Fritz	2,504	5,178
Henderson	2,970	4,598
Lomenthal	2,463	5,277
Morris	2,543	4,869
Oakman	3,445	5,055
Sliney	3,245	5,307
Steltz	2,838	4,581
Zoornan	3,070	5,457

University Athletes

Compare now the strength tests of these men as taken at the beginning and end of the five months' experiment, during which they reduced their daily intake of protein food more than 50 per cent

“Every man, without exception, showed a decided gain in his muscular power as measured by the strength tests.... Further, most of the tests indicated that the gain was progressive, each month showing an improvement, in harmony with the growing effect of the diminished protein intake. With these subjects, the only tangible change in their mode of life which could in any sense be considered as responsible for their gain in strength was the change of diet. Consequently, it seems perfectly justifiable to conclude that the observations presented afford reasonable proof if the beneficial effects of a lowered protein intake upon the muscular strength of man

Athlete Group-Figures Represent Total Strength

Athlete	January	June
Anderson, G. W.	4,913	5,722
Anderson, W. L.	6,016	9,472
Bellis	5,993	8,165
Callahan	2,154	3,983
Donahue	4,584	5,917
Jacobus	4,548	5,667

Schenker	5,728	7,135
Stapleton	5,351	6,833

“It harmonizes with the view that the normal requirements of the body for food, under which health, strength, and maximum efficiency are best maintained, are on a far lower level than the ordinary practices of mankind would lead one to believe. The widespread opinion that a rich protein diet, with the correspondingly high rate of protein metabolism, is a necessity for the preservation of bodily strength and vigor, is seen to be without foundation

“Another fact to be emphasized in this connection was the conviction, gradually acquired by many of the subjects, that they suffered less from fatigue after vigorous muscular effort than formerly. This was especially conspicuous in the case of Donahue, whose work on the varsity basketball team called for vigorous exercise. It is interesting to note that this athlete, of 63 kilos body weight, for the last four months of the experiment showed an average daily catabolism of 7.45 grams of nitrogen, corresponding to breaking down of 46.5 grams of protein material daily. Yet, with this low rate of protein exchange, he maintained his position on the team with satisfaction to all, and with the consciousness of improved physical condition and greater freedom from fatigue. Other subjects, as the laboratory workers of the professional group, observed that the customary late afternoon fatigue, coincident with the continued walking and standing about the laboratory, gradually became far less conspicuous than usual; so that there seemed to be a consensus of opinion that in some way the change in diet was conducive to greater freedom from muscular weariness.” - Russell H. Chittenden, *The Nutrition of Man*, pages 194-208.

Fatigue and Endurance

Fatigue tests by the ergograph have shown that the high protein diets of meat eaters greatly lessen endurance. In 1904 and 1907 a Japanese investigator, working in the University of Brussels, published experiments on endurance, wherein meat eating and vegetarianism were contrasted. The ergograph was used to make the experiments. This instrument is so arranged that the forearm is clamped to the table top, the fingers being left free. By means of a cord running from a thimble on the end of one finger over a pulley to a weight of two to five kilograms (4.5 to 11 pounds), the finger lifts the weight regularly to the timing of a metronome. This is continued until the muscle is fatigued and no longer able to contract.

It is noted that in the beginning the contractions are of nearly uniform length. In a little time, however, the lines fall off in length, becoming shorter and shorter, until finally the muscle ceases to contract altogether, and no amount of will power will make it contract. Under normal conditions, lactic acid accumulates in the tissues, and it is necessary to wait until it is changed back into sugar. For vegetarians this recovery time is two minutes, but for meat eaters it averages ten minutes. Because of other fatigue poisons, such as uric acid, the remnant fatigue is greater.

‘We shall lastly point out the phenomenon of “remnant fatigue,” or accumulation of fatigue. If we let pass a moment, two minutes in these experiments, and we

try to measure how much recuperation has taken place in the muscle, it is surprising to see that male vegetarians can recuperate almost the total amount of their strength in that short time. Nothing of the sort had ever been observed before, and though this varies considerably, it was found in our experiments to be about ten minutes with meat eaters. Thus it would seem that the capacity for work is still greater on that account than has been previously tabulated.” - J. L. Buttner, *A Fleshless Diet*, page 132.

Note the contrast in these fatigue curves. The greater endurance of vegetarians is in marked contrast to the quick fatigue of meat eaters.

Arm Holding

At about the same time, Professor Irving Fisher of Yale University was conducting similar experiments with vegetarians and meat eaters. He chose several different methods, but we shall have space to consider only one—holding the arms horizontally as long as possible. The results are an interesting comment upon the fatiguing effects of meat eating.

“The first comparison (for arm holding) shows a great superiority on the side of the flesh abstainers. Even the maximum record of the flesh eaters was barely more than half the average for the flesh abstainers. Only two of the fifteen flesh eaters succeeded in holding their arms over a quarter of an hour; whereas twenty-two of the thirty-two abstainers surpassed that limit. None of the flesh eaters reached half an hour, but fifteen of the thirty-two abstainers exceeded that limit. Of these, nine exceeded an hour, four exceeded two hours, and one exceeded three hours.” -Ibid., page 139.

The conclusions are obvious—caffeine, uric acid, and other tissue wastes are fatigue poisons, lessening endurance, hastening fatigue, and greatly retarding the recovery from fatigue.

Prejudice Persists

Chittenden’s conclusions have never been disproved. No flaw could be found in his experiments. Yet such is the force of preconceived ideas, and especially the blinding influence of dietetic habits that many students of nutrition never fully accepted them. The attitude of two prominent students and writers on nutrition is particularly instructive.

Abraham Lusk, an eminent American authority, before World War I repudiated Chittenden’s conclusions that a low protein, and hence a nearly meat-free diet, is not only adequate for nutrition, but is superior to a high protein diet, especially in the matter of physical energy and muscular performance. During the war, Professor Lusk was employed by the United States Government to teach dietetic economy to its soldiers and citizens. Now he publishes, with the authorization of the Government, the ideas he formerly repudiated, and advocates the lessened consumption of meat by civilians in order that it may be sent overseas to its soldiers, arguing that we would even be physically better off by so doing. This necessity for food economy served to make better known these dietary principles.

Professor McCollum was another who decried “parsimony in nutrition,” meaning the Chittenden standard, or low protein diet, and advocated liberality in diet.” Yet he is unable to find any fault with the conclusions of Professor Chittenden. Note his

acknowledgment:

“There was no indication that the men who participated in this experiment were not in excellent physical condition at the end of the nine months during which they were nourished on an abstemious although somewhat more liberal diet both in energy and protein than that which Chittenden had taken with apparent benefit....

“There can be no doubt that the diets which these men took did not lead to any observable deterioration in their physical well-being. All practically maintained their body weights, or at least lost only such amounts as would be anticipated as the result of the physical exercises some of them indulged in during the test. Their strength increased during the experiment where records were taken, and all were said by their observers to be in a normal and healthy condition at the end of the experiment.”-E. V. McCollum and Nina Simmonds, *The Newer Knowledge of Nutrition*, 3d ed., pages 55, 56.

Fallacy of Non Flesh High Protein

It is quite possible to overeat on protein without the use of meat at all. The old-fashioned vegetarians who substituted for

meat an equivalent of protein derived from nuts, peas, beans, lentils, or, in the case of the so-called “lacto-vegetarians,” eggs and milk and the milk products were probably not deriving as much benefit from their abstention from meat as they should have done if they had not been so careful to replace it with non-flesh protein, particularly as the non flesh sources of protein have many of the disadvantages of meat. Uric acid exists in large quantities in all the legumes. Eggs contain a substance known as xanthin, which is closely allied to uric acid. See Goodwin Brown, *Scientific Nutrition Simplified*.

It will be seen from these quotations that there are two important phases of the protein question which are commonly misunderstood and consequently misinterpreted:

First, the stimulating effects of a high protein ration called in the science of nutrition “the specific dynamic effect of protein.” Subjective stimulation with objective weakening is confusing and has to be demonstrated to be understood.

Second, while with vitamins and minerals the optimal ration is at least two to four times the minimal for preventing deficiency diseases (scurvy, rickets, pellagra, beriberi), with protein the optimal ration for the greatest strength, endurance, and rugged buoyant health is much nearer the minimal body requirements than the customs and beliefs of the past or of today. Much excess of protein food above the minimal body requirements results in loss of strength, in early fatigue, and in the degenerative diseases of the heart, blood vessels, and kidneys. In Mellariby’s experiments, in McCay’s experiments, and in some recent experiments even vitamin deficiency states have resulted from excess of protein has been shown that large amounts of protein require or use up in some way such vitamin A, D, C.

These two phases of the effects of protein appear to be contradictory or conflicting. For this reason they are commonly misunderstood. This misunderstanding is widespread among the literate and educated as well as the illiterate and uneducated, among many men of science and among the populace who know no science.

Do the testimonies throw any light on the protein question? Are they

agreement or at variance with scientific findings and practical tests, laboratory and otherwise? In answer to this inquiry let us note the following facts.

1. The testimonies speak of stimulating foods and those that are not stimulating. A careful study of this subject in the discussion of overeating and of fasting together with the false impression of strength from meat eating, makes this matter clearer and in perfect accord with scientific facts regarding the specific dynamic effects of protein, which becomes a matter of practical importance when protein is in much excess of body needs. These agree with the facts stated by Best and Taylor regarding the wasted energy of a high protein diet and its being unsuited to heavy muscular work. It is in agreement with the facts deduced from the experiment of Moore in Harvard, the experiments of Chittenden of Yale on both soldiers and athletes, and the Springfield experiment made by the Carnegie Nutrition Laboratory under the direction of Professor Benedict.

While originally written on an entirely different subject from diet, Sir Williams Broadbent's statement of the effects of stimulants most aptly applies to this protein question also: "A falsehood which dies hard is the idea that stimulants of whatever kind actually give strength and are necessary for the maintenance of health and vigor. Such is not the case, and the well-worn comparison that they are the whip and spur and not the corn and grass is strictly accurate. Anything accomplished under the influence of stimulants is done at the expense of blood and tissue, and, if frequently repeated, at the expense of the constitution."

2. Scientific research has shown how small is the amount of protein the body needs and that the excess above this small amount is thrown out as so much waste. This need does not vary with exercise or rest, with sedentary occupation or heavy muscular work. The amount for a man of 70 kilograms or 154 pounds-is given by Chittenden as 40 grams and by Sherman as 45 grams. In discussing the making of nut foods the testimonies point out this limitation in the ability of the body to utilize "food so rich that the system cannot properly assimilate it." Other statements on the same subject indicate that what is meant is the total amount of the given constituent in the entire ration and not merely the amount in any one article of food.

These are the statements: "With nuts may be combined grains, fruits, and some roots, to make foods that are healthful and nourishing. Care should be taken, however, not to use too large a proportion of nuts." "Care should be taken not to reduce the

bill of fare to a few articles, using little else than the nut foods." "These foods should not be used too freely." "As combined in large proportions with other articles in some of the recipes given, they make the food so rich that the system cannot properly stimulate it." I have been instructed that the nut foods are often used unwisely, that too large a proportion of nuts is used, that some nuts are not as wholesome as others. Almonds are preferable to peanuts. But peanuts in limited quantities, may be used in connection with grains to make nourishing and digestible food. "Three years ago a letter came to me saying, 'I cannot eat the nut foods; my stomach cannot take care of them.' Then there were several recipes presented before me; one was that there must be other ingredients combined with the nuts, which would harmonize with them, and not use such a large proportion of nuts. One tenth to one sixth part of nuts would be sufficient, varied according to combination. We tried this, and with success." -Counsels on Diet and Foods, pages 363-365.

No other nutritive' element in nuts except protein is so abundant that the system cannot properly assimilate it. This limitation of assimilation is not alone an individual peculiarity, but is a universal law, as stated by Best and Taylor, Chittenden, Sherman, and all others who have done research in this matter. When Chittenden's men consumed 53 grams of protein daily per 154 pounds of body weight, their systems assimilated or appropriated for body functions and structures only 40.3 grams daily. This leaves an excess above body needs and uses of 13 grams. It is not this small excess, or even up to the Chittenden low protein allowance of 60 grams daily, that does any harm. It is the large excess commonly used, especially when not neutralized or counteracted (in various ways) by a high proportion of fruit, vegetables, and milk, from which the major part of the really needed protein should come. The common dietary habits in America have been shown to result in a marked deficiency of vitamins and minerals, which come from these protective foods and unrefined cereal grains. It is this deficiency in fruit, vegetables, and milk that should give us concern and not protein deficiency.

Relative to this matter Henry C Sherman makes the following statements: "During the World War [I] the Inter-Allied Scientific Food Commission set minimum standards for calories and for fat, but refrained from suggesting any corresponding standard for protein, because it was believed that with a food supply adequate in energy value there would be no practical danger of protein deficiency. This view is strikingly confirmed by the study of actual American dietaries, of which hundreds have been examined without finding one which was of adequate energy value but too low in protein."

He further states: "For the practical understanding of the relation of food to health, it suffices to remember regarding the proteins that they are so widely distributed among foods of both plant and animal origin that it is hard to conceive of any danger of a protein deficiency in a dietary adequate in other respects. When the supply of staple foods is such as to ensure excellence of mineral content and vitamin values, the protein supply will be provided with even greater relative abundance."

3. The practical solution of the whole question of the protein ration and of the amounts and proportions of protective foods that should constitute a complete and well-balanced diet is given by Henry C. Sherman of Columbia University. This practical guide is given in terms of his personal habit, guided, as he says, "by the newer knowledge of nutrition." It figures out to about nine servings of fruit and vegetables daily; of fruit and tomatoes a little more than five servings daily, and of other vegetables a little less than four servings daily. In the sixth edition of his *Chemistry of Food and Nutrition* he says that the use of fruit has been raised to a still higher level: When fruit is abundant, 868 pounds a year of citrus fruits and the usual amounts of other fruits. Speaking of the nutritional evaluation of a large number of dietaries he says: "When 224 dietaries already referred to were grouped according to the prominence of fruit and vegetables in them, it was found that as vegetables and fruit became more prominent there was increase in the energy, phosphorus, calcium, and iron values (and we may infer, in the vitamin A, C, and G values also) of the diet, while the protein remained practically unchanged. Thus the use of vegetables and fruit seems to improve the food value of the diet at every point at which the American dietary is likely to need improvement.

"The dietaries in which milk, vegetables, and fruit (together) were prominent averaged lower in cost and higher in energy, protein, phosphorus, calcium, and iron; and

undoubtedly they also had higher vitamin A, C, and G values.

“Such investigations of the data of actual food consumption, viewed in the light of the findings of recent nutritional research, make it clear that the average or typical American food budget can be improved by giving greater prominence to milk, vegetables, and fruit, the money needed for this being obtained if necessary by reducing the expenditures for meats and sweets.”

There are notable differences in the amino acid requirements of man and animals. This being true, there are also differences in the total amounts of protein from different foods which may be necessary for maintenance in man and animals. One such difference is given in the following conclusions from comparison experiments with the protein of eggs, milk, and soy flour.

Further studies in protein needs for human nutrition were reported in The Journal of Nutrition for October 10, 1945, by workers in the Division of Animal Nutrition and the Department of Home Economics of the University of Illinois, Urbana. The article entitled, “The Protein Requirements of Adult Human Subjects in Terms of Protein Contained in Individual Foods and Food Combinations,” is by Mildred Bricker, H. H. Mitchell, and Gladys M. Kinsman. They declare:

“Fifty nitrogen balance periods were carried out upon nine women subjects to determine the requirements for protein during adult life for different types of dietary protein. The protein foods tested were milk, soy flour, white flour, a combination of soy flour and white flour containing 13 per cent of the former, and a well-balanced mixture of protein foods.”

“Table 3

Test Foods	Required for Protein Equilibrium Milligrams per basal calorie.	Required Per Day Grams.
Milk	2.760	22.4
White flour	4.763	38.7
Soy flour	2.876	23.4
Soy-white flour	3.380	27.5
Mixed foods	3.124	25.4

“It may be concluded that milk nitrogen is definitely superior to the nitrogen of white flour and of soy flour plus white flour in the combination used. Patent white flour is definitely inferior to all other sources of dietary nitrogen tested.”

“The nitrogen requirements for equilibrium given in Table 3 may be computed in terms of conventional protein (N x 6.25) for the conventional body weight of 70 kilogram’s. Such a person would have a surface area of about 1.8 square meters and a basal

metabolism of approximately 1,650 cal. per day. Hence, his daily requirement of protein from the sources tested would be: from milk, 28.5 grams; from white flour, 49.1 grams; from soy flour, 29.7 grams; from soy flour 13 parts and white flour 87 parts, 34.9 grams; and from the mixed diet, 32.2 grams. If the ration of minimum endogenous urinary nitrogen to basal calories is less in women than in men, as the results of Palmer, Means, and Gamble (14) may suggest, the above values should be increased by about 18 per cent.

“The above estimates of protein needs in adult life assume that the nitrogen output from the body is composed solely of the urinary and fecal output, and that the protein requirements of adulthood are completely covered when the body is in nitrogen equilibrium.”

The following is a still more recent research regarding the protein requirement of adults:

“There is comparatively little satisfactory factual information concerning the protein requirement of adults on mixed diets. The data which have been offered on the basis of nitrogen balance studies suffer from the defect that the level of nitrogen fed was not sufficiently low to produce a negative balance or the protein was not fed sufficiently long to assure a reasonably constant nitrogen output. If proper attention is not given to these details, the determined nitrogen requirement tends to be too high. The recommended allowance of the National Research Council for protein, 1 gm. per kilogram of body weight per day, is generally conceded to be at least 50 per cent higher than necessary. It is recognized that a substantial portion of the population consumes considerably less protein than this without developing ill effects, as judged by present methods of examination.

“With this need for exact information in mind D. M. Hegsted, A. G. Tsongas, D. B. Abbott, and F. J. Stare (Journal of Laboratory Clinical Medicine, 31:261, 1946) undertook a study of the protein requirement of 26 adults who were fed diets devoid of animal protein and low in their content of protein. These subjects were subsequently given diets in which part of the protein was replaced by meat, soy flour, wheat germ, and white bread. Thus the influence of ‘higher quality’ proteins could be estimated. The subjects were apparently healthy adults ranging in age from 19 to 50 years.

“When the results of all the nitrogen balance studies on the all-vegetable diet were plotted against body weight, surface area- nitrogen intake per kilogram of body weight, and nitrogen intake per square meter of body surface, it was found that correlation was best with body surface. According to the equation obtained the estimated intake at zero balance was 2.88 plus or minus 0.17 grams of nitrogen per square meter of body surface. Thus, a man whose weight is 70 kg and height 160 cm. would require between 4.68 and 5.27 grams of nitrogen per day from the all-vegetable diet, which corresponds to from 29.3 to 32.9 grams of conventional protein per day.

“The data for the diets in which meat replaced one third of the constituents of the all-vegetable diet showed a poor correlation, but when all of the constituents of the diet were reduced by approximately 15 per cent, thus reducing the total nitrogen intake, excellent correlation was found. The estimated requirement on this diet was found to be 2.41 plus or minus 0.04 grams of nitrogen per square meter which would give a protein requirement of from 25.7 to 26.5 grams per day for a man weighing 70 kg.

“The authors conclude that from these studies it would appear that the

National Research Council's daily recommended allowance of 70 grams of protein for an adult weighing 70 kg is most generous and could, if necessary, be reduced to 50 grams and still provide approximately 30 per cent margin above requirement." - Nutrition Reviews, Volume 4, Number 9, Pages 264-266.

This more exacting determination of the amount of protein needed in adult life and its astonishingly small amount fits in perfectly with the low protein intake necessary to cure certain skin diseases caused by excess protein above the body needs or by some perversion of protein metabolism associated with or caused by deficient oxidation or elimination of protein wastes. Also still more notable in relation to the optimal protein intake is the disappearance of the toxemias of pregnancy during the latter part of, and for a year after, World War 1 and now again after World War II in countries where there has been extreme food shortage.

It is to be noted that the reduction in the amount of protein needed 'Or maintenance in adult life occurring when meat is added to the purely vegetable diet is due to the greater relative amount of certain amino acids in meat over vegetables. This is especially notable with tryptophan. However, this amino acid and lysine are, also present in greater percentage in milk and egg protein, as will be seen by referring to the table on page 251 or to the more complete tables given in works on nutrition. This is another reason for the advantage of the ovo-lacto-vegetarian diet over the exclusively vegetarian diet. However, soybeans have a much higher per cent of lysine than any other food, but are deficient in tryptophan.

To make it clear how generous an amount of protein ordinary menus supply above body use for a person of 154 pounds weight, three menus are given, each of which contains 50 per cent or more protein above what the experiments of D. M. Hegsted and others demonstrate as necessary on a vegetarian diet containing milk or milk, and eggs.*

MENU NO.1 45 Grams Protein

Breakfast

Grams		Servings		Protein	Fat	
200	Milk	1 glass	6	8		10
30	Whole-wheat bread	1 slice	3	0		15
200	Orange juice	1 glass	2	0		24
14	Sliced peaches	1 medium	1	0		17
30	Shredded wheat biscuit	1		3	1	23
10	Butter	1 pat	0	9		0

Menus by Miss Avis Dixon, Dietitian.

Dinner-Noon Meal

Grams Carbohydrate		Servings		Protein		Fat
240	Milk	1 cup	7	10		12
150	Baked potato	1 medium	5	0		27
100	Asparagus	6 to 8 stalks	2	0		3
100	Sliced tomato salad	1 medium	2	0		3
100	Cooked banana squash	0.5 cup		2	0	6
50	Dates	6	1	2		39

Supper-Evening Meal

Grams Carbohydrate		Servings		Protein		Fat
50	Corn puree	0.25 cup		2	1	10
100	Milk	0.5 cup	3	4		5
30	Whole-wheat bread	1 slice	3	0		15
100	Banana	1 medium	1	0		22
50	Strawberries	3/8 cup	0.5	0		3
25	Avocado	3 medium	0.5	7		1
100	Fresh figs	3 medium	1	0		18

Total Protein for Three Meals 45

MENU NUMBER 2 50 Grams Protein

Breakfast

Grams Carbohydrate		Servings	Protein	Fat
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200	Milk	1 glass	6	8	10	
50	Egg	1	6	6	0	
30	Whole-wheat bread	1 slice	3	0	15	
100	Applesauce	0.5 cup	1	0	12	
200	Grapefruit juice	1 cup		2	0	18
10	Butter	1 pat	0	9	0	

Dinner-Noon Meal

Grams Carbohydrate		Servings		Protein	Fat	
200	Milk	1 glass	6	8	10	
100	Sweet potato	1 small	2	1	27	
100	Green string beans	0.5 cup	2	0	6	
100	Sliced beets	0.5 cup	3	0	9	
30	Whole-wheat bread	1 slice	3	0	15	
20	Butter	2 pats	0	19	0	
50	Shredded lettuce	1/8 head		1	0	
1.5						
15	French dressing	1 tablespoon	0		15	0

Supper-Evening Meal

Grams Carbohydrate		Servings		Protein	Fat	
150	Tomato broth	0.75 cup		1.5	0	5
12	Rice	1 tablespoon	0	0	2.5	
60	Whole-wheat bread	2 slices	6	0	30	
50	Sliced tomato	3 slices	0.5	0	1.5	
0	Lettuce	1 leaf	0	0	0	
15	Mayonnaise	1 tablespoon	0	12	0	

10	Butter	1 pat	0	9	0
200	Milk	1 glass	6	8	10
175	Fresh pear	1 medium	2	0	26

Total Protein for Three Meals 51

MENU NUMBER 3 50 Grams Protein

Breakfast

Grams		Servings		Protein	Fat	
Carbohydrate						
200	Hot milk	1 glass	6	8	10	
10	Ovaltine	1 tablespoon	1	1	7	
120	Oatmeal	0.66 cup	5	2		
20						
60	Cream	4 tablespoons	2	12	2	
200	Grapefruit	0.5 medium	1	0	9	
100	Fresh apricots	4	1	0	12	

Dinner-Noon Meal

Grams		Servings		Protein	Fat	
Carbohydrate						
200	Milk	1 glass	6	8	10	
100	Lima beans	0.5 CUP	8	1	22	
150	Steamed potato	0.5 cup	5	1	27	
100	Tomato or spinach	0.5 cup	2	0	3	
100	Celery	3 stalks	2	0	3	
50	Olives	6	0	11	2	
15	Butter	1.5 pats	0	14	0	

Supper-Evening Meal

Grams		Servings	Protein	Fat	
50	Asparagus puree	0.3 cup	1	0	1.5
150	Milk	0.75 cup	4.5	6	7.5
20	Whole-wheat toast	0.66 slice	2	0	10
100	Red raspberries	0.66 cup	1	0	
12					
120	Sliced pineapple	2 slices	1	0	14
100	Steamed brown rice	0.66 cup	2	0	24
15	Butter	1.5 pats	0	14	0
Total Protein for Three Meals			50.5		

Testimonies Give Prominence to Protective Foods

Concerning the making of meat substitutes the testimony statement that “one tenth to one sixth part of nuts would be sufficient, varied according to combinations” (with other ingredients), certainly does not voice any danger of a deficiency of protein, but rather the danger of excess. In perfect accord with this is the mention of the “grains, fruits, and some roots” which may be combined with nuts “to make foods that are healthful and nourishing.” Grains are much lower in protein than peanuts, which contain 26 per cent of protein, and than almonds, which contain 21 per cent. Fruits and vegetables (with the exception of ripe mature legumes) are low in protein. When the percentage of protein in foods made of one-tenth to one-sixth part of nuts combined with any of these is figured out they would be far from having the protein equivalent of meat.

Studying further the matter of statements regarding foods to be used when meat is omitted, we may ask this question: Do the testimonies support the idea that there is any danger of a deficiency of protein or any other element of nutrition when meat is omitted and an ovo-lacto-vegetarian diet adopted? Do the testimonies infer or take for granted that only high protein foods are adequate to replace meat? In order to answer these questions let us analyze all the statements made.

“Where plenty of good milk and fruit can be obtained, there is rarely any excuse for eating animal food.”-Counsels on Diet and Foods, page 394. Since neither milk nor fruit are high protein foods, this single statement certainly carries no such implication.

“Meat is not essential for health or strength, else the Lord made a mistake when He provided food for Adam and Eve before their fall. All the elements of nutrition are contained in the fruits vegetables, and grains.” - Ibid., page 395.

It is a mistake to suppose that muscular strength depends on the use of animal food. The grains, with fruits, vegetables, contain all the nutrition to make good blood.” - Ibid.

page 396.

“When flesh is discarded, its place should be supplied with a variety of grains, nuts, vegetables, and fruits, that will be both nourishing and appetizing.” - Ibid., page 397.

“Some fall into the error that because they discard meat, they have no need to supply its place with the best fruits and vegetables, prepared in their most natural state, free from grease and spices.” - Ibid., page 399.

“Parents can secure small homes in the country, with land for cultivation, where they can have orchards and where they can raise vegetables and small fruits to take the place of flesh meat.” Ibid. Page 400.

In none of only high protein foods must be used to-. In one, fruits, grains, and vegetables are listed as meat substitutes; in another, only milk and fruit; and in two others, only vegetables and fruits. In the other two, nuts, the only food of high protein content mentioned, are included with other foods and not singled out as the only suitable meat substitutes.

These statements regarding foods to be used where meat is not used are particularly impressive since among many the arguments for a high protein diet are largely based upon the assumed, though unstated, idea that the higher protein ration of a meat diet is necessary and consequently that vegetarians must eat more protein, replace meat by some high protein food, or in some way secure the equivalent of the protein of diets including meat. Sherman's statement regarding protein is that when total calories are adequate and the supply of foods is such as to ensure excellence of vitamin and mineral values, “the protein will be provided with even greater relative abundance.” This applies to vegetarian menus as well as meat-including menu it is shown clearly by the protein content of the balanced diet menus of the pamphlets compiled by the- writer, *The Balanced Diet and Before the Baby Comes*. In both these the total protein runs somewhat over the Chittenden standard. It should be remembered that the Chittenden standard itself is from seven to twelve grams higher in protein than were the diets used by Chittenden in his human experiments and also higher than in the Carnegie Nutrition Laboratory experiments supervised by Benedict. Both of the menus-the one for men and the one for women (prenatal diet)-given in these leaflets conform to the high proportions and amounts of fruit, vegetables, and milk specified by Sherman as “adequate in calories” and able to “ensure excellence of vitamin and mineral values,” diets “guided by the newer knowledge of nutrition.”

When the testimony statements are carefully compared with actual scientific research, there is found to be a definite agreement on all phases of the protein problem, not only regarding any necessity for meat, but any necessity for any other really high protein food. McCollum's acknowledgment of the full adequacy of the ovo-lacto-vegetarian diet, admitting that it may even be superior to a meat diet, leaves little more to be said. After the final conclusions regarding a low protein diet were reached at the Carnegie Nutrition Laboratory, Professor Benedict admitted: “I have eaten more humble pie today than ever in my life before.” The research had shown that the low protein ration was not only equal but superior to the higher.

For those who cannot make a thorough study of the science of nutrition, there is need for some simple, practical directions or rules by which a complete, well-balanced diet

may be secured. From years of study and use in the instruction of patients has come an easily applied guiding principle of proportions.

1. The protective foods-fruit, vegetables, and milk should constitute three out of four or four out of five (75 to 80 per cent) of the servings of food for the day.

2. The acid-ash and high protein foods make up the other fourth or fifth of the servings for the day.

3. The total amount of food (total calories) should be guided by the principle of “partaking freely of the bountiful supply of food the Creator has provided for our sustenance.” Sherman’s statements of the amounts of these protective foods for daily use completes this general rule.

These simple rules will provide for an adequate amount of protein, at most an amount which by its moderate excess above the needs of the system will do no harm. About half of the protein comes from the daily quart of milk. These proportions regulate the acid-base balance, making the urine slightly acid. They provide for the daily saturation of the body tissues with the water soluble vitamins, provided the breads and cereals are whole grains.

It is still commonly believed by the great majority of people that eating meat is necessary for strength. The scientific evidence is quite to the contrary, namely that meat eating lessens both strength and endurance. And, moreover, any very high protein diet is unsuited to heavy muscular work as has been demonstrated and the conclusion stated together with its physiological basis by Best and Taylor in *The Physiological Basis of Medical Practice*. These now experimentally demonstrated facts were pointed-out by the testimonies in 1905 in this statement: “It is a mistake to suppose that muscular strength depends on the use of animal food.”-*The Ministry of Healing*, page 316. The true effects of a high protein diet (and meat is the most commonly used high protein food) was told in the testimonies in these words: “Flesh food also is harmful. Its naturally stimulating effect should be a sufficient argument against its use.” - *Education*, page 203. “When the use of flesh food is discontinued, there is often a sense of weakness, a lack of vigor. Many urge this as evidence that ‘flesh food is essential; but it is because foods of this class are stimulating.’” - *The Ministry of Healing*, page 316. “The weakness you experience without the use of meat is one of the strongest arguments I could present to you as a reason why you should discontinue its use. Those who eat meat feel stimulated after eating this food, and they suppose they are made stronger. After one discontinues the use of meat, he may for a time feel a weakness, but when his system is cleansed from the effect of this diet, ‘he no longer feels the weakness, and will cease to wish for that which he has pleaded for as essential to his strength.’” - *Counsels on Diet and Foods*, page 397. These statements, written in 1905, 1903, and 1896, are so fully and exactly in accord with the facts (ascertained by scientific research as to occasion astonishment, among those who have no knowledge of the spirit of prophecy (as of divine origin. How else could it have come except from (such a source?)

Biological Value of Protein

Optimal protein is not alone a matter of the total quantity of protein-large or small-that the body needs or can use profitably and without damage. Some single types of protein

are adequate in all respects and for all purposes; others are not. There are essentially two principal features of such biological value; these are the growth value and the maintenance value. To these may be added the value in maintaining nitrogen balance on restricted protein intake. Only a few of the most important facts can here be given. These values depend upon the amino acid composition of the various proteins (albumins, globulins, phosphor-proteins). More than any other these biological values depend upon the percentages of lysine and tryptophan in the composition of the respective proteins. Nevertheless it is not this simple.

Selecting only these two amino acids in the percentage composition of the proteins of certain much-used foods of contrasting values for growth and maintenance makes it easier to understand than to use a larger and more complete table of amino acid composition for many different proteins.

Sherman states that in many experiments no other amino acids can take the place of lysine and tryptophan. Lysine is essential for growth, while tryptophan is essential for maintenance. The proteins of milk and eggs support both growth and adequate maintenance. Wheat proteins alone are not efficient for growth because of the small per cent of lysine. Soybean protein is efficient for growth, but alone it is not adequate for maintenance because of the small per cent of tryptophan. It is evident that lysine and tryptophan must both be present in larger percentages if nutrition from infancy to old age is to be fully and adequately supported. Sherman states further: "Rose and coworkers find this to be true also for the maintenance of nitrogen equilibrium in man." - *Chemistry of Food and Nutrition*, 7th ed., p. 67.

"With egg protein, approximately 77 per cent of the biological value is due to growth and 23 per cent to maintenance. With the lower-quality proteins this ratio decreases so that with wheat gluten only 26 per cent of the biological value is due to growth, while 74 per cent is due to maintenance. These data are for rats that are receiving a diet composed of approximately 10 per cent protein

"When the level of protein intake is increased, there is a decline in the fraction of absorbed protein that is utilized for maintenance. At the same time the fraction utilized for growth rises to a maximum and then declines. The net result of these changes is a fall in the biological value." - *The Journal of Nutrition*, Volume 32, No. 5.

This means that there is a limit to the body utilization of protein, as has been so fully demonstrated by many other experiments on both animals and man. This explains the great overgrowth of Louis H. Newburgh's rabbits which were fed meat protein, which has a lysine content of 7.6 per cent-higher than any other protein except that of soybeans, which is 9.1 per cent. Other flesh foods also contain a high percentage of lysine chicken, 7.2 per cent; halibut, 7.4 per cent; shrimp, 7.6 per cent. Of these rabbits fed meat, Newburgh stated: "Nothing we ever fed rabbits was so pleasing to them. As a result they grew to be abnormally large and gave the appearance of great vigor. Visitors to the laboratory were impressed with the fine appearance of these animals." But this excessive growth and fine appearance were secured at the expense of damaged kidneys. He stated further: "You see that a year of this diet has produced a really serious injury to the kidney tubules.... The cells that perform the excretory function of the kidney have largely disappeared." - *Proceedings of the Third Race Betterment Conference*, page 408.

Such scientific facts were tersely put by Mary Swartz Rose, who wrote:

“Protein can be economically used when a small proportion is mixed with carbohydrate or carbohydrate and fat, but when taken as the sole source of energy, is burned at a rate that is wasteful in the extreme. As long as carbohydrate and fat are available, muscular work is not done at the expense of the protein supply. When protein is used as fuel, the nitrogen which it contains is not an asset but a liability to be gotten rid of as speedily as possible.” - The Foundations of Nutrition, 3d ed., 1938, Page127.

What Are the Dangers of a Meatless Diet?

Is there danger of protein deficiency in a meatless diet? Are there any building stones (amino acids) of complete proteins lacking in an ovo-lacto-vegetarian diet? To these questions scientific research has answered with an unequivocal NO! Neither in quality or quantity of protein is there any deficiency in such a diet. Eggs can be eaten to excess and produce damage in the body. Milk is unlikely to be taken in excess. Scientific research specifies a quart a day as optimal.

All these facts are revealed in such works as that of Henry C. Sherman of Columbia University on the Chemistry of Food and Nutrition. Yet one of the most persistent errors held even by many vegetarians is that a non-flesh diet means deficiency of protein, and that in order to avoid this, a considerable amount of high protein food must be eaten when flesh foods are not used. A rather recent unscientific attack upon the facts reveals how far-fetched and erroneous, yet how persistent, is this idea. One advocate maintains that anything less than 75 grams (two and a half ounces) of protein daily over “long periods of time” results in diminished function of the thyroid gland, and that the final result is myxedema. The same occurring in the newborn is called “cretinism.”

In Switzerland, where there has been so much of these diseases, the occurrence of cretinism, myxedema, and large cystic goiters has been greatly decreased since the use of iodized salt was begun in 1922.

“In a well-known valley of British Columbia called Pernberton Meadows, the incidence of goiter was so great that it was difficult to raise calves, lambs, and pigs.”

“Keith (1924) studied the problem of goiter in the Pernberton Valley. Many of the men, almost every woman, and every child born in this district, had an enlarged thyroid. Pigs were born hairless, calves were goiterous, mares became goiterous, and many colts were carried beyond full term and showed traces of myxedema. The farm animals were more subject to goiter in late winter and early spring. Many of the eggs of fowls, although fertile, failed to hatch, the apparent reason being a thickening of the white envelope within the shell. As a result of giving iodine, most of these conditions have now disappeared. No cases of goiter could be found among the inhabitants of an Indian village located on the same site in this valley; they were here many years before white men settled here. The Indians and their pigs obtained sufficient iodine from the large amount of salmon annually consumed.” - E. V. McCollum and Nina Simmonds, The Newer Knowledge of Nutrition, 4th ed., 1929, Page 395.

The Handbook of Nutrition, written by twenty-eight experts, specialists in nutritional research, under the auspices of the Council on Foods and Nutrition of the American Medical Association, makes no mention that protein, high or low, has anything at

all to do with thyroid function, although there are twenty-three pages on the subject of iodine and thyroid function, and thyroid diseases. Nor in the section on protein is there any mention whatever of protein's having any influence on thyroid function. The idea might arise because protein fed alone (without carbohydrate or fat) gives a metabolism of 130 calories, while carbohydrate alone gives 106, and fat alone, 104. But when protein is fed with carbohydrates and fat in ranges of protein of 10 per cent, 25 per cent, and 45 per cent, the heat production showed not an increase, but "only slight diminishing throughout the entire range of increase in protein content of these diets." This was recently demonstrated by Forbes and others in a series of six animal experiments from 1939 to 1944. See The journal of Nutrition, Volume 28, Number 3, September, 1944. Best and Taylor in their text on The Physiological Basis of Medical Practice state definitely that it is only when protein is fed alone that it shows a metabolic rate above that of carbohydrate alone or fat alone.

The idea might have come from knowledge of the stimulating qualities of meat or other high protein food. But this is muscle stimulation, as revealed by Dr. Robert Moore of Harvard University in experiments regarding heart muscle. This primary stimulation is followed by premature muscle depression and undue fatigue occurring in much the same way as the primary stimulant action of coffee is followed by a secondary and premature depressant or fatiguing effect, as shown by H. C. Wood in muscle contraction tracings. These scientific facts cannot in any way be used, or rather misused, to bolster up any such unscientific idea as that protein has anything whatever to do with thyroid function or basal metabolism. We see hundreds of cases a year of low metabolism (hypothyroidism) some of them very low. The great majority of these are meat eaters and have also a higher than normal protein waste (non protein nitrogen) in their blood chemistry tests. Even some of the vegetarians who have hypothyroidism show also a higher than normal protein waste in blood chemistry tests, revealing that they are using a higher than normal protein ration.

The idea that thyroid deficiency with myxedema results from an ordinary vegetarian diet is totally without any scientific foundation whatever. Moreover, this idea is productive of much harm, as we have found from thorough examinations and tests of blood chemistry and blood pressure in persons who are eating according to this fallacy. The reason for this review of scientific facts is that many vegetarians are being misled by such ideas regarding the needs of the body for protein.

Here are two patients now in the sanitarium, ages 52 and 59 years, both of whom have high blood pressure-180 systolic and 100 diastolic. One has accumulation above the normal of protein wastes in the blood, and the other has arteriosclerotic nephritis (Bright's disease). One has a metabolism of 20 per cent below normal and the other 21.5 per cent below normal. Their high protein diet did not save them from thyroid degeneration, but it did cause high blood pressure and kidney disease in one, and high blood pressure and abnormally high protein wastes in the blood of the other.

In adult life protein serves only for repair of the "wear and tear" on the protein tissues of the body-mostly muscle tissue and an almost infinitesimally small amount for making enzymes and endocrines. This need, as given by Sherman from 109 experiments done by many different experimenters, ranged from 21 to 65 grams, averaging 44.4 grams of protein daily for individuals of 70 kilograms (154 pounds) of body weight. See Chemistry of Food and Nutrition, 6th ed., pp. 204, 205. It is actually difficult to reduce protein in the diet below 50 grams a day with one of good appetite and using the necessary large amounts and

proportions of the protective foods-fruit, vegetables, and milk-as dictated by the newer knowledge of nutrition. The nitrogen of protein above this moderate amount is split off by the liver and quickly thrown out by the kidneys as waste. This fact is positively stated by Best and Taylor. See *The Physiological Basis of Medical Practice*, First ed., Page 887; 4th Edition, Page 553. This excess cannot be built into tissue of muscles or any other organ or structure of the body, or even stored up for future use. It cannot be assimilated.

The testimonies give evidence of this same fact of physiology. Concerning nut foods they state that “combined in large proportions with other articles in some of the recipes given, they make the food so rich that the system cannot properly assimilate it.”-*Counsels on Diet and Foods*, page 364. This is a simple statement of the same fact as given by Best and Taylor, and as stated by Sherman. A small or moderate excess of protein above the body needs, if the balance is alkaline in ash, does no harm. It is a diet in which high protein foods are freely used, as among meat eaters, that does harm, though other proteins in excess also damage the liver, kidneys, and blood vessels.

In the use of the word assimilate there is seen a fine choice of words which might not be expected of “one who had not learned in the schools.” If the word absorb had been used, the statement would have been unscientific for the reason that the system can absorb almost any amount of protein-the notable nutritional substance in nut foods. But the system cannot build into fluid or solid tissues of the body, that is, ‘assimilate, any more protein than determined by the researches of Hegsted and others, namely, 29.3 to 32.9 grams for an individual of 154 pounds when on an all-vegetable diet, or 25.7 to 26.5 grams where meat replaced one third of the constituents of the all-vegetable diet. Such a fine choice of words is commented upon in a humble manner by Ellen G. White in a statement quoted by F. C. Gilbert in *Divine Predictions of Mrs. Ellen G. White Fulfilled*, page 227: “I have all faith in God. I know the perfection of His government, He works at my right hand and at my left. While I am writing out important matter He is beside me, helping me. He lays out my work before me, and when I am puzzled for a fit word with which to express my thought, He brings it clearly and distinctly to my mind.”

Dr. W. D. Sansum of Santa Barbara by experiments on rabbits, which ordinarily never have hard arteries and other degenerative diseases, showed that even oat protein in excess causes high blood pressure, hardening of the arteries, and Bright’s disease. But it is interesting to note that in Sansum’s experiments a high protein diet from soybeans produced no hardening of the arteries, though it did produce high blood pressure with accumulation of protein wastes in the blood and Bright’s disease.

It is true that protein is not stored in the body, but this is no reason whatsoever for consuming large amounts daily. As revealed by all scientific research, much excess above the limited need for protein in adult life helps to cause the degenerative diseases which shorten life. Louis H. Newburgh of the University of Michigan showed by many animal experiments that other high protein foods, even milk protein (casein) concentrate in the form of cheese, produced serious and sometimes fatal disease of the kidneys. The diets he used for comparison in their relative effects were from varying per cents of protein from cheese, beef muscle, and liver. The damage to the kidneys increased with increase in per cent of protein and the duration of the diets and was least with cheese, more with beef, and most with liver. Here we have the scientific evidence that diets excessive in protein, whether from grains, cheese, or beans, are also damaging to vital parts of the body mechanism.

To conclude the subject, let us repeat the conclusions drawn from the latest and most exacting experiment on protein requirements.

“The authors conclude that from these studies it would appear that the National Research Council’s daily recommended allowance of 70 grams of protein for an adult weighing 70 kilograms is most generous and could, if necessary, be reduced to 50 grams and still provide approximately 30 per cent margin above requirement.”

This means that in adult life one ounce of protein a day supplies approximately what the body needs for a man of 154 pounds weight. A quart of milk contains this amount. Anyone with a fair appetite will usually get at least 50 per cent more than this requirement. A meatless diet including milk and eggs (three a week) will give fully 30 to 50 per cent more than this amount of protein and usually double, that is, 60 grams or 2 ounces a day. The common dietary danger is excess, not deficiency, of protein.

Where milk and eggs are excluded from the diet, there may be a vitamin deficiency, first the antianemic vitamin folic acid, and probably also vitamins A and D.

Summary of Protein Requirements

“In Lusk’s exhaustive experiments upon dogs rendered diabetic by phlorizin, 58 per cent of the total weight of protein broken down in the body (whether in fasting or on a meat diet) was eliminated in the form of glucose.” - Henry C. Sherman, *Chemistry of Food and Nutrition*, 6th ed., p. 117; 7th Edition, Page 121. This differs in no way from carbohydrates taken as such.

“By experiment it has been found that if a meal extra rich in protein be eaten, an increased elimination of nitrogenous end products can be observed within two or three hours, and probably much the greater part of the surplus nitrogen will have been excreted within twenty-four hours of the time it was taken into the stomach

“In the sense sometimes called ‘bookkeeping with the body’ the extra excretion is entirely attributable to the extra intake; but as previously inferred from the concept of dynamic equilibrium, and now directly demonstrated in experiments, with isotopic nitrogen, there is always some exchange of material.” - *Ibid.*, 6th ed., Page 115; 7th ed., Page 120.

“Folin (1905) published three remarkable papers. He made it clear that the process of the destruction of the greater part of the protein which is digested and absorbed, and of its conversion into the waste products which constitute the normal components of the urine, differs markedly from that type which is involved in the normal functioning of the tissues of the living body. The end product of the first type is principally urea, while creatinine and uric acid are prominent components of the latter. When a diet free from protein or other nitrogenous compounds is taken in amount sufficient to cover the energy requirements of the body, the urine will, after a few days, contain about 60 per cent of its total nitrogen in the form of urea, 18 per cent as creatinine, 7 per cent as ammonia, and 3.4 per cent as uric acid. The remainder, which will amount to about 12-14 per cent of the total, is in forms which are in great measure uncharacterized, and which cannot as yet be estimated individually. A urine having this composition represents what Folin termed endogenous metabolism. He distinguished it from exogenous metabolism, which is concerned with the

destruction of food protein that has never become a part of the living protoplasm. The magnitude of the endogenous process is surprisingly constant, whereas that of the latter is very variable, and is determined by the consumption of protein.”-E. V. McCollum and Nina Simmonds, *The Newer Knowledge of Nutrition*, 3d ed., Pages 80, 81.

“The physiological state represented by the constant type of protein in metabolism will remain nearly unchanged only when sufficient carbohydrate is ingested to maintain energy equilibrium. In the absence of sufficient carbohydrate for this purpose, protein degradation, at the expense of tissue protein, will take place, about 58 per cent of the carbon being converted into carbohydrate.

“Therefore in the absence of sufficient carbohydrate, as was shown by Ringer (1912), an additional amount of protein is essential, above the ‘wear and tear’ quota. This portion of dietary protein can be spared by carbohydrate, but not by fats, since all efforts to demonstrate the formation of glucose from fats have thus far failed.

“Folin and Denis (1912) applied their analytical methods for the determination of urinary constituents to the elucidation of the mechanism of protein metabolism. They clearly demonstrated that, as amino acids are absorbed from the gut, their concentration first rises in the portal blood, then in the liver, and as the blood passes from the liver into the systemic circulation, the latter shows a high tide of amino acids. The high level in the blood soon falls, while that of the muscles and organs rises, showing that these tissues remove amino acids from the blood. Simultaneously with the flooding of the liver, systemic blood, and tissues with amino acids, the formation of urea begins, and continues until the blood and tissue content of these acids returns to the fasting level, after absorption from the gut is completed. Van Slyke and Cullen confirmed Folin and Denis’s findings in every detail

“The significance of the ‘deposit protein’ which is retained for a time after high protein feeding, and which puzzled the older investigators, is now clearer. It is not protein, but amino acids, held in the tissues, which form a reservoir. The lag extending over several days, when extreme changes are made in the protein intake, is explained by the existence of this reservoir.” -E V. McCollum, Elsa Orent-Keiles, and Harry G. Day, *The Newer Knowledge of Nutrition*, 5th ed., pp. 82, 83. Compare Best and Taylor, *The Physiological Basis of Medical Practice*, 4th ed., pp. 545-550.

“Many experiments have shown conclusively that increased work, when accompanied by a sufficient increase in the amount of fats and carbohydrates fed, does not necessarily increase the metabolism of protein

“Comparing the figures either per unit of weight or of surface, it will be seen that muscular work sufficient nearly to double the energy metabolism had no appreciable effect upon the amount of protein metabolized as measured by the nitrogen output.”-Henry C. Sherman, *Chemistry of Food and Nutrition*, 7th ed., pp. 215, 216.

When animal chemistry began to be studied Liebig’s views were accepted as scientific. “Liebig believed that such physiological functions as muscular contraction and glandular activity appeared to proceed at the expense of the albuminous tissue structures. The function of nutrition, therefore, was to replace destroyed tissue protein.... Voit established the fact that even when the daily protein intake is high, protein is not stored, but is, except in the growing animal, degraded during a period of about twenty-four hours into urea, and other

metabolic end products of protein metabolism, and these products are excreted in the urine.”
- McCollum, Keiles, and Day, The Newer Knowledge of Nutrition, 5th Edition, Pages 8, 9.

19. THE BALANCED DIET

THREE main features in dietary balance should be given special consideration:

First, the amounts and proportions of the protective foods those foods with high vitamin and mineral content.

Second, the balance between the acid-ash and the alkaline-ash foods-the acid-base balance.

Third, the amounts and kinds of protein optimal for health, efficiency, and longevity.

These three cannot be entirely separated, for we have to consider whole natural foods. Perhaps most important of all we must arrive at some simplified rules by which the average man or woman may find it easy to regulate the diet without burdensome computation or consulting lengthy tables of nutritional values. Units, grams, milligrams, or pounds simply cannot be used in everyday life.

Practically considered, the protective foods-those high in vitamins and minerals-are also the alkaline-ash foods. On the other hand, the high protein foods, with the exception of certain legumes, are the acid-ash foods. For this reason the subject of balance mainly concerns the relative amounts of the alkaline-ash protective foods on the one hand to the acid-ash high protein foods on the other. With some exceptions we may call this quantitative relationship the principal feature of the balanced diet.

The newer knowledge of nutrition by which the vitamins have become known, together with their importance in rugged, buoyant health, has given special emphasis to this idea of balance in the diet, particularly because meats, white flour products, refined sugar confections, and sweet desserts have but little or none of these important elements.

With the discovery of the function of each vitamin there has been determined the minimal amounts necessary to prevent rickets, scurvy, and other deficiency diseases. This is important knowledge, but it is not enough for superior health. Vigorous, buoyant health with abounding energy and vim demand a far larger quantity than is barely sufficient for the prevention of these deficiency diseases. In the determination of what constitutes a complete balanced diet, the optimal, or best, for health, strength, endurance, longevity, and the highest qualities in physical, intellectual, and spiritual development and attainments should be the guiding principle. We should add one more requirement the ability to live peaceably with our neighbors, for it has been incontestably demonstrated that the deficiency of certain nutritional elements on the one hand and the excess of certain other foods on the other hand produce nervousness, irritability, lack of self-control, quarrelsomeness, and insubordination. Such objectives are worthy of serious study. This is what God designed for the children of Israel as specified in the seventh chapter of Deuteronomy. It is what has been further elaborated in the Testimonies. The newer knowledge of nutrition has illuminated this instruction and given scientific certainty to the accuracy of these messages.

Vitamin Requirements

To give even the briefest possible review of research regarding the quantitative requirements for each individual vitamin or mineral to secure abounding health, including resistance to infections, would take a considerable library in itself. But this information, however complete, is not practical for common use as vitamins come in whole natural foods, as do proteins, carbohydrates, and fats. Besides selecting whole foods unrefined, we must know how much of the different classes of food should be eaten to secure these optimal amounts. Certain foods richest in these vitamins have been designated “protective foods.” Not that other foods do not contain vitamins, but the protective foods are especially rich in these dietary factors.

Henry C. Sherman has been prominent in determining the features of quantitative balance which make for optimum health and longevity. In 1931 he wrote: “It might be of interest to note what the laboratory experimentation on animals that can be kept under dietary control throughout the whole life cycle, and, when desirable, through successive generations, indicates on that point. It indicates clearly that with respect to vitamins A, C, and G the optimal intake is far above the amount which can be definitely proved to be necessary, as judged by the development of the Symptoms. That is, to enable the individual and its offspring to do the best requires far more of vitamin A, C, and G than the amount that is required to prevent the appearance of any of the typical symptoms of the deficiency disease. The recent work on the relation of Vitamin C to teeth shows that, for the complete protection of the teeth, twice as much vitamin C is required as for the prevention of the longer-known symptoms of scurvy. The work of Mellanby and Green shows that to get the full anti-infective effect, whatever that may be, of vitamin A, requires about four times as much vitamin A as is required to prevent the characteristic symptoms of vitamin A deficiency. In our own laboratory, experiments just completed and not yet published indicate that at least twice as much vitamin G gives improved condition in nutrition as the amount required to prevent the signs of vitamin G deficiency.” - The journal of the American Medical Association, November 14, 1931, Page 1430.

In 1937 Henry C. Sherman specified those foods which must be more largely used to secure these optimal amounts of protective elements-the vitamins and minerals.

“When the 22.4 dietaries already referred to were grouped according to the prominence of fruit and vegetables in them, it was found that, as vegetables and fruit became more prominent, there was increase in the energy, phosphorus, calcium, and iron values (and, we may infer, in the vitamin A, C, and G values also) of the diet, while the protein remained practically unchanged. Thus increasing use of vegetables and fruit seems to improve the food value of the diet at every point at which the American dietary is likely to need improvement.

“The dietaries in which milk, vegetables, and fruit (together) were prominent averaged lower in cost and higher in energy, protein, phosphorus, calcium, and iron; and undoubtedly they also had higher vitamin A, C, and G values.

“Such investigations of the data of actual food consumption viewed in the light of the findings of recent nutritional research make it clear that the average or typical American food budget can be improved by giving greater prominence to milk, vegetables,

and fruit, the money needed for this being obtained if necessary by reducing the expenditure for meats and sweets.” -Chemistry of Food and Nutrition, 5th ed., p. 535.

Again, in 1941, after giving the nutritional characteristics of five chief types of food, together with the deficiencies of bread stuffs, sugar, fats, and meats, Sherman specifies those changes from common custom which should be made in the amounts and proportions of these foods to secure optimal health.

“It becomes apparent that a dietary made up, as so many American dietaries are, too largely of breadstuffs, meats, sweets, and fats, may be satisfying to the palate and to the traditional demand for variety, may furnish ample protein and calories with fats and carbohydrates in any desired proportions, and yet may fall far short of furnishing optimal amounts of some of the mineral elements and vitamins. We now understand how it is that liberal allowances of fruits, vegetables, and milk in its various forms, serve (in ways which until recently could not be fully appreciated) to make an ordinary dietary or food supply more conducive to optimal nutrition and health.

“It will have been noticed that eggs were not included in the above characterizations of the chief types of food. In most respects, eggs may be regarded as intermediate between meat and milk.” - Chemistry of Food and Nutrition, 6th ed., Page 508.

Following these principles and generalizations, Sherman gives his own personal food habits tabulated over several years of time, which were, as he says, guided by the newer knowledge of nutrition.

“Thus one student of nutrition consumed in the course of a recent year: 1,577 servings of fruit and fruit products; 275 servings of tomato or tomato juice; 1,577 servings of other vegetables. During the same year the total consumption of meats, poultry, fish, and shellfish was 300 servings; of eggs, 116 servings. The servings of fruits, vegetables, and their products were of at least average conventional sizes, so that probably the 3,259 servings or portions consumed in the year represented at least 800 pounds of fruits and vegetables as they come to the kitchen, or the same as the highest levels of fruit and vegetable consumption recommended by the US Department of Agriculture in 1933 or in 1935. The servings of meat averaged less than conventional size; probably meat consumption here was near the level of the lowest figures which the Department of Agriculture has recommended. The 116 servings of eggs in the same year were about as often of one as of two so that the consumption was probably about 12 to 15 dozen. Here a food habit guided by the newer knowledge of nutrition and giving more than average prominence to fruits, vegetables, and milk, at the same time afforded greater pleasure than the more conventional American food habit of the past, and at somewhat less cost.

“Later, the same student of nutrition found that the place of fruit in his dietary had progressed to a higher level. In a year in which they were abundant, he consumed 868 pounds of citrus fruit as well as the usual amounts of other fruits.

“Most families and most individuals undoubtedly could build health to higher levels by giving to fruit and to milk in its various forms a larger place in the dietary.”- Chemistry of Food and Nutrition, 6th ed., Page 531.

When these total amounts or servings of vegetables are figured out with the fruit which “had progressed to a higher level,” we have not less than three or four servings

daily of vegetables and five or six servings daily of fruit.

One of the advantages of a very large fruit ration has been shown by Ritzinan and Carpenter. "The respiratory exchanges of four male and five female adult goats were determined under basal conditions after feeding "twenty-five grams of glucose, fructose, or galactose." "Fructose caused the greatest increase in the respiratory quotient and the greatest increase in the metabolism of carbohydrates. Glucose was next in these effects, and galactose had the least effects." - See The journal of Nutrition, Volume 28, Number 2, Page 77, August, 1944.

Another of the advantages of this high fruit ration is the organic acid content of fruits. As mentioned elsewhere, the acid citrates and tartrates (citrus fruits and grapes) have the same action on calcium and phosphates as vitamin D. The citrates also increase tissue saturation with vitamin C. This has been shown by Meyer and Hathaway of Cornell University for potassium citrate and still greater for orange juice as a supplement, resulting in greater "utilization" of vitamin C. See The journal of Nutrition, Volume 28, Number 2, Page 99, August, 1944.

Of course both fruit and uncooked (salad) vegetables are the principal source of vitamin C (also called "ascorbic acid" and C "vitamin acid"). The prevention of scurvy is only one of the uses of vitamin C. For this purpose only a small amount is needed. Lesser or relative deficiencies cause a great variety of defects in the body which, when once produced, cannot be remedied by taking larger amounts. These are the firmness, tensile strength, resistance to compression and torsion, of bone, tooth structure, cartilage, tendon, ligaments, and all supporting and connective tissue structures. The following data are given to emphasize these uses of vitamin C and to call attention to the fact that large amounts of fruit and vegetables are needed to supply these essentials for strong, resistant body tissues and for energy, strength, endurance, and resistance to infections. For these purposes many times more the amount of vitamin C are required than that necessary to prevent scurvy.

Albert Szent-Gybrgyi, M.D., found that vitamin C is necessary for the normal function of all the body cells in the burning of food stuffs. For his work on vitamin C he received the Nobel prize in medicine for 1937. All the cells of the body are held together with a cement like substance, as bricks are held by mortar. Vitamin C maintains this material in normal consistency. This connective tissue is used in the formation of cartilage, ligaments, tendons, walls of all blood vessels, and forms the matrix of bones and teeth which holds the minerals, calcium, and phosphate. In the same manner as concrete depends on cement for its strength, so do the substances between the cells and in the bones, teeth, ligaments, and all supporting tissues depend on vitamin C for strength and resistance to strain or pressure. Lack of vitamin C causes weakening of all these tissues. It is as if one tried to make concrete without cement or with only a fraction of the amount needed. The gravel would remain, but it would crumble for lack of the needed material to hold it together.

If vitamin C is inadequately supplied at the time the teeth are forming, the resulting enamel is thin. Few minerals are laid down in it. If the deficiency is severe, the enamel may be entirely missing. A deficiency in early childhood causes slow growth of the teeth or even cessation of growth for the duration of the vitamin C lack.

After the tooth has erupted, a lack of vitamin C causes the foundation of the dentine to break down. This breakdown allows the minerals to be freed, and they are excreted

in the urine and feces. The dentine thus becomes porous and soft. If decay penetrates the enamel, it meets little resistance and quickly infects the pulp, causing the tooth to die and eventually to be lost. If a partial vitamin C deficiency exists, a bonelike substance is formed, which, although hard, is much more soft and porous than normal dentine. Hemorrhages often occur in the pulp, and pulp stones form which may press against the nerve until the death of the tooth results. A dead tooth always becomes infected and must eventually be extracted.

When generous amounts of vitamin C are added to the diet of animals which have lacked this vitamin, normal formation of the dentine is resumed within a few hours. Presumably the same change occurs in humans under similar circumstances. Six times as much vitamin C is required to prevent tooth changes as to prevent scurvy. The widespread partial lack of vitamin C in the American diet undoubtedly plays a role in our much-too prevalent tooth decay. The foundation of the bones is formed of a material which depends on vitamin C for its strength. When vitamin C is partially lacking, this foundation breaks down, causing minerals to be freed, which are excreted. The bones are left rarefied and somewhat spongy; although hard, they lack the strength of normal bones. Persons who eat too little foods containing vitamin C therefore have bones which break easily.

When the partial deficiency of vitamin C occurs during growth, bone formation slows down, or in severe deficiency may stop altogether. Capillaries in the bones, necessary to carry minerals and oxygen to the growing bony tissue, fail to form. Many of the minerals already laid down are carried away. The bones break easily; the joints may become enlarged; hemorrhage often takes place in the bone marrow; and cartilage formation either ceases or is abnormal. Growing pains, frequently suffered by children, are thought to be caused by an undersupply of vitamin C.

A vitamin C deficiency can thus cause a stunting of growth owing to its interference with normal bone development. For example, children grow more in the summer than and fall than in the winter and spring. Although other causes enter into the picture, the greater abundance of vitamin C in summer is undoubtedly significant.

The minerals calcium and phosphorus are of tremendous value to the body. If eaten in excess, they are normally stored in the ends of the long bones. When vitamin C is lacking, excess minerals cannot be stored. There is no base to hold them. Valuable as they are, they are lost from the body.

If generous amounts of vitamin C are added to the diet, dramatic changes take place. In animals, new bone foundations, or matrix, forms within twenty-four hours, and minerals are quickly laid down. These changes take place when adequate vitamin C follows a deficiency, whether during childhood or advanced age.

Many persons who never get adequate vitamin C have bones which break easily at a minor fall or injury. The amount of vitamin C in the blood and urine of people whose bones break easily has repeatedly been found to be abnormally low.

The walls of all blood vessels throughout the body depend on vitamin C for their strength. Although a partial lack of vitamin C causes changes in all blood vessel walls of capillaries are most affected. Capillaries, which cannot be seen except under a high-powered microscope, have walls made of a single layer of cells, cemented together with minute quantities of connective tissue. No other body tissue depends for its strength on such

a small amount of cement like material. If a vitamin C deficiency exists, therefore, the capillary walls break down before those of other blood vessels.

Every cubic inch of body tissue is crossed and crisscrossed with thousands of invisible capillaries. Healthy capillaries are elastic, like rubber bands. If you receive a blow when vitamin C is abundant in your diet, the capillaries stretch with the indentation of the blow. They do not break, and blood is not freed into the tissues. On the other hand, when vitamin C is inadequate, a similar blow causes the capillaries to break. A bruise indicates that thousands of capillaries have been broken and that the blood they were carrying has been spilled into the tissues. When even a partial vitamin C deficiency exists, capillaries are broken, cells die, and the stage is set for bacterial infection. Whether or not infection actually results depends on the number of bacteria reaching the point where the hemorrhages have taken place and the food supply is waiting.

Broken capillaries, ever present when vitamin C is undersupplied, allow the body to be susceptible to infection in still another way. The broken capillaries offer a means by which bacteria can be transported from one part of the body to another.

A bruise, especially one which is caused by a trivial injury, indicates not only that changes are taking place in the bones, teeth, and blood vessels throughout the body, but it tells you a food supply is being furnished for bacteria and that there is a means of transportation to take bacteria to the waiting food supply. An area of skin discoloration characteristic of a bruise, therefore, should suggest danger of infection unless larger amounts of vitamin C are included in the diet. When vitamin C is abundantly added to the diet, the walls of the capillaries become strong within twenty-four hours.

In healthy mouths the gum tissue fits tightly around the base of each tooth. If vitamin C is partially lacking, the gums become puffy and spongy, and bleed easily.

Dr. Milton T. Hanke of the University of Chicago carried on an experiment in an orphanage where the diet of several hundred children was considered adequate except for vitamin C. The children's gums were badly infected, swollen, and spongy, and bled easily. Each child was given daily, in addition to the regular orphanage food, two glasses (sixteen ounces) of orange juice to which was added the juice of one lemon. The gum infections cleared up quickly, and less decay occurred.

In northern countries and in parts of the United States where the intake of vitamin C is limited, pyorrhea is more common than in tropical countries where foods rich in vitamin C are abundant. If pyorrhea is not too far advanced, two glasses of fresh citrus juices taken daily, or the vitamin C equivalent from other sources, together with an entirely adequate diet, will do much to restore mouth health.

In healthy eyes an unusually large amount of vitamin C is concentrated in the lens. This vitamin C content is greatly reduced in animals or humans suffering from vitamin C deficiencies. Cataracts have been produced in aged guinea pigs by restricting their vitamin C intake. The lens in the eyes of people sixty to eighty years old has been found to be almost lacking in vitamin C. Investigators have reported marked improvement following the giving of large amounts of vitamin C, up to 300 milligrams daily, to persons with cataract, especially if the condition is not too far advanced.

The tissue which is formed in the healing of any wound or injury is known as

scar tissue and depends on vitamin C for strength. During World War I it was noticed that many wounds were slow in healing or failed entirely to heal. When fresh foods were given the soldiers, the wounds healed normally. Since that time many experiments have been carried out which show that the speed of healing, the strength of the scar tissue, and even the maintenance of strong scar tissue are dependent on the amount of vitamin C included in the diet.

The same principle applies to the healing of bones. When vitamin C is lacking, the bone foundation, or matrix, fails to form, and the ends of the broken part are unable to knit. Partial lack of the vitamin leads to slow, imperfect healing, which leaves the bone weak.

Many clinical experiments have been carried out to study the healing action of vitamin C. For example, fifty children whose tonsils were removed were given two glasses (sixteen ounces) of orange juice before and following the operation. They healed much more rapidly and suffered fewer hemorrhages than the same number of children without the extra vitamin C. Abundant vitamin C has been found to increase speed of healing and to decrease hemorrhage in all types of surgery and after the extraction of teeth. Well-informed dentists and surgeons now insist that their patients eat foods high in vitamin C both before and after any type of operation.

In many diseases strong scar tissue must be maintained to prevent new infection. Examples are the healing of ulcers in the digestive tract and the lesions of tuberculosis. Liberal amounts of vitamin C, therefore, necessary to maintain strong scar tissue, must always be included in the diet.

Tests of the strength of the capillaries indicate that from one third to two thirds of the population of the United States are mildly deficient in vitamin C. People in the West get more vitamin C than Easterners do. For the same amount of money spent on foods, people living in cities on the Pacific Coast buy three or four times more vitamin C than those on the Atlantic Coast.

Vitamin C also functions in the production of energy in each of the millions of body cells. As the red corpuscles in the blood combine with oxygen and carry it, so does vitamin C combine with and carry hydrogen from the breakdown of all foodstuffs. Studies indicate that vitamin C is particularly concerned with the using of fats and proteins in the cells.

The third function of vitamin C is that of helping the body to fight bacteria, bacterial toxins, poisons, and many foreign substances which sometimes reach the blood stream.

The amount of vitamin C in the blood and urine has been found to be unusually low during common colds, fevers, particularly scarlet fever, throat infections, influenza, infections of the sinuses, mastoids, and ear, arthritis, rheumatism, rheumatic fever, and all types of lung infections.

A number of diseases have been produced by bacteria being injected into animals lacking vitamin C-rheumatic fever in guinea pigs; infections of the heart and arthritis. Claus W. Jungeblut, M.D., of Columbia University found that only 5 per cent of monkeys injected with poliomyelitis virus (into the brain) remained alive with no paralysis, whereas of those treated with natural vitamin C, 32 per cent remained alive without paralysis.

Since vitamin C so readily dissolves in water, it cannot be stored in the body. Its solubility causes it to be lost whenever water is lost from the body, as in urine and perspiration. The excessive drinking of water causes unnecessary losses of the vitamin. Activities which increase perspiration also increase vitamin C loss.

Studies have shown that vitamin C is used twice as fast during manual labor and strenuous exercise as when the body is at rest. The need for the vitamin is therefore doubled for the duration of the activity.

We have seen how infection increases the need for this vitamin. The extent of such an increase is not known and undoubtedly fluctuates.

A newborn infant has about four times as much vitamin C in its blood as the mother has. Since this amount was put there by nature, it is assumed to be the ideal quantity. If no vitamin C is given, this amount falls in three or four days to an extremely low level. Vitamin C must, therefore, be supplied by a supplement of fruit juice or synthetic vitamin C, if the vitamin in the blood is to be maintained at the level for good health. At least fifty milligrams daily should be given to maintain this level.

Dr. Sybil L. Smith of the United States Department of Agriculture has warned in *The Journal of the American Medical Association* that foods rich in vitamin C must be started at an extremely early age and in much larger quantities than were formerly given. The desired amount, or fifty milligrams, of vitamin C can be supplied by the following:

0.333 cup (100 c.c.) fresh orange juice

0.333 cup (100 c.c.) fresh lemon juice

0.500 cup (125 c.c.) grapefruit juice

0.875 cup (250 c.c.) tomato juice

0.875 cup (250 c.c.) pineapple juice

“It seems rather startling to give a newborn infant one-half cup of orange juice daily, but the results have been excellent. Physicians sometimes prescribe a small tablet supplying fifty milligrams of ascorbic acid [vitamin C] which can be easily dissolved in an ounce of drinking water and given daily.”

It appears that the need for vitamin C increases with advancing years. An older person who wishes to enjoy his last years in the best health possible should plan his diet so that it will contain ample vitamin C.

The idea that elderly people require something more in the way of vitamins than they can ordinarily get from their regular diets is not new. As quoted by Stephenson and others (W. Stephenson, C. Penton, and V. Korenchevsky, “Some Effects of Vitamins B and C on Senile Patients,” *British Medical Journal*, 2:839, 1941), there is considerable decrease in storage of vitamin C in various body organs with increasing age. The explanation of this phenomenon was stated by various workers not to lie in a fundamental difference of selection of diet between young and old people, but rather in a faulty metabolism or deficient

absorption of the vitamins by the aged.

H. A. Rafsky and Bernard Newman have indicated that people over sixty have a great need for vitamin C, niacin, and thiamine, as indicated by the larger amounts needed to saturate them compared with amounts needed by younger people. Referring to their work on thiamine, these authors state: "As people reach an advanced age, the so-called normal diet is perhaps insufficient to provide the thiamine requirements of this age group; in outlining a diet for these individuals, the factors of absorption and assimilation must be taken into account. Vitamin B, Excretion in the Aged," *Gastroenterology*, 1:737, August, 1943.

Perhaps the gradual advance to achlorhydria, which is a progressive chronic condition, as are most other senile features, parallels to some extent the lessened utilization of vitamins by the aged. As is the case with vitamin deficiency conditions, the disorders of old age are characteristically chronic, progressive, and usually insidious in onset. Significant to the question in hand is a statement made recently by the Committee on Diagnosis and Pathology of Nutritional Deficiencies of the National Research Council: "The prevalence and severity of the chronic processes increase with age. Most of the chronic changes have hitherto been regarded mistakenly as characteristics of senescence. In reality, however, they are deficiencies developing over a lifetime." – "Inadequate Diets and Nutritional Deficiencies in the United States," *Bulletin of the National Research Council*, 109:20, November, 1943.

"Vitamin C and Defense Against Infection" is the title of a paper in the *Klinische Woehenschrift* by Dr. S. Thaddea. Although the action of vitamin C has been investigated, little has been known of its role in the infections. Clinical medicine, however, has shown a growing interest in the destiny of vitamin C in the intoxications and infections. Experimental and clinical tests have demonstrated the decisive role of the adrenal glands in the defense of the organism against infection. Changes in the adrenals are present in acute infections, together with clinical symptoms indicative of cortical dysfunction. Normally the adrenal cortex is of all parts of the body the richest in vitamin C. Favorable results can be obtained in diphtheria toxin, intoxication, and in infectious diseases by enriching the vitamin C content of the adrenal cortex. In experimentation with diphtheria intoxication of guinea pigs, the percentage of survivals among animals which had received the vitamin treatment was greater than among the control animals. The adrenals and liver of treated animals were observed to be completely normal, whereas these organs in the control animals showed marked changes due to the inflammation and, in addition, an obvious deficiency in vitamin C content. In experimental tuberculosis of guinea pigs the loss in weight of the experimental animals is arrested and the life span lengthened. In pneumococcic sepsis of the white mouse, too, the typical picture is less pronounced, and the liver suffers less damage if the animal has received preliminary treatment. Thus there is experimental evidence indicating that the administration of vitamin C leads to a remarkably strengthened resistance to various intoxications and infections, while further organic changes take place only in slight degree or are entirely lacking.

From a clinical standpoint these experiments demonstrate that the elimination of vitamin C in the urine at the height of acute infection or in the more severe febrile types of pulmonary tuberculosis may be especially low. Obviously there exist certain connections between the height of the fever and the excretion of vitamin C. Experimentation with intravenous injection of vitamin C has demonstrated that acute infectious diseases and exudative types of pulmonary tuberculosis are accompanied by an increased demand for

vitamin C. In contrast to healthy subjects, persons suffering from infectious disease retain a greater part of the administered vitamin C in order to replenish the depleted vitamin C reserve. Conversely, persons affected with sclerotic forms of tuberculosis fail to present any demonstrable deficit in vitamin C. In tuberculosis pulmonary hemorrhages, too, the vitamin C excretion is manifestly lowered; but, after the bleeding has stopped, the values rise again to normal. In acute infections and in the exudative and cavernous type of tuberculosis, the cerebrospinal fluid undergoes great depreciation of the vitamin C values. Administration of the vitamin raises the C level in the spinal fluid.

Some persons who are sensitive to various wholesome foods can be relieved of these allergic reactions by large doses of vitamin C. Professor Harry N. Holmes of the Oberlin College chemistry department reports that 70 per cent of twenty-seven allergic patients have been relieved and can eat such foods without disturbances. A further 18 per cent reported improvement. The doses of vitamin C required are large-500 milligrams. The normal amount in the diet is twenty-five to thirty milligrams. See *Annals of Allergy* 1:235, 1943.

Cut Toxic Arsenical Effect in Treatment of Syphilis

After three years of research, Dr. A. C. Ivy, head of the physiology department of Northwestern University, announced that a way had been found to reduce some of the ill effects of mapharsen, the arsenical compound used in the treatment of syphilis.

Dr. Ivy, in experimenting on animals, used vitamins C and P in combination to produce a synergistic action. He prepared a dosage of mapharsen which killed 90 per cent of the animals to which it was given.

When a similar dosage was mixed with a crystalline solution of pure vitamin C, only 72 per cent of the dogs to which it was administered died. When treated with vitamin P alone and given the same dosage of mapharsen, only 57 per cent died.

The mapharsen dosage then was administered in conjunction with a combination of vitamins C and P. The death rate, Dr. Ivy disclosed, then dropped to 17 per cent.

“The way in which the vitamins theoretically produce their favorable effect is quite complicated, although it is known that they act on the enzymes and cells to protect the cells against the toxic properties of the arsenic,” Dr. Ivy explained.

A striking comment on health-destroying dietary habits is made by Rackham Holt in his story of the life of George Washington Carver when he says: “In an occasional hollow a bit of cane flashed startlingly green-cane for sweetener which would make up one of that health-destroying triumvirate of meat, meal, and molasses.” - Page 172.

The dominant food in the American diet for many years was meat. This gave way partially to breads and breakfast foods (all cereal grain product-). Now both are dominant in amounts and proportions of all other foods, especially running much higher than the protective foods of fruit, vegetables, and milk, which collectively should make up three fourths or four fifths of the servings of food for each day. This present-day great

preponderance of structural or repair food in adult life is what is causing so much degenerative disease of the heart, blood vessels, and kidneys-constituting, in 1942, 44 per cent of all deaths at all ages.

Dental Health

Milk, fruit, and vegetables in large amounts and in large proportions are especially necessary for dental health. These large amounts and proportions are of the greatest importance in children. The foundation for this dental health is laid by the mother before the child is born. In the perfection of architectural pattern of the jaws and teeth with symmetry and beauty, the responsibility rests upon both parents even before conception.

Whole-grain cereals without refining and the nonuse by mother and child of refined sugar, candies, confections, cakes, puddings, custards, all sweet desserts, and the most damaging combinations of milk or cream and sugar together, such as on mushes and breakfast foods, are necessary for the prevention of gingivitis, pyorrhea, gumboils, and dental caries.

Concerning the specific amount of food containing the necessary vitamin C for dental health, another investigator gives these conclusions:

1. The average American diet is adequate in calories, but appears to be deficient in certain substances that are requisite to dental health. This dietary deficiency may be the ultimate cause of much of the gingivitis (inflammation of the gums) and pyorrhea and dental caries (cavities) with which we are affected.

2. Gingivitis and dental caries can occur in the majority of a large group of children who are receiving a quart of milk, one and a half ounces of butter, a pound of vegetables, half a pound of fruit, and one egg nearly every day.

The addition of a pint of orange juice and the juice of one lemon to a diet that is nearly adequate in all other respects supplies something that leads to a disappearance of most of the gingivitis and an arrest of about 50 per cent of the dental caries.

Of foods containing vitamin C, this investigator advises:

8 ounces of orange juice and the juice of 0.5 lemon once or twice a day.

0.25 to 0.5 head of lettuce.

0.5 pound of fruit besides the orange juice.

0.8 to one pound of vegetables daily.

Vitamin C from fresh, uncooked fruits and vegetables is especially necessary in liberal amounts to preserve the integrity of the cementum. This structure once damaged by deficiency of vitamin C seems never to recover. With pyorrhea and gumboils once begun in childhood, it is impossible to fully stay their progress in later life. It is in this diseased condition that the combination of refined sugar with milk or cream seems to have its most damaging effects. Breakfast mushes with sugar and cream are especially harmful. The

scientific explanation may not be clear, but the facts are so fully borne out by voluminous experience that there is no doubt of their certainty.

Speaking further of the enlarged meaning of the term protective foods as coined by E. V. McCollum, Henry C. Sherman says: "The research findings of recent years have extended this concept in two ways. We have come to realize that enrichment of the dietary in vitamin C and riboflavin, as well as in vitamin A and calcium, is usually beneficial; and this is not merely for protection against actual deficiency, but also for the promotion or enhancement of vitality-of 'positive,' or 'buoyant,' or better-than average, health. Thus the idea has, perhaps, already outgrown the literal meaning of the word 'protective; but the term continues to do services with this enlarged and more constructive significance.

"In this sense, and with the objective broadened to include the enrichment of the diet in the four factors, calcium, ascorbic acid [vitamin C], riboflavin, and vitamin A, we now apply the term 'protective foods' to milk, fruit, vegetables, and eggs. Wider definitions of the term 'protective foods' have also been proposed. Milk furnishes all four of the chemical factors just mentioned and is an outstanding source of three of them. While each of the other three types of food here called 'protective' is regarded as a good or excellent source of some one of the four factors. The richness of eggs in vitamin A and riboflavin fully entitles them to a place in the category according to this latter criterion, and the vitamin D and iron content of eggs and the high nutritive value of their proteins are all nutritional assets, especially for the growing child; but eggs do not, like the other protective foods, have the property of reducing intestinal putrefaction and promoting the development of a wholesome bacterial flora in the digestive tract, and for this and some other reasons eggs are more cautiously emphasized, while of milk, fruit, and vegetables we now believe that (within reason) the larger the proportion of the needed calories taken in these three forms, the better." -Chemistry of Food and Nutrition, 6th ed., pp. 515, 516.

Concerning eggs, Sherman's average between twelve and fifteen dozen a year, thirteen and a half dozen, gives 3.3 eggs a week. Eggs are a necessary food and should not be discarded. Because of their high protein, acid-ash, and cholesterol content they should be used only moderately. Sherman's allowance tallies with other scientific research as given in previous chapters.

It should be remembered that all these figures are on the basis of the number of servings a day or week for a man of 70 kilograms, or 154 pounds, weight. A woman of 125 to 130 pounds should eat about four fifths the amount of food eaten by a man of 154 pounds weight.

Vitamin Saturation

Vitamins A and D are stored in the liver so that probably three months might elapse with none of these in the food before the stores in the liver would be exhausted, provided these stores were ample to begin with. Such is not the case with the water soluble vitamins-the C group of anti-hemorrhagic vitamins and the B complex. For this reason the daily food should contain the full optimal, and in this case maximal, requirements for tissue saturation. This is practically judged by the estimation of any one of these in the urine, after which a large dose of this same vitamin is given. If half of this large or excessive dose "spills over" in

the urine it is considered that the body tissues are full or saturated with this vitamin and will hold no more. If less than half “spills over” in the urine, it is regarded as evidence that the tissues are not filled or saturated and so held it back to supply this optimal amount. It requires a large number of servings of fruit and vegetables daily and one quart of milk to provide for such tissue saturation. But here there should be injected the proviso that breads and cereals must be whole grains, unrefined and with their full original content of wheat germ or its equivalent in other grains, else B1 or thiamine will be deficient. Much has also been said elsewhere in these studies regarding the importance of the water-soluble vitamins in vital resistance to infections and the large amounts necessary for protection.

The carotene of plants is the source of vitamin A in animals. The colorless or preformed vitamin A is made in the liver from the carotene of the green and yellow vegetables. In thyroid-deficient animals this does not occur, or but imperfectly. Fishes get their liver stores of vitamin A by making it from the green algae and plankton of water life.

Vitamin D is made by the action of ultraviolet light on ergosterol in the skin. Climatic conditions of fog and cloud, together with smoke and dust, have greatly limited this process in many parts of the world. And, of course, the wearing of clothing also interferes with it.

A non flesh diet is deficient in vitamin D and in preformed A, unless milk and eggs are used. To make sure of an ample supply, fish-liver oils may be used. While liver extracts have therapeutic value in secondary and pernicious anemia, Rose found that for normal nutrition egg does all that liver can do. On this fact Sherman remarks: “Obviously, then, if one of these is to be emphasized in the teaching of nutrition and food values to the - public, it should be the egg.”-Henry C. Sherman, Chemistry of Food and Nutrition, 6th ed., P. 533. This is important not alone because it can accomplish all that liver does in these diseases and in prevention, but also because whole liver as a food is distinctly detrimental and its use is known to produce the degenerative diseases-cardio-vascular-renal-by means of its high protein content, its acid ash, cholesterol, and its content of the end products of protein metabolism.

Moderate deficiency of vitamins A and D are much more common than the extreme deficiencies. The keratotic degenerations of all epithelial-covered membranes and epithelial-derived organs and glands is such a large subject that more than allusion to it cannot be made here. Vitamin A is necessary in liberal amounts to prevent such degenerations and the consequent breaking down of the first line of defense against infections. This is a mechanical barrier, and these mucous membranes must be kept in a healthy condition all the time by a liberal diet of foods rich in carotene and vitamin A. The quart of milk a day with three eggs a week and three or four servings of vegetables a day give ample amounts of these two vitamins. In chapter 10 is given the research work showing that the alkaline citrates and tartrates (citrus fruits and grapes) have a physiological activity like that of vitamin D. It has been shown that these organic acid salts of citrus fruits and grapes accomplish this by correcting the imbalances of calcium and phosphorus in the food eaten. They also increase calcium absorption and decrease calcium elimination. It will be seen that this effect is a most important one for those who live in a cloudy, foggy, or dust- and smoke-laden atmosphere or whose use of milk (preferably from cows on summer pasture) and eggs may be deficient. It is evident that it also provides for supplementing the vitamin D in the moderate use of eggs as specified by Henry C. Sherman.

That milk and eggs should be included in a complete diet adequate in all nutritional elements seems hardly to: need more demonstration than has been given by scientific research. Nevertheless some without such knowledge have taken extreme views of statements made in the testimonies regarding the dangers in the use of these animal products. A careful study of all such statements reveals clearly that these dangers reside not in these two foods in so far as their chemical constituents are concerned, but in the transmission of infections from infectious disease in dairy animals and poultry. Dairy animals are susceptible to tuberculosis and undulant fever, and to some other infections, so that rigid and frequent inspection and testing are necessary to ascertain that they are free from these. As to eggs the matter may seem quite different, yet United States government inspectors leave no doubt that poultry and feathered creatures in general have the largest incidence of cancer, a condition which is share by hatchery raised fish. Chopped whole liver, because of its full content of vitamins (both fat soluble and water soluble), is conducive to rapid growth of minnows. But it also contains carcinogens, some of which may be entirely chemical in nature, as are other provocative carcinogens, but it is especially likely also to harbor viruses of types and proclivities which are now definitely demonstrated to be neo-plastic, or cancer-producing.

Numerous references to protection against bacterial and virus infections by ample amounts of vitamins C and the B complex are given elsewhere and so need not be repeated here. That many conditions nowadays called “food allergy” are actually not allergy at all, but vitamin deficiencies, that is, imbalances of the diet, is made almost certain by the report of H. N. Holmes that vitamin C saturation in 19 Out Of 27 patients enabled them to eat foods to which they had formerly been allergic, with no distress or very little reaction, and five reported some improvement. “On the basis of these results, the author credits vitamin C treatment of food allergy with 80 per cent success. Allergies to chocolate, milk, cheese, eggs, wheat, oranges, lemons, bananas, tomatoes, asparagus, potatoes, pork, and fats were overcome. It is worthy of note, says Holmes, that oranges and lemons were on this list.” - *Annals of Allergy*, 1:235, 1943. The complete relief of certain skin diseases by proper physiological balance in the diet is discussed under “Skin Disease Pathogenesis” farther on in this chapter.

Acid-Base Balance

In 1912 Sherman and Gettler analyzed a large number of foods, computing the balance between amounts of chlorine, phosphorus, and sulfur, on the one hand expressed as equivalents of cubic centimeters of normal acids; and the amounts of calcium, magnesium, potassium, and sodium, on the other hand expressed as equivalents of cubic centimeters of normal alkali. In the main, fruits and vegetables are alkaline, in ash and meats, eggs, cheese, and cereal grains are acid in ash. Because the body by means of a buffer system maintains the blood at a slightly alkaline reaction, it has been maintained that there was no particular health significance to this matter of the acid-base balance in the diet. Concerning the merits of this question Sherman says:

“Much the greater part of the research which bears upon the question has been directed toward the elaboration of the theory of the maintenance of acid-base balance in the blood. So brilliant have been the results that there has been a tendency to overlook the limitations. Relatively little attention has yet been given to the important findings of Rous

(1925) that all or most of the body tissues are somewhat less alkaline than the blood plasma, while the organs in which the nutritional processes are particularly active are, or may be, frankly acid (around pH 5.6). Thus some of the most important parts of the body get only partially the benefit of the buffering capacity of the blood, and so may be more influenced by an excess of acid-forming elements in the food than the studies of the blood would seem to suggest.

“The working out of the problems of the buffers and the carbonic-acid-carrying capacity of the blood is an outstandingly brilliant triumph of physicochemical research. This knowledge of the blood, however, does not solve the problems of acid-base balance in all the separate organs of the body, nor permit one to say with confidence whether the balance of acid-forming and base-forming elements in food is or is not of practical significance in human nutrition.” - Henry C. Sherman, *Chemistry of Food and Nutrition*, 6th Edition, Pages 247, 248.

“The experiments of Stockman and Johnston show that all the cereal grains (rice, rye, wheat, oats, and corn) examined proved to be poisonous to monkeys when they constituted the bulk of their diet, even when relatively large amounts of fruit, milk, and butter were consumed along with them. They were poisonous also to rabbits and guinea pigs. Also acids isolated from the various grains and given as sodium salts, hypodermically and orally, to healthy animals with their ordinary diet were poisonous and produced similar symptoms. The pathological changes were the same in the two tests and implicated chiefly the nervous system, but the bones and viscera also were more or less involved. The pathological changes fully accounted for the various symptoms. The poisonous substance is in all an acid or acids, but possibly not the same in all. The most probable explanation of their action is that they not only are irritant and poisonous in themselves, but also have a secondary effect of gradually or suddenly withdrawing alkalis and especially Calcium from the blood and tissues. It is not, therefore, question of vitamins or of any kind of deficiency in the grains, for all the animals were getting vitamin-containing foods in abundance. The larger the quantity of cereal food consumed and the larger the dose of acid given orally or hypodermically, the more severe were the symptoms, facts which militate against any idea of a deficiency.” - R. Stockman and J. M. Johnston, in *Journal of Hygiene*, London, 33:151-294, April, 1933.

Demineralization of the bones is so common in middle and advanced age as to arouse a suspicion of this effect of an acid-ash diet. This is also an urgent reason for the inclusion of alkaline ash food in such large proportions as 3 to 1 or, better, 4 to 1 of acid-ash food on the basis of standard portions or servings.

As we have already seen in the experimental work on arteriosclerosis and nephritis, it is of importance in the healthy action and integrity of certain organs, notably the heart, the liver, and the blood vessels. This seems to be due in some way to the acid ash of the diet making the blood vessel walls permeable to cholesterol, while an alkaline-ash diet protects the blood vessels. In the case of the liver and kidneys it seems to be due to the damaging effects of a preponderance of acid ash and nitrogen and phosphorus wastes upon active cells of the organs. Excess of protein food increases blood pressure and also increases blood vessel, heart, and kidney damage. With the general rule for dietary balance of three or four servings of fruit, vegetables, and the milk to one of grains, eggs, cheese, and meat (if the latter is to be used) this appears to avoid the damage to the kidneys, and, in blood, two were normal and seven had a high figure. At the end the case of the liver, the high content of

carbohydrate and vitamins appears to be the factor of safety.

The popular fear of excessive starches in the diet does not rest on any scientific evidence. Pemberton's finding of a low metabolism in a high proportion of arthritic patients was the start of this notion some years ago, since which it has spread to cover an indefinite field. The logical treatment of arthritis, if accompanied by hypothyroidism, is to bring to normal the oxidation by thyroid medication, not the reduction of the natural carbohydrates of the food to correspond with the reduced thyroxine induced oxidation.

Alkaline-Ash Diet

"Ten women and two men started on an experimental diet for one month. One man and two women did not stay, closely to diet and were not counted in the summary. One of the girls who did not continue the diet said that she did not know why she didn't stick to it, as she felt much better while taking it.

"The diet began February 6, and consisted of a low protein alkalizing diet, with lemonade between meals, using two lemons a day. The following tests were made before starting the experiment and at the close: body weight, blood pressure, pH of the urine, non protein nitrogen of blood, hemoglobin, red count, and urinalysis. Blood pressure and pH were repeated weekly.

"The following were the results obtained:

"Two had a blood pressure moderately elevated above that for their age group. This dropped to normal.

"Three had normal blood pressure remaining, the same.

"Four had low blood pressure with no change.

"Five lost weight slightly.

"Two remained the same in weight.

"Everyone had a highly acid urine. The first week all but one came up to neutral or alkaline. Several dropped back to acid at the end of the third week, but admitted that they had not been living up to the diet strictly, but all came up to the alkaline side the last week.

"As regards the non protein nitrogen (protein wastes) of the blood, two were normal and seven had a high figure. At the end of the third week five of the seven dropped considerably and the other two slightly, bringing all within normal limits.

"In hemoglobin and red counts, five gained in both, two dropped slightly, but these two seemed to have other factors influencing the result: two showed a gain in the red count, the hemoglobin staying the same.

"By urinalysis nothing abnormal was found in any except the excessive acidity.

"While on the diet the following symptoms of long standing were relieved:

"Four had been troubled with chronic constipation of long standing, and all were definitely relieved.

"One had daily headaches, which disappeared entirely.

"Nine complained of fatigue, all were relieved wholly or considerably.

"Three continually having colds, did not have a cold during this month.

"Two caught cold since the diet was discontinued, but said they began eating candy and sweets as soon as restrictions were removed.

"One complained of fullness and bloating after eating. Relief occurred after the first week, and swelling of the ankles disappeared.

"Several said they did not require as much sleep, and slept better.

"Another said that the head was clearer, he could think better.

"Two had heartburn, and were relieved.

"Another one claimed that since being on diet, it made her sick to her stomach to eat between meals. Another said she had no more craving for candy. Still another had no desire to overeat.

"Eleven others heard about the diet and went on it voluntarily, with the following results:

"One had persistent headache from which she could get no relief; headache disappeared after the first week. Of five others with blood pressure higher than normal for their age group, in one it was moderately elevated and dropped to normal. In one with hereditary tendency to high pressure it was definitely elevated above the extreme allowance for the age group, with reduction to normal. In one of middle age and moderately high pressure of long standing the pressure was reduced to normal. In two beyond middle age with very high pressure, moderate reduction occurred at once, but the pressure readings are still definitely elevated.

"The following instructions were given to those on the test dietary. Required foods as follows:

BREAKFAST:	1 serving steamed figs
	1 large glass orange juice (water)
10:30 A.M.	1 glass lemonade (1 lemon to 8 oz. water)
DINNER:	1 serving celery
	1 serving spinach
3:30 P.m.	1 glass lemonade
SUPPER:	1 serving lettuce
	1 large glass orange juice

"Restrictions: Not more than three slices of whole-wheat bread a day. Not more than two eggs a week. A cereal may be eaten for breakfast on days when an egg is not eaten. Ice cream should be made without eggs.

meats. “The following foods --r not to be eaten at all: peanuts, walnuts, lentils, corn,

“No eating between meals. No eating of candy or sweet desserts at any time.

“The following foods may be used freely in addition to the ones mentioned as required:

Cucumbers	Lima beans	Apples
Rhubarb	Apricots	Pears
Carrots	Radishes	Bananas
Beets	Mushrooms	Sweet potatoes
Olives	Watermelon	Milk
Parsnips	Potatoes	Baked beans
Cabbage	Prunes	Grapes
Cauliflower	Cherries	Cranberries
Pineapple	Plums	Dates
Muskmelon	Turnips	Kidney beans
Raspberries	Raisins	Almonds
String beans	Squash	Peas
Peaches	Buttermilk	Cream

“1. Drink six glasses of water a day.

“2. Make the diet consist essentially of vegetables and fruits.” - Grace Parker, RN, “An Alkalinizing Diet Experiment,” Life and Health, July, 1928.

This experiment was made in 1928 at the Washington, D.C., Sanitarium. Today it might more appropriately be called a high vitamin or high protective food experiment. The protein was 50 grams daily. The rather remarkable relief of many common ailments certainly reveals the advantages of a diet running to at least 75 to 80 per cent fruit, vegetables, and milk.

Protein

In considering the amounts and proportions of protein which should make up a balanced diet, we enter upon a highly controversial field. It will be necessary to give weight to facts and facts only, well attested by scientific research. The opinions of men who study scientific matters may be used if based upon discovered truths; without these their opinions and judgments may be of little worth or even entirely wrong. This is well illustrated in the admissions of McCollum and Lusk regarding their preconceived ideas concerning the

optimal protein ration. Both of them admitted all the facts relative to the advantages with no discoverable disadvantage and even the great superiority of the low protein diets used by Chittenden. It must be recalled that the actual protein content of Chittenden's diets with the soldier and athlete groups was as low as 48 grams per 70 kilos of body weight and also that the nitrogen balance studies on these men showed that their bodies were actually using only 40 grams of this 48 grams allowance. The diets used by Russell H. Chittenden himself and his laboratory co-workers were lower than this. M. Hindbede used over periods of years even still lower protein rations, yet maintained full working capacity with Madsen, the stocky) muscular-built man, and great improvement in health and working capacity with Jorgensen, the slender, underweight man. Benedict's wording of his admission in this regard is even more striking-eating "humble pie" (see page 249) is certainly not common to men of science, and especially not concerning a subject where appetite, habit, and custom are so largely involved.

What we have produced in regard to protein is not enough; there are still other items governing the protein factor in the balanced diet which are of equal if not greater importance. These items are the acid-base balance and the vitamin content of the food. Practically considered, these two are not separable, for the protective foods and the alkaline-ash foods are largely the same. Only one exception exists, that of ripe, mature beans and other legumes, and this is largely because of their exceedingly high protein content, running from 50 per cent higher than the protein of lean meats to double the amount of protein in soybeans as compared with that in beefsteak.

In the experiments of F. R. Nuzum and W. D. Sansum, high blood pressure, increased nitrogen wastes in the blood, albumin and casts in the urine, and nephritis all occurred with the large use of soybeans. Only arteriosclerosis did not occur in this group of animals. The nitrogen wastes in the blood ran higher than in the other groups throughout the experiments and attained a much higher final level than in either of the other two groups on excessive grain and animal protein diets.

Skin Disease Pathogenesis

It is evident that it is the acid ash of the food that makes the blood vessel walls permeable to cholesterol with later the deposit of calcium soaps in the damaged tissue of these blood vessel walls, together with the fibrosis which occurs when the cholesterol is absorbed and disappears from these same blood vessel walls. Here are important facts from pathogenesis, that is, disease production, which must have their place in determining what constitutes a complete balanced diet for optimal health and longevity.

It is to be noted that both acid-ash diets and extreme alkaline ash diets produced hypertension and increased nitrogen wastes in the blood. These are abnormal conditions and must of necessity sooner or later lead to disease of some kind. In an exhaustive investigation into the causes of certain skin diseases Jay F. Schamberg of Philadelphia in 1913 reported that no demonstrated causes were discovered, but stated: "Cases of psoriasis were likely to improve under a low protein diet or, conversely, apt to grow worse under a high protein diet." - Journal of Cutaneous Diseases, October, 1913. In 1930 Schamberg reported blood chemistry studies on 1,000 cases of various types of systemic (generalized) skin diseases including eczemas, psoriasis, and general pruritis

(itching). These studies were made with blood estimations for urea nitrogen, non protein nitrogen, and uric acid. On the basis of the maximum normal of non protein nitrogen at 40 milligrams per cent he reported that 22.6 per cent of eczema cases had 40 milligrams or more non protein nitrogen in the blood, while in general pruritis (itching) 36. 1 per cent had 40 milligrams or more. This standard for non protein nitrogen is higher than is now considered a normal range. As Schamberg gives the figures for 875 of the cases studied, a re-evaluation on the basis Of 30 milligrams per cent as a maximum normal may be made. Of 455 cases of eczema 80 per cent had more than 30 milligrams. In 50 cases of psoriasis 67 per cent had more than 30 milligrams, and in 34 cases of generalized pruritis 85 per cent had more than 30 milligrams. In 1932 Schamberg wrote:

It is a source of astonishment to me that the profession of dermatologists has scrutinized only to an infinitesimal degree the statement of Schamberg, Kilmer, Ringer, and Raiziss made after a long and painstaking research nearly two decades ago, to the effect of the influence of diet on psoriasis. The very laborious, extensive, and expensive studies in question resulted in the conclusion that there was a positive nitrogen metabolism in psoriasis.

Accompanying this presentation of the subject was a series of 'before' and 'after' photographs, however, which constitute to my mind irrefutable documentary evidence of the statement that a 'low protein diet' in the sense in which this term was employed has an enormous influence on the course of the psoriatic eruption.

"Within the period of eighteen years that has elapsed since the publication of the Research Studies in Psoriasis, further evidence has come to me of the verity of the foregoing statement. In only one case of psoriasis have we not been able to effect a virtual disappearance of the psoriasis eruption by diet. The photographs published in 1913 constitute documents that cannot be denied.. How can the effect of a low protein diet in psoriasis be explained? There is a rapid growth, proliferation, and exfoliation of epidermal cells in psoriasis. For this growth these cells require building material, which can be obtained only from one source -the blood and lymph streams. The principal building material required by these cells is protein. It is at once evident that since these cells are endowed with a powerful 'growth impulse' (wachstumstrieb), the velocity of their growth will be directly proportional to the amount of 'building material' in the form of protein that is placed at their disposal. A high protein is therefore prone to stimulate their growth, because it provides all the necessary components of the epithelial cells. By keeping the patient on a low protein diet, on an amount just enough to cover the body's 'wear and tear' quota, a condition is brought about in which no extra protein can be supplied to the rapidly multiplying cells of the skin.... I have never observed any harm result from keeping a patient on a very low protein diet for months at a time; the caloric supply should, however, be sufficient to maintain the patient's body weight. Chittenden, a number of years ago, advocated the advisability of keeping individuals on a six gram level of nitrogen, and Hindhede has shown that nitrogen equilibrium and mental and physical efficiency can be maintained for long periods on diets containing even less nitrogen."-The journal of the American Medical Association, May 7, 1932.

In my own experience this principle of low protein alkaline-ash diet, that is, reducing meats, breads, cereals, cheese, and eggs, and increasing fruit and vegetables (with milk) to a level Of 75 to 80 per cent of all servings of food, has cleared up the worst cases of infantile eczema and adult psoriasis, even cases where the skin of the entire body was involved. Mere leaving off meat is not adequate. The whole chemistry of the body must be

changed from high protein acid ash to low protein alkaline ash by means of a great preponderance of the protective foods-fruit, vegetables, and milk. These facts of disease production and disease cure are also guiding factors in determining what constitutes a balanced diet. To give a proper acid-base balance, so as to secure an alkaline-ash result and keep the body fluids slightly alkaline and the urine slightly acid requires three or four servings of fruits, vegetables, and milk to one of breads, cereals, eggs, and cheese.

Brief histories of three of the worst cases I have seen are given to illustrate the therapeutic necessities in these skin diseases and also to show the criteria for a normal balanced diet.

INFANTILE ECZEMA. Male infant 10 months of age with a rash of several months' duration; rough, scaly, horny skin surface on a red base, covering scalp, cheeks, arms, diaper region, knees, and legs. Diet had been 1 egg a day, cereal twice a day, milk, bacon, and scraped meat, with fruit and vegetables limited.

Changes made in the diet: Removed all cereals, breadstuffs, eggs, and meats. Prescribed: Breakfast, milk, baked potato, large dish of applesauce. 11:30 AM, 6 to 8 ounces of orange or tomato juice. 1 PM. Dinner, 2 vegetables and milk. 5 PM, 6 to 8 ounces fruit juice. Supper, clear vegetable soup or cream vegetable soup with zwieback softened in it, milk.

Outcome. The rash cleared entirely in two weeks.

INFANTILE ECZEMA. Male child 22 months old, weight 18 pounds, had never walked, and parents were told he never would walk or be normal mentally. Had been in a children's hospital since birth. Eczema covered arms, legs, diaper region, face, and scalp. Foods previously allowed: homogenized milk, rice, and oatmeal cereals; fruits-apple, pear, prunes; vegetables-summer squash, carrots, artichokes, beets, eggplant. Meat-all kinds. Restrictions (supposed to be made on allergy basis): no eggs, wheat cereals, or citrus fruits. Medication: thyroid 0.1 grams daily; elixir phenobarbital, 1 teaspoonful daily for restlessness and scratching (the child appeared stupid and irresponsive even to loud noises close to ears). Arm and leg restraint to prevent scratching.

Changes made in the diet: 8 AM, baked potato, applesauce, milk. 11: 30 AM, grapefruit juice, 3 ounces. Dinner, 1 PM, two vegetables and milk. 5 PM, 4 ounces tomato juice. 6 PM, cooked fruit, 8 ounces milk, oatmeal.

Outcome. In five days the rash was much lessened. In two weeks it had all disappeared and there was no need of restraint against scratching. He was getting the previously forbidden fruit juices. In three weeks he gained 1/2 pounds and was walking. In four months after the diet was changed, the child was on a general diet, including cereals but excluding eggs. He was a bright, but not perfectly normal, child, alert, inquisitive, walked with good balance and was precise in hand and finger movements. Thyroid and phenobarbital were discontinued with the change in diet. Medication: fish-liver oil and B complex vitamins.

PSORIASIS AND HIGH BLOOD PRESSURE. June 3, 1943, a married woman aged 34, weight 325 pounds. At 10 years of age she began to have round spots of white scales on a red base on legs and arms. These would disappear, and they recurred off and on every three years. Cured it with ointments. Had tonsillitis in April, 1943, since which the eruption has spread all over the body, arms, legs, and head except the face. Ears and scalp

are covered. Has been overweight all her life. The flesh is quite tender to pinching. Diet history: Breakfast, none. Dinner, meat, potatoes, vegetables. one green salad, cooked beans, gravy, bread, one to three biscuits, one glass of milk, beef or chicken, pie or fruit for dessert. Supper, milk, corn bread and butter, prunes. To keep the scales down she takes two or three lemons a day, and that helps also to keep down "the acid water from the stomach." Skin itches all over. Blood pressure 180/120. Pulse rate 92. Abdomen 68 inches in circumference. A large roll of abdominal fat hangs away down over the thighs. The hair is thickly matted, with hard horny adherent scales extending down on forehead, ears, and neck. Skin: All over the body are spots 0.25 to 0.5 or half an inch in diameter, mostly round with a red, raised base covered with dry adherent scales. This is especially bad over the elbows and immediately below, also over and below the knees and over the ankles. Over the lumbar spine there is an area 7 inches long and 3 inches wide covered with a heavy thick leathery skin of the same character as the other lesions, except that the skin is more thickened and there is a greater thickness and hardness of the dry horny epidermis from 1/8 to 1/4 inch thick. The urine is highly acid, with a faint trace of albumin and sugar, and fine granular casts. Diagnoses: obesity, psoriasis, hypertension with blood pressure 180/120, and secondary anemia.

Treatment. No meat, chicken, or fish. Two glasses of fruit juice a day. Two glasses of lemonade each afternoon. Five servings of fruit daily. Four servings of vegetables, including potatoes and one fresh vegetable salad. Bread limited to one slice at each meal, including cereal as alternate for 1 slice of bread. Eggs, none for several months, then 2 a week only. Milk, three glasses a day. Prescription: liver extract and iron, 4 capsules; brewer's yeast tablets, 8 ; halibut-liver oil (5,000 units A), 1 capsule a day.

July 21, 1943. There is little of the red-based crusty areas left on the arms, some on the elbows posteriorly. It is much less about both ears. The eruption is greatly decreased on the legs. The red bases remain, but the scaling is much diminished except on the knees. On the abdomen the eruption has not changed greatly, but the spots are spread out. Under the breasts the skin is greatly improved. The area over the hollow of the lumbar spine has changed little, but there is less of the hard dense crust.

March 30, 1944. The patient returned and said the eruption entirely disappeared the fore part of December, 1943. There is no remnant of the psoriasis anywhere on the body or in the scalp. The reddened areas under the large breasts, under the pendulant abdominal fat hanging down over the groins and thighs, and over the upper inner surfaces of the thighs are entirely clear of redness and scaling. There is a scarcely perceptible 3/16, inch in diameter area of slightly rough skin on the back of the left elbow, and there are one- or two-millimeter spots near it. The heavy incrustations, one-eighth to one-fourth inch thick, over the hollow of the lumbar back are all gone. There are no scales or even dandruff in the hair where it was heavily matted with dense incrustations. There are none in the ears or at the edges of the hair. Blood pressure, 112/82 and 115/80. Urine pH has risen from 5 to 6, and there are no casts and no trace of albumin or sugar.

Conclusion. Here is a most extreme psoriasis in an obese woman of 35 years of age and recurring off and on for 25 years, with high blood pressure of 180 systolic and 120 diastolic, with marked nitrogen retention in the blood, and casts and a trace of albumin and sugar in the urine. Nine months have elapsed since a change in diet to a physiologically balanced one with no medication, internal or external, except the vitamin concentrates, and

liver extract and iron for the anemia. The psoriasis has all disappeared, only faintest traces remaining. Marked high blood pressure has dropped to normal. Nitrogen retention has decreased to only slightly above normal.

Exfoliative dermatitis is another skin disease which shows a high blood content of non protein nitrogen and which is relieved by reducing the protein of the diet to a low figure-bare maintenance level, on or about 30 to 35 grams per 70 kilograms (154 pounds) of body weight. One such patient who was entirely relieved by a diet high in fruit and vegetables later had a recurrence because the wife insisted he could not live upon such a diet. When first seen, this man's entire body, scalp, and even the face were thickly covered with large, dry scales of epidermis. On returning to the free use of meat he had a complete recurrence of the disease. It is possible that there is a definite predisposing factor in psoriasis and exfoliative dermatitis or even in eczema, besides the active cause of excessive protein intake. Some persons with these diseases have a low basal metabolic rate. This low oxidation may have a bearing upon the occurrence of the skin eruption, as the use of thyroid extract sufficient to restore the metabolism to normal has been of great benefit and seems to have hastened recovery in these cases of such types of skin disease.

Headaches, Irritative and Convulsive Diseases

Here is a rather bizarre group which cannot be classified in any way fully to satisfy a scientific grouping, except that they come in clinical syndromes and have causes which can be met with complete success. The largest section of this motley group is Group 1, Idiopathic epilepsy. It is called "idiopathic" since the cause or causes are not supposed to be known. The first case of this disease came under the writer's observation about 1910. The convulsions occurred in the early morning, 4:30 to 5 AM. Inquiry revealed that they were preceded by the eating of peanuts and peanut candy late the night before. Stopping this entirely and putting the boy on a vegetarian diet soon stopped the seizures, provided that the protein was kept low and that no heavy protein food was eaten at the evening meal. About twenty five years later, on hearing a report of success with large doses of brewer's yeast tablets, this was added-24 tablets a day, 8 at each meal. It proved so successful that the worst cases, even of many years standing, have been relieved. This, however, has been only in comparatively young persons (under 30 years of age), that is, those who have not had a half lifetime of such convulsions.

It would appear from these experiences that there are two causes: first, heavy protein food, especially of forms of food difficult of digestion, and, second, the use of a large amount of refined food and sweets. The stopping of these, with the use of brewer's yeast tablets, rich in vitamin B, provides the proper nourishment of nerve cells and consequent relief of irritability. This irritability has been well demonstrated by human experiments given in a preceding section (chapter 2).

Group 2, Epilepsy of ovarian deficiency. This is a rare occurrence. It is characterized by convulsive seizures which occur in some certain time relative to the menses. This may be shortly before, during, or after the period, but not occurring at other times. Dietary regulations should be the same as for the other group, but the essential treatment is the use of a highly potent ovarian hormone. The writer uses alphaestradiol by hypodermic of 10,000 units once a day for three to five days before the accustomed paroxysms. This should

be kept up by 0.5 milligram tablets of the same two or three times a day until the time of susceptibility to convulsions is over. This program must be repeated for each period. The occurrence of convulsions in these cases is in the premenstrual week, during, or in the postmenstrual week.

Headaches. The above is the same treatment which we have used since 1916 for the treatment of premenstrual headaches and irritability. It began with the use of corpus luteum, later by whole ovary extracts, and now by the individual ovarian hormones, alphaestradiol preferred. The same dietary regulations as for epilepsy should be followed, though this alone is not the solution of the problem of ovarian headaches, irritability, or epileptic seizures of this particular type. See Abbott, "Periodic Headaches of Ovarian Origin," New York Medical Journal, November 6, 1920.

Minimal Protein

In determining the absolute or minimal body requirements for protein, Sherman gives the following summary of all research which has been done:

In an examination made in 1920 of the available literature upon this subject there were found 109 experiments upon adults showing no abnormality of digestion or health, in which the diet was sufficiently well adjusted to the probable requirement and the nitrogen balance showed sufficient approach to equilibrium to make it appear that the total output of nitrogen might be taken as an indication of the protein requirement. These experiments were made in the course of 25 independent investigations in which 47 different individuals (39 men and 8 women) served as subjects. For purposes of comparison the daily output of total nitrogen in each experiment was calculated to protein and this to a basis of 70 kilograms of body weight. Reckoned in this way, the apparent protein requirement as indicated by the data of individual experiments ranged between the extremes of 21 and 65 grams, averaging 44.4 grams of protein per 70 kilograms of body weight per day.

"Average results for men and for women were practically identical when calculated to the same basis of body weight (for women 44.6 grams, and for men 44.3 grams, per 70 kilograms).

"Study of the data recorded in the original papers indicates that the differences in amounts of protein catabolized in the different experiments cannot be attributed primarily to the kind of protein consumed nor to the use of diets of fuel values widely different from the energy requirements. Apparently the most influential factor was the extent to which the subject had become accustomed to a relatively low protein intake such as is best calculated to throw light upon the question of the actual requirement. In the desire to avoid any danger of arbitrary selection of data, the writer probably erred in the direction of including some experiments which gave misleadingly high results because of too short periods on the low protein diets. The best data would probably yield an average result not far from 0.5 grams in protein per kilogram of body weight per day for normal adult maintenance after allowing a reasonable period for adjustment to such a low protein diet." - Henry C. Sherman, *Chemistry of Food and Nutrition*. 6th Edition, Pages 204, 205. In the seventh edition the same figures are given.

Thus Sherman admits that in order to be impartial he was partial to some

experiments which gave “misleadingly high results,” since the duration of the experiments was too short. Further, that the most reliable data would probably give only 35 grams per 70 kilograms of body weight, or 0.5 gm. protein per kilogram.

The conclusion is inescapable that if ample protective foods -fruit, vegetables, and milk-are chosen to secure “excellence of mineral content and vitamin values” “that it is hard to conceive any danger of a protein deficiency,” and, further, that protein will be supplied with even greater relative abundance, that is, than the vitamin and mineral content.

As to the exact amount of higher than minimal protein below which no, damage to any part of the body (liver, kidneys, or blood vessels) occurs, it is difficult to determine, since minor excesses continued over a long time produce disease as well as greater excesses in a short time. The quantitative and time factors are both involved and may be reciprocally, that is, inversely, proportionate in the production of the same process. In considering the protein factor in disease production there is the significant deduction made. by Weiss and Minot from the experiments of Newburgh and Clarkson:

In this study they compared the effects of protein and of cholesterol feeding and found excess of either capable of producing arteriosclerosis, but that relatively less excess protein than cholesterol was necessary to obtain the same degree of atheromatous change in the aorta. They pointed out that the experimental rabbits whose nitrogen intake from protein food was about 1.1 gram per kilogram of body weight, which is about four times the normal requirement, developed arteriosclerosis in six months to a year; whereas rabbits ingesting practically no cholesterol in their natural diet required 250 milligrams of cholesterol in capsules daily to develop arteriosclerosis.” - Ibid., page 236.

With a much higher protein content in the diet (soybeans of Sansum’s experiments), there was no arteriosclerosis. This can mean only one thing; namely, that the diet must give an alkaline ash if arteriosclerosis is to be avoided. This conclusion is amply justified, since arteriosclerosis did occur with the acid-ash diet of oats, and that without any cholesterol whatever in the diet.

Vegetarians and Protein Diet

The overall conclusion is this-that the claim that vegetarians are in any practical danger of protein deficiency when fruit, vegetables, and milk are taken in such amounts and proportions as to constitute three fourths or four fifths of the diet without any high protein food whatever is wholly unjustified. The claim that vegetarians must have high protein foods accompanied by a list of such high protein foods so as to make up this supposed deficiency results in a great excess of protein and usually acid-ash proteins, for beans are the only high protein food not acid in ash. Eggs, cheese, including cottage cheese, and meat substitutes of all kinds, when used to make up such supposed deficiency, will give up to a gram of protein per kilogram of body weight, and in nearly all cases much more. This observation is borne out by hundreds of blood chemistry tests and by the clinical results in persons who are taking seriously such ideas and are eating these high protein foods in considerable quantities. As in meat eating, all excess protein has a stimulating effect and deceives the user; so he is sure that that is what he needs.

Let it not be supposed that no breakfast, a small noon lunch, and half an

evening dinner will at all satisfy nutritional needs. There should be a substantial breakfast, a hearty dinner, and a light supper. Nothing less than this is sufficient for perfect nutrition. With such meals and giving attention to securing the necessary balance of three or four servings of fruit, vegetables, and milk to one of breads, cereals, eggs, cheese, beans, and nuts, the protein will run about 50 to 60 grams daily for a man of 70 kilograms body weight. With alkaline ash and the other neutralizing factors, such as certain vitamins, this moderate excess of protein above body needs does no known harm. It will be noticed that the amount of protein suggested is not the same in all parts of this book. On page 54 it is stated as 45 grams; on page 298 as 50 to 60 grams. Successive researches into the actual use by the body of protein for repairs in adult life have shown a notable though only moderate decrease in the amount required. Beginning with the work of Chittenden in 1903 and on down to the latest and most exacting experiments of Hegsted and others, there is this remarkable general agreement. Certain conclusions are inevitable. After quoting from Folin, Chittenden makes this statement: "The average man, with his ordinary dietetic habits, consumes more nitrogen than the body can possibly make use of."-Russell H. Chittenden, *The Nutrition of Man*, 1907, page 148.

Chittenden then draws his own conclusions, which are these: "The voluminous exogenous protein catabolism so conspicuous in most individuals would seem to have no justification in fact, or in physiological reasoning. What good, for example, can be 'accomplished by this constant splitting off of nitrogen, with its subsequent speedy removal from the body? The organism can neither use it nor store it up, and why therefore should this daily burden of an excessive and accelerated protein catabolism be borne? As we have seen, the energy of muscle work is derived mainly, and can come wholly, from the breaking down of non-nitrogenous materials, fats and carbohydrates.'"-Ibid., pages 149, 150.

In some experiments only the individual use made of the protein is quoted without adjustment of the figures to the so called standard weight of 154 pounds. In others this adjustment is made from individual weights to a uniform standard weight of 70 kilograms (154 pounds). Day by day there will be variations in the amount of protein a person consumes. In general it would seem better to keep this excess nearer the lower figures of 40 or 50 rather than eat so that the protein consumed will reach a 65 to 70 grams ration.

Where some food of animal origin is included, such as milk and eggs, the amino acid assortment actually reduces the protein requirement by about 5 grams per individual of 70 kilograms.

The ovo-lacto-vegetarian diet is therefore entirely adequate without any endeavor to reach the amount of protein commonly consumed by those who eat meats. With all this research work of the past fifty years, the testimonies fully agree in pointing out that in some of the recipes (for nut foods) "they make the food so rich that the system cannot properly assimilate it."-Counsels on Diet and Foods, page 364.

What Is a Balanced Diet?

In the approximate order of their discovery, the research listed below gives the evidence that the chief governing feature and most important factor in the balanced diet is found in the large amounts and proportions of the protective foods-fruit, vegetables, and

milk, i.e., three or four servings of these to one of all other classes of food, principally the higher protein acid-ash foods.

1. Protein-Chittenden's work, 1904.
2. Acid-base balance-Sherman and Gettler.
3. Alkaline ash-Washington experiment, 1928.
4. Calcium-Sherman, 1931. Sherman and Campbell.
5. Protein-Schamberg, 1931.
6. Vitamins and minerals-Sherman, 1937, 1938.

Nutrition is the principal factor in both health and disease. Research has given the evidence. Scientific evidence should govern conclusions.

Mortality statistics show that the cardio-vascular-renal diseases are today the largest causes of death and the shortening of human life-44 per cent of deaths at all ages.

Research has suggested the idea that these diseases are at least partly due to excess of protein and fats of animal origin.

The most prevalent causes of disease, infections, and physical, nervous, and mental disability up to the age of forty are today due to diets deficient in vitamins and minerals-deficiency of the protective foods.

Protein and fats of animal origin produce disease by their excess, not by their deficiency.

Vitamins and minerals-protective foods of fruits, vegetables, and milk-produce disease and disability by their deficiency, not by their excess.

These excesses and deficiencies are the most prevalent faults of the diets of civilized peoples today. "Disease of almost every description is pressing upon the people; yet they seem willing to remain in ignorance of the means of relief, and the course to pursue to avoid disease." - E. G. White, *Counsels to Writers and Editors*, page 127. Education in nutrition and foods is more needed today than ever before. Balance in the diet is the most important feature of this education. Perverted appetite is the largest hindering factor in this education. Information and scientific knowledge are available. But they need to be simplified and disseminated. 'All who believe and proclaim the truth should not only practice health reform, but teach it diligently to others.' This will be a strong agency in calling the attention of the unbelieving to consider that if we are intelligent upon this subject in regard to healthful diet and practices, we would be sound on the subjects of Bible doctrine."-Ibid., pages 125, 126.

Education of the Palate

"It is, of course, a truism that every part of the body should serve the other parts and the body as a whole. Whenever training is needed to ensure this, such training (whether given by adults to children, or whether it be self-training at whatever age) is an important part of one's education. Now that scientific research has shown how great is the influence of food upon nutritional well-being (internal environment) and resulting health and

happiness, efficiency and usefulness, it is clear that the intelligent education of the palate to welcome and relish the best kinds and relative amounts of foods, as judged by their nutritional characteristics, is much more important than any previous generation can have understood. Only those who have studied the newer findings of nutritional research can fully realize this-and many otherwise intelligent people still allow their food intakes to be guided by the whims of an uneducated palate instead of by the scientific knowledge which is now well established and readily available.

“To start with the unspoiled young child and educate his palate as he learns the use of other senses is the best and most profitable way, but even the re-education of an adult palate to a more intelligent food habit may be well worth while. And if it is undertaken wholeheartedly, it is not unduly difficult.” - Henry C. Sherman, Chemistry of Food and Nutrition, 5th ed.

Select One Serving From

HIGH PROTEIN FOODS

CEREALS	Protein
Wheat kernels	12.6
Wheat bread	9.7
Oats	16.7
Corn	8.4
Rice	8
LEGUMES	
Beans	22.5
Beans, soy	40
Peas	24.6
Peanuts	25.8
Lentils	25.7
NUTS	
Walnuts	18.4
Almonds	21

ANIMAL PRODUCTS

Eggs	13.4
Cheese, American	28.8
Cheese, cottage	20.9

MEATS

Beef	20.3
Chicken	19
Fish, canned	15.3

Three or Four From

LOW PROTEIN FOODS

FRUITS	Protein
Peaches	0.7
Apples	0.4
Oranges	0.8
Tomatoes	0.9
Grapes	1.3

DRIED FRUITS

Dates	2.1
Raisins	2.6
Prunes	2.1
Figs	4.3

VEGETABLES

Potatoes, Irish	2.5
Beets	1.6
Carrots	1.1
Green corn	3.1

GREEN VEGETABLES

Lettuce	1.2
Spinach	2.1
Green peas	7
Cabbage	1.6
MILK	
Milk	3.3

The figures above are percentages by weight in 100 grams of edible portion. The above brief lists are examples of the high protein foods and low protein foods. Others in the same class will not greatly differ in the per cent of protein. Of the high protein foods there are four classes, -meats, animal products, legumes, and nuts, to which should be added grains, as their higher protein content, though moderate, in time results in an accumulation of protein wastes in the blood because of the acid ash (in animal experiments, in six weeks), while beans, with 22 per cent protein (almost as much as liver) but an alkaline ash, leave no excess of protein wastes in the blood until nine months. The low protein foods are fruits, vegetables, and milk.

The balanced diet is not a set, rigid thing. There are individual, occupational, seasonal, and other variations permissible and necessary. Those who lead a more vigorous outdoor life suffer less than others, and later in life, from the excesses of the American diet, and less from its deficiencies, because of a better appetite and therefore eating more liberally. For a man of average weight (154 pounds, or 70 kilograms) of sedentary occupation with moderate exercise, approximately the following amounts and proportions of the different classes of food constitute a balanced and adequate diet. Women will eat less than men. Laborers will eat much more because of the added energy requirement, which is physiologically supplied by carbohydrates-vegetables, potatoes, and bread. Less is required in warm weather and warm climates than in winter and in cold climates. It is totally unnecessary to figure calories or grams. If a balanced diet is taken, both the danger of undernourishment and that of overeating are largely avoided.

Foods to Be Used More Freely

Vegetables. Four servings a day. Potatoes are a substantial and most wholesome vegetable, and should be substituted for the larger bread ration of the ordinary diet. Use two servings a day; more is allowable for larger energy and heat requirements. The common prejudice against the potato because it is a starchy food is wholly unwarranted. A baked potato, with a glass of milk and two servings of fruit, balances the customary slice of breakfast toast or breakfast cereal. Other cooked vegetables, two servings a day. Salad vegetables, one serving a day.

Fruit. Six servings a day-fresh, canned, or dried. Still larger amounts of fruit may be used without over alkalizing or unbalancing nutrition. Fruit suffers little or no loss in cooking and canning. Fruit juices and unfermented fruit-juice beverages, one or two glasses a

day before or between meals.

Three glasses a day for adults. Children, four-glasses. This supplies the needed lime. Cream and butter in addition as used with other foods and in cooking.

Foods to Be Limited

Grain Products. A total of such foods equivalent to about three or four slices of bread a day. This includes crackers, cookies, cakes, breakfast cereals, and all breadstuffs, whether of rice, corn, barley, oats, rye, or wheat. Use dry, well-toasted, whole-grain breakfast cereals, not mushes. Less than this equivalent of total-grain products may be used without deficiency or loss in any way.

High Protein Foods. Four classes-meats, animal products (as eggs and cheese), legumes, and nuts. It is better to alternate these high protein foods rather than to take two or more servings at one meal.

Meats. These include fish, sea food, and fowl. There is no difference between red and white meats as to their nutritive effects or harmfulness in constitutional diseases. There is no absolute need for meat in the nutrition of man, and meat substitutes are unnecessary. A fully adequate and balanced diet can be had without them.

Eggs. Two or three eggs a week, besides their moderate use in preparing other foods. Two eggs a day is greatly in excess, and even one a day is more than is usually beneficial. The yolk may be used more freely than the white, and is the part rich in vitamins A and D.

Cheese. Once or twice a week, mostly as cottage cheese.

Legumes. Peas, beans, lentils, etc., once or twice a week. Green peas and string beans may be used much more frequently, as also other fresh vegetables.

Nuts. One or two small servings a week. Most nuts are alkaline ash; but walnuts are acid in ash, and so should be used less than others. Peanuts, also acid in ash, are difficult to digest, and are much less desirable; only small servings and infrequent use should be made of them. Peanut butter is open to the same objection.

Salt. Salt is necessary, but use it moderately.

Fatty Foods. Butter and cream are wholesome, and may be used in moderation. Vegetable cooking oils are more healthful than animal fats for this purpose. Where procurable, ripe, cured olives and avocados may be used quite freely, especially the olives, even to every day or every meal.

Foods to Be Avoided

Refined Sugar. The large use of sugar common in the American diet (about one hundred pounds annually a person) is more harmful than meat. The combination of sugar with milk or cream in the same preparation is the worst possible. The most commonly used of such dishes are mushes with sugar and cream (or milk) and sweet desserts. The addition of eggs to such combination of sugar and cream is also harmful. Custards are therefore far from

being beneficial.

Candies, Sweet Desserts, Cake, and Pastry. These, if used at all, should be eaten only in small servings and rarely, at least not daily or frequently. The excess of refined sugar or refined starches they contain is harmful.

Condiments and Spices. Pepper and mustard are harmful. Spices may be used in very moderate amounts only.

Tea, Coffee, Cocoa. Tea and coffee are harmful stimulants, and should not be used. Coffee substitutes may be used. Cocoa and chocolate, if used, should be taken moderately and not frequently.

Eating Between Meals. Eating at all times of the day is most harmful. Putting food into the stomach before the emptying from the previous meal delays that emptying of the stomach from eight to twelve or even fourteen hours, whereas it should empty in less than five hours. Other than water and fruit-juice beverages, nothing should be taken between meals.

Summary

When tea, coffee, and strong condiments are omitted, and when refined sugar and breads and cereals made of refined grains, together with meats, are eliminated from the diet altogether or almost altogether, a balanced diet is made up of not less than 75 per cent of fruit, vegetables, and milk. Other foods known as acid-ash foods should be used in a proportion not exceeding 25 per cent.

Both scientific experiment (animal and human) and clinical experience with well persons and with a great variety of diseases has fully sustained this proportion as the most essential element in the balanced diet. It is important also because it automatically balances all other essentials. This means that one serving of acid-ash food should be balanced by not less than three servings of protective, alkaline-ash foods-fruit, vegetables, and milk. For example, one slice of bread or one serving of any other grain product should be balanced by three servings of fruit and vegetables. With one egg are to be eaten three servings of fruit and vegetables. While milk is to be included with these protective foods, it need not exceed three or four glasses a day. Meats, if used, must be balanced in the same way, except that a still greater proportion of fruit and vegetables is required-about 80 per cent, or 4 to 1. The balanced diet is 75 per cent fruit, vegetables, and milk.

20. THE WISDOM OF THE BODY

DR RICHARD C. CABOT, professor emeritus of clinical medicine in Harvard Medical School, made this statement before the Massachusetts Medical Society: "A considerable period of residence on the surface of this earth has not impressed me with the wisdom of the human mind. It is the wisdom expressed through the human body that has impressed me." – The Diplomat. National Board of Medical Examiners, Volume 10, January, 1938.

Wilson and Willis of the Mayo Clinic expressed a similar confidence in the

wisdom of nature as manifest in the resistance of the body to infectious disease. They wrote: "When the relationship of bacteria to infectious disease was first brought to the attention of the scientific world, for a long time the specific germ was the chief object of study. Experience soon taught us, however, that in combating infectious diseases it is even more important that we familiarize ourselves with those conditions of the body by which nature combats disease." - Proceedings of the Staff Meetings, Mayo Clinic, 1910, page 118.

It would appear from the work of many scientists that nature is not limited to one way of protecting the body against infectious disease. There are indeed many different ways by which this is accomplished. In Dr. Cabot's speech, already referred to, he, remarked:

"We have been seeing this afternoon some of the disturbances of our heat balance brought about for the therapeutic purpose by heat treatment. But nature knew all along that to produce fever was one of the ways of curing disease. Nature has always used thermotherapy. A few years ago physicians tried to reduce fever temperatures. Now we produce them." - The Diplomat, January, 1938, page 438.

This treatment by artificially produced fever is now being effectively used to treat syphilis of the brain, gonorrhoea, undulant fever, chorea, and other infectious diseases in which previous methods have failed. Fever, or heat treatment, is not the only method nature uses to combat infectious diseases. Graziani, an Italian physician, injected rabbits with filtrates of typhoid cultures and kept them at different temperatures (Plus 38', 32.2', and minus 40' C.). Those kept at low temperatures developed more agglutinin than those kept at higher temperatures. He also experimented with rabbits kept at 32 C, bathing half of them morning and evening in water at 20' C. for thirty minutes. The animals treated by cold bathing produced more agglutinin than the others. In typhoid infections the reaction to cold water and cold air is one of nature's methods of protection.

Ecker and O'Neil (American Journal of Public Health, Volume 227, 1922) Page 1050) found that typhoid agglutinin titers in rabbits were decreased fully 50 per cent by hyperthermia treatment. Hadiopoulos and Bierman (Journal of Laboratory and Clinical Medicine, Volume 20, December, 1934, Page 227) found that complement fixation antibodies in rabbits immunized against pyogenic cocci were similarly depressed. This means that artificial fever and the reaction to cold bathing have differing effects in different infections.

Agglutinin is called an antibody. In different infectious diseases many different antibodies are produced, but only a few of these seem to have definite and lasting protective powers. Elie Metchnikoff (The New Hygiene, pages 8-11) pointed out this fact early in this century, and it has become more and more evident that many so-called antibodies are mere by-products and have no real protective value such as is found in the agglutinin of typhoid infections.

Some antibodies, however, are definitely protective. It was by a study of nature's storehouse of these means of protection that tetanus antitoxin and diphtheria antitoxin, as well as the Pasteur method of immunization against the virus of rabies (hydrophobia), were discovered. Vaccinations against cholera and several other diseases have also been perfected.

In 1937 Arthur Locke (Journal of Infectious Diseases, 1937, pages 60, 106) of

the Western Pennsylvania Institute of Pathology published his researches on the heat mechanism as related to protection against the pneumococcus and the virus of the common cold. His experiments consisted in classifying animals according to their ability to recover from chilling, which has been popularly believed to be closely related to the pneumonias. Those animals that could recover from a three-degree chilling in twenty minutes were given intravenous injections of as high as eighty-three pneumococcus germs per cubic centimeter of blood. Ninety-two per cent of these animals lived and showed no fever or other manifestations of infection. On the other hand, those that took two hours to recover a normal temperature after a three-degree chilling, all died if injected with as few as six pneumococci per cubic centimeter of blood.

Arthur Locke found a similar relationship in man between oxidation and resistance to the common cold. The margin between the coefficient of poor oxidation and the coefficient of protective oxidation to respiratory diseases was an exceedingly narrow one. The poor oxidation gave a coefficient of 0.49, and the efficient protective oxidation a coefficient of 0.61.

Spiesman and Arnold (*American Journal of Digestive Diseases*, September, 1937) of the University of Illinois and the Chicago Health Department found that changes in diet and the use of hydrotherapy produced increased resistance to the common cold. It may be that these agents produce their effects at least in part by increased oxidation. The stimulation of oxidation is one of the principal effects of both heat and cold. According to the form of hydrotherapy used, oxidation has been shown to be increased by as much as 17 to 110 per cent.

The protective foods, by their content of the oxidation reduction vitamins (C and the B complex), might produce their effects in the same way. Vitamin C destroys every known virus with which it has been experimented, and it even neutralizes bacterial toxins, such as those of diphtheria and tetanus. After injections of the virus of poliomyelitis into the brains of monkeys, Claus W. Jungeblut (*Journal of Experimental Medicine*, January, 1937; September, 1939) found that with treatment with natural vitamin C there were 32 per cent of monkeys that lived without paralysis against 5.1 per cent not so treated. All viruses are known to be vulnerable to oxidation; while protoplasmic poisons, such as carbolic acid, formaldehyde, and the sulfa drugs, have no lethal effects upon them whatever.

In water purification Kassel and his co-workers (J. F. Kassel, D. K. Allison, F. J. Moore, and M. Kaime, *Proceedings of the Society of Experimental Biology and Medicine*, 53:71, May, 1943) of the University of Southern California found the same quick destruction of the virus of infantile paralysis by the oxidation effects of ozone as compared with the chlorination of water. Ozone destroyed the polio virus almost instantly (within two minutes), while nearly three hours were required for destruction by chlorine in the water containing the virus.

W. B. Rose (*The Foundations of Nutrition*, 1938, page 266) of Yale found he could produce in dogs a blood stream infection by withholding vitamin B₁₂, and then promptly cure it by giving that vitamin. This was *Bacillus aerogenes capsulatus*, a gasproducing organism.

Esther Cottingham and C. A. Mills (*Journal of Immunology*, 47:493, December, 1943) of the University of Cincinnati experimented with certain vitamins as to

their effect upon the destruction of bacteria by the phagocytes (white blood cells and some fixed cells). In mice on vitamin B, 2 milligrams per kilogram of weight for three weeks, 33 per cent of the cells had ingested bacteria injected into the peritoneum. If the vitamin was reduced to 1 milligram, only 20 per cent of the cells had ingested bacteria. No ingestion of bacteria was found after the use of 0.5 milligram of vitamin B for the same length of time.

With pyridoxine (of B complex) 4 milligrams per kilogram of weight for seven weeks in rats yielded blood whose white cells took up an average of 13.5 bacteria per cell in four minutes. On a partial deficiency diet (0.5 milligram of pyridoxine per kilogram of weight) the white cells took up only 3.9 bacteria per cell. Similar or even greater reductions in phagocytosis were found in rats fed a diet partially deficient in thiamine, riboflavin, pantothenic acid, choline, or combined vitamins A and D. "Since rats and mice synthesize ascorbic acid (vitamin C), tests of vitamin C deficiency were made on guinea pigs. Leucocytes of adequately fed guinea pigs would take up an average of 18.3 microorganisms per cell in vitro, and 99 per cent of these cells showed evidence of bacterial destruction by the end of one hour. On a vitamin-deficient diet, phagocytosis was reduced to 7.3 bacteria per cell, with intracellular digestion (of the bacteria) reduced to 74 per cent."

A high bacteriacidal action of a spleen extract is reported by Nutini (L. G. Nutini and C. W. Kreke, *Journal of Bacteriology*, 44:661, December, 1942) and his co-workers in the Institutum Divi Thomae of Cincinnati, Ohio. This extract in a certain medium prevented the growth of all strains of hemolytic streptococci, but not of pneumococci or staphylococci.

Other experiments indicate that there are bacteria-destroying elements called "lysozymes" in tears, sputum, nasal secretions, and saliva. Still others have shown that a virus-destroying enzyme especially active against influenza virus is present in human nasal secretions. "That mucous surfaces are self-sterilizing has long been the opinion of clinicians."

Heaslip of South Australia found the occurrence of scarlet fever, diphtheria, and infantile paralysis definitely less among the communities that ate more largely of fruit and vegetables than those who ate little of such protective foods.

It is becoming more and more evident that many of these germ protective body mechanisms are dependent upon a diet high in certain elements, especially the vitamins. Maintaining an intestinal flora of harmless bacteria is also dependent upon the diet, especially a diet consisting largely of milk, fruit, and vegetables, while meats, fish, chicken, shellfish, and oysters produce an intestinal flora of highly virulent nature with much putrefaction of these protein foods. These are some of nature's methods of combating infectious disease.

In his further comments upon these powers of defense, Dr. Cabot asks some relevant questions: 'We say this is done by the healing power of nature. But what is nature? What are the characteristics of this power? The first is that it has a superhuman wisdom. We all admit the wisdom of the healing powers at work in the body, powers of which our therapeutics are a very long distance behind. Where does this force come from? Where do we get the healing substances in our tissues? Out of our food and water and the air we breathe—that is, out of the bounty of the universe.'

Dr. Cabot then cuts directly across our hesitation, the unmentioned reluctance of most physicians and other men of science to admit frankly that there is an intelligence superior to ourselves, an omniscient and omnipotent Creator. He says: "Now, if we see in our medical work a power superhuman in wisdom and in goodness, one that works all the time and that comes out of the cosmos, I do not see why we should be afraid of that name. It is perfectly obvious that it is God. Why should physicians be afraid to use those letters, G-O-D? That is only the proper word that represents those facts; 'nature' is a very foolish word to use for them, for no one knows what that word means. So instead of *vis medicatrix naturae* we should say *vis medicatrix Dei*. It is the power of God on which each one depends today for the fact that he is here instead of being underneath the earth."

"There is no reason, then, so far as I can see, why doctors should be afraid of the simple, old-fashioned word, God. The medical profession has learned in studying disease more about the meaning of this word than the vast majority of the so-called religious people. Why not tell this truth, because it is true?" -*The Diplomat*, January, 1938.

This hesitancy, this reluctance, or fear, to say that God is the author of all these marvelous superhuman provisions for our protection from infections and from all other diseases should surely not embarrass Seventh-day Adventist doctors or any other Christian physicians. Certainly we can readily admit with Dr. Cabot that these healing powers at work in the body are indeed from God and that "our therapeutics are a very long distance behind" them. Surely there is profound wisdom in making an intensive and prolonged, yes, a lifetime, study of nature's laws and means of protection, because they are God's laws.

Study them in the recorded researches of scientists. Study them with the definite conviction that when discovered, God's ways are always best, always superior to any mere human ways of combating disease of any kind. The determining importance of this superior protective intelligence-*vis medicatrix Dei*-is well stated by the biographer of the Mayos: "An ample experience on the post-mortem service is likely to teach a young surgeon, in the words of the section head, 'How important is the protection of the Lord in any operation, even a supposedly harmless one.'" -*Helen Clapesattle, The Doctors Mayo*, page 652.

It is refreshing and strengthening to one's courage, in acknowledging this dependence and in praying for wisdom to co-operate with the Lord in both medical and surgical practice, to come across such frankness on the part of a well-known physician. Nor is it at all difficult to see that the physician must co-operate with God and work in accordance with His laws, the laws of physiology, if he expects success in his work. He should certainly not try to treat disease "without nature's aid." To do so is only to invite disaster, delay, or failure, producing damage or derangement of the delicate mechanism of the body and sacrificing many lives. It is surely an egotistical, self-sufficient man, with little scientific knowledge and still poorer discernment, who would employ means that work counter to nature's laws and finely wrought balances.

The importance of such careful, painstaking study was pointed out by E. G. White in 1887. She wrote: "If self sufficient, he [the physician] will read articles written in regard to diseases and how to treat them without nature's aid; he will grasp statements and weave them into his practice, and without deep research, without earnest study, without sifting every statement, he will merely become a mechanical worker. Because he knows so

little, he will be ready to experiment upon human lives, and sacrifice not a few. He did not do this work with evil design, he had no malicious purposes; but life was sacrificed on account of his ignorance, because he was a superficial student, because he had not had that practice that would make him a safe man to be entrusted with human lives.” - Medical Ministry, Page 139.

Even new, modern, or generally used remedies must be brought to this test-do they aid nature or work counter to it? If these guiding principles mean anything at all, they certainly mean that treatment of the sick should be physiological, that is, in accord with nature’s laws, the physiological laws of the body, the laws that God has established for our benefit, our health, our protection against disease, and our recovery from disease. They also mean that those methods are harmful which are not in accord with physiological laws; and even though they may not produce death, they result in derangement of the intricate and delicate chemical mechanisms of the body, preventing or delaying recovery from sickness, and adding so much more against which the recuperative powers of nature have to contend.

It may be reasonably asked: “How is a physician to know all of nature’s laws of normal or physiological function?” A lifetime is not long enough to learn them. Many men of science have spent their entire lives studying and experimenting in order to ascertain the body mechanisms and biochemical activities. Though much has been learned, the field of the unknown is still vastly greater than the known. We stand on the shore of a world encircling ocean of science, casting pebbles, and observing but surface effects of our experiments.

With a good beginning regarding physiological laws, how are we to know what means of treatment are in accord with these physiological laws, and what means are not, but run counter to them? The first is an almost unlimited task, and the second is not far behind it. Must we try everything that is advanced before we can know? Must we find out by the method of trial and error, watching the results on human subjects before we can determine what is physiological and what is not? I wonder if this method is not rightly named “trial and error.” Is there not some method that could be called “trial and success”? Are there not means which, when rightly used, even with our human limitations Of knowledge, can be safe, sound, and successful? May we not at least start out in the direction of success, wasting no time with that which God tells us is harmful? Do we not have a pattern-a blueprint-for our medical work? Is this guide still good today, or is it out of date? Have its principles been outmoded and superseded by man’s devising, by something better than God has given us?

The events delineated in *The Great Controversy* are now occurring before our eyes. *Medical Ministry* was written by the same human instrumentality. Is it reliable or unreliable? It deals with scientific facts, later corroborated by research. The large majority of medical principles which have come through this same instrumentality were not only unknown to medical science when they were written, but were entirely contrary to the accepted ideas of the majority of medical men of that day. I have personally sought out scientific research bearing on many of these principles given from 1865 on down to the latest written, and have found every one of them corroborated by research done thirty to seventy years later on. I know of only two that yet remain to be fully demonstrated and accepted by medical research and even one of these is nearly complete in scientific confirmation. Look up a few medical books written from 1865 to 1890. Of how much scientific value are they today? Could you say of them what has proved true of the testimonies?

We cannot counterwork God's methods or ignore them and expect success in its greatest fullness, for health and lives will then be sacrificed.

21. PREVENTION AND TREATMENT OF DISEASE

ONE cannot intelligently live for health without a knowledge of the laws of life and the will to conform to them. "From the first dawn of reason, the human mind should become intelligent in regard to the physical structure." - Medical Ministry, page 221.

These physiological laws are not changeable to suit our tastes, appetites, habits, customs or whims, superstitions or ignorance. They are inexorable. If they are transgressed, the results are the same whether such transgression is willful or ignorant. "Since the laws of nature are the laws of God, it is plainly our duty to give these laws careful study. We should study their requirements in regard to our own bodies, and conform to them." - Testimonies, Volume 6, Page 369.

Disease is largely traceable to unhealthful habits in eating, drinking, dressing, the use of stimulants and narcotics, overwork or inactivity, unequal taxation of mind, emotions, and physical structure, unsanitary surroundings, dampness or cold, lack of fresh air or sunshine, worry, anxiety, self-centered or introspective habits. The laws of nature cannot be broken without incurring disease sooner or later, even though it may take years for the harmful effects to become apparent. Hereditary diseases are also largely of the same origin, though it is often difficult or impossible to trace them to any specific transgression of nature's laws. Doubtless they are due to many combined causes.

The prevention of disease lies in a knowledge of what constitutes good and bad habits in relation to health, and then in the strict observance of nature's laws. Recovery and healing are accomplished, not by drugs, but by forces within the body itself. that is, by those agencies with which the Creator has endowed it. Human efforts must be in accord with these agencies and laws.

If they are not, the result is delay or defeat, which adds to the burden of disease. When the causes of disease are removed and unhealthful habits are corrected by the observance of the laws of physiology, and treatment is in accordance with these laws, utilizing the healing forces of nature both within and without the body, recovery will take place unless permanent damage to tissue structure has occurred. Even in organic and incurable disease physiological treatments may relieve suffering and accomplish much good.

Errors in Diet

The most common cause of disease in the human family is a misuse of one of the absolutely necessary functions of the body eating. Scientific researches have been progressively demonstrating this for many years, but the general public is slow to accept and apply the principles discovered. Long ago we were instructed: "Those foods should be chosen that best supply the elements needed for building up the body. In this choice, appetite is not a safe guide. Through wrong habits of eating, the appetite has become perverted. Often it demands food that impairs health and causes weakness instead of strength.

cannot safely be guided by the customs of society. The disease and suffering that

everywhere prevail are largely due to popular errors in regard to diet.”-The Ministry of Healing, page 295.

For example, spinal curvature is due to a lack of milk (lime), a lack of vitamin D in the food, or a lack of sunshine, or a disproportionately large amount of grain products (bread and cereals) in the diet. Wrong posture or undue strain on some part of the skeletal framework causes weakened structure to bend. Rickets is a more exaggerated form of these same deficiencies or disproportions. Inflamed gums and pyorrhea are primarily due to lack of a high proportion of fruit and vegetables in the diet (Vitamin C). Cavities in the teeth are due to a lack of fruits, vegetables, milk (lime), and vitamin D.

Luxurious living, with rich meats and desserts, is a direct, traceable cause of much of the degenerative disease of the heart, blood vessels, kidneys, and liver. The body can use only about an ounce and a half of protein food in twenty-four hours (for a man of one hundred fifty-four pounds). A small excess is common because of the abundance of protein and its wide distribution in all foods, but it is harmlessly and quickly eliminated if the diet is well balanced by the alkaline-ash and protective foods. Hearty diets often contain two or more times this amount, and are usually highly acid in ash. The liver must split off this excess, and the kidneys must excrete the wastes, which processes are hindered by the excess acid ash of these customary diets. This means over work and favors degenerative changes in the vital organs of the body.

Gross overweight or excessive use of fats and oils in the diet may result in early hardening of the arteries, a ruptured blood vessel in the brain (stroke of apoplexy), or sudden death from clotting of the blood in the (coronary) artery of the heart wall. Diabetes is another disease of degeneration that is common in obesity and is related directly to unbalanced diets which are heavy in rich desserts, meats, and fats. Hard arteries with gangrene of the toes is a not uncommon complication. During the recent financial depression, which made it difficult for some to secure these rich foods, the mortality rate dropped to a notably low figure. In World War 1, Denmark, during eighteen months of food blockade and shortage due to drought, had the lowest mortality rate in Europe at any time. While food shortage doubtless produces or increases certain kinds of malnutrition, yet it definitely decreases the degenerative diseases of the blood vessels, kidneys, and heart.

Protective Foods

The vital resistance to many diseases, notably the infections, is greatly reduced by the customary diets low in fruit, vegetables, and milk. Colds are especially the result of such lack combined with an excess of the acid-ash foods-breads, cereals, eggs, meat, and sweet desserts. Respiratory infections take ready hold in those who lack the vigorous circulation needed to warm the body after chilling. Active exercise in fresh, cold air, exposure to warm sunshine, and warm baths followed by a cold shower or a cold rub are among those health habits which help to prevent colds, influenza, and pneumonia. Likewise, living in overheated houses and sitting inactively in cold or damp rooms without sunshine are directly conducive to these diseases.

Sun baths (ultraviolet light and heat) directly stimulate the blood vessels of the skin and thus prevent internal congestion, especially of the lungs, which in turn helps to

prevent respiratory infections. The protective foods (those rich in vitamins and minerals), in a proportion of 75 to 80 per cent of the diet, have been shown to be necessary for the prevention of a large number of diseases, including many common infections, some of which are often fatal. This is especially true of respiratory infections which make up the largest share of common diseases. Headaches, even those connected with sedentary indoor life, are often relieved entirely by a diet rich in the protective foods, which are also nature's alkalizers. Drug alkalizers contain no vitamins or health-sustaining minerals. Besides this, free soda in the stomach is harmful and interferes with digestion. Fruits give the natural fruit acids which are helpful to stomach digestion, and fruits and vegetables liberate the alkaline minerals which keep up the normal alkalinity of the blood. Many disorders of an obscure nature are associated with lack of the proper reserve of liver sugar, and may be quickly relieved by a diet rich in fruits and vegetables. Nausea and vomiting are not an infrequent direct result, as the common "bilious" attack testifies.

Constipation is also, in the majority of cases, due to the physical inactivity of sedentary occupations, together with a diet of rich meats and desserts which have no natural food residues and a low content of vitamins, which stimulate the intestinal muscles. A large ration of fruits and vegetables often remedies this difficulty, because the foods are rich in vitamin B, fruit acids, and soft residues, which stimulate the appetite and the intestinal movements.

Eating between meals puts food into the stomach before it is empty from the previous meal. This delays the food already in the stomach often as long as eight to twelve hours. Food eaten at breakfast may still be in the stomach at dinnertime or suppertime, or even at bedtime. Peanuts, ice cream, bananas, or almost any food eaten between meals produces such delay. The result is harm to the stomach and the system generally, together with many obscure distresses which in some persons come on at once, but in others only after many years of such abuse have weakened the entire body.

Not alone in the matter of health preservation and disease prevention are the laws of physiology inexorable and unvarying. In the treatment of disease the healing of the body is likewise based upon physiological laws. Misunderstanding in this field is all too common with those who are sick. The body will often stand both the burden of disease produced by unhygienic diet and other wrong habits and the added burden of harmful drugs or other misguided traditional or conventional treatment. As a consequence, the sick often think that final recovery has come because of the drugs and unphysiological means instead of in spite of them.

The healing forces within the body itself, and the natural forces without, which, properly applied, are made to conform to the physiological laws of healing, are those that bring about recovery from disease.

The harmfulness, long ago proved, of such drugs as calomel as a cathartic, strychnine as a stimulant, quinine as a medicine for colds, acetanilide for fevers, and alcohol for colds and pneumonia, has become known among well-informed people. Ignorance, however, still keeps them in all too common use. To these have been added a host of new drugs which are no less harmful. Old-fashioned soda now parades under pseudoscientific dress as an alkalizer. New coal-tar drugs, such as amidopyrine, are sold in so many forms and under such a variety of trade names as to be confusing even to the physician; and many

deaths have resulted from damage done by these drugs to nature's own protective means against infections-the white blood cells and their activities. The barbiturate sedative drugs are widely in demand. When more than a few doses are used, the longer continued or more frequently repeated, the greater the nerve irritation and instability produced. Space prevents the mention of many other both useless and harmful drugs that are in popular demand by the public.

Penicillin, a nonpoisonous chemical produced by a certain mold, is replacing highly toxic drugs in many different infections. It is already being found more potent in the treatment of gonorrhea and with prospect also of highly beneficial results in syphilis. Even the fever which results from acute infections is now regarded as one of nature's means of destroying the germs, and has by artificially produced fever in some infections been so proved.

Practical Application

Space forbids any but a brief consideration of the place which physiological means should occupy in the treatment of disease. Gratifying advances in scientific medical practice have been accomplished by research into nature's laws. The ductless-gland products-insulin, thyroid, and pituitary, adrenal, ovarian, and other extracts-are, of course, of the greatest use in specific deficiencies and disorders of the body, and no argument is necessary to prove their truly physiological nature. Likewise diphtheria and lockjaw antitoxins, meningitis serum, typhoid vaccine, smallpox vaccine, and some others are natural means, perfected for human use by experiment upon animals. We owe much to the researches of such scientists as Pasteur, Metchnikoff, Flexner, and many others. There are, however, other infections, in which nature's means of protection or relief reside not in these antitoxins or serums, but in other physiological functions which must be brought into curative activity by water, heat, cold, ultraviolet light, massage, electricity, or other forces collectively known as physical therapy. These have been and are being investigated and applied to human ailments, and are today occupying a rapidly widening field of usefulness. The oldest and best of these-hydrotherapy-still fills the largest and most diversified field of usefulness.

In 1932 there was published the volume entitled *Medical Ministry*, a work compiled from the letters, manuscripts, and published articles of Ellen G. White. The only thing that could give these writings value is their acceptance as from the spirit of prophecy. If they are of divine origin they have superior value as from the Creator of the human mechanism and are as reliable today as when they were penned, for facts and mechanisms of God's created beings do not change.

"Nature will want some assistance to bring things to their proper condition, which may be found in the simplest remedies, especially in the use of nature's own furnished remedies." - *Medical Ministry*, page 223. Dr. Richard C. Cabot cuts straight across this term natural remedies and calls them what they are, the divine power of God-vis medicatrix Dei. He points out a whole line of natural remedies of which "our therapeutics are a very long distance behind."

Can man with present-day scientific knowledge make remedies superior to those made by God? Are these remedies superior to what the testimonies call nature's

remedies? This is an important question. It is not alone superiority that is important. Nature's remedies, that is, God's remedies, do not disorder or damage the human mechanism, while the great majority of man-made medicines produce serious damage to the delicate tissues and finely balanced functions of the body mechanisms. These damaging medicines are spoken of in the testimonies as drugs. They are toxic, or poisonous, substances. In works on *materia medica* after consideration of the effects and uses of each drug there is added its toxicology, its poisonous or damaging effects. Let us note some of the statements in the testimonies regarding drugs: "Drugs always have a tendency to break down and destroy vital forces, and nature becomes so crippled in her efforts, that the invalid dies, not because he needed to die, but because nature was outraged. If she had been left alone, she would have put forth her highest efforts to save life and health. Nature wants none of such help as so many claim that they have given her. Lift off the burdens placed upon her, after the customs of the fashion of this age, and you will see in many cases nature will right herself. The use of drugs is not favorable or natural to the laws of life and health. The drug medication gives nature two burdens to bear, in the place of one. She has two serious difficulties to overcome, in the place of one."-Medical Ministry, page 223.

"The first labors of a physician should be to educate the sick and suffering in the very course they should pursue to prevent disease. The greatest good can be done by our trying to enlighten the minds of all we can obtain access to, as to the best course for them to pursue to prevent sickness and suffering, and broken constitutions, and premature death. But those who do not care to undertake work that taxes their physical and mental powers will be ready to prescribe drug medication, which lays a foundation in the human organism for a twofold greater evil than that which they claim to have relieved."-Ibid., pages 221, 222.

"Those who sin against knowledge and light, and resort to the skill of a physician in administering drugs, will be constantly losing their hold on life. The less there is of drug dosing, the more favorable will be their recovery to health. Drugs, in the place of helping nature, are constantly paralyzing her efforts. They do not inquire into their former habits of eating and drinking, and take special notice of their erroneous habits which have been for many years laying the foundation of disease. Conscientious physicians should be prepared to enlighten those who are ignorant, and should with wisdom make out their prescriptions, prohibiting those things in their diet which he knows to be erroneous."-Ibid., page 224.

"We are health reformers. Physicians should have wisdom and experience, and be thorough health reformers. Then they will be constantly educating by precept and example their patients from drugs. For they well know that the use of drugs may produce for the time being favorable results, but will implant in the system that which will cause great difficulties hereafter, which they may never recover from during their lifetime. Nature must have a chance to do her work. Obstructions must be removed, and opportunity given her to exert her healing forces, which she will surely do, if every abuse is removed from her, and she has a fair chance."-Ibid., pages 224, 225.

"Our people should become intelligent in the treatment of sickness without the aid of poisonous drugs. Many should seek to obtain the education that will enable them to combat disease in its varied forms by the most simple methods. Thousands have gone down to the grave because of the use of poisonous drugs, who might have been restored to health by simple methods of treatment. Water treatments, wisely and skillfully given, may be the

means of saving many lives.” - Ibid., page 227.

“Drug medication is to be discarded. On this point the conscience of the physician must ever be kept tender, and true, and clean. The inclination to use poisonous drugs, which kill if they do not cure, needs to be guarded against. Matters have been laid open before me in reference to the use of drugs. Many have been treated with drugs and the result has been death. Our physicians, by practicing drug medication, have lost many cases that need not have died if they had left their drugs out of the sickroom.

“Fever cases have been lost, when, had the physicians left off entirely their drug treatment, had they put their wits to work, and wisely and persistently used the Lord’s own remedies, plenty of air and water, the patients would have recovered. The reckless use of these things that should be discarded has decided the case of the sick....

“Nothing should be put into the human system that will leave a baleful influence behind. And to carry -ut the light on this subject, to practice hygienic treatment, is the reason which has been given me for establishing sanitariums in various localities.

“I have been pained when many students have been encouraged to go where they would receive an education in the use of drugs. The light I have received on the subject of drugs is altogether different from the use made of them at these schools or at the sanitariums. We must become enlightened on these subjects.” - Ibid., pages 227, 228.

Sir William Osler, perhaps the greatest physician of his generation, is reputed to have said concerning medical men: ‘We put medicine of which we know little into bodies of which we know less to cure diseases of which we know nothing at all.’

The education needed by physicians to avoid the evils of drug prescribing is a thorough knowledge of physiology and of nutrition, effects of sunlight, heat, cold, oxidation, and other elements involved in physiological processes. This necessity in the reform of physicians and their medical practice is well stated in two short paragraphs.

“Seeds of Death”

“When you understand physiology in its truest sense, your drug bills will be very much smaller, and finally you will cease to deal out drugs at all. The physician who depends upon drug medication in his practice, shows that he does not understand the delicate machinery of the human organism. He is introducing into the system a seed crop that will never lose its destroying properties throughout the lifetime. I tell you this because I dare not withhold it. Christ paid too much for man’s redemption to have his body so ruthlessly treated as it has been by drug medication.

“Years ago the Lord revealed to me that institutions should be established for treating the sick without drugs. Man is God’s property, and the ruin that has been made of the living habitation, the suffering caused by the seeds of death sown in the human system, are an offense to God.”-Medical Ministry, page 229.

Education without this intimate knowledge of physiology and the body’s natural means of protection results in a superficiality and self-sufficiency well pointed out in this paragraph:

“If self-sufficient, he will read articles written in regard to diseases and how to treat them without nature’s aid; he will grasp statements and weave them into his practice and without deep research, without earnest study, without sifting every statement, he will merely become a mechanical worker. Because he knows so little, he will be ready to experiment upon human lives, and sacrifice not a few. This is murder, actual murder. He did not do this work with evil design, he had no malicious purposes; but life was sacrificed on account of his ignorance, because he was a superficial student, because he had not had that practice that would make him a safe man to be entrusted with human lives. It requires caretaking, deep, earnest taxation of the mind to carry the burden a physician should carry in learning his trade thoroughly.” - Ibid., page 139.

Notice some of the expressions concerning the effort needed to become competent in physiological or natural therapy: “deep research,” “earnest study,” “sifting every statement,” “requires care-taking, deep, earnest taxation of the mind.” This will cause them to put their wits to work to wisely and persistently use the Lord’s own remedies.

Notice also what is required in the physician who discards drug giving: “The first labors of a physician should be to educate the sick and suffering in the very course they should pursue to prevent disease. The greatest good can be done by our trying to enlighten the minds of all we can obtain access to, as to the best course for them to pursue to prevent sickness and suffering, and broken constitutions, and premature death. But those who do not care to undertake work that taxes their physical and mental powers will be ready to prescribe drug medication, which lays the foundation in the human organism for a twofold greater evil than that which they claim to have relieved.

“A physician who has the moral courage to imperil his reputation in enlightening the understanding by plain facts, in showing the nature of disease and how to prevent it, and the dangerous practice of resorting to drugs, will have an uphill business, but he will live and let live.”-Ibid., pages 221, 222.

In Counsels on Health there are twelve statements regarding the harmfulness of drugs; in The Ministry of Healing there are eighteen; in Loma Linda Messages, twenty; and in Medical Ministry, fifty-six. Some of these are manifest repetitions.

Dangerous Drugs

No piece of machinery is so intricately complicated and finely adjusted as the human body. Yet many persons who would not trust their automobile in the hands of any but a skilled mechanic will tinker with their own bodies when they are out of order. What is equally bad, they will not hesitate to take a neighbor’s pet prescription, though that neighbor may know nothing about the malady that needs treatment.

First of all, the untrained person is incompetent to make a reliable diagnosis. Pain in the abdomen may be due to gravel from the kidney or to gallstones or appendicitis, or it may be simple intestinal colic. Pain is a call for diagnosis-ascertaining the cause-not for a painkiller. If the pain is due to gravel, operation is not indicated. If due to simple colic from improper food, castor oil or other cathartic may be indicated; but if the pain is due to appendicitis, cathartics are dangerous and often fatal. An ice bag may be helpful; but, after all, appendicitis needs surgery-a surgeon’s diagnosis and operative skill. These, however, are

only a few of the causes of abdominal pain, so that much knowledge and diagnostic skill are required.

Blood with the stool may be from piles or from cancer, or even from ulcer or other diseases. To go to the drugstore and ask for a pile cure without first going to a physician for a diagnosis may result in overlooking a cancer, and so, with ignorant self-diagnosis and self-medication, delay may result in death.

Many other examples of easy confusion of diseases without skilled examination might be given. The whole realm of diseases is full of them. The dangers of self-diagnosis are followed by the dangers of self-medication, for a large number of drugs are harmful, poisonous, and if used at all, must be used only in a restricted field, often only for a single disease.

This phrase, "the practice of medicine," is of course an old one, and comes from the days when medicine was considered the chief means of treatment for the sick. It still clings, though it has well outgrown its name. Today of far greater importance and greater benefit, without poisonous effects, are the use of hydrotherapy (hot and cold water in various ways), fresh outdoor air, sunshine and sunlamps, massage and electricity, together with rest or exercise as indicated at the time. Collectively these means are now known as physical therapy, and to some extent are beginning to be taught in regular medical schools. Of course vaccines, serums, antitoxins, ductless-gland extracts, and vitamins are all nature's own means, and so physiological and rational when appropriately applied. Some diseased organs or parts of the body may need to be removed, and so surgery is the rational and necessary means of treatment. Unfortunately, both radium and X ray can do good only by doing harm, destroying or damaging some wild growth such as cancer, and they both also produce damage to healthy tissues and organs unavoidably exposed to their rays at the same time. Nature's means of restoration are versatile, comprehensive, and if used understandingly are not harmful—that is, they are not intrinsically poisonous.

Dangerous Remedies

The great majority of drugs produce damage to one part, or even to many parts, of the body. Through the years there has been a continuous procession of these poisonous or toxic drugs. The medical profession has discarded them as one after another has proved more harmful than beneficial. There are still some poisonous drugs used to kill parasites and intestinal worms that may have to be used, since no other ways of ridding the body of them are known. However, many infections are more successfully treated by hydrotherapy and with much quicker recovery than by any drug. A brief survey of drugs once popular and of those now in vogue, will show how their supposed benefit has nearly always been claimed because of insufficient knowledge.

For many years strychnine was regarded as a valuable stimulant and tonic, often combined with iron and quinine, and was given for all sorts of run-down conditions. It was considered a specific for surgical shock and heart emergencies. In 1903 Dr. George W. Crile, after extensive animal experiments, wrote: "After giving the strychnine, the animals not yet in complete shock, always passed into a deeper degree of shock. In any degree of shock, after the administration of a therapeutic dose of strychnine, the animals passed into

deeper shock. Later in the research it was found that the most convenient and certain method of producing shock for experimental purposes is by the administration of physiologic doses of strychnine.” Another noted medical authority has said: “Dosing with strychnine to the heart is like kicking a dying horse when he is down.”

Quinine is nearly a specific in destroying the malarial parasite, and it is successful in the great majority of cases. However, it damages, paralyzes, or destroys the white blood cells, which are our chief means of protection in by far the majority of infectious diseases. Elie Metchnikoff, the great Russian bacteriologist, said: It is not only opium and alcohol which hinder the phagocytic [germ-destroying] action. A number of other substances regularly employed in medicine cause the same results. Even quinine, the effect of which in malarial fevers is indisputable, is a poison for the white blood cells. One should, therefore, as a general rule, avoid as far as possible the use of all sorts of medicaments, and limit oneself to the hygienic measures which may check the outbreak of infectious disease.”

Prevention and Treatment of Disease

Forty years ago coal-tar medicines were much used for fevers and headaches, and as pain relievers. Fever is lessened by the poisonous action of these drugs on the heat centers and on the processes of oxidation in the body. They depress the heart action. They cause breaking up of the red blood cells and damage the hemoglobin so that it cannot carry the necessary amount of oxygen from the lungs to the tissues of the body. The blood forming organs are also damaged, so that the granule-containing white blood cells, which protect us against acute infections, are so diminished that germs multiply rapidly and illness with fever results. The harmfulness of these medicines (acetanilide, phenacetin, and amidopyrine), at one time sold widely as headache relievers, is now well known to physicians.

Next, after the earlier coal-tar drugs, came a whole group of pain relievers recommended for rheumatism and arthritis. The most widely used of this class was atophan, but they all contained cinchophen or some derivative. After a few years, cases of hardening of the liver (cirrhosis) from the poisonous action of these drugs began to be reported. Then came reports of cases of acute degeneration of the liver, most of which were fatal.

Barbital was introduced in 1903, and the barbituric acid group of drugs is widely used. They are all sedative or nerve quieting and are sleep producers. There are forty or more on the market under all sorts of names. Among these the amyals are widely used. They are not the harmless sleeping potions they are supposed to be. Actual damage in the brain and nerve tissues occurs, and many disabilities and distresses result, not the least of which is a mental depression and hopelessness occurring with prolonged use. Dr. Webster in 1930 wrote: “As was to be expected, many cases of untoward effects or actual poisoning arose as a result of over dosage or accident. Many reports of chronic poisoning are finding their way into literature, owing to the fact that elimination of the drug is slow, and cumulative effects are prone to arise.”

Barbital is definitely habit-forming. Dr. Work in 1928 reported one hundred cases of barbital poisoning seen in his practice. He concluded that “barbital is a danger to the community without restriction of its sale.”

For a number of years obesity cures have either been wholly a fraud, that is,

having no effect whatsoever, or they have contained thyroid extract. This gland product is legitimately used where the patient's thyroid gland is deficient. In all cases medical tests should be made to determine such deficiency. When used where no such deficiency exists, it may do untold harm.

Sulfa drugs have produced damage to some of the organs and functions of the body. Each year new ones have been produced in a search for that which will be less toxic. The most common damage has been the destroying of the white blood cells which protect the body from bacteria. These are the granulocytes. Children are especially susceptible to this damage to the white blood cells. It has been found that the germs sometimes acquire a marked resistance to the drugs so that their use a year or two later has little or no effect in destroying certain strains of streptococci. Sometimes the kidneys are damaged by sulfa drugs, and cases are reported where, in addition to kidney damage, the ureters became blocked with crystals of these drugs.

In estimating the dangers and the benefits of sulfa drugs, Austin E. Smith, M.D., secretary of the Council on Pharmacy and Chemistry, American Medical Association, makes this authoritative statement:

“They cannot safely be used for self-medication; they may produce distressing and even dangerous side effects; they can only be used in the treatment of certain infections, not all, and not for cancer, common cold psoriasis, or many of the other diseases so frequently encountered in life. On the other hand, in their field of usefulness they produce marvelous results. They reduced the death rate, to mention two examples, of meningitis from more than 35 per cent to 5 per cent, and of pneumonia from more than 25 per cent to about 1 per cent.”

Thiouracil is being used to treat exophthalmic goiter. It, too, damages the white blood cells, resulting in a drug fever. It also is responsible for skin rashes, as is common with the sulfa drugs. Nausea, dizziness, headache, abdominal cramps, joint pains, inflammation of the parotid salivary glands, jaundice, diarrhea, and edema (swelling of limbs) have all been reported in medical journals from the use of this drug. It has been advocated merely as a preparation for surgery for goiter, but the softening of the thyroid gland produced by the drug makes surgery more likely to result in hemorrhages from the gland than where it has not been used.

Practice of Best Physicians

“All along the history of medicine, the really great physicians were peculiarly free from the bondage of drugs.” This was written in connection with medical comments upon Sir William Osler's book *The Principles and Practice of Medicine*. Through numerous editions this book easily held first place in the libraries of American physicians.

On the occasion of the fifteenth anniversary of the founding of Johns Hopkins University, Dr. Osler gave the principal address, entitled, “Recent Advances in Medicine.” Among other things he emphasized as one great advance the diffusion among the public of more rational ideas concerning the treatment of disease, stating as an interesting psychological fact that “the desire to take medicine is perhaps the greatest feature which

distinguishes man from animals.”

Continuing, he declared: “Of one thing I must complain, that when we of the profession have gradually emancipated our-

selves from a routine administration of nauseous mixtures on every possible occasion, and when we are able to say, without fear of dismissal, that a little more exercise, a little less food, and a little less tobacco and alcohol, may possibly meet the indications of the case, I say it is a just cause of complaint that when we, the priests, have left off the worship of Baal, and have deserted the groves and high places, and have sworn allegiance to the true God of science, that you, the people, should wander off after all manner of idols, and delight more and more in patent medicine, and be more than ever in the hands of advertising quacks. But for a time it must be so. This is yet the childhood of the world, and a supine credulity is still the most charming characteristic of man.”

22. PHYSIOLOGICAL THERAPY

THE study of the testimonies gives broad basic principles by which Seventh-day Adventists are to reform medical practice. These testimonies do not go into detail as to just how each and every illness should be treated. But they emphasize the natural methods, that is, the methods by which the powers of the body itself are to be utilized to combat disease. These are those which the Creator Himself devised. These are those of which God approves. The testimonies further state that this requires an intimate and extensive knowledge of physiology, and that the acquirement of this knowledge means “deep research, “earnest study,” “taxation of the mind,” and putting “their wits to work” on the part of physicians. Furthermore, they say that “those [physicians] who do not care to undertake work that taxes their physical and mental powers will be ready to prescribe drug medication,” also that such a physician “will merely become a mechanical worker,” “because he was a superficial student,” “because he knows so little,” and therefore “will be ready to experiment upon human lives.”

Medical journals and medical books are literally filled with recommendations for the use of drugs. As the years have come and gone these drugs have come and gone. Today there are more than ever before. Increase of scientific knowledge, especially of the synthetic making of drugs, has greatly multiplied them. The undiscerning physician, “without sifting every statement,” will grasp statements and weave them into his practice. Such a physician, the testimonies state, is not “a safe man to be entrusted with human lives.” If they mean anything at all, these statements mean that those who have this light from a divine source should sift “every statement.” Sifting certainly means discarding some of such statements. The question may properly be asked as to what kind of sieve is to be used in this process of sifting. The testimonies also, answer this inquiry and make the sifting process conform to a definite pattern. “When you understand physiology in its truest sense, your drug bills will be very much smaller, and [if you constantly increase this knowledge] finally you will cease to deal out drugs at all.”

“The physician who depends upon drug medication in his practice shows that he does not understand the delicate machinery of the human organism.” The human agent in communicating these important matters to us who bear the weighty responsibility for human

health and lives takes a humble attitude in making such strong statements condemning this practice. Her statement is this: "I tell you this because I dare not withhold it. Christ paid too much for man's redemption to have his body so ruthlessly treated as it has been by drug medication." Should not we who have been given this light and have learned how to use natural physiological means in the treatment of disease, also feel the responsibility of passing it on to others who have not been taught the supreme importance of such matters in medical practice?

Influenza and Pneumonia

In order to make these principles as clear as possible let us take for detailed study that disease, or rather group of diseases, which ranks third in mortality statistics in these enlightened United States. This disease is pneumonia and other acute respiratory infections. It is in infections that toxic drugs have been so largely used, under the idea that only poisons would kill bacteria and viruses. This is well pointed out in the old saying: "They aimed at the germ, but hit the patient." Through the last forty years there have been constant and informative changes in the treatment most popular, but there has been no change in God's plan of treatment. The most that we can say is that our own practice has improved as we have studied physiological research and become better acquainted with God's methods. But first of all we have had to leave "off entirely drug treatment," put our I-wits to work, and wisely and persistently, use "the Lord's own remedies, plenty of air and water." I quote these as they are given, because they are precisely what we have had to do in order to accomplish successfully the treatment of pneumonia and other acute respiratory infections. If we had not been fully convinced that drugs are harmful and left them off, we would never have studied diligently into physiological research and methods.

Notice the summing up of conclusions from a great mass of research which is given by Wilson and Willis: "Experience soon taught us, however, that in combating infectious disease, it is even more important that we familiarize ourselves with those conditions of the body by which nature combats disease." - Mayo Clinic, Volume 1910, Page 118. Is not this what God has been trying to teach us these many years? Certainly there is no appeal to science or scientific advance that can bolster up the use of toxic drugs.

Let us return to the study of the treatment of pneumonia and the acute respiratory infections. Romberg and Passler (1895 and 1901) have shown by animal experiments that the chief danger to the circulation in infectious diseases comes through paralysis and derangement of the vasomotors, and is not due to any damage to the heart itself. They used infections with the pneumococcus, the *Bacillus pyocyaneus*, and the diphtheria bacillus; the first producing a true septicemia, the latter a local lesion with a general toxemia. See Deutsch, *Archiv fur klin., Med.*, 1895, 64:652763; Passler, in *Munchen Med. Wochenschrift*, 1901, 48:8. Passler further showed that this derangement is caused by loss of the control exercised by the vasomotor centers in the medulla and spinal cord, the peripheral vasomotor nerves and muscles remaining intact. Reflex effects are still possible.

Concerning pneumonia, Sir William Osler says: "Death is most frequently due to the action of the poisons on the vasomotor centers, with progressive lowering of the blood pressure. An all-important indication is to support the circulation. Hydrotherapy and keeping the patient out of doors are of great value for this."-Principles and Practice of Medicine,

eighth edition. This was said, of course, regarding lobar pneumonia, and the latter referred to the use of fresh cool air.

The method we have used has been a combined treatment of a hot foot bath with a succession of three or even four fomentations to the chest over all lung areas involved. While the last fomentation is still in place, a cold mitten friction is given to the arms, then the last fomentation is removed and, with the mitts already on the hands of the nurse and soaked in ice water, a brisk and brief friction is given to all parts of the chest-front and sides only. These parts are then dried, as the arms have previously been, by rubbing with a rough (Turkish) towel. One foot is removed from the hot water, and the leg and foot are treated by the cold mitten friction as one operation. The other leg is then treated in the same fashion. Lastly the back is treated by the cold mitten friction. More detailed description of treatment and its effects are given in the author's text, *Physical Therapy in Nursing Care*.

The notable effects of hydrotherapy in acute respiratory diseases are: first, the reduction of congestion in the lungs by drawing the blood to the extremities, skin, and other peripheral parts; second, stimulation of the white blood cells to pick up and destroy the infection (phagocytosis); and, third, the keeping of the blood vessels acting, thus preventing the chief cause of death-blood vessel paralysis.

These principles give the basis of the therapeutic advantages of the effects of heat with cold friction in pneumonia and other acute respiratory infections. It has been this combination which has given us the most highly gratifying results. It took some years to learn why and how to combine and apply these methods, as there was some unknown factor which prevented securing the relief of inflammatory processes in the lungs by methods which had been successful in other organs. This was finally discovered in a study of anatomy. In response to my inquiry, a specialist told me there were no vasoconstrictor nerve fibers to the lungs and bronchial areas as to other internal organs. A careful search in Gray's Anatomy confirmed this statement. The completely successful use of this study was realized by us in the treatment of lobar pneumonia shortly before the great pandemic of influenza of 1918 and 1919, but required a change in methods of applying the hydrotherapy.

There must also be a change from the breathing of cold air in lobar pneumonia to warmed air in influenza and influenza pneumonia, as we learned by our own experiences and confirmed by reports of similar experience at Camp Wheeler, Macon, Georgia. These discoveries enabled us to secure marvelous success when all around us people were dying and physicians were helpless in the face of this great scourge.

Speaking of nature's means of protection, Alexis Carrel in *Man the Unknown* (pages 206, 207) says:

"Microbes and viruses are to be found everywhere, in the air, in water, in our food. They are always present at the surface of the skin, and of the digestive and respiratory mucosas. Nevertheless, in many people they remain inoffensive. Among human beings, some are subject to diseases, and others are immune. Such a state of resistance is due to the individual constitution of the tissues and the humors, which oppose the penetration of pathogenic agents or destroy them when they have invaded our body. This is natural immunity.

"This form of immunity may preserve certain individuals from almost any

disease. It is one of the most precious qualities for which man could wish But natural immunity does not exclusively derive from our ancestral constitution. It may come also from the mode of life and alimentation, as Reid Hunt showed long ago. Some diets were found to increase the susceptibility of mice to experimental typhoid fever. The frequency of pneumonia may also be modified by food. The mice belonging to one of the strains kept in the mousery of the Rockefeller Institute died of pneumonia in the proportion of 52 per cent while subjected to the standard diet. Several groups of these animals were given different diets. The mortality from pneumonia fell to 32 per cent, 14 per cent, and even zero, according to the food. We should ascertain whether natural resistance to infections could be conferred on man by definite conditions of life. Injections of specific vaccine or serum for each disease, repeated medical examinations of the whole population, construction of gigantic hospitals, are expensive and not very effective means of preventing diseases and of developing a nation's health. Good health should be natural. Such innate resistance gives the individual a strength, a boldness, which he does not possess when his survival depends on physicians."

In 1913 Butterfield and Peabody (*Journal of Experimental Medicine*, 1913, 17:578) showed that the pneumococcus lessens the capacity of the blood for combining with oxygen, due to the formation of methemoglobin. In uncomplicated cases of pneumonia the decrease of respiratory surface is completely compensated for, and the oxygen content of the blood is within normal limits. In the terminal stages of fatal cases there occurs frequently a progressive diminution in oxygen content in the blood, associated with a simultaneous loss in power to combine with oxygen. This is a factor of importance in the causation of death in many cases of pneumonia. Locke's researches reveal still more fully the importance of a vigorous mechanism of oxidation in the prevention of pneumonia, and they explain one of the main advantages of hydrotherapy in the treatment of this infection.

The researches of Arthur Locke of the Institute of Pathology of the Western Pennsylvania Hospital (1937) demonstrated that perfect oxidation in animals would destroy to such a high degree virulent pneumococci injected directly into the blood stream that 92 per cent of such animals injected with as high as eighty-three germs per cubic centimeter of blood survived and the blood became sterile of bacteria in one hour, with no fever and without apparent injury, while animals with poor oxidation functions all died. In regard to the common cold in men, the same highly protective oxidation faculties were shown by tests done by metabolor technique. Where this perfect, fully normal oxidation is lacking or has been depressed by "taking cold," that is, by chilling, which is so well known as the immediate cause of influenza, pneumonia, and the common cold, it can be stimulated and remarkably raised by properly applied hydrotherapy. Note the effects of baths at various temperatures, as given by Rubner (*Archiv fur Hygiene*, 1903, bd. 46).

Bath at	CO2	O2
61 0 F.	plus 64.8 %	plus 46.8 %
860 F.	plus 31 %	plus 16.2 %
910 F.	minus 1.8 %	plus 6.2 %
1040 F.	minus 3.9 %	plus 3.2 %
1110 F.	plus 32.1 %	plus 17.3 %

These effects are enhanced by percussion or friction combined with the application of water at low temperatures as shown by Rubner:

	Douche at 61' F.	Bath at 61' F.
CO2 exhaled	plus 149.9%	plus 64.8%
O2 consumed	plus 110.1%	plus 46.8%

Dr. Fred B. Moor used metabolor technique and determined corresponding stimulation of oxidation by hydrotherapy treatments, one of which was practically identical with the most effective combination treatment that we have used for acute respiratory infections.

This research in physiology lays the scientific basis of tonic hydrotherapy in stimulating the body's oxidation functions in the treatment of pneumonia and the common cold. They demonstrate the great advantages of hydrotherapy in actually destroying the pneumonia germ by nature's methods, without the use of toxic drugs-those drugs that do not aid nature but do seriously damage and often destroy the body's means of combating infections. Here is a germ-destroying power in nature's methods far exceeding anything accomplished by toxic drugs.

Relative to virus diseases (the common cold and influenza) it has been shown that vigorous oxidation will destroy these viruses, moreover, that vitamin C is like peroxide of hydrogen and when placed with any and every known virus completely destroys them. This is true not only of the viruses of influenza and the common cold, but also of the virus of infantile paralysis. Claus W. Jungeblut, 1937, 1939, is authority for that statement.

The stimulation of oxidation by properly applied hydrotherapy and plenty of fresh air in the treatment of all types of acute respiratory infections, including the pneumonias, is not only the most efficient and scientific treatment of these diseases, but it involves no toxic or damaging effects upon the white blood cells or any other functions, tissues, or organs of the body. The use of fruit juices, with their content of vitamin C and their alkalizing properties, gives effects not secured by penicillin; but penicillin does destroy the pneumococcus and streptococcus without any toxic effects or damaging any of those body functions which are of such great value in infectious fevers.

The testimonies are scientific, reliable, and have given us advance information years before science discovered these same facts. They are as true today in reference to toxic drugs and to natural physiological methods of treatment as the day they were written. Scientific advance in drug making has only given us more highly toxic drugs, more damaging to the body's delicate structures and mechanisms, than those of fifty years ago. Let us show by our practice that we believe the testimonies. They do not need our personal interpretations. They mean what they say, and should be taken as they read. With this determination to study and practice God's methods for the treatment of the sick, may we not read again and with a working faith in them decide to study physiology as God has so urgently pleaded with His people to do?

In the hands of the writer these principles and methods have worked, and worked supremely well, in the worst cases of pneumonia and in the most deadly epidemic of influenza (1918-1919) this world has ever known. They have even saved the lives of many who had been given up to die, for some of whom I personally entertained no hope whatsoever. Many of these researches in the body's natural means of protection against infections came years after we had discovered and successfully used these natural physiological treatments of hydrotherapy in pneumonia and acute respiratory infections, and only served to more fully explain the wide range and completeness of physiological treatment in sharper contrast with man-made drug therapy and the harmfulness of the latter.

The following chart, which shows the various disease conditions in acute respiratory infections, such as severe influenza and the pneumonias, and the physiological methods of relieving them, will help the reader to grasp more readily the efficiency and comprehensiveness of truly rational, scientific treatments.

Acute Respiratory Infections

Disease Conditions	Rational Treatment	Effects
Congestion of lungs in congestion; tones first stage circulation.	Heat with cold friction	Relieves up and equalizes
Infection in lungs and destruction of blood stream cells	Heat with cold friction	Increases germs by white blood and antibodies of serum.
Germ poisons alkalization, oxi poisons.	Heat with cold friction	Increases elimination of germ
Acidosis alkalization, oxidation	Fruit juices and heat with cold friction wastes.	Increases and elimination of acid

Blood-vessel weakness blood vessel activity and final paralysis (the poisons which cause cause of death) vessels.	Heat with cold friction	Stimulates and removes paralysis of blood
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Deficient lung and tissue tissue oxidation sue respiration in the lungs.	Heat with cold friction	Stimulates and interchange of gases
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Since physical therapy and hydrotherapy are taught but little in medical schools or used in hospitals where interns are given experience, it can hardly be expected that these physiological means would be understood.

Should not these scientific facts give us greater respect for the natural physiological factors of resistance to disease and a more profound regard for all physiological laws? Should they not also persuade us that health comes from obeying these laws and not from medicine bottles and pills, or even from scrums and vaccines in any but the few cases in which science has shown that these antitoxins are really nature's own methods of protection? Might it not also help us to remember with reverence that back of nature there is a great intelligence and omnipotence, the Creator who devised and ordained its forces, materials, relationships, and laws? In the shadow of this reverence may we not give more faithful obedience to these laws of life and health, and seek more diligently to learn all His ways for us-physical, intellectual, and spiritual?

Disease	Conditions	Treatment	Effects
1. Bacteriemia phagocytosis.		Heat with cold friction	Increases
2. Bacterial toxemia. oxidation and elimination of toxins.		Heat with cold friction	Increases
3. Acidosis oxidation and supplies Vitamin C.		Fruit juices, and heat with cold friction	Increases alkalization, and elimination,
4. Leucopenia		Heat with cold friction	Produces

leucocytosis.

5. Vasomotor paresis.
toxemia. Vascular tonic

Heat with cold friction

Removal of

6. Congestion of Lungs.
Vascular tonic

Heat with cold friction

Derivation

Blood Poisoning (Lymphangitis)

Fifty years ago in a dispensary near the stockyards district of Chicago many cases of this condition were treated. These men had received cuts or bruises while working in infected meat, and virulent conditions were extremely common. Red, angry areas and red lines along the lymphatics with abscesses and rapid fatalities were known to follow. These men often said the doctor had told them that amputation of a hand or arm was the only thing that would save their lives. Dr. W. B. Holden had these men treated by immersion of the infected part alternately in hot and cold water (ice water with chunks of ice in it)-two minutes in the hottest water that can be borne and boiling water added at intervals to maintain this highest tolerable temperature, then one half minute in the ice water. This was kept up for from fifteen to twenty minutes and repeated two or three times a day. No amputations were ever done, but abscesses if appearing were opened and drained. The alternate immersion in hot water and ice water was continued after the lancing. This was observed by the writer in 1900 to 1903, long before the days of sulfa drugs and penicillin, and he has continued it with the utmost success down to the present day. The effects are due to the stimulation of the white blood cells in picking up and destroying the bacteria of these virulent infections.

23. INFANTILE PARALYSIS

THAT the necessary technical details may be more readily grasped by the non-medical reader, it should be borne in mind that in 1941 and 1942 there were no adequate explanations of the way in which the Kenny treatment secures such really remarkable results. The first part of the following study makes it clear that the moist heat of fomentations by two processes acts as a two edged sword, which sword is oxygen. This oxygen kills the polio virus, for perfect body oxidation destroys this virus. It cannot live in the presence of an ample supply of oxygen. Second, a nerve cell dies in eight minutes where oxygen has been completely cut off. It is asphyxiated, and no subsequent supply of oxygen can revive it. The larger and hotter the fomentations and the longer they remain hot the greater are the effects, first, because internal congestion and edema of the spinal cord are relieved, and so oxygen is carried in to the spinal cord by the circulation; second, because hot applications to the skin actually increase oxidation within the body, as shown by the researches of Rubner (1903) and much later by Moor. Rubner used gas analysis of the inspired and expired air, while Moor used basal metabolism technique. There is also the oxidation reduction mechanism, of which vitamin C is a part. In the film "Energy Release From Food" it is pictured as a pendulum swinging back and forth. A spark or flame of oxidation denotes each swinging contact.

Not all knowledge of disease and its treatment has come through deliberate scientific research. It is certain now that the Kenny treatment of this disease holds therapeutic means of greater value than anything previously discovered. The report of W. H. Cole and M. E. Knapp (*The Journal of the American Medical Association*, 116:2577, June 7, 1940 and subsequent reviews of the effects of this physical therapy treatment show results little short of miraculous. They have been well attested by careful check and comparison, and that by physicians who were by no means carried away by superficial appearances or first impressions.

In October, 1941, a small group of physicians attending the Minneapolis meeting of the International Postgraduate Assembly gathered to witness a five-week checkup of children treated by the Kenny methods. Among these physicians were some who voiced a decided opinion that the results were much superior to splinting. It was reported that of eight patients sent in to be put in the Drinker respirator, four who were given its benefits died, while the four others not put into the respirator but treated by Elizabeth Kenny were alive. One of these, a young man of about twenty years of age, seen by the writer, had an atrophy of the right deltoid and weakness of the right arm muscles, but he was able to sit upright on the treatment table and was making a good recovery for one having such severe involvement as that of the respiratory centers in the medulla.

The treatment used by Elizabeth Kenny in infantile paralysis was devised in an emergency when she was unacquainted with the cause or pathology of the disease. She tried to relieve the first and most prominent outward manifestations of the disease, the muscle pain and muscle spasm. It was these she saw. Her treatment was symptomatic. Even now she does not in any way ascribe any results obtained to direct effects upon the pathological state in the spinal cord, the nerve ganglia, or the meninges where the virus is known to lodge. The virus has not been found in the muscle tissue itself. Moreover, the initial effects of the virus upon the motor cells or the meninges is irritation, with the resultant muscle tension, spasm, and pain. Death of the motor cells occurs later, even though that may be only a few hours or days later. Of one hundred cases of poliomyelitis observed in the San Francisco Hospital, Brainerd, Katz, Rowe, and Geiger report that "all cases exhibited the phenomenon described by Kenny as muscle spasm." Wayne McFarland, M.D., also reported verbally to the writer that all cases of poliomyelitis in the Los Angeles General Hospital show muscle spasm.

Here is a hydrotherapy application that in the acute stage of the disease prevents paralysis and even saves life, as shown by the outcome in the eight cases of respiratory involvement. Is death in such cases due solely to tense spastic muscles and accumulated mucus in the bronchial tubes? Do the Kenny fomentations have any effect at all upon the pathological state in the spinal cord or only upon the resultant spastic muscles? The moist heat relaxes the affected muscle fibers, relieving venous congestion and stagnant circulation in these muscles. This gives the patient much immediate relief and allows the affected muscles to contract and relax with greater freedom. Nevertheless the final paralysis and atrophy of the muscles is not primarily due alone to tension, congestion, or any other changes within the muscle itself. It is due to the death of the motor cells in the spinal cord. How can the Kenny fomentations save the motor cells deep in the spinal cord and far removed from the immediate heating effect of these fomentations?

Does symptomatic treatment applied by moist heat have other effects in the

acute stage of poliomyelitis than those effects specified by Elizabeth Kenny? Is there experimental evidence of effects upon the pathological condition in the spinal cord itself? This study is addressed solely to answering this inquiry. The effects of the Kenny fomentations upon muscle spasm present in the affected and the opposed muscles and upon the general muscle spasm shown to occur in the acute stage of poliomyelitis is not to be minimized in any way. It is certainly highly important and beneficial. Is this all there is to the effects of fomentations in the acute stage of the disease, such as in these four cases involving the respiratory centers and in the early stages whatever the location of the motor cells involved? It is in this early stage, even before a certain diagnosis can be made, that the most remarkable results of the Kenny treatment occur. The re-education and muscle recovery treatment of the Kenny method rests upon a known and acknowledged physiological basis. This basis was well explained in editorials in *The Journal of the American Medical Association* of December 6 and 20, 1941. Let us turn now to experimental research for an answer.

In 1910 Louis B. Wilson and Byrd C. Willis (*The Journal of the American Medical Association*, 55:921, September, 10, 1910) Of the Mayo Clinic made this statement: "When the relationship of bacteria to infectious disease was first brought to the attention of the scientific world, for a long time the specific germ was the chief object of study. Experience soon taught us, however, that in combating infectious diseases, it is even more important that we familiarize ourselves with those conditions of the body by which nature combats disease." Among these methods by which nature combats infectious diseases are phagocytosis, opsonins, antitoxins, agglutinins, and other antibodies. There may be still other methods by which nature combats bacterial and virus diseases. Every attempt to discover and utilize any humoral method of immunity to the poliomyelitis virus has thus far only led up a blind alley and proved wholly disappointing. "Phagocytosis" in poliomyelitis is not of the virus but of the dead neurons. The neuronophages do not destroy the virus. So there is no evidence of this type of cellular resistance, but rather the virus is selectively neuronocytotropic. Let us not be too myopic and postdirectional in our vision. We need to study the methods of resistance and immunity of the host. In poliomyelitis there is as yet some undiscovered element of resistance and immunity, as evidenced by the small proportion of the population attacked to the total number exposed to the disease at the time of an epidemic. Moreover, the virus is now known to be present in the intestinal tract and bowel discharges of a large number of unaffected persons during an epidemic.

This study is an endeavor to discover the conditions of the body that make up this natural resistance or immunity to the polio virus; and, if possible, adapt it to therapeutic use. The first requisite is an accurate knowledge of the pathological changes in the spinal cord in the acute stage of the disease.

From examinations of the spinal cord in poliomyelitis virus infected monkeys, William Boyd states: "When the meninges are opened, the cord bulges out. It is firmer than normal. When cut across, this bulging is very noticeable. It is due to marked edema. The gray matter of the cord and brain may appear hyperemic." - *The Pathology of Internal Disease*, 3d. ed., 1940. Speaking of the earliest stage of the disease, the stage before paralysis is manifest, E. W. Hurst found that "even at this early stage the motor cells in the anterior horn had begun to show signs of degeneration." - "Histology of Experimental Poliomyelitis," *Journal of Pathology and Bacteriology*, 32:1202, December, 1929. "The process of cell death may be incredibly rapid. Hurst found that in the preparalytic stage in the monkey only early lesions

could be detected in the nerve cells, whereas twenty-four hours later the anterior horn cells were represented by a necrotic mass of debris. This agrees with the remarkable suddenness and completeness of the paralysis. There can be no doubt that the destruction of the nerve cells is due to the direct action of the virus upon them.”-William Boyd, op. cit.

Here are two notable pathological changes in the spinal cord: first, the congestion and tense edema; second, the incredibly rapid reduction of the neurons to “a necrotic mass of debris.” All who are familiar with the physiological and therapeutic effects of hydrotherapy will recognize at once that moist heat to the skin surface produces marked reddening and a greatly increased amount of blood in the skin and adjacent tissues, thus reducing internal congestion and edema. In this case where the internal congestion is located in the spinal cord, a disproportionately large amount comes from the spinal cord areas involved, thus permitting a freer circulation so that all elements carried by the blood and lymph will better reach the beleaguered neurons in that area. Of all elements carried by the circulation, oxygen is the most important, for ten to fifteen minutes’ total anoxia of the motor cells spells death from which there is no recovery by subsequent supply of oxygen, as has been so thoroughly shown by Cyril B. Courville, M.D., in his *Untoward Effects of Nitrous Oxide Anesthesia*, 1939. In addition to making oxygen available to the neurons, hot applications increase oxidation. This was shown many years ago by Rubner (*Archive fur Hygiene*, 1903, bd. 46) by gas analysis of the inspired and expired air. More recently it has been shown by Fred B. Moor (personal communication, 1941) by means of the basal metabolism technique. If anoxia is a factor in the death of the motor cells, this much may be expected in protection of these cells by moist heat-fomentations.

Apparently the more probable chief cause of the destruction of these motor cells is the direct action of the virus. This, too, is “incredibly rapid,” and from the pathological appearances of the early lesions in the preparalytic stage to “a necrotic mass of debris” may be only twenty-four hours. Can fomentations applied in the preparalytic and irritative stage of painful spastic muscles save these motor cells from destruction? Two entirely different lines of research seem to have a direct bearing upon the answer to this question.

“Jungeblut (‘Vitamin C Therapy and Prophylaxis in Experimental Poliomyelitis,’ *Journal of Experimental Medicine*, 65: 127, January, 1937) determined that multiple paralytic doses of poliomyelitis virus, when mixed with very small amounts of crystalline vitamin C are rendered noninfectious as determined by intracerebral injections of such mixtures into rhesus monkeys.” Destruction of the poliomyelitis virus is also accomplished by known oxidative agents such as peroxide. Jungeblut concludes that the antitoxic effect of this vitamin is by oxidation. It is effective against many different bacteria, viruses, and even chemical agents. Is it possible that the physical agent, moist heat, by relief of edema in the spinal cord allows oxygen to reach the neurons, and, by stimulation of intracellular respiration, thus permits them to survive; while, by the same moist heat, oxygen reaches the lodging place of the polio virus and destroys it, also by an oxidative process? Which of these two processes is the one by which the moist heat of the Kenny treatment prevents destruction of the nerve cells? Is it by preventing asphyxia of the cells or by an oxidation process causing death of the virus, and so indirectly protecting the neurons?

A critical comparison of the acute pathology of the spinal cord in poliomyelitis, as stated by Boyd (op. cit.), and the acute pathology of the nerve cells in

anoxemia, as given so extensively and in detail by Courville (op. cit.), present an entirely different picture. Neither is the clinical picture in anoxemia or anoxic death at all like that of the acute stage of poliomyelitis even in its worst form, the bulbar type. We are, therefore, led to conclude that moist heat protects the nerve cells of the anterior horn by this indirect method, that of oxidation effects acting as does vitamin C in killing the virus in vitro and probably in vivo as shown further on by Jungeblut in therapy with vitamin C. It must, however, be admitted that the toxic action of the polio virus might wipe out all evidences of anoxic death of the cells since the production of the evidences of asphyxia require at least a short survival period, which does not occur with autopsy of monkeys as soon as paralysis becomes evident. Cyril B. Courville (by personal letter) contributes the following statement, upon which the above admission is based: "If these cells were completely asphyxiated and the monkey failed to survive for any length of time, such changes in the cell would not become evident, for it takes time for cells to degenerate after they have died. It is perfectly possible, thereupon, to have cells completely dead and yet show no microscopic evidence of the fact, unless the individual survived considerably longer than did the cell. My own estimate is that survival from 40-48 hours is necessary before any great amount of change is evident in the cell, although I understand that in some other researches a shorter interval of time has been proposed."

In recent research work still other factors bearing upon the prevention and treatment of poliomyelitis have been discovered. One of these lines is a connecting link to the physiological basis of the Kenny methods of hydrotherapy. It deserves special consideration. In addition to the direct antitoxic action of vitamin C upon the poliomyelitis virus, Claus W. Jungeblut, M.D., (op. cit.) found that treatment of virus-infected monkeys by 1 to 5 grams of vitamin C doubled the number of non-paralytic survivors as compared with untreated controls. "Vitamin C is found in all normal body fluids which possess poliocidal properties (serum, tears, placenta, pregnancy urine, adrenal extracts). Next to the adrenal glands, it is present most abundantly in the central nervous system." In a later research Jungeblut states further: "Ascorbic acid has proven capable of inactivating by direct contact in vitro every toxin and virus that has been investigated." If we are to accept vitamin C, therefore, as a therapeutic agent on the basis of its established physiological action rather than of its normal role in nutrition, the question arises in what way the anti-infectious effect of ascorbic acid in poliomyelitis can be correlated with its biochemical activity. Since it is commonly suspected that one of the functions of vitamin C is to regulate the oxidation-reduction potential of cellular respiration, it becomes relatively easy to imagine that an increased supply of the vitamin, which has a tendency to diminish during the infection, serves to maintain the oxidation-reduction system of nerve cells at a level at which the oxylabile virus is restrained from intracellular propagation. While this suggestion is still entirely hypothetical, it is in harmony with the observations of Brodie and Wortis, who have demonstrated a diminution in the oxygen consumption rate of nerve tissue infected with poliomyelitis virus."

"The chemical forces that lead to inactivation of the virus by vitamin C are not known. However, some light has been thrown on the possible mechanism of the reaction by the work of Lojkin, who studied in great detail various phases of the inactivation of crystalline tobacco mosaic virus by i-ascorbic acid. According to this author, the inactivation that occurs in vitamin C virus, systems is neither due to the reduced ascorbic acid nor to the irreversibly oxidized dehydroascorbic acid, but rather to the action of a specific intermediate product which is formed in the course of the catalytic auto-oxidation of ascorbic acid under

the influence of copper ions; evidence is adduced to suggest that this product is a peroxide. Similarly, Kligler and Guggenheim, in studying the detoxication of tetanus toxin by ascorbic acid, arrive at the conclusion that oxidation is an essential part of the reaction which serves to destroy both toxin and vitamin. It is generally accepted that poliomyelitis virus is peculiarly susceptible to the action of certain oxidizing agents, such as hydrogen peroxide, potassium permanganate, chlorine, and ultraviolet light; quantitative data, however, on the virucidal effect of hydrogen peroxide are incomplete.” - Claus W. Jungeblut, M.D., “Further Contribution to Vitamin C Therapy in Experimental Poliomyelitis,” *Journal of Experimental Medicine*, 70:385, September, 1939.

Another piece of research bridges the gap between oxidation stimulated by moist heat and the oxidation produced by the biochemical influence of vitamin C. It demonstrated that a vigorous oxidation mechanism governs vital resistance and immunity to the acute respiratory infections of pneumonia and the common cold. Introducing his report of this research, Arthur Locke says: “This is a report of an investigation into the part played by fitness in preventing infection of the type encountered in pneumonia and in common cold.

“Fitness was defined, for the purpose of the investigation, as ability to support a forced performance of work at an effective rate of speed. Methods were developed for the approximation of a fitness rating; for man, in terms of capacity for oxygen replacement during exercise; and for rabbits, in terms of capacity for temperature recovery after chilling.”

For resistance to the common cold, “the fitness rating was estimated for man in terms of c.c. of oxygen consumed per minute per sq. m. of body surface during maximal effort with the arms and legs on a machine resembling a stationary bicycle. Both the arms and legs were exercised in order to permit the subject to work at an easy speed and yet consume oxygen at a sufficiently rapid rate to produce breathlessness within 1.5 to 3 minutes. The subject was placed on the machine and asked to exercise slowly, until the movements involved became natural and coordinated. A mask was fitted over the face and connected through a breathing tube to the oxygen reservoir of a recording metaborator loaned by the McKesson Company. Easy breathing was instituted, the arms and legs once more started in motion, and attention centered on the driving of the machine at a rapid but supportable speed until the approach of breathlessness, as indicated on the oxygen consumption record. The average number of colds reported, during the seven-month period studied, was between two and three. Sixty-four per cent of the total number of subjects with a fitness rating above 0.6 reported fewer than this average, and 80 per cent of the number with ratings below 0.5, more. The margin between 64 per cent opportunity of getting through the season with one cold or less and 80 per cent risk of having four colds or more was between fitness levels of 0.61 and 0.49, exactly as in the rabbit.” – “Lack of Fitness as Predisposing Factor -in Infections of Type Encountered in Pneumonia and in Common Cold,” *Journal of Infectious Diseases*, 60:106, January-February, 1937.

In rabbits, fitness was determined by the time required to recover from chilling, which was produced by immersion in cool water to a three-degree drop from the normal temperature.

Those that could recover from this reduction of temperature in twenty minutes were given a rating of 1 and those requiring 125 minutes for the completion of the temperature recovery were rated 20/125. After intravenous injection of as high as eighty three

pneumococci per c.c. of blood, 92 per cent of the rabbits rated as I recovered with no fever or other symptoms of infection and destroyed the eighty-three pneumococci within one hour. The rabbits with the lowest rating as above could not destroy within one hour as few as six pneumococci per c.c. of blood, and none survived.

These researches demonstrate beyond any doubt that natural resistance to the virus of the common cold and to pneumonia is based upon a vigorous heat mechanism with its oxidation mechanism. The virus of poliomyelitis has “an exquisite susceptibility” to oxidizing agents, among which vitamin C is preeminent, because it is a natural nutritional element destroying the virus in vitro and in vivo, the latter as shown by twice as many recoveries when monkeys are treated with synthetic vitamin C over the controls. In the use of the natural vitamin C, the nonparalytic survivors are six times as many as the untreated controls. Vitamin C, therefore, takes a definite part in natural resistance to the virus. Here, then, is another method of natural resistance and immunity besides phagocytosis, antitoxins, and other antibodies.

Commenting upon the past centering of attention on antibodies as the chief immunity mechanism, Thomas M. Rivers says: “Indeed, certain investigators are now of the opinion that antibodies are nothing more than by-products of infection and play no significant role in resistance to poliomyelitis.” – “Infantile Paralysis,” a symposium at Vanderbilt University, New York, The National Foundation for Infantile Paralysis, 1941.

Where oxidation elements of a vigorous heat mechanism in natural resistance to the common cold, pneumonia, and the poliomyelitis virus are lacking, they can be forced by the thermal stimulation of appropriate hydrotherapy such as the “Kenny foment” in acute poliomyelitis, and by the combination’ treatment of the hot foot bath, fomentations to the chest, and the cold mitten friction in the common cold, influenza, and pneumonia. With these physical therapy measures should be combined the free use of orange juice and lemonade carrying the natural vitamin C to make complete the mechanism of intracellular respiration and natural oxidation.

Varied hydrotherapy measures meet and relieve other pathological processes which are present, such as congestion, edema, acidosis, and vasomotor paresis. The Kenny treatment of poliomyelitis may be slightly called “symptomatic treatment.” However, symptomatic treatment of any disease by hydrotherapy measures or other forms of really physiological therapeutics accomplishes far more than the relief of the discomforts of aching or pain. It acts directly upon disease processes and relieves by restoration to normal. For example, in such a serious infection as the influenza pandemic of 1918 and 1919, in which millions died, sometimes in a day or two after its onset, scientifically applied hydrotherapy relieved the aching in the back and limbs and the headache, but also attacked and changed six fundamental disease conditions at the origin. See George Knapp Abbott, M.D., Fred B. Moor, M.D., and Kathryn L. Jensen-Nelson, RX, *Physical Therapy in Nursing Care*, 1941. These six conditions are bacteriemia, bacterial toxemia of extreme grade, acidosis from sub-oxidation, leucopenia, extreme blood vessel paralysis due to toxic vasomotor paresis, and lung congestion and pneumonia of the inflammatory-edema type. It was the radical relief of these disease processes by checking the causes that saved many lives where the outlook appeared entirely hopeless. The relief of internal congestion and edema, together with the forced reaction in the body heat mechanism and oxidative effects of the hydrotherapy used in that influenza epidemic, show a striking similarity to, if not full identity with, the most

essential effects of the Kenny "hot foments" in the acute stage of poliomyelitis. Nothing is more firmly established in physical therapy than the reduction and relief of internal congestions and inflammations by the application of moist heat to the surface of the body; nothing more fully proved than the increase of oxidation by thermal application. Here are two protective therapeutic effects vitally needed in the acute stage of poliomyelitis. Do the Kenny fomets have any such effects upon the virus itself and upon the pathological state in the spinal cord so as to prevent destruction of the motor cells, or are the effects solely by relaxation of muscle spasm?

Thus far there has been discovered no cellular or humoral mechanism of immunity or therapy against the polio virus; no known toxic agent or protoplasmic poison that will destroy the virus in vivo, except an oxidizing agent. This agent is both physiological and nontoxic. This oxidizing agent increases the number of non-paralytic survivors among polio-virus-injected monkeys by 600 per cent. A vigorous oxidizing heat mechanism has been shown to protect animals against the pneumococcus administered intravenously and to be a large factor in man-the most important so far discovered-in natural resistance to the virus of the common cold. The blocking or exhaustion of this vigorous oxidation mechanism by chilling, or by overexertion and over fatigue, render man and experimental animals extremely susceptible to pneumonia, influenza, and colds, as shown by the most common experiences of man and by this experimental work of Arthur Locke. Now the same exquisite susceptibility to the polio virus has been experimentally and clinically demonstrated as also occurring from chilling, trauma, and such overexertion as a strenuous tennis match, a difficult mountain climb, an athletic contest, or a cross-country run, by Frey, Zenke, Voss, Bremer, Rudder and Peterson, Nase, Sabin, and Levinson. See editorial, *The Journal of the American Medical Association*, May 31, 1941, Page 2506.

It is remarkable that so slight a difference in fitness ratings in Locke's experiments-changes between .61 and .49 in oxidation should be a gauge of such a striking difference in immunity to the pneumococcus and the virus of the common cold. Certainly there is some chemical change intimately connected with and dependent upon the vital fires of the body that determines the resistance and immunity of the body to these infections. Such chemical change or changes are not merely bacteriostatic or virustatic, they actually destroy these infective organisms, and that by wholly physiological and nontoxic means. These small differences in oxidation are more than covered by various thermal applications of heat and cold which produce reaction. In Rubner's experiments such applications produced an increase in oxygen consumption of from 17 per cent to as high as 110 per cent.

The forced stimulation of oxidation by moist heat has been most successfully used in the therapy of the acute respiratory infections of the common cold, influenza, and pneumonia, the latter two of the worst types. Now this long-used method of hydrotherapy is being applied in the acute stage of poliomyelitis with acknowledged outstanding success. Does it work in the same way upon the known primary pathology of the disease in the spinal cord where the infective organism is lodged, destroying the motor cells, and whence originates reflex irritation with muscle spasticity, or does it act only upon the secondarily reflexly irritated and spastic muscle. It can hardly be possible that the Kenny fomets secure the admittedly beneficial effects upon the painful and spastic muscles without also reducing the congestion and edema of affected parts of the spinal cord and, by enhanced oxidation, being also virucidal.

Further evidence of oxidation as the crucial factor in the successful treatment of poliomyelitis in the earliest stage has recently accumulated. Speaking of the anterior horn cells of the spinal cord, Hart E. Van Riper, M.D., writes: "Preliminary observations indicate that the virus of poliomyelitis may inhibit utilization of glucose by these cells. If this is true, such alteration would mean a serious loss in energy. Further studies have shown that there is a considerable derangement or disorganization of the oxygen-carrying enzymes following an infection of the nerve cells by the virus of poliomyelitis...."

"Electromyographic studies show that the acute paralytic muscle at rest is usually electrically active as compared with the normal muscle at rest, which is usually electrically quiet. Recent reports from the Scandinavian countries differ somewhat from these conclusions in that they indicate that both the normal and the paralytic muscles at rest can be electrically inactive, although it is much more difficult and, in fact, sometimes almost impossible to put the paralytic muscle in a position in which it is electrically inactive."-The journal of the American Medical Association, Volume 135, No. 2, September 13, 1947, page 75.

Whether this indicates direct disorder of neuron stimulus to muscle fiber contraction or possibly a disorder of the choline mechanism (nerve fiber ending which touches off muscle contraction) and its cholinase reduction is academic to the real problem of what prevents this disorder. And yet injection of a weak solution of lactic acid (0.1 c.c. of 0.05 to 0.3 per cent) into the muscle of a white rat showed within thirty seconds "a retraction of many of the end plates" where the choline mechanism is located. "By the end of twenty-five minutes many or, at times, practically all of the end plates and epilemmal axons had disappeared, the rate depending on the lactic acid concentration." -The journal of the American Medical Association, Volume 125, No. 11, July 15, 1944, Page 791, with four other references given to original research by Fletcher and Carey.

Low metabolism always results in accumulation of lactic acid and lactate and so may itself be a factor as well as the direct effect of the polio virus. The entire round of cause, effect, and further cause and effect, all related to sub-oxidation, makes a vicious circle into which prompt oxygen therapy is imperative. The reduction in utilization of glucose and all the disorders present in poliomyelitis indicate a definite reduction in oxidation. Part of this is of course also a direct result of impaired function of motor neurons involved in polio virus infection. The wide spread of neuron damage in the bulbar form of poliomyelitis is given in the recent article by The Minnesota Poliomyelitis Research Commission. See The Journal of the American Medical Association, Volume 134, No. 9, June 28, 1947, Pages 757-762. In their classification of the regions involved it is evident that there is this widespread disorder, including an upper and lower cerebral group with subdivisions a and b of both of these, and a third of combined cerebral and bulbar lesions with a focal and a diffuse subgroup, and a fourth of combined bulbar and spinal involvement. Administration of 100 per cent oxygen gave truly remarkable results. Of four stated conclusions the fourth reads: "Clinical symptomatology indicative of cerebral involvement is common in bulbar poliomyelitis. These symptoms usually are caused by anoxia [deficiency or lack of oxygen] and clear up after oxygen therapy."

Cerebral involvement such that psychic and mental defects are manifest and in some of which permanent impairment of the mind results, is similar to, if not identical with, encephalitis of the epidemic type. Observations regarding symptoms and results of oxygen

therapy are significant of the most important treatment in these conditions, whether the causes are actual virus infection of nerve cells or edema resulting in anoxia of the nerve cells of mental function-that is, non-motor centers. Apropos of this, two paragraphs are quoted from the report of The Poliomyelitis Research Commission:

In many patients, especially those in respirators, a typical toxic confusional state appears about one week after the onset of the illness and lasts about a week. These persons develop fixed ideas and stubbornness which gradually merge into paranoid projections about members of the nursing or medical staff. These ideas are occasionally replaced by obvious misinterpretations, hallucinations, and irrationality. Contact with reality can be restored in some persons by lighting the room more brightly, by permitting a view of the street outside the window, or by a visit from a close member of the family.

“Although many patients with bulbar poliomyelitis showed the clinical symptomatology indicative of cerebral involvement, only a small number actually had inflammatory changes within the cerebral hemispheres. However, it was noticed that the cerebral symptoms would frequently disappear after measures were taken to ensure adequate oxygenation of the patient. This was accomplished by tracheotomy, suction or oxygen under positive pressure by mask or tracheotomy. This led to the conclusion that many of the cerebral symptoms seen in bulbar poliomyelitis were secondary to cerebral anoxia rather than to direct involvement of the brain by the virus. In poliomyelitis the common factors that may result in deficient oxygenation of the blood are as follows: obstruction of the air passages by secretions or by paresis of the vocal cords; failure of the peripheral or central respiratory mechanism; failure of circulation; pulmonary complications, especially atelectasis or hemorrhagic pulmonary edema, and failure of the mechanical devices used in treatment. The appearance of the encephalitic symptoms, therefore, serves as a warning to re-examine these patients for the various causes of anoxia. Persistence of the symptoms despite attempts to improve the oxygenation is of serious prognostic import.” - *Ibid.*, page 761.

Whether there is direct virus infection of the neurons or only the anoxia of cerebral edema, the crucial factor in treatment is to get oxygen to the nerve cells before they are destroyed. Here again we must point out the great importance of the work of Courville previously quoted. The causes and proper treatment of this oxygen deficiency is also stated in this same article by Baker and others: “These symptoms frequently are caused by a hypoxia and may be present before the appearance of cyanosis. The use of the oximeter may aid in the detection of these early hypoxic states.” - *Ibid.*, page 759.

Factors of Susceptibility

What are the factors that determine susceptibility to the polio virus? These have already been pointed out. First among these there is the food and nutritional factor of vitamin C in its role in the oxidation-reduction mechanism. This vitamin is found in fresh fruits and vegetables. The writer has taken thousands of diet histories, noting the number of servings a day of these two food classes which people ordinarily consume. It is often not more than one or two a day of fruit and seldom much more of vitamin-rich vegetables-potatoes and raw vegetable salads. This is far short of what Henry C. Sherman of Columbia calls conforming to the newer knowledge of nutrition, which is four servings daily of vegetables and five or six of fruit, including a liberal allowance of citrus fruits. National polls

of dietary habits have shown a serious and widespread vitamin deficiency in America.

The vitamins of the B complex are also essential to perfect body oxidation. This necessity for perfect health is so well stated by Urbach and LeWinn and in such few words that it may well be quoted here: "The vitamins of the B group are essential to the oxidation-reduction mechanism of all living cells because they serve as the prosthetic or chemically active group in the coenzyme systems involved in that mechanism. When there is an inadequate supply of these substances, cellular metabolism is impaired and, in the course of time, functional and subsequently organic changes make their appearance. The disordered cellular metabolism permits the accumulation of intermediary products of carbohydrate oxidation, such as pyruvic and lactic acids."-Erich Urbach and Edward B. LeWinn, *Skin Diseases, Nutrition, and Metabolism*,

1946, page 166. McConnick pointed out this factor in susceptibility some years ago, and it received a little publicity, but evidently not as much as its importance would warrant.

For the past ten years the present writer has been much interested in the discovery of another large group who also show

a notable hypoxia-in a generic sense an anoxia. It is the group who reveal a low basal metabolism. Part of this motley number, the arthritic group, were specified by Pemberton many years ago as having a low metabolic rate; but, unfortunately, he suggested reducing carbohydrate intake to accommodate the ability of the system to oxidize it. This ultimately gave rise to the fear of the use of much "starchy" food, though today few remember the evolution of this delusion. We see from four to six hundred cases a year of low metabolism (hypothyroidism) masquerading under the diagnosis of arthritis, neuritis, colitis, headaches, neurasthenia, sacroiliac troubles, heart disease, gall-bladder disease, and with many other symptoms distinctive of nothing in particular, among which are numbness, itching, tenderness of the flesh, insomnia, frequent colds, sinus infections, bronchitis, and marital infelicity manifest as nervous irritability. However, in the younger age group, who seem to be more susceptible to polio myelitis, there are usually none of these suspicious manifestations except a notable susceptibility to colds and other respiratory infections.

There is also the known infrequency of pregnancy due to hypothyroidism and the complicated course of pregnancy in both mother and infant as a result of deficient diet in the mother. Nearly all the latter factors are also factors in oxidation. The force of muscle contraction is dependent on oxidation, whether in labor at childbirth or in mountain climbing. Endurance and nerve stability are intimately connected with that principal source of energy within the human body-oxidation.

[It must be admitted that down to the present time animals deprived of or deficient in vitamins of the B complex have not shown any greater susceptibility to the polio virus than have other animals on a full protective diet.]

There is another group of infantile paralysis cases that need special emergency attention in order to prevent or relieve anoxia of the brain stem and medulla. It is those where pharyngeal mucus drops into the trachea and so precipitates or increases anoxia of the involved nerve cells. This has been extensively explained by Priest, Boies, and Coltz of the University of Minnesota Medical School and associated Minneapolis hospitals

C7racheotomy in Bulbar Poliomyelitis," reported in *Annals of Otolaryngology, Rhinology, and Laryngology*, June, 1947, Pages 250-263). It is done by tracheotomy with aspiration of these blocking secretions and in some cases even positive pressure oxygen system connected to the patient's trachea by a tracheotomy tube. The nerve centers of respiration and circulation may be involved in the polio virus infection, and here, where the outlook is so grave, early attention to oxygen therapy is most important. Even the respirator (iron lung machine) may cause mucus to be sucked into the trachea and cause early death because of increased anoxia. "Of all body tissues, neural tissue is the least capable of withstanding oxygen want. This is especially true in poliomyelitis, where the central nervous system is already damaged by the virus. The primary purpose of tracheotomy is to ensure proper and constant oxygen supply."- *Ibid.*, page 255.

With the Kenny hot packs quickly and efficiently done and with 100 per cent oxygen inhalations, with or without tracheotomy according to individual and local conditions of mucus blockage of the trachea, there are collectively a group of therapeutic measures, all of which have to do with getting oxygen into the circulation and *to the involved areas of anoxia. This oxygen therapy kills the virus and saves the life of the nerve cells. Oxygen therapy in these nerve virus infections is truly a marvelous lifesaving agency. This we first pointed out in 1941, and now other measures to secure oxygen therapy are more fully demonstrating these same physiological necessities in poliomyelitis.

The next piece of worth-while research should be the extensive use of basal metabolism and the oximeter in well persons (including children) to determine the matter of oxygen saturation of the blood and tissues as a definite and proved element in resistance to both bacterial and virus infections. Some of this may be the repeating of such experiments as those of Claus W. Jungeblut and Arthur Locke by means of these two instruments -the metabolor and the oximeter. There are however two hindrances to the interpretation of the basal metabolic rate. First, the delusion that a person can be in basal condition who gets up in the morning, dresses, and drives to the laboratory with an hour of rest before the test is done. In one case the difference in the result between such common method and the reliable one, done before the person gets out of bed in the morning, proved to be that between minus 3 per cent and minus 18 per cent. In this case a grain and a half more thyroid extract was necessary to restore to a normal level of oxidation. Second, minus 10 per cent copied from book to book is not correct. From experience with several thousand cases, including the relief of intangible nonobjective but nevertheless real distresses, this conclusion has been borne in upon us. Minus 10 per cent takes at least one grain of thyroid extract to bring the metabolism up to normal. Another difficulty is the lack of present reliable literature regarding the symptomatology methods and precautions which must be taken in treatment by thyroid extract. This includes the education of the patient as well as the physicians in general practice. In the case above referred to, a year later the home physician advised reducing the thyroid dosage by one grain. This promptly resulted in a new group of symptoms totally different from any of which she had at first suffered following the thyroid surgery. Restoring the one grain soon put a stop to these newly acquired symptoms, and again the patient was well. In her case some parathyroid glandules had inadvertently been removed with the thyroid surgery, but the parathyroid medication had been kept constant throughout.

Another matter of supreme importance is a retest of the metabolism after gradually increasing doses of thyroid have reached a constant unvarying dosage for at least

two months. Hypothyroid patients are so nervous, restless, and liable to disturbed sleep that a first test may not fully show the degree of the efficiency. The later tests are therefore much more reliable. All the patients with herpes zoster-shingles-upon whom we have done metabolism tests have shown a definitely low metabolic rate. This virus is also a neurotropic virus.

A normal metabolic rate after a good night's sleep, with the test done before getting out of bed, is not lower than minus 5 per cent. The general rule for varying degrees of deficiency is 1 grain of thyroid for each 8 per cent below the center of a normal range, that is, 0 per cent. This means that-

Minus 8 per cent requires 1 grain of thyroid

Minus 16 per cent requires 2 grains of thyroid

Minus 24 per cent requires 3 grains of thyroid

Minus 32 per cent requires 4 grains of thyroid

Minus 40 per cent requires 5 grains of thyroid

These dosages should be built up by slow stages or steps of one grain, or better- .05 grain of thyroid for two to four or even six to eight weeks. Only a few persons need to have the steps reduced to 0.25 grain. Any added or undue nervousness should subside before further increase in thyroid dosage should be made. The same is true of consciousness of increased force of the heartbeat. These are about the only two difficulties of which patients complain.

Because of nervousness and poor sleep at the first test some persons on a retest, after taking a grain or more of thyroid, may show a lower metabolism than at first and will need more than the first projected dosage. Few patients will require more than four grains of thyroid to restore to normal range. However, 5 or 6 or even 6.5 grains of U. S. D. thyroid daily for maintenance of normal metabolism have been required by a few. There is no evidence that a thyroid gland once degenerated or lessened in functioning tissue will ever regenerate. On the other hand, we have never seen one undergo further degeneration by thyroid medication. Whatever dosage of thyroid is required to bring the metabolism up to normal must be maintained the rest of life.

The use of X ray or radium for hyperthyroid goiter does more harm than good, as I have had occasion to observe in a large number of persons thus treated some fifteen to twenty years previous.

Taking iodine does not change the metabolism or restore the thyroid gland to normal in so far as the individual is concerned. Its effect over several or many generations might be different. The matters of metabolism pertaining to oxidation have a very definite bearing upon the occurrence of acute respiratory infections such as sinus infections and head colds, also acute bronchitis, influenza, and pneumonia, as well as infantile paralysis.

Date: January 1, 1949

PROGRAM FOR: Samuel Schafer

HYPOTHYROIDISM

METABOLISM RATE MINUS 20 per cent

Take thyroid grain 1 daily for 2 to 4 weeks.

Then take thyroid grains 1.5 daily for 4 to 6 weeks.

Then take thyroid grains 2 daily for 6 to 8 weeks.

Then take thyroid grains 2.5 daily for at least two months, before repeating the metabolism test.

The retest is to determine how much thyroid you will need for maintenance the rest of your life. Do not stop taking thyroid before this retest, or at any time. Continue taking thyroid as long as you live.

Fish-liver oil cap. two daily for one month, then one daily thereafter.

Brewer's yeast tablets 8 daily.

Thiamine (25 mgm.) tablets 1 daily.

All these may be taken with a glass of orange juice 10 or 15 minutes before breakfast.

Note: Record date each step in thyroid dosage is begun. If nervousness or pounding of heart occurs wait until it ceases to bother, before further increase in thyroid dosage is begun. Do not lessen thyroid dosage because of any such disturbance.

Throughout all these acute infections, diet of inadequate quantity of the protective foods-fruit, vegetables, and milk plays an important part.

While there are large areas all over the earth from which most of the iodine has been washed off and is now deposited in the ocean, yet experience indicates no benefit by use of iodine as a medicine to restore the thyroid gland to normal. It has, however, been shown that there is some benefit by the use of iodized salt. This is true in Switzerland, where hypothyroid goiter and cretinism have been prevalent, also in the State of Michigan, where for some fifteen years there was a lessened number of operations for goiter compared with the number of other operations done during the same interval. The observations regarding hypothyroid goiter in Pemberton Meadows, where one tribe of Indians were exempt from goiter while all other humans and all the animals were afflicted with goiter, are significant, for it was noted that in generations partaking of iodine-rich food there was a notable absence of thyroid disease. In this Indian tribe sea food had been freely used for many centuries. In the case of these Indians it was salmon, but sea vegetation is also saturated with iodine.

New Facts About Penicillin

Early announcements about penicillin stressed that, unlike the sulfa drugs, it was entirely harmless. Continued experience with it has shown' this claim to be untrue. Large numbers of reactions, some severe, have now been reported. An account of them has been published in *The Journal of the American Medical Association* (Volume 132, Page 915) by Dr. W. J. Morginson of the University of Utah School of Medicine. He describes the findings at a big Army hospital and refers to dozens of articles which have appeared in medical literature. Sensitivity to penicillin has been due in part, but not wholly, to impurities in the drug. It is likely to appear after repeated doses. The list of these reactions covers scores of manifestations, including many skin outbreaks, swelling of various parts of the body, headaches, chills, fever, vomiting, abdominal cramps, convulsions, shock, nervousness, depression, hallucinations, mania, heart trouble, and unconsciousness. One death was reported.

In the large Naval Medical Center at Bethesda, Maryland, twenty thousand patients have received penicillin in the last four years. Among the first two thousand, only a few slight reactions were reported. At the present time, however, the effects are more severe and are shown by from 8 to 10 per cent of those receiving the drug. Penicillin is now on sale in the form of ointments, mouth washes, lozenges, lotions, and first-aid dressings. This is declared to be objectionable for the following reasons: (1) the results are uncertain and questionable in comparison with established remedies; (2) the potential danger of sensitizing the patient to the drug, so that it cannot be used in a later emergency; and (3) the risk of precipitating a reaction in a previously sensitized person.

At the Atlantic City meeting of the American Roentgen Ray Society in 1947 there was an outstanding exhibit by Vincent W. Archer, M.D., of the University of Virginia Hospital, on how chemotherapy masked symptoms so as to obscure and delay important diagnoses. He cited the following typical cases, giving X-ray evidence.

“(1) The response of a sigmoid diverticulitis to sulfadiazine delayed discovery of a sigmoid carcinoma.

“(2) Chemotherapy so obscured the clinical picture in a post pneumonia lung abscess that the patient was placed in a tuberculosis sanatorium.

“(3) Penicillin caused a fibrosarcoma to follow the clinical course of a Brodie's abscess.

“(4) Penicillin obscured the progress of a perinephritic abscess, delaying drainage until an empyema developed.

“(5) Penicillin discouraged but did not cure a lung abscess, leading to the development of bronchiectasis.

“(6) Penicillin frequently completely obscured the clinical picture in osteomyelitis. The progress of this disease, he said, must now be followed by X ray more closely than ever before.

“(7) The clinical picture of an acute cholecystitis was abruptly obscured by penicillin. For two weeks a severely diseased gall bladder was kept completely silent.

“(8) Penicillin discouraged but did not cure a mastoiditis; this confused the X

ray as well as the clinical picture, in that bone destruction did not take place.” - General Electric X-Ray News, Volume 19, Number 10, October, 1947, page 5.

Benefits Derived From the Newer Chemotherapy

The mortality rate from pneumonia after sulfa drugs were introduced by comparison with mortality rates before their introduction show a decided and unmistakable reduction. This cannot be denied. Certainly for those physicians who are unacquainted with the scientific application of hydrotherapy, sulfa drugs and penicillin are to be preferred. There are no figures available for comparison with the use of hydrotherapy and probably never will be. The writer could cite only his own personal experience and that of a few who have given hydrotherapy an opportunity to show what it can do. The experiences with hydrotherapy before and during the great influenza pandemic of 1918 and 1919 are still vivid in my mind. Numerous persons left to die were saved by hydrotherapy. Some of these had been under the drug therapy of those days. Twenty years later I saw one who had been given up after sulfa drug therapy who was saved by a specialist in physical therapy who applied hydrotherapy by the methods outlined here. Many others with pneumonia through the last ten years have given us the very marked contrast in favor of hydrotherapy.

Having had through the years many young children with meningitis, we know how hopeless are the majority. Of one child of seven years the spinal puncture showed the epidemic type (non tuberculous). He would certainly have died without the use of penicillin. After seven daily spinal taps with penicillin injected the extreme opisthotonos was gone and the child's life saved. Hydrotherapy could not possibly have saved this child.

In specific gonococcus pelvic infections (tubal pelvic inflammatory disease) the use of hydrotherapy has so promptly and completely cured these unfortunate women that since 1925 we have used no other means, neither sulfa drugs nor penicillin. The method is the copious vaginal irrigation with the hottest water that can be borne administered by means of the colon irrigation apparatus, using about eight gallons. This is followed by the hot hip and leg pack with ice bags over both groins under the upper end of the hot pack. This is continued for thirty minutes and finished with a cold mitten friction. The relief comes in about ten minutes after the hot pack with ice bags has been applied. This is another condition that has been, or is still being, treated by chemotherapy-sulfa drugs and penicillin or similar therapy-with much better results than before. To those who have not learned how to use these methods of hydrotherapy, I would say by all means use the best known methods of chemotherapy. Better still, secure an opportunity to study the methods of physical therapy, hydrotherapy, as previously referred to in this volume.