The new health guide / edited by Sir William Arbuthnot Lane.

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THE NEW HEALTH GUIDE

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THE NEW HEALTH GUIDE

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CONTENTS

FOREWORD

In August 1934 the New Health Society held a Summer School in Malvern. The contributions to this volume form a part of the lectures and discussions at the School.

Nothing could be more gratifying than the widespread interest shown in these discussions. Such interest reflects a welcome attitude of mind on the part of the lay public and is an indication of the great need for health education in all its aspects.

The work of the physician is not hindered but substantially helped by the intelligent co-operation of his patient. The best co-operation of all is so to regulate our lives as to obviate the need of the physician's services except in the maintenance of health at a high point of efficiency. That may be a counsel of perfection, but it is at any rate one in which the medical profession is beginning to make its voice heard. Preventive medicine, in its most intimate, personal sense, is no longer the exclusive territory of the Ministry of Health and the sanitary authorities. The public expects from its medical advisers some regulation of its daily habits and some guidance in the normal needs of the body in health. Especially in regard to diet demands are made on the physician, and these he is not

always able, or indeed trained, to fulfil. Public opinion is influencing medical schools in this respect and I look forward to important changes in the medical curriculum which will enable the general practitioner to give better effect to the accepted results of modern research in nutrition.

The contributions to the New Health Society's summer conference, therefore, provide not only an epitome of public interest, but also a stimulus to public opinion both inside and outside the medical profession. Broadly the subjects covered fall within the two categories of nutrition and mental health. The interest in nutrition has remained unabated since the New Health Society came into being ten years ago, while that shown in psychology is widening rapidly. Each tendency has yet to find a full measure of acceptance within the profession, but there is little doubt that these branches of study must ultimately work out their practical salvation through clinical experience.

I should like to take this opportunity of expressing on behalf of the Council of the New Health Society our grateful appreciation of the services of the distinguished lecturers whose invaluable co-operation ensured the success of the School. And I must add how warmly we welcomed the presence of Mr. Bernard Shaw at several of the lectures and how greatly the Society appreciated his interest and participation in the discussions which followed.

W. ARBUTHNOT LANE

DIET AND RACE

by

S. HENNING BELFRAGE

M.D., M.R.C.S., L.R.C.P.

CHAPTER I

Diet and Race

BRILLAT SAVARIN, the great French philosopher, who was also a great epicure, once said that the destiny of nations depends on what and how they eat. It would be an interesting study to inquire into the relationship between the rise and decline of the great civilizations of the past and the changes that took place in the national dietary. We should often find that periods of supremacy in the arts of war and peace were associated with sound dietetic habits, and that the decline of the advanced states of civilization were marked by a decline in the mental capacities and the bodily physique of the people. Examples of such changes in the dietary among whole races of people have occurred within living memory, if on a smaller scale, and provide sufficient evidence for us to accept such changes as an all-important factor in the history of civilization. It is, at any rate, quite certain that before the dawn of history, during the hundreds of thousands of years in which we now know that man has inhabited the earth, the story of his migrations and conquests over the face of the globe is based on the natural food supply, on the changes that occurred in it due to geological and climatic

disturbances over vast periods of time, and on the development of new tastes and appetites. If we are to accept the fact—as we probably must—that the cradle of the human race was in the tropical climes of the Indo-Malaysian continent, now for the greater part submerged beneath the sea, we must picture earliest man as subsisting on the natural fruits and green shoots and leaves, roots and tubers, honey, insects and birds, and such-like natural products as lay to his hand in the tropical vegetation. This happy state called for no cultivation and induced no desire to migrate to other regions. That he could live and thrive on so simple a dietary is evidenced by the fact that in the case of his nearest relations in the animal kingdom—the great apes—an identical dietary has continued to maintain a magnificent physique, great strength and the highest mental capacity below the human level.

Such vast changes in the climatic conditions as marked the great glacial epochs produced an extensive alteration in the food habits of early man. The tropical and semi-tropical vegetation which had previously covered the whole earth's surface, not excluding the present Arctic and Antarctic zones, disappeared, and this almost certainly resulted in the change over from this largely vegetarian diet to one that must have been almost entirely carnivorous. Man learnt to snare fish and the larger birds, and to fashion

himself weapons and traps with which to kill the wild beasts in his vicinity and defend himself not only against them but also against his fellow men fighting desperately for a bare subsistence. Such conditions rapidly induced our forefathers to collect into tribes and communities, and this became more universal as the dawn of civilization arose with the development of the art of agriculture, first practised, it is believed, on the eastern shores of the Mediterranean. The wild grain was cultivated and roots and tubers, such as are still largely used by native tribes, were propagated. Where there were grassy plains he learnt how to domesticate the meat- and milk-providing animals that soon developed into the flocks and herds we know to-day, and as man has known them for thousands of years. It must be remembered, however, that this dawn of civilization with its arts and science of agriculture is, in proportion to the span of man's existence on the earth, a tale but of yesterday. Through vast ages man was an herbivorous animal and there have, as yet, taken place no definite changes in his anatomy or physiology corresponding to this change in his dietary, ancient history though this epoch may seem to us. Nevertheless the change of dietetic habits has not only made new demands on his mental capacity, and therefore induced development of his mental powers, but has also had a definite

physio-chemical influence on his bodily and mental processes. It has been chiefly responsible for making man what he is to-day as compared with his ape-like ancestors. Unhappily it would seem that man has now passed the summit of his success in feeding himself—a summit marked by the period during which he reaped the full benefit of the principles, which nature and experience had taught him through the ages. The so-called advance of civilization is driving him from the fields into the cities, and vast changes in his dietary have taken place and will continue from bad to worse unless some mode of reversion to the old conditions can be found. Native races are imitating the more cultured ones, and it is becoming increasingly difficult to find a people who have not become contaminated with the bad dietetic habits of the industrial world.

England may be said to have reached its highest degree of perfection in feeding its people in the seventeenth century, when salads, potatoes, oranges, and root crops were introduced and established as essential parts of its food to supplement her natural resources. With the beginning of the nineteenth century, the introduction of sugar as a cheap food, the milling of cereals, and the factory production of canned, preserved, and otherwise manipulated foodstuffs, she began a downward course. This has undoubtedly been marked by a deterioration in the physique and

a lowering of the general standard of health and resistance to disease which continues to fill our hospital wards and outpatient rooms, costs the nation millions of pounds annually in medical services and loss of earning power, and threatens to reduce us permanently to a C3 race. And this deterioration is showing itself also amongst the more primitive races where the same pernicious influences are at work.

It is only within the last two decades that we have properly understood the principles involved in this question of racial dietary. It has become evident that no dietary is satisfactory unless it includes certain indispensable components and that former theories based on, say, meat eating, or vegetarianism, or on a low or high protein element in the diet, are no longer tenable. The keynote to successful nutrition, as McCollum was the first to point out, is the selection of such foods in such variety and quantity as will supplement each other's deficiencies—in other words to select a properly balanced dietary.

It has been clearly shown that, even though it includes a surprising variety of foodstuffs, a diet may yet fail to secure adequate nutrition. Accurate observations on a thoroughly scientific basis of the relationship of the health and physique of various races to their dietary are few in number, and there remains a large field for research before we shall possess really accurate data. Laboratory

experimental work on the feeding of small animals whose life cycles are rapidly repeated and can therefore be observed over several generations in respect of their fertility, growth, freedom from disease, and general behaviour have clearly shown that these are completely dependent on the arbitrary selection of their food by the experimenter. By suitable variations in the feeding he can rear a healthy, vigorous, and fertile stock or produce a race of weaklings that speedily dies out.

Similarly the breeder of live stock can determine the success or otherwise of his industry. Surely therefore this must hold true for the human species. Looking round now on natural methods of feeding we find a truly surprising variety of habits, which at first sight appears to be contradictory in their results. Take carnivorous feeding for example. Some purely carnivorous animals are remarkable for their fine physical development, their agility, muscular strength, and nervous vigour. Such are the wolf, tiger, and lion, and among birds the eagle and the vulture. Some races of mankind are also largely carnivorous, such as the Eskimo, Laplanders and the North American Indian in his primitive state.

It is interesting to note in passing that those races, and the wild animals with whom they share their taste for animal-flesh food, are lazy and lethargic when well fed, but capable of

tremendous activity when they are hungry. Their standard of intelligence is comparatively low. These characteristics may well be due to the fact that a large meat consumption favours the growth of certain bacteria in the intestine, causing poisoning of the blood-stream and consequent mental and physical lethargy. Indeed no dietitian to-day advocates this type of dietary. Vegetarianism on the contrary is held by many to conduce to a more active mind and a more spiritual outlook. There is probably some truth in this idea, and it may well depend on the cleaner intestine of the vegetarian. The fact that races like the Eskimo, and the carnivorous animals, succeed in preserving a high standard of health is, however, capable of explanation. These carnivorous men and animals eat all parts of their animal victims—the blood, bone marrow, and bones, the glandular organs and the fat. Civilized man has a deplorable preference for the muscle meat, as in joints, chops, and steaks, and draws the line generally with only occasional use of the internal organs. Thus we have only recently come to recognize the dietetic value of liver.

There are certain dietary essentials that are contained only in the glandular organs, the blood, the marrow, and the bones. These balance the many dietary deficiencies of muscle meat alone. If such meat takes a too prominent part in the dietary these deficiencies are not likely to be

made good by other articles of diet. Speaking of the North American Indians, it is instructive to note that when they came to live in the Reservations under the benevolent Government which had acquired their lands, and their diet, as supplied from the Government stores, came to consist of milled cereals, canned foods, and such like, they became infested with tuberculosis, rheumatism, and tooth decay, and are now rapidly dying out. Carnivorous men and animals have fine strong teeth, but it has been found that the younger generation of Eskimos living under more civilized conditions show the same amount of tooth disease and defect as do those of the children of our great cities. There has been a similar happening in Iceland, a country where the people until the middle of last century subsisted on milk, mutton, fish, and eggs. They have since imported large quantities of white flour, polished rice, and other manufactured foods. Dental decay has increased rapidly.

A pleasanter picture is afforded by the children of the crofters in the Hebrides. They are fed for a long time by their mothers' milk, and the crofters and their wives, and the children, after weaning, live mostly on fish, fish liver, much milk, a few potatoes, and a little oatmeal. The diet is therefore preponderantly of an animal type. Though climate and housing are deplorable and the winter darkness unduly long these children

do not get rickets. The preponderance of denatured cereal food and sugar that characterizes the diet of so many of our city children is a striking contrast.

Turn now to the opposite kind of diet, viz. one in which vegetable products largely preponderate. That such a human dietary can succeed in maintaining a highly satisfactory standard of health and physique is shown by that of the natives of the state of Hunza in the extreme North of India. We are indebted to Sir Robert McCarrison, R.A.M.C., who lived among them for some years, for this observation. These people subsist largely on cultivated grains eaten in their natural condition, but thoroughly well cooked, on vegetables, including green leaves and tubers, and on fruits. They get a certain amount of milk and butter and goat's meat only on feast days. Their span of life is extraordinarily long and practically all the diseases, especially those of the digestive tract, which menace life in civilization, are unknown among them. McCarrison never saw a case of appendicitis, gastric ulcer, or cancer. Their physical strength and powers of endurance are remarkable. All this despite a severe winter climate and the most primitive living conditions.

The Zulus of South Africa before the advent of the white man enjoyed a similar physical development and lived on a very similar diet. So also did the New Zealand Maori in his virgin

territory. These latter people, as was probably the case throughout Polynesia, used certain methods of agriculture, of storing and of cooking their vegetable foods, which made such a dietary possible for them but is obviously not available in a civilized community. We are indebted to Mrs. Hornibrook for much information on these points. Roots and tubers were largely used in the place which cereals and sugar occupy in the Western dietary, i.e. as the principal energy foods. Such products were the taro, the cassava, the dahlia, and the sweet potato. The starch-bearing trees, such as the sago palm, the bread fruit, and the banana, were also much used, and also the roots of the giant bracken fern. These foods made up the bulk of the diet. Meat was an occasional luxury, but fish was often eaten.

It is probable that such a dietary was that of primitive man for tens of thousands of years—the use of shell-fish is evidenced by the great deposits of shells found on the site of ancient lake dwellings. These foods undoubtedly formed the most important part of the diet of native man from the earliest times, but his method of cooking was one that secured the utmost degree of digestibility. This was a very important factor, since much of the nutritive content of vegetable food is inaccessible to digestion and absorption unless it is rendered so by efficient cooking. Those who would have us return to an unfired diet are apt

to forget this very essential point. Most of the starch and other nutritive elements in these foods is enclosed in cellular walls which must be broken down in order to render their contents accessible to the digestive juices. On the other hand fish, and perhaps birds, could be and were eaten raw after preliminary cleaning. Cooking of the tubers and roots was done in ground ovens. Holes were dug in the ground in which suitable stones were placed and a fire lit. When the stones were sufficiently heated they were covered with wet matting, and on this the food was placed, and this again was covered with another wet mat of flax, and the mat covered up with the earth taken from the hole. A little water was then poured through a hole made down to the stones. This caused the food to be thoroughly steamed, after which a slow baking process took place lasting for twenty-four hours or longer. In this way the starchy contents were first hydrated and softened and then thoroughly converted to dextrin—starch in its most digestible form. This method of cooking starchy foods is still practised in some out of the way parts of the world and might well be imitated and adapted to modern requirements by the Western world. Many digestive and metabolic disorders can be traced to the imperfect cooking of our starchy foods and it is common knowledge that popular methods of cooking vegetable foods deprive these foods of some of the most important

nutritive elements and are therefore, not only wasteful, but definitely harmful.

The native dietary included also the use of the pulses, and these were allowed to germinate before being cooked. Ample supply of the anti-scurvy vitamin was thus assured. We may learn valuable lessons from the dietetic customs of these native races even though they are as a whole unsuitable to man in the Western world living under totally different conditions. Some remarkably interesting observations carried out on two native tribes inhabiting South Africa by Drs. Orr and Gilks, are worth quoting, because they go to show that even under identical living conditions as to climate and general hygiene a preponderance of animal food in the diet produces a higher standard of bodily physique and greater freedom from disease than does a diet such as we have just been considering. The Masai tribe are a pastoral people, whose sole occupation is to tend large herds of cattle, sheep, and goats. Their staple articles of diet are meat, milk, and blood—the latter drawn from the living animal. They also use infusions of various roots and leaves, and while the warriors of the tribe confine their diet to these animal foods and the vegetable infusions, the rest of the population, in addition to this main part of their dietary, eat some bananas, cereal grain, sugar, and honey.

The other tribe observed was that of the Akikuyu, who are agriculturists and live on a diet which is chiefly vegetarian. This consists of cereals, tubers, plantains, pulses, and green leaves. Meat is scarcely ever eaten and very little milk is available. The Masai diet is very rich therefore in protein, fat, and lime—the Akikuyu diet is rich in carbohydrates, but poor in lime and vitamin content. Comparing the physique and health of the two tribes, the average Masai male is five inches taller and 23 lb. heavier than the Akikuyu, and his tested muscular strength 50 per cent greater. The Masai tend to suffer from constipation and rheumatoid arthritis, but otherwise is much freer from disease than the Akikuyu. These observations tend to show the undoubted value of animal products in the dietary and are evidence against the practice of pure vegetarianism.

There are as a matter of fact no races who are purely vegetarian to the same extent as some of the lower animals. People inhabiting the northern parts of China are great consumers of green leafy vegetables, and as they eat also the entire grain of wheat and not rice, as in the more southern parts of the country, and also get a fair amount of meat, their dietary is an excellent one. They are well developed and capable of great strength and endurance, as was evidenced in the labour gangs they supplied during the Great War. The southern

Chinaman is smaller and weaker than his northern fellow countrymen.

As a general rule the Oriental diet, say that of China and Japan, is an unsatisfactory one, more especially since polished rice has taken the place of whole rice, and the dietary generally has become sophisticated. The food available in these countries for young children is mostly unsuitable, milk and its products being scarce and often unobtainable. If it were not for the fact that mothers often do not wean their infants for four or five years the infant mortality would be much worse than it is. Hence rickets is rare and the children are, during their infancy, often better off than our children who are weaned early on to a diet of the bread and potato type. After weaning, however, the Chinese or Japanese child is worse off than the American or European, because of the lack of milk. Japanese who migrate to California and get a better diet in the shape of milk, eggs, and meat, in two or three generations are found to be taller and of more robust physique than their home-staying countrymen. Polished rice in those countries, like white flour in Europe and America, fills too large a place in the total dietary and is a very definite menace to sound nutrition. When a badly balanced food, such as polished rice or white flour, bulks largely in the total dietary, other foods that can compensate for their deficiencies are in consequence

not used in sufficient amount—hence the total diet is a badly balanced one.

There is good evidence that a superior type of diet is one in which milk and its products form the prominent protein constituent instead of meat. Races of pastoral nomads, whose occupation is that of tending and subsisting on flocks and herds, are invariably a vigorous and aggressive people. Examples are to be found in the past in the Aryans and Mongols, who spread victoriously from their high pasture lands in Central Asia over the greater part of the globe, though they not infrequently degenerated later into ease-loving agriculturists. The ancient Jews, the Bedouin Arabs, and tribes from the Sahara desert, the Russian Cossacks, and the ancestors of the Turks, are other examples of races possessed of great physical perfection and high intelligence. Such shepherd tribes living often under most adverse climatic and geographical conditions, and compelled to wander ceaselessly in search of fresh pastures in the face of constant hostility and with no settled dwelling places, have been possessed of great courage, hardihood, and mental activity. While milk, generally soured and obtained from camel or goat or mare, and milk products provided the greater part of their dietary, it was supplemented with moderate amounts of meat, cereals, and dates.

The liberal use of milk among the people of the

Scandinavian countries, the Balkan States, and throughout wide areas of Asia, is also almost certainly responsible for the excellent physique and exceptional prolongation of healthy life often found among these people. The observations of McKay on the various races in India also go to show that the pastoral tribes are vastly superior specimens to the purely agricultural ones who subsist mainly on rice. The contrast between, say, the rice-eating Bengali and the Sikh, who is principally fed from dairy animals, is very striking.

In passing, it is highly instructive to note that recent observations on school children in this country have shown that a daily sufficient allowance of milk has an effect in improving the physique and mentality of the children in a way that no other kind of supplementary food can effect.

Failure of many well-fed and consequently healthy races to progress socially has, of course, been determined by economic and geographical conditions. Such conditions as have rendered their lives one long hard struggle for subsistence and left them no opportunity to develop the arts and sciences have naturally retarded their progress in the social sphere.

But if one asks the question whether we of the Western world of ultra civilization have reaped from the health standpoint a commensurate bene-

fit from our higher social developments, most of us I think would answer in the negative. The changes that have taken place in our dietary, along with the growth of industrialism, are proving to be a disastrous failure when we look at the physical deterioration that is only too evident. The increased consumption of denatured cereals, the use of the wrong kinds of meat foods, the vastly increased consumption of sugar, the use of butter substitutes, of too many tinned foods, and the addition of chemical preservatives to many food products, are some of the faults of commission. Equally vital faults of omission are the lack of sufficient dairy produce, of unmanufactured cereals, of fresh vegetables, and of fruit. Our cooking methods are often deplorable and we fail to adequately manure the soil from which, in the last resort, the essential constituents of our food are derived. As a consequence, in spite of the fact that for one reason and another the span of human life in this country and America is increasing, the amount of physical and mental disease and disorder in proportion to the population is steadily increasing, despite all the advances of medical and surgical sciences.

It is true that some of the diseases directly due to the grosser kinds of food deficiency are lessening in incidence—diseases such as rickets and scurvy and beriberi. Nevertheless, there is a clear connection between most of the early degenerative

diseases, the deplorable standard of physique that makes it impossible to maintain our former standards of physical development requisite for military and police services, the almost universal tooth and mouth disease amongst our children, and the prevalence of catarrhal and rheumatic complaints—between these and the failure to secure a properly balanced dietary for the so-called lower classes. There is no excuse for those who can afford a sufficient variety of food—they must be taught the elements of sound nutrition and then be left to take the consequences if they wilfully ignore the simple laws.

It has been the object of the New Health Society to assist in educating the public in the principles of sound dietetics. In the last resort it is public demand that must bring about the necessary reforms, and of these reforms I would place first an increased supply and consumption of milk, and moreover of milk that at an economic price is free from all harmful contamination.

Next I would stress the increased cultivation and use of garden produce in allotments and market gardens, with improved methods of distribution, and, thirdly, the increased use and production of wholemeal flour.

History and the observation of the various diets in use throughout the world to-day teach the inestimable value of these three classes of food in

ensuring that *sine qua non* of health—the balanced diet.

If we are to see a radical improvement in the standard of health of the next generation—and who will deny that such improvement is very necessary—we must see to it that our children are better fed. The State must take a hand in this. Progress has been made with the milk feeding in schools, so that every child may now get at least a half-pint of milk a day at a price that every parent with the aid of a State grant can afford. In the Utopian state there would be free dinners at every State school—dinners arranged to provide the highest standard of nutrition. In this country it has been estimated that the cost of such an enterprise would be something round twenty millions a year. Even this large sum should surely not be outside the bounds of practical economics. The necessary increase of home food production would alone justify it. The return in health would be incalculable. Surely if the British race is to maintain its honoured place in the world we must see that we rear healthy and vigorous children. This cannot be done unless we ensure them a sounder and ampler dietary than under present economic conditions the parents can provide.

FOOD AND DIGESTION

by

JOHN CAMPBELL
PH.D.
(*Late of the Ministry of Food*)

CHAPTER II

Food and Digestion

My colleague, Dr. J. Neil Leitch of the London School of Dietetics, has already dealt with the properties and sources of the principal food factors; it now remains to consider the changes which proteins, carbohydrates, and fat undergo before finally passing into the blood-stream.

There are only two foods that will diffuse into the blood-stream without digestive action, viz. dextrose and alcohol. All other forms of food require to undergo a breaking-down process into final products that will either pass directly into the blood-stream through the capillary walls or into the lymphatic system via the lacteals. The final digestive product of all carbohydrate foods —e.g. starch, dextrin, milk sugar, malt sugar, and cane sugar—is dextrose in which form it diffuses into the blood capillaries, and in proteins the end factors are the amino acids.

Part of the fat is emulsified and is readily absorbed by the villi and passes to the lacteals, and so enters the lymphatic system to be finally discharged into the blood-stream from the thoracic duct into the junction of the left jugular and sub-clavian veins.

THE ALIMENTARY CANAL

These digestive changes are effected by the digestive juices as the food slowly passes along the alimentary canal from the mouth to the junction of the small intestine with the large bowel. The alimentary canal begins with the gullet, or food pipe, which pierces the diaphragm, expanding into a large pear-shaped organ, the stomach.

The stomach narrows (the pyloric portion) at the right side and is continued as the small bowel, the junction being controlled by a sphincter muscle, which relaxes at intervals, allowing the contents of the stomach to pass the pyloric opening.

The small bowel is divided into three parts:

(1) The duodenum, about 12 inches in length.
(2) The jejunum, which is 8 feet in length.
(3) The ileum, which is 12 feet in length.

The end of the ileum joins, on the lower right side of the abdomen, a dilation termed the caecum, the junction being guarded by a lip-like valve termed the ileo-caecal valve, which freely allows the bowel contents to pass into the caecum.

From the caecum arises a small finger-like blind end appendage, known as the vermiform appendix. The caecum is continued into the large intestine, about 6 feet in length, passing up the right side,

continuing across the abdomen and down the left side to join the rectum in the pelvis.

The intestines lie loosely in the abdominal cavity, the small bowel being greatly convoluted, and its coils supported and joined by a membrane —the mesentery—which carries the blood and lymph vessels.

The food is forced through the alimentary canal by the co-ordinated contraction of the muscle layers (peristalsis), a process occupying from twelve to eighteen hours for the complete passage before evacuation in the form of faeces.

GENERAL STRUCTURE

The alimentary canal shows the same general structure throughout its entire length, but the nature of the mucous membrane differs considerably in the various sections.

A microscope section shows the following structures:

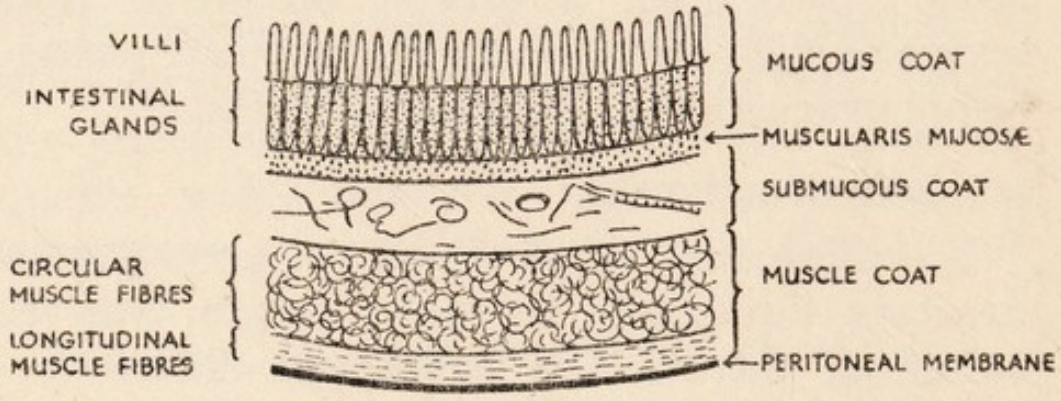
(1) An outer lining membrane.
(2) An involuntary muscle coat of two or more layers.
(3) A sub-mucous coat of connective tissue containing the large blood and lymph vessels.
(4) A thin muscular layer—the muscularis muscosae.
(5) The mucous layer of glands with a rich network of blood capillaries.

The muscle coat consists of two layers—an inner stratum in which the fibres are disposed of circularly, and an outer layer of longitudinal fibres.

Of these the circular layer is relatively the thicker and more important.

In the stomach there is a third layer, the fibres

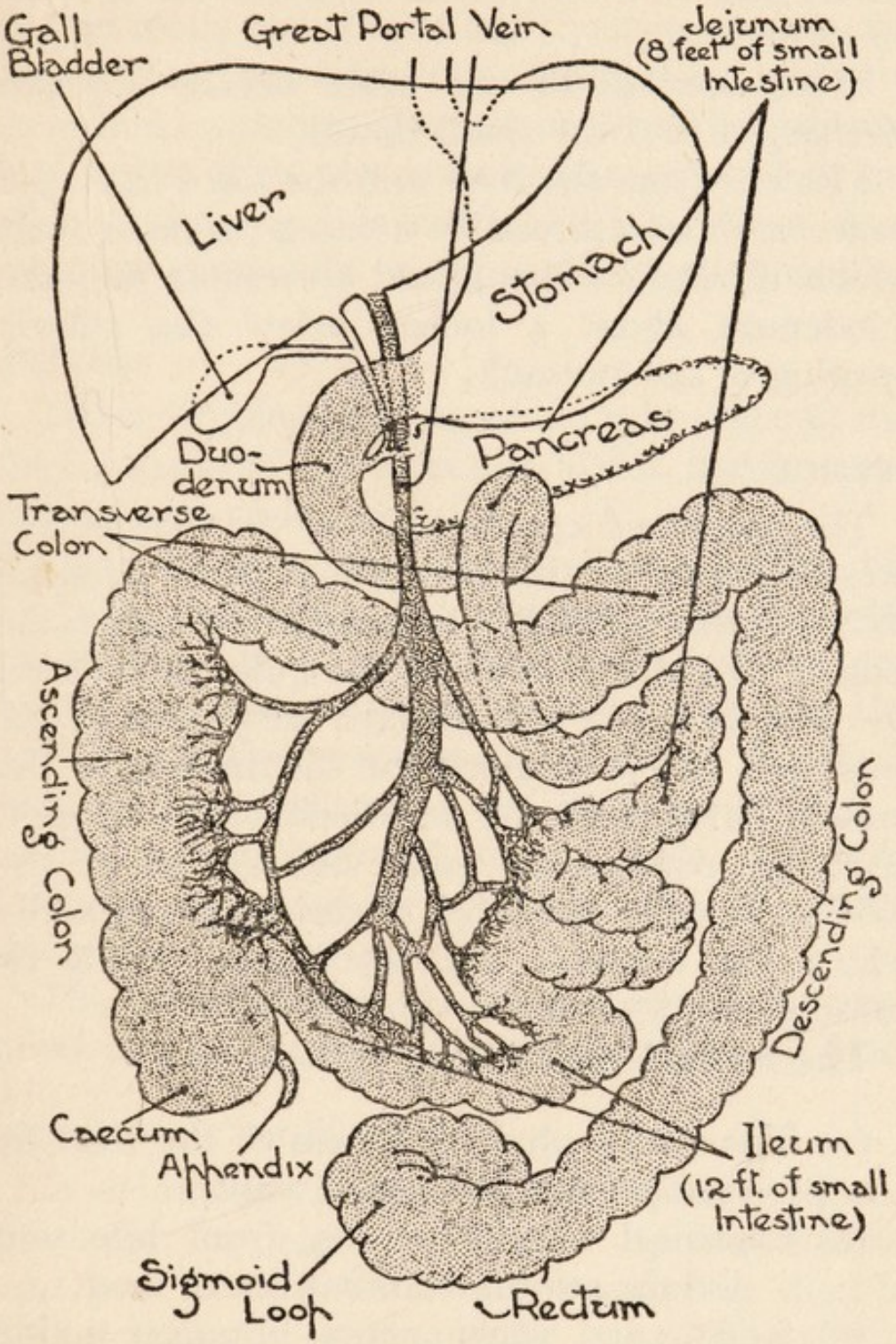
DIAGRAM OF STRUCTURE OF SMALL INTESTINE



of which are disposed more or less in a figure-of-eight path. The mucous membrane of the stomach carries the gastric glands which secrete the various constituents of mixed gastric juice.

In the small bowel the mucous membrane is greatly modified. It carries tubular glands secreting intestinal juice, and also minute finger-like projections termed the villi, concerned in the absorption of digested products.

In the large intestine the villi are absent, and the glands of the mucous membrane mainly secrete the viscous substances termed mucus,


Gall Bladder
Great Portal Vein
Jejunum (8 feet of small Intestine)
Liver
Stomach
Duo-denum
Pancreas
Transverse Colon
Ascending Colon
Descending Colon
Caecum
Appendix
Ileum (12 ft. of small Intestine)
Sigmoid Loop
Rectum

which acts as a sort of lubricant to the moving bowel contents.

The secretions of two other organs are also discharged into the small bowel.

The bile from the liver and the juice from the pancreas or sweetbread flow into a common duct, which discharges the mixed secretions into the duodenum about 4 inches below the pyloric opening of the stomach.

PERISTALSIS

The combined contractions of the involuntary muscle layers of the alimentary canal produce characteristic worm-like contractions by which the food is moved within it. In the gullet and bowel the general result is a forward movement of the food, but in the stomach the distribution of the muscle fibres, with the additional figure-of-eight layer, in conjunction with the closure of the pyloric muscle, produces a churning effect, by which the contents are thoroughly mixed by constant motion with the gastric juice.

The natural stimuli to peristalsis are—

(1) The direct physical action of the food by contact with the bowel walls.
(2) Chemical stimuli arising from bile and certain soluble constituents of food.
(3) Reflex and other nerve impulses acting directly on the muscles.

We thus visualize digestion as the slow passage of food along the alimentary canal, mixing in the various sections with the appropriate digestive secretions, which in the end convert the proteins into amino acids, the carbohydrates into dextrose, and emulsify and saponify the fats; these final products eventually reaching the blood-stream.

ENZYMES

The molecular changes which take place in the food principles are brought about by ferments termed enzymes.

These ferments usually act on the indiffusible foods by duplication into smaller molecules with the assumption of water, the process being termed hydrolysis. The action is strictly limited by the acid or alkaline reaction of the media in which they are functioning and also by temperature.

The human enzymes, for example, will only function properly at approximately the body temperature of 100° F.

The table on pages 42 and 43 gives the more important human enzymes and their action on food.

SUMMARY OF DIGESTION

In the Mouth.—Food mechanically reduced and prepared for gastric digestion by mastication and part of the starch converted into dextrin and maltose. Proteins and fat not acted on, and sugars merely dissolved.

Alimentary Canal Section	*Digestive Juice*	*Ferments and Active Principles*
Mouth	Saliva	Ptyalin
Stomach	Gastric juice	Rennin Pepsin Lipase
Liver (small bowel)	Bile	Bile salts (Act with lipase of pancreatic juice)
Pancreas (small bowel)	Pancreatic juice	Trypsin Amylase Lipase (Acts with bile salts)
Small bowel	Intestinal juice	Erepsin Invertase Maltase Lactase
Large bowel	Secretion of mucus	No digestive ferments

Reaction of Juice	*Food Acted upon*	*Products of Digestion*
Neutral	Starch	Dextrin and maltose
Acid (HCl 0·2 per cent)	Milk	Milk curdled
	Protein	Proteins into Peptones
	Fat	Slight breaking up of fat
Neutral or slightly Alkaline	Fat	Fats emulsified and partly split up into fatty acids and glycerine
Alkaline ($NaH(CO_3)_2$)	Protein	Peptones and amino acids
	Starch	Dextrin and maltose
	Fats	Emulsified and part split up into fatty acids and glycerine
Alkaline	Proteins Gastric peptones	Amino acids
	Cane sugar	Invert sugar, i.e. dextrose and laevulose
	Malt sugar	Dextrose
	Milk sugar	Dextrose galactose
—	Absorption of water and contents concentrated for excretion	—

Stomach.—Digestion of starch continues for a very short period. Milk is curdled by rennin. Proteins are converted into peptones by pepsin in conjunction with its concomitant hydrochloric acid. When the percentage of HCl falls below or rises above the optimum of 0·2 per cent peptonization is inhibited. Thus conditions of achylia (low acid) or hyperchlordria (high acid) delay gastric digestion.

A small proportion of fat is acted on by the ferment lipase, facilitating the unmasking of protein for peptonization in single foods containing adipose tissue.

Small Bowel Digestion.—The acid contents of the stomach (chyme), which are passed through the pyloric opening into the small bowel, are first neutralized and finally rendered alkaline. Ordinarily the contents consist of undigested starch, protein, fat, various sugars derived from food, malt sugar from salivary digestion, and peptones from gastric action.

These various food principles mix with and are acted upon by bile, pancreatic juice, and intestinal juice throughout the entire length of the small bowel to the ileo-caecal valve, resulting in the production of dextrose, amino acids, emulsified fats and soaps, according to the table given, with a residue of indigestible matter, chiefly as cellulose and fibre.

The contents of bowel as they pass through the ileo-caecal valve into the caecum are of a thick

soup-like consistency, the solids consisting mostly of indigestible matter.

Absorption.—Only diffusible bodies like alcohol, dextrose, and amino acids, dissolved in water are able to pass through the capillary walls, and all mucous membranes are capable of some degree of absorption.

To a small extent absorption takes place in the stomach, but generally the diffusible products of digestion are taken up by the villi and the mucous membrane of the small bowel is lined with myriads of these minute finger-like projecting structures. Each villus has a blind central tube, termed a lacteal, which joins the lymph vessels in the wall of the bowel, and a blood supply distributed as a fine network of capillaries in the tissue surrounding the lacteal.

As the bowel contents move over the villus coat the dextrose and amino acids are absorbed and diffuse through the capillary walls directly into the blood-stream, while the emulsified fat particles pass into the lacteals and thence into the lymphatic system.

The drainage from the bowel lymphatic system is collected into the receptaculum chyli, thence up the thoracic duct to join the venous system on the left side of the neck.

It is important to note here that the bowel blood is collected by the portal vein which serves the liver, in which organ the products of digestion,

e.g. dextrose, amino acids, etc., undergo further modifications before passing into the general circulation.

Large Bowel Functions.—The mucous membrane of the large bowel is characterized by a very abundant capillary system and gives an extensive absorbing surface. The glands are for the most part of the mucous type, the secretion acting as a surface lubricant to the moving contents.

The chief function of the large bowel is to consolidate the faeces to a suitable consistency for excretion and this is effected by the absorption of water. In constipation and intestinal stasis, the stagnant faeces undergo microbic fermentation and decomposition with the formation of toxic bodies which are absorbed *pari passu* with the water into the systemic circulation, producing general toxaemia, with its repercussions on the incidence of rheumatism and anaemia, etc, hence the importance of maintaining normal bowel action, by including a proper proportion of roughage in the form of whole cereals, fruit, and vegetables and an optimum of vitamin B.

Some Hints on Digestion.—Good digestion is favoured by—

(1) Thorough mastication of the food. Eat slowly and appreciatively.
(2) Avoidance of over-eating.
(3) Allowing suitable intervals between meals

to give the stomach time to rest and prepare for the next meal.
(Generally three meals are sufficient with about three to four hours' intervals.)

(4) Avoidance of an excess of beverage at the meal time.

(5) Resting from either mental or manual work after a meal.

(6) For sedentary workers the principal meal being taken in the evening, when the day's work is over.

(7) A warm glassful of diluted grape, orange, or lemon juice on rising.

The psychological aspect is also important. The tasteful presentation of savoury meals, with enticing odours, and served so as to appeal to the aesthetic senses, have important repercussions on the secretion of the digestive juices and the enjoyment of food.

Food served on artistically decorated coloured crockery is much more appealing than when just plain white plates are used, and costs no more. Spotless napery, shining glass and cutlery, and a few flowers, make all the difference in the art of dining.

Even in the humblest of homes food can be properly cooked, and served in an appetizing form, and a spotless dinner table and appointments is not the privilege of the rich, but is within the reach of every housewife.

It is well before dining to drop the watchful guard and mental strain which marks our working hours, for mental irritation has a marked inhibitory effect on salivary and gastric digestion, and to those who approve, a moderate accompaniment of alcohol (either as wine, beer, or whisky) has a marked effect in promoting this necessary relaxation.

One fruit-juice cocktail, with a modicum of alcohol in the form of gin, whisky, or sherry, is perfectly harmless, and will often work wonders in the way of restoring the mental outlook from the tension of business activities to the more tolerant and good-natured frame of mind, suitable for our hours of relaxation and the enjoyment of a properly cooked and perfectly served dinner. Harmonious, interesting, or even inconsequent conversation, too, is the natural concomitant of the true art of dining, raising the mere vegetative function to the higher level of mental enjoyment.

IMPORTANT FOODS

Cereals and Bread.—For ages the cereals and their products have formed the main staple foods of millions of people, and bread is the chief food of civilized nations.

In tissue-building qualities, however, they fall far short of complete efficiency, as the percentage and quality of the proteins is low. The cereals also lack fat, the two richest being oats (5 per cent) and maize (4·5 per cent).

The cereal proteins do not reconstitute into human tissue economically, and in this respect are greatly inferior to those derived from animal sources.

For example, as the sole source of nitrogen it would require 40 oz. of the main wheat endosperm protein gliadin to reconstitute 1 oz. of muscle protein.

Of the cereals the proteins of rice appear to be best and those of maize the worst from the biological standpoint.

It is significant that native races use the grain foods in their entirety, and thus gain the advantage of the better-class proteins, and the vitamins of the germ and integument.

White bread, made from endosperm white flour from which the germ and bran have been eliminated, forms one of the main staple foods of this country, but it cannot be regarded as a good tissue-building ration. In the first place the percentage of protein is very small, averaging about 6·5 per cent according to Hutchison, and as already pointed out the endosperm protein is poor in tissue-building properties.

White bread also lacks the vitamins and phosphates of the germ and bran. The chief solid constituent of bread is starch, forming nearly 50 per cent of the total weight, and is therefore a good source of carbohydrate fuel and energizing food.

The chief value of white bread lies in the presentation of starch in a most palatable and convenient form for every meal. The panary processes, with oven-baking, develop a flavour which does not result in satiety, however much is eaten, and the physical form in the shape of a vesiculated loaf is convenient for keeping and serving purposes.

Bread undoubtedly provides one of the cheapest sources of carbohydrate calories in general mixed dietary, but when it forms the staple food of children, under economic conditions which do not allow of the provision of compensating foods, containing animal protein, calcium phosphate, and vitamin-bearing fats, malnutrition and backward growth are almost certain to result.

Wholemeal bread made from the entire wheaten berry is slightly better in protein than white bread, and yields a higher content of calcium phosphate, and also provides vitamin B.

The roughage in the form of bran also acts as the necessary ballast in bowel action, and helps in this way to counteract the constipation produced by the refined character of modern cereal foods, and a common deficiency of vegetables and fruit in the diet.

Notwithstanding this, however, even wholemeal bread is still mainly a fuel food and requires, like white bread, supplementary rations of animal protein and fat in the form of butter, eggs, milk,

meat, and fish to balance up the diet in the tissue building and growth factors that white bread lacks.

Milk.—Cow's milk is one of the few complete foods, providing all the proximate elements necessary for the maintenance of life. In cow's milk these elements are in the exact proportions needed for the growing body of the calf, but in relation to the human the ratios are not correct.

The proteins of milk are of A1 quality, reconstituting into human tissue with very little waste, and milk provides a rich supply of calcium phosphate, with an optimal proportion of fat and also carbohydrate in the form of milk sugar.

Fat-soluble vitamins A and D and water-soluble vitamin B are also present in notable potency.

Two of the greatest drawbacks to milk as a daily food are the dangers of milk-borne disease and the coarse character of the rennin curd, the latter presenting considerable digestive difficulty to the human system.

The pasteurization of milk—holding milk for thirty minutes at 145° F.—overcomes to a great extent the first objection, as the process destroys most of the pathogenic germs, including the active tubercle bacillus, thus giving protection against milk-borne disease, and this safety is achieved without appreciable loss of nutritive properties. In the roller powdering of milk also

the pathogenic flora are destroyed without vitiation of the vitamin content.

The digestive difficulty in raw milk cannot be naturally overcome, though it is minimized by drinking milk very slowly, or taking through a straw.

It is, however, solved by the roller process of milk powdering, which produces a flocculent pin-head curd, in the reconstituted milk, in contra-distinction to the solid junket curd of raw milk.

Milk powder is used in enormous quantities for infant feeding and for other dietetic and culinary uses.

There are two methods of drying milk:

(1) The spray process.
(2) The roller process.

In the former the milk is sprayed into hot air chambers, the dried milk falling to the bottom as a fine powder, and in the latter it is fed on to a revolving steel roller, heated internally by steam, the dried product coming off as a thin film, to be subsequently powdered by passage through a sifting machine.

The former process produces a powder which gives a very good emulsion, but some of the vitamin C potency is lost. In the roller process the emulsion is not quite so perfect, but there is no measurable loss of vitamins according to Hess

and Unger, and a much higher degree of bacteriological purity is attained.

Milk powder, especially if prepared by the roller process, is sterile to pathogenic organisms and is thus quite safe for infant feeding and child dietary, and in addition it presents the curd in the same digestible physical condition as breast milk, which explains the great success of roller dried milk powder as used in the Infant Welfare Centres and the Infant Departments of our hospitals.

We are low down in the list of milk-consuming nations, and it is certain that if the milk consumption in this country could be increased, especially among children, it would mean a substantial improvement in the physique and the good health of the nation.

Butcher's Meat and Fish.—Butcher's meat, especially ox beef, is biologically the most economical of all proteins in adult dietary.

The amino acid derivatives are complete in range, and are in much the same proportion as those yielded by human tissue. It thus reconstitutes into human cells and tissues with the minimum of waste.

Fish dietetically may be divided into two classes:

(A) Those in which the fat is stored in the liver (white fish).

(B) Those in which the fat is disseminated generally throughout the body (fatty fish).

The former group comprises generally the white fish, e.g. cod, halibut, haddock, whiting, plaice, sole, etc., while the latter includes the salmon, mackerel, herring and its cured forms, the kipper, bloater, etc.

The fatty fish yield fair quantities of vitamin-containing fats, in addition to high quality protein, while the white fish provide chiefly protein without fat or vitamin.

The liver oils from the white fish, e.g. cod and halibut, are very rich in vitamins A and D, and are most valuable adjuncts in infant and child dietary as supplementary rations for the prophylaxis and cure of rickets and the maintenance of normal growth.

It may be reasonably concluded that our modern conditions of dietary demand a daily ration of animal protein to supplement the low value of cereal and vegetable protein, and especially is this necessary in child dietary to provide the essential amino acids in economical proportions for the growth of the muscular and glandular systems.

Fruit and Vegetables.—Fruit is a food which appeals irresistibly in appearance, flavour, and table serving to the aesthetic senses, and its

inclusion in our daily dietary is necessary for good health.

The chief constituents are water, sugar (dextrose and laevulose), fruit acids (citric, malic, tartaric), salts, cellulose and flavouring bodies with water-soluble anti-scorbutic vitamin C.

In the first place fruit is a natural thirst-quencher by reason of the high percentage of water it contains in the form of juice, and the sugar provides a "petrol" fuel food, which is assimilable without digestion.

The fruit acids have most refreshing gustatory effects on the palate, and are most useful as diuretics and solvents of the products of nitrogenous metabolism.

Contrary to the common idea, fruit though acid does not increase the acidity of the blood and actually decreases the acidity of the urine, promoting the excretion of waste products.

The salts yield valuable additions of potassium, calcium, and magnesium to the dietary.

The soft cellulose of fruit is a valuable aid to natural peristalsis, and a generous daily ration is one of the best means of preventing constipation with its sequelae of injurious systemic toxaemia, due to the absorption of toxins in the large bowel from the stagnating and fermenting faeces.

The citrus fruits (orange, lemon, grape fruit) are especially valuable as thirst-quenchers and blood purifiers. A glass of warm, diluted orange,

grape, or lemon juice on rising is a very substantial aid to good health.

The salad and cooking vegetables are also valuable on account of the roughage and mineral substances they supply to the body.

Sodium, potassium, calcium, magnesium of iron, and other bases are found in vegetables, and they are all necessary for the mineralization of the serum and corpuscles of the blood, the tissues and the digestive juices, and a generous daily ration of seasonal salad and/or green cooked vegetables would do much to maintain the mineral balance of the blood and tissues.

Canned Foods.—The canning industry has travelled a long way towards precision and safety since the days of Appert, the inventor of the process, and the world owes a debt of gratitude to the band of research workers who have made it possible for the "fruits" of the earth to be distributed to non-orchard countries far removed from the zones of fruit production.

This conservation of seasonal harvests of fruit and fish, by introducing a variety of foods to our tables, available at all times, independent of climate or season, has greatly raised the standard of living and brought into our national dietary a most welcome addition to our choice of salutary and appetizing foods.

The English canners are particularly to be congratulated on the advances they have made

during recent years, and the home-produced brands of fruits, vegetables, pastes, fish, and various meats, bear evidence of the highest attainment in precision, of manufacture, safety, and gustatory properties in dietary.

Modern canning processes provide for the proper harvesting and grading of the fruit and vegetables, for rapid sterilization, and for cooling without oxidation, thus preserving the vitamin content of the raw food.

The internal lacquering of the tins, and the use of the double seaming method of hermetically sealing without the use of solder, eliminates all possible risk of metallic contamination.

On the authority of Sir William Willcox, the eminent toxicologist, it can be stated without qualification that the dangers of food poisoning from the consumption of canned foods is negligible, and that our English brands can be put on our tables with the greatest confidence.

Practically all fruits, including strawberries and most vegetables, are now canned by the English firms, providing us with these delicious and salutary dietary adjuncts throughout the entire year.

THE KILO-CALORIE

This term is a thermal unit of measurement and implies the heat required to raise 1 litre of water through 1° C. It is used to express the

comparative energy of foods when completely oxydized in the body.

The net calorie values of the proximate principles of food are as follows:

1 gram of fat	= 9·3 calories
1 gram of alcohol	= 6·7 calories
1 gram of protein	= 4·1 calories
1 gram of carbohydrate	= 4·1 calories

Thus 1 gram of fat when completely oxidized will produce sufficient heat to raise the temperature of 1 litre of water by 9·3° C., and so on with the other food factors.

In relation to fat, protein, and carbohydrate it is important to realize that any surplus over immediate wants can be stored in the body against subsequent requirements, but alcohol cannot be so conserved, any excess over the current capacity for oxidation being ultimately excreted.

In a balanced diet for an average adult in light occupation, the calories should be approximately distributed as follows:

Fat	30 per cent
Protein . . .	17 per cent
Carbohydrate .	53 per cent

As the work increases additional calories are required, mainly from the carbohydrate sources. The protein calories are the most essential, of

which from 500 to 600 are required daily, supplied by 4 to 5 oz. of dry, good-quality protein.

The following table gives an approximate estimation of the number of required calories for the conditions specified:

	Calories
Adult *Basil metabolism*: The heart, respiratory and bowel muscles in action with the maintenance of the bodily temperature at 98·4° F.	1,500
Adult of average weight and in sedentary vocation.	3,000
Adult in light work up to	4,000
Adult in hard work up to	5,000

Various conditions modify the optimal conditions of an average normal diet, and the more important of these may now be considered.

SEX

Generally the male requires one-tenth more total calories than the female.

CLIMATE AND SEASON

Climatic conditions affect the rate of the loss of heat through the skin and lungs. In cold countries the loss is rapid, and therefore a compensation must be made in the diet by a generous supply of fat, the highest fuel-value food for the production of heat. The Eskimo, for example, will easily consume and utilize one or two pounds of blubber daily, while the coolie's ration in the form of rice, fish, and occasionally a little meat only provides an ounce or two.

Generally, it may be formulated that in cold seasons and climates the fat calories must bear the main burden of the increase required.

PREGNANCY

A deficiency of calcium phosphate and iron, high-quality proteins, and vitamins A and D in the mother's diet lays the foundations in the foetus of anaemia, dental diseases, and rickets.

The diet of the mother should not only provide for the maintenance of her own body, but also the extra ration required by the foetus, and this is best supplied by a daily intake of high-quality animal protein, dairy produce—eggs, milk, butter —wholemeal bread, with fruit, green salad, and vegetables.

Liver and spinach should be included two or three times weekly for the iron and copper content, to provide the iron reserve stored in the liver of the foetus.

THE NURSING MOTHER

During the nursing period the mother's diet should provide the extra mixed calories for the provision of breast milk.

A baby weighing 7 lb. at birth will commence after a few days with a requirement of about 350 calories, increasing at six months to about 600.

Here again the mother's daily diet should include high-quality animal protein for tissue

building, milk and wholemeal bread for the supply of calcium phosphate and vitamin B, butter and other animal fats for the provision of vitamins A and D. Fruit and green vegetables in season will supply vitamin C and the other essential mineral salts required for lactation.

BEVERAGES

Beverages play an important part in human dietary, and supply in very pleasant forms the required extra separate ration of water.

They may be classified into—

(1) The caffeine and allied group (tea, coffee, cocoa).
(2) Alcoholic liquors (beer, wine, and spirits).
(3) Fruit beverages.
(4) Mineral waters.

The Caffeine Group.—The members of this group contain caffeine or allied alkaloids, which act as nervine and cardiac stimulants, and in moderation may be regarded as harmless dietary adjuncts giving a very welcome exhilaration at times of the day when the tired brain and nervous system require a fillip.

The infusion of tea contains, among other constituents, caffeine, volatile oils, and tannin compounds.

The caffeine confers the exhilarating and stimulating properties, while the tannin compounds

may be regarded as the undesirable constituents, having in excess a definitely inhibitory effect on digestion, giving astringent properties to the infusion.

In the preparation of tea, the chief object is to ensure an optimum of the caffeine, with a minimum solution of tannin compounds, and inasmuch as caffeine is more soluble than tannic acid, this desideratum can be reached by limiting the time of infusion to five minutes for China tea and three minutes for Indian, Assam, and Ceylon types.

Hints in Tea-making.—(1) Purchase the best quality of tea that the means will allow. Young leaves, especially in the tips and edges, contain far less tannin than the older foliage and stalks, and the finer qualities of tea consist mainly of the former.

(2) Allow one slightly heaped teaspoonful of leaves for every person and "one for the pot."

(3) China teas generally give a less tannin content than the Indian varieties.

(4) Use a non-metal teapot and heat before putting in the tea.

(5) Use water that has just come to the boil, and pour into the teapot while boiling.

(6) Infuse China tea for five minutes and other teas three minutes.

(7) Serve to emptiness, and do not add hot water for "a second brew." The second cup contains very little of the stimulating caffeine, but a comparatively high percentage of tannin compounds.

(8) If a second round of cups is desired, use two teapots of the required capacity. Make sufficient tea for two cups for each person in one teapot and infuse as usual. When brewed pour the made tea through a strainer into the second heated teapot. This strained infusion can be kept under the cosy, or on the hot plate, for any length of time without increase of the tannin content.

(9) The addition of milk to tea softens the astringent character, the casein combining with the tannic acid to form a protein tannate, thus partly nullifying its astringent effects.

Tea in moderation, and properly prepared, is harmless, and may be considered a desirable addition to our daily dietary, rousing the nervine and cardiac functions, either in the morning, after the quiescent sleep period, or in the afternoon, when the brain is just a little fagged, needing a slight stimulant to complete the day's routine.

Tea in excess, especially if improperly prepared,

is harmful to the nervine, cardiac, and digestive systems.

Coffee.—Coffee differs from tea, mainly in gustatory properties, having a different flavour, and being much more fragrant, and on this account it is the proper concomitant to the after-dinner cigar.

The physiological effects are much the same as in the case of tea, the caffeine acting as a nervine and cardiac stimulant, it being a matter of individual taste as to which is served at breakfast.

Apart from the added sugar, milk, or cream, the nutritive value of tea and coffee is negligible.

Cocoa.—Cocoa stands in a somewhat different category to tea and coffee inasmuch as it has a food as well as a stimulating value. In addition to caffeine, which is present in small quantities, cocoa also contains an allied alkaloid known as theobromine.

The beverage as prepared by hot water contains notable proportions of fat, protein, and carbohydrate, and recent researches have shown that cocoa fat has a vitamin A and D value equal to that of milk butter, and contains a notable percentage of the organically combined phosphorous lecithin.

The flavour of cocoa is characteristic and quite distinct from that of tea and coffee, but it is not so stimulating. Milk beverages with a cocoa or chocolate basis, like chocolate milk, are

especially valuable in child dietary, and combine nutritive value with mildly exhilarating and tonic properties.

Alcoholic beverages.—From earliest times alcoholic beverages have occupied a permanent place in human dietary and we can safely assume "that ethylic alcohol is by far the most important constituent of alcoholic liquors from the point of view of its action."*

Alcohol is the result of the fermentation of sugar by yeast, with a concurrent production of carbon dioxide, and its physiological action is that of a narcotic, producing inhibition or relaxation in the cerebral centres and many nervine functions.

It has also an energy value as a fuel food of 6·7 calories per gram, but in this relation it should be noted that it can only be so used for current metabolic needs. The capacity of the blood for complete oxidation is strictly limited, and any surplus above the optimal capacity exerts a definite cumulative narcotic effect on the brain and nervine system as the surplus in the blood increases. Professor Mellanby puts this maximum capacity in the average adult at about 10 cb.c. per hour, equal to about one-third of an ounce.

"But in truth men in general do not drink alcoholic beverages because they regard them as

* *Alcohol: Its Action in the Human Organism*, p. 5, H.M. Stationery Office, 1918.

'foods.' The use of alcohol is dictated by the fact that to the majority the taste of alcoholic beverages and the immediate effects are agreeable." In these words the place of alcoholic beverages in our dietary is admirably summed up in the brochure already named as mainly a psychological factor in diet. It is stated that the effect of alcohol is to bring about a relaxation of the watchful care which the modern stress of life necessitates over our words, judgments, and actions, during our working day. The cerebral tension is relieved, and the brain is in a more receptive condition for the lighter impressions of life which should mark our recreative hours, and our outlook certainly becomes more tolerant and enjoyable. It is, of course, entirely a matter of individual choice and opinion as to whether this channel of relaxation is approved and adopted.

We may now consider briefly the various kinds of alcoholic beverages.

Malt Liquors.—Beer is produced from fermented barley malt worts, and in addition to the alcohol content contains a notable proportion of dextrin and malt sugar, so that it may be considered a true food beverage. The percentage of alcohol varies from 3 to 6 per cent by volume.

Wines.—Wines are produced by the fermentation of the juice of the grape or other fruits.

In the natural grape wines, the maximum alcoholic strength is about 14 per cent, but port

and sherry, being fortified with spirit, may contain as much as 20 per cent of absolute alcohol.

In addition to alcohol the sweet wines contain small quantities of grape sugar, but in the "dry" kinds the amount present is negligible.

The "light" natural dinner wines contain from 9 per cent to 12 per cent of absolute alcohol by volume.

Cider.—Cider is the fermented juice of the apple and in addition to about 4 per cent of alcohol contains natural fruit acids and salts with a little sugar. It is one of the most salutary of alcoholic beverages.

Spirits.—Spirits are the distillates from fermented liquors and may be regarded as solutions of alcohol. Brandy is produced from wines, rum from cane sugar, gin and whisky from grain.

Of the spirits, the home-produced Scotch whisky is the most popular. It is distilled from fermented barley *malt* worts in pot stills, and contains in addition to common alcohol a number of secondary constituents—higher alcohols, aldehydes, ethers, and organic acids—which confer the characteristic aroma and flavour. The absolute alcohol content is 40 per cent by volume.

Raw Scotch whisky is unsuitable for dietetic purposes, being harsh and fiery to the palate, but when matured in wooden vats and/or sherry

casks it mellows and softens, and develops the pleasing gustatory properties of flavour and aroma which make matured Scotch whisky the favourite of connoisseurs.

In using whisky as a beverage a matured blend should be chosen and the spirit should be taken in proper dilution.

In this relation it should be noted that no whisky is allowed out of bond under three years and the well-known proprietary blends are bottled at from seven to ten years old.

Alcoholic beverages should be taken in strict moderation, i.e. within the optimal metabolic capacity of the individual, as excessive use, in common with many other foods and drinks, is deleterious to health, and may even produce actual disease.

They are most useful when taken in conjunction with food. A fruit-juice cocktail, with a modicum of spirit before dinner, is a pleasant aperitif, and the properly cooked and well-served meal is nicely rounded off to those who approve by a Scotch whisky and soda or a glass of wine or beer.

I do not venture to express an individual opinion on the very controversial subject of the harmlessness or otherwise of moderate drinking, but am content to quote the unanimous report of the Advisory Committee, appointed in 1916 by the Central Control Board (Liquor Traffic) fully representing the opposing views, to consider the

effects on health of the consumption of alcoholic beverages.

The following extracts are to be found on pages 131, 132, and 133 of the report:

> "We deal here solely with the physiological aspect of the alcohol question and our consideration of this aspect leads us to recognize that the agreeable effects which the majority of people experience from the use of alcoholic beverages can be produced by doses of alcohol moderate in quantity and taken in adequate dilution and at sufficient intervals, which will not in normally constituted persons be attended with appreciable risk to physical or mental health.
>
> "The temperate consumption of alcoholic liquors in accordance with these rules of practice (in dilution and not in excess) may be considered to be physiologically harmless in the case of the large majority of adults, and this conclusion is fully borne out by the massive experience of mankind in wine- and beer-drinking countries."

Fruit Juices.—Of late years the use of bottled fruit juices, diluted either with plain or mineral waters, has come into vogue, and this will have an important influence on health, giving us the advantage of the salutary properties of fruit at all times of the year. Orange, lemon, and grape fruit juice are available.

Mineral Waters.—These drinks are mainly used as dilutants for other beverages, e.g. spirits, wine cups, iced phosphate drinks, ice-creams, etc., and the gas CO_2 gives sparkle and tonic properties to the liquid. The soda, potash, and lithia varieties are also beneficial in furnishing alkaline salts to the blood.

We might include among this class ginger beer, brewed from sugar with ginger and containing a small proportion of alcohol, and the non-alcoholic aromatic beverages like ginger ale.

These are useful in providing thirst quenchers appealing pleasantly to the gustatory senses.

THE PRINCIPLES OF NUTRITION

by

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CHAPTER III

The Principles of Nutrition

I—The Essentials of a Balanced Dietary

Dietetics, properly speaking, is the scientific study of nutrition. It has to consider the necessities of the body, not merely as a machine requiring fuel, but as a sentient being with likes and dislikes, and all the psychological factors which make one man's meat another man's poison. It has to consider the circumstances and conditions of life, otherwise it will be of no practical use. Too many food theories based on the behaviour of rats or savages fail when applied to office girls or the unemployed. It requires a sound knowledge of chemistry, physiology, and psychology as well as other sciences. While useful analogies can often be derived from other realms of nature, dietetics is complex enough when concentrated on a particular race or class of mankind, and no clarity of thought can be attained by diffusing the study to aim at everything and thereby hit nothing.

Food contained in foodstuffs should consist of elements which the body requires in its construction or reconstruction. Many waste materials, including cardboard, could be truthfully advertised as slimming because they contain nothing of use to the body, but why eat them? Food

faddists have been known to extol almost every variety of material as the perfect food on which they themselves live and grow healthy, but they should know better than to ask others to submit to the same regime.

The first lesson to learn in Dietetics is the infinite adaptability of the human body. The history of mankind is the history of a being all but immortal even in the physical sense that can endure privation or plenty, prodigality or puritanism, pain or pleasure, without breaking. Nations have existed on inadequate food for centuries before fading away, others have made their belly their god, until at long last they rot their bodies with food-poisons. Small wonder that individuals may seem to defy the principles of dietetics with impunity.

Some are foolish enough to imagine that a lifetime of careless feeding can be remedied by a shilling bottle of medicine. Hungry England is spending money on abolishing slums, rebuilding Waterloo Bridge, the Insurance Act with rivers of drugs—all good and useful in their way, but impotent to promote the welfare of humanity. Build bonny babies to be the fathers and mothers of to-morrow of a race resistant to disease, immune to the stress and strain of modern life; build on rock instead of sand. Base your principles of building on sound common sense. Don't give him food because he likes it, unless it is good

for him. If he cries for a sharp knife you would scarcely let him have that. Don't justify the diet of the poor because they are used to it: 400,000,000 people exist on rice because they cannot afford better. Don't base your dietetic theories on the supposed habits of savages you have never seen. Their freedom from disease is proportional to their distance from properly organized medical investigations.

Objection has been made to the study of the human body as a machine, but surely we may rightly do so if we realize that this is one aspect only. An engineer knows by inspection the difference between a petrol, heavy oil, or steam, engine. If one proposed to run a petrol engine with steam he would naturally be indignant. The body is less particular and more adaptable and is often given the wrong fuel by design or error. Man possesses jaws capable of tearing like carnivora or grinding like herbivora; a stomach adapted to digest flesh—a single bag, not multiple. If man were designed to live on a vegetable diet his gastric anatomy would be entirely different. He would need an enormous large intestine where vegetable masses could ferment. A horse empties his bowels every three hours and may pass 40 lb. faeces a day. The relative length of the body to the alimentary canal is indicative of dietetic adaptability: cat 4 times, man 5, horse 13, camel 16, sheep 30. Again stomach capacity

tells the same tale. Cat one quart, dog 7, man 14, horse 220, ox 360. Man then is intended to eat partly a meat diet.

What then are the constituents of that diet? Obviously the constituents of the body in the proportion in which they are needed to supply elements for growth, repair, heat, or energy. Chemically these constituents belong to the following groups: protein, fat, carbohydrate, vitamins, roughage, mineral salts, and water.

How are these chemically translated into body tissues? These complex changes of disintegration and rebuilding are known as metabolism. The rate at which they take place is called the metabolic rate and the minimum rate is known as basal metabolic rate. The unit of measurement is a calorie defined as that amount of heat required to raise 1 grm. of water through 1° C. No system of dietetics can be scientific if it ignores the accurate measurement of metabolism, but this is not meant to suggest that such measurement is the only basis of advice, for roughage, vitamins, mineral salts, and water do not come within the computation of calories, yet are essential ingredients of any dietary. Let us now examine these dietary constituents in detail. Proteins form the principal part of muscles, bones, and many other tissues, and as a source of nutriment they are of unique importance, for they and they alone can build and repair the tissues. These proteins are

composed of substances known as amino acids, which in their turn form the basis of many secretions in the body. Without all these amino acids life cannot continue. With insufficiency life becomes a mere existence. Thus we have, at one end of the scale, meat and milk proteins containing all the essentials, and at the other end gelatine, a protein almost devoid of nutriment. Often the chief nutriment in calve's foot jelly is added sugar, and this may be just as well, for the gelatine content must certainly be the most expensive and roundabout way for any poor invalid to obtain the strength he needs.

Carbohydrate produces heat and energy—these two factors cannot be divorced, as both are characteristic of all life. Just as proteins vary widely in their nutritive value, so do carbohydrates. Some sugars can be utilized to the extent of 100 per cent. Starches are in an intermediate place. Cooked cellulose is almost incapable of digestion by human beings, yet is included in the tables of food values as part of a "carbohydrate percentage." It is uneconomical and throwing an added burden on the body to eat much cellulose. Roughage is more advantageously obtained in raw salads where the mineral salts are still retained. Carbohydrates need, then, to be wisely selected and to be increased *pari passu* with the amount of work of the subject. A practical application of this teaching is that a navvy should

eat the potatoes, Yorkshire pudding, and gravy for energy, while his children eat the meat for body building. *Fat*, if it contains vitamins A and D, forms fuel and also keeps one fit. These vitamins protect from infection and enable the sun's rays to activate ergosterol in the skin. According to their content of these vitamins, fats have been classified into "good" and "bad." Good fats are butter, cream, cod-liver oil, suet, and dripping; bad fats are lard, bacon fat, almond, olive, and cottonseed oils. The old-fashioned idea of fats producing heat is incorrect. All energy produces heat, and apart from energy heat is not normally produced in the human body by internal measures. A certain amount of fat is advantageous even in summer, as we shall see when we study the matter in detail.

Vitamins are chemical substances found abundantly in fresh foods, but with difficulty in preserved foods. Their importance has, however, been greatly exaggerated, and it is never necessary for persons in normal health to take vitamin concentrates. Indeed many such preparations contain very little vitamins.

Roughage is another constituent of every dietary which has been greatly overrated. People now eat the contents of pin-cushions and mattresses in an effort to supply more roughage. The average diet contains quite enough for ordinary purposes.

Water needs greater boosting than it gets. What with the prevalent teaching not to drink with meals, use less water, and so on, we are apt to concentrate our excretions unduly and fail to rid the system of poisonous substances. Some people imagine that if you drink with a meal, your food swims about in a watery waste in a vain hope of reaching the side walls and getting digested. Actually fluid is quickly squeezed out of the stomach by muscular contraction, and it is only in such abnormalities as an atonic stomach that care has to be exercised as to drinking with meals.

Lastly, mineral salts have to be considered as they form the basis of teeth and bone as well as being necessary constituents of all the body fluids. They are plentiful in uncooked foods, but are easily washed away and lost in prepared foods.

II—Protein and Body Building

There are two possible uses for proteins in human metabolism. Primarily they are required for tissue formation or body building. Secondly they can be partially converted into carbohydrates and thus form a source of energy.

Chemically, protein consists of the elements carbon, hydrogen, nitrogen, oxygen, and sulphur, often phosphorus as well, and these are built up into amino acids—chemical compounds which

form the basis of protein structure, just as bricks form the structural units of a building.

The chemical consideration of protein, however, gives an incomplete picture, for no protein is consumed as a pure chemical substance; it is often mixed with other dietary constituents, causing it to have different effects when eaten, and it may contain extractives known as purins and guanadins, which have no function in forming tissue or yielding energy, but merely flavour or stimulate. In some cases their presence is actually harmful.

The three most important amino acids are cystine, tyrosine, and tryptophane, and unless these three are present in ample amount a protein is called incomplete. It is also spoken of as being low in biological value. The reason why the presence of these amino acids is so vital is that they are required for the manufacture of hormones —complicated chemical secretions which control all the functions and responses of the body. With diminished supply of suitable proteins these hormones become scanty too, while further depletion leads to death. There may be as many as one hundred amino acids linked together to form a single protein, but the number and order of linking matter little, as they become quickly separated in the process of digestion. The nature and proportion of those amino acids is the vital factor. A chain of ninety-nine links might be

useless *by itself*, because the missing link was that of an essential amino acid. Another chain of but three links might be useful, because each essential amino acid is present. Supposing we colour our essential amino-acid links red, white, and blue, supposing we join one protein chain to another, then at a glance we can see how a useless chain *by itself* may become *useful* when linked to another with links of a different colour. Such a combination should be sought for in diet and is spoken of as the supplementary value of proteins.

Translating these similes into actual foodstuffs, we may say that protein of animal origin is far more valuable to human beings than that of vegetable origin. Obviously they must be more akin. It is easier to turn the muscle of a sheep into that of a human being than to convert a bag of beans into that muscle.

Two further observations are needed. There are exceptions to this rule. Gelatine, though an animal protein, is of little use. Rice and potato proteins, though vegetables, are of a very high value. By taking a mixed meal containing meat and cereals, or milk and cereals, the advantages of these proteins are increased on account of the supplementary value as explained above. Protein of a high biological value raises the biological value of other poorer proteins when taken with them.

No consideration of the sources of food proteins

would be complete without drawing attention to the economic factor. Proteins, although so necessary, are among the most expensive of foods, and it therefore behoves us to reduce the total amount consumed to as low a level as possible, consistent with health, and also to make use of the supplementary value of protein by using the cheaper sources of supply. Skimmed milk contains most of the proteins of the original milk, and as such is good building material and extremely cheap. Milk protein is indeed of exceptional value, a fact on which sound vegetarianism rests. The orthodox view is that the animal protein is an essential constituent for any body-building diet; whether the source is meat or milk matters little. To add milk proteins to bread, or to nut and vegetable dishes, gives them a truly saving grace.

Herrings and sprats are another valuable building food, although from the economic point of view the 60 per cent wastage must be remembered. With suitable cooking the cheaper cuts of imported meat can be made as nourishing as the best home killed. If the digestion is good the pulses should be given a place in the dietary. A thousand calories of peas cost less than 2d., of beef 1s. to 3s. 6d. according to quality and cut. Potato protein is another which demands notice. It is of excellent quality and cheap. Potatoes are filling but not fattening. Recent experiments

suggest that soya beans will soon be economically grown in this country. They contain more protein than any other of the pulses.

Having seen the good points of protein dietaries, we must now consider one supposed disadvantage. Many proteins are closely associated with purines. All meat and meat extracts are rich in them. Diseases such as gout, rheumatism, migraine, and even asthma have been attributed to them. There is very little evidence, however, that a purine-free diet is curative in these conditions, or that purines are a constant factor in their cause. Very often a change of dietary on cutting out meat provides more roughage and vitamins, which are the real factor in producing improvements.

There are individuals who undoubtedly show an idiosyncrasy to purines, but they are few and far between. Dr. Francis Hares's diet for many of these conditions was particularly generous in meat proteins, i.e. in purines, while an exclusively protein diet, known as the Salisbury cure, consists of lean meat and hot water. The Eskimo, the Masai, and some other races eat large quantities of meat, and there is no evidence that it produces harmful results even after many generations. Indeed the more meat a nation eats the finer the physique of that nation. To quote myself, "Beef made Britain ruler of the world, while bygone dynasties crumbled on a diet of rice."

We started by saying that protein would be

used for body building or for energy. If used for energy, protein can be converted into glucose, and undoubtedly is so converted in nature. This process should, however, be restricted, as it is uneconomical, and while enough protein should be given to allow a margin for conversion, it should not be given with the intent of supplying energy.

Even allowing for the cost of protein and its possible disadvantages in individual cases, we may still say that 80–100 grm. per day is the lowest amount which should be taken. Much less is permissible for short periods, for example 25 grm. is possible as minimum. Low protein consumption during the recent war (40 grm. per day) was shown to be a cause of hunger oedema. Without meat proteins diet becomes excessively bulky. The advantages of meat far outweigh the disadvantages.

In concluding this portion of our study reference is made to one of the most remarkable discoveries of modern dietetics. Until 1923 pernicious anaemia was a uniformly fatal disease; shortly after that date it was found to be curable by liver. In fact many types of anaemia benefit by liver, and in a lesser degree by kidney and meat muscle. Milk and vegetables lack such properties, so that a meatless diet predisposes to and cannot cure anaemia.

III—Carbohydrate—the Supply of Energy

Carbohydrates differ from proteins chemically in that they contain carbon, hydrogen, and oxygen in the same proportions as water. They are, therefore, sometimes referred to as watered carbon.

Nearly all carbohydrates are of vegetable origin. Glycogen is one notable exception, being found in the liver and in shell-fish, and lactose, the sugar of milk, is another.

Just as proteins vary considerably in nutritive value so do carbohydrates. Glucose can be absorbed direct without conversion and is thus classed as a stimulant as well as a food. Within a few moments of drinking a glucose solution it is circulating in the blood-stream. Hence its value to athletes and all those requiring instant energy. Glucose is largely taking the place of alcohol in hospitals as a stimulant and many people think it contains all the advantages with none of the disadvantages of alcohol when used medicinally.

Lactose demands special mention, because it is the natural sugar of milk, and thus for infant feeding, although manufacturers often substitute cane sugar, which is cheaper but not so good. Cane sugar tends to be sickly and thirst creating and readily ferments. It is also of course noticeably sweet. Lactose has none of these characteristics, and is therefore preferred. If people would only taste the contents of the bottle before

feeding baby, many unfortunate dietetic experiments would cease.

Next in order of importance comes Maltose. The advantage of giving this form of sugar is that not only is extra nourishment afforded, but on account of the diastase found in these malt extracts carbohydrate digestion is greatly aided. Recent experiments have been performed by the technical staff of the London School of Dietetics on the effect of these maltose-containing beverages, using Bourn-vita as it contains more diastase than other similar preparations. It was found that it greatly helped digestion of starches and was itself of course most easy to digest.

Another sugar which may be looked upon as partially pre-digested is invert sugar, of which honey contains about 75 per cent. It is preferable to cane sugar in a raw state, but not necessarily preferable to jam. The longer a jam is boiled the more sugar is inverted. Some experiments on the subject give the following figures of the proportion of cane sugar inverted: strawberry jam two-fifths, raspberry three-fifths, marmalade five-sixths, plum six-sevenths. Some jams are made of glucose, but although the flavour of the fruit is not so much brought out, the jam is quite wholesome and nutritious. The gelatinizing power of jam is due to pectin derived from the fruit. It breaks down into pectose which has little nutritive value.

The remaining sugars can be considered to-

gether, citing cane sugar as a type. At the present time nearly 5 oz. of sugar is consumed per head per day. Much of this comes from beet and not sugar cane. Properly taken it throws little burden on the digestive tract, and it is particularly valuable in feeding invalids. The abuse of sugar on the other hand has definite disadvantages; when an excess is taken some will be excreted by the kidneys with consequent irritation. Concentrated sugary masses in the stomach have a tendency to absorb water. They irritate the stomach and will of course cause thirst. They retard the emptying time of the stomach and set up fermentation with consequent discomfort and irritation.

Those who are habituated to consuming an excessive amount of sugar usually eat little of the necessary vegetables and fruits, consequently they suffer a deficiency of vitamins and mineral salts. An excess of any carbohydrate seems to absorb or render ineffective vitamin B with decreased enjoyment of food and a consequent decreased excretion of gastric juice.

Some people imagine that because brown bread is better than white, so brown sugar has valuable dietetic properties not found in white. This is not the case. Brown sugar contains more water and a higher proportion of invert sugar; it is therefore inferior in sweetening power.

Passing on to starchy foods, the most con-

centrated are the various cereals. Because these foods contain such a preponderum of carbohydrates it is advisable to take meat or milk with them, in order to balance them with protein and fat. The staple grains vary in different countries—wheat in England; oats in Scotland; rye in Scandinavia; maize in Southern Europe, South Africa, U.S.A., and Mexico; millet in Africa; and rice in Asia. Each of these cereals also contains proteins and fats in varying amounts, but none of them in sufficient quantity to form an adequate diet. Those whose economic position enables them to supplement their diet satisfactorily, show it by their stamina and intelligence. Unfortunately there are many millions in a less advantageous position with consequently injurious results.

In passing we may refer to bread and its characteristics. The New Health Society rightly advocates wholemeal bread on all possible occasions, and there is little doubt that if the average population chose wholemeal bread instead of white the general health would improve. There are many people, however, who cannot tolerate wholemeal bread on account of its irritating properties, and such should certainly select a white bread and make up for the lost vitamins and mineral salts by taking an ordinary mixed diet. An 80 per cent milling, known as standard bread, can be tolerated by many who cannot take wholemeal.

There is a curious habit much in vogue to-day of taking toast, rusks, and similar products for slimming. The only loss suffered by these products is water by evaporation. In their crisp state they absorb more butter than bread, so that the meal as eaten is of much greater calorie value than the original bread. They tend to fatten rather than slim.

The remaining carbohydrates such as fruits, nuts, and vegetables are characterized by their excessive bulk compared with their nutritive value. This is advantageous when the subject is constipated and it is valuable as an aid to elimination, but when persisted in must inevitably lead to needless distention. The wateriness of a purely vegetarian diet is an important factor in producing low resisting power, which characterizes such persons.

Undoubtedly bread and potatoes form the best energy-producing foods in the British Isles. Potatoes are not fattening, they contain too much water for that. They contain, however, good-quality protein and some mineral salts and vitamins, and provided they are cooked in their skins most of those are conserved.

The root vegetables provide less nourishment and more roughage than the other carbohydrates mentioned. Such as cabbage provide an extreme amount of cellulose, which is practically devoid of nourishment, in fact they are not only poor in nutrients as purchased but become poorer by

cooking. Their value as a source of mineral salts depends on methods of cooking. Very often as served they are devoid of vitamins and depleted in mineral salts, being so much ballast and of very doubtful utility.

A much better source of vitamins and mineral salts is raw fruits and salads. Much may be learnt from the successes of the nature curer when using grape, orange, and other cures. A diet of nothing but twenty oranges a day for a week or ten days has an intense eliminative effect, and this is still further increased if the patient enters a home for such a cure and pays twenty guineas a week. Raw grated carrots, turnips, and other vegetables are much superior to the same in a cooked state. Those who find difficulty in taking salads should try shredding the whole finely with a saw-edged knife and masticating well.

Food fruits such as bananas, dates, figs, and raisins if well ripened present carbohydrates mostly in the form of invert sugar and are hence easily assimilated. Nuts on the other hand, although fairly rich in protein and fat, are most difficult to digest, hence they are often specially prepared to overcome the mechanical difficulties of digestion.

It has been said that the energy derived from carbohydrate is like that of the cow, capable of placid, plethoric existence and toil. Races of mankind who exist on vegetarian diets show the

same characteristics. A mixed diet saves that large expenditure of nerve and blood concentrated in the digestive organs, leaving it free for other purposes and tending towards a higher intelligence and a quicker initiative.

IV—Fat and Fat-Soluble Vitamins for Fitness

Fat lubricates, supplies calories in small bulk, and is the vehicle for vitamins A and D. The amount of fat which can be taken with safety depends on the amount of carbohydrates which accompanies it. Fats are deficient in oxygen, they are compounds of glycerine and fatty acids, and these fatty acids vary considerably and determine to a large extent the food value of the fat. For instance, the fatty acid in butter is known as butyric, in margarine, oleic or stearic acid.

To understand the importance of fat we must first of all follow it through the alimentary canal and see what becomes of it. Fat in the mouth hinders or even prevents salivary digestion. I am no cook, but I am told that the test of good frying is to measure the grease ring on a piece of paper put under fried food. If the food is properly fried, it should leave no ring at all, only isolated patches of fat. If sodden with fat, it will leave a large ring and will be most indigestible.

The reason for this is purely mechanical. Fat has such a high surface tension that as the teeth and

movement of the jaws divide carbohydrate and protein food into small pieces, each piece gets a coating of fat around it and thereby "water-proofs" itself to the digestive juices. Therefore, in eating fried food, be sure it is not sodden with fat.

When the meat reaches the stomach the salivary digestion of the carbohydrates gradually stops, and digestion of proteins begins. Little, if any, fat-splitting enzyme is found in the stomach, but the fat still acts as a retarding influence in peptic digestion. This is not necessarily a bad thing as we shall see later on. The emptying time of the stomach, however, is appreciably delayed.

When the partly digested food reaches the small intestine a physical change comes over it of the utmost importance. The fats are acted on by the lipase—an enzyme from the pancreas—and with the help of the bile the fats produce soaps. Just as the presence of fat has hitherto slowed and hindered digestion, so now it hastens and helps it. The fat comes into its own as a lubricant. It is the greatest and best lubricant which nature provides. In the form of soaps it enters the intestinal walls to be resynthesized into fatty acids and so absorbed.

What of the utility of fat as a source of energy? While protein and carbohydrate only provide 4·1 calories, fat provides 9·3 per gram. Hence we get carbohydrate as the most bulky of foods, proteins more compact, fats most compact of all.

But, as we have already seen, the amount of fat which a man can safely metabolize is definitely limited by the amount of carbohydrate which he simultaneously oxidizes, for fat burns in the fire of carbohydrate and without sufficient carbohydrate the fire smokes. Its exact use we shall see in a moment when we discuss the regulation of meals to the needs of the body.

Perhaps the greatest use of fat is that the calories it supplies are not all used as energy, but are reserved as a store in the body for use during enforced starvation. This store contains the vitamins A and D or, at any rate, their precursors. There is no evidence to show that carbohydrates when taken in excess and converted into fat and stored, have the same use.

The most idiotic craze of the present day is extreme slimming. In spite of all the accounts in the daily Press about people dying because of slimming treatments, people still try and adopt these extreme measures. Fat is the buffer of the body, the tissue paper which keeps the folds in and the creases out, the cotton wool which protects delicate points. Fat is the great insulator against cold. Fat stored in the body is that on which we live when our digestion cannot work, when our stomach cannot tolerate food, and when we are racked with pain and fever. If we are without those stores, we stand a worse chance of recovery.

Having praised the fat, we must now apply a control. Fat is a vicious circle. Be so much fat, and because of the conservation of heat which that fat produces, you will, if you go on eating, get still more fat. How then to get thin? You must become a cannibal—eat yourself—eat your own fat. Try a day—three days—ten days on one to twenty oranges a day and nothing else but water. The carbohydrate of the orange will burn your body fat away. Take exercise—try skipping. Massage it away. Self-massage, whether by hand or rubber bands and rollers, is an excellent method of starting the fat to move away.

Now let us consider fat as a source of vitamins A and D. Vitamin A is easy enough to provide even apart from fats. Carrots, apricots, peaches, oranges, palm oil, and maize all contain vitamin A in sufficient quantity to make a balanced dietary.

Vitamin D, however, is difficult to obtain and is only found in animal foods. Fish-liver oils are the best source—halibut, cod, herring, or sprats. Eggs are valuable, so also butter, milk, and cream. The amount of vitamin D in butter and milk depends on the amount of sun shining on the cow. That is why New Zealand and Australian butter in winter time should be preferred to home produce.

Vitamin D can be produced in a more pleasant manner by sunlight shining, not on the cow but

on the human being. I doubt whether nudism is a suitable cult for our climate, but I cannot help admiring the pertinacity, foolhardiness, or bravery of the nudist—call it what you like. Anyhow, if we all wore less clothes we would be better off. If we exercise in bathing slips in the open air, it is far better than in ordinary clothes indoors.

Now we are in a position to sum up the selection of food for a given purpose. If you want urgent and immediate energy, take sugar. If less urgent, take starch. If you require body-building foods, choose proteins—remember it stimulates metabolism, so do not overdo it in summer. If you are on sentry-go, if you want your meal to last you as long as possible, eat more fat. The digestion will be slowed down, the energy will come along in five to eight hours instead of five to eight minutes as with sugar. Fat is the hidden arsenal which intimidates the disease enemy and holds him at bay.

V—Mineral Salts and Roughage. The Water-Soluble Vitamins

The body contains about 7 lb. of mineral matter —most of which is in the bones and teeth. There are eight important minerals required and others in small amount. The important ones are phosphorus, sulphur, potassium, sodium, calcium,

magnesium, chlorine, and iron. While the minerals provide no heat, they are intimately bound up with the body processes for providing energy. Muscles need calcium and potassium to enable them to contract; the thyroid gland, that great controller of metabolism, needs iodine; the blood needs iron.

It is seldom necessary to take mineral salts other than in the form of food, and if a balanced diet is taken, that should be sufficient to supply them all. Indeed, it would seem preferable to take them in this form rather than as inorganic salts or so-called tonics.

There are great variations in the mineral content of foods depending on their past history. Thus meat varies in its mineral content according to the pasturage of the cow or sheep, etc., and cereals vary according to the soil on which they grow. Even if the soil is deficient, however, in a given mineral, the plant or animal shows some power and capacity of concentrating it.

Taking the mineral salts in order, we shall deal first with Phosphorus. Its importance as a building material can scarcely be overrated. Wherever building is going on at its fastest, there phosphorus is abundantly present. As it is contained in the cell nuclei, the more the cells the more the phosphorus. Its richest source of supply in foodstuffs is Gruyère cheese. Mutton, ordinary cheese, eggs, beef, milk, beans, and chocolate are other

valuable sources. There is evidence that brain activity is increased and the nutrition of the nerves improved by taking more phosphorus-containing food. Contrary to popular belief, fish is not particularly rich in phosphorus, nor does fish make brain. Fish roe is a more abundant source than fish itself. Wholemeal bread contains more phosphorus than white bread.

Sulphur is present in eggs and milk products. It is a necessary regulator in the biochemistry of the intestine.

Potassium is present in eggs, beef, and legumes, and is necessary as a cell constituent both in blood and muscle cells. A lack of potassium is shown in greatly weakened muscular contraction evidenced chiefly in the heart muscle. People suffering from weakness of the heart muscle as distinguished from valvular lesions should carefully note this, and remember that potassium salts may be curative as well as preventative.

Sodium is found abundantly in all animal foods, and there seems to be no serious results in limiting the sodium intake of the body to such foods and omitting table salt. On the other hand, the taking of much table salt has not yet been proved as harmful provided sufficient water is taken with it. Vegetarians need more salt than those on a mixed diet, partly because they miss salt derived from animal foods and partly because vegetable foods contain much more potassium

than sodium, and this tends to cut out the sodium by some biochemical antagonism.

Calcium is perhaps the most important of the minerals as it is the basis of bone and teeth, of blood-clotting, and many more physiological processes. Without abundant lime a baby grows rickety, but unless the expectant mother lays in ample stores of calcium beforehand she will have difficulty in coping with the demands of her baby during the nursing period.

An excess of calcium in the body has been blamed as the cause of calculus, atheroma, and other conditions, but the proof of this is very difficult, and so far it appears to be more dangerous to take too little calcium than too much. The best sources of calcium are cheese, milk, eggs, green vegetables, butter, and nuts.

Magnesium is usually present in foods in the same proportion as calcium. Its chief use in the body is in the formation of buffer solutions to maintain the relative neutrality of body fluids.

Chlorine is taken almost entirely in the form of common salt. The chlorine metabolism is disturbed in acute fevers, but otherwise its significance is obscure. The chief use of chlorine in the body is for the manufacture of hydrochloric acid, secreted from the stomach wall.

Iron is found in spinach, yolk of egg, beef, apples, lentils, strawberries, white beans, peas, potatoes, and wheat. Leafy vegetables also contain

a useful amount, especially parsley. Milk is a very poor source. There is abundant iron to be found in the ordinary mixed diet without resource to the chemist's shop. Combinations of iron with blood or meat are less easily assimilated than with vegetables. Ferruginous wines are of little, if any, value, and if anyone insists on taking iron in a form other than diet, let them try a rusty nail in their bottle of drinking water, an expedient found invaluable for anaemic chickens.

There are other minerals which need to be mentioned briefly. Iodine is found in sea fish and controls thyroid metabolism. Lack of it predisposes to goitre. Manganese has an effect on fertility; fluorine and silica on teeth and bones; zinc and other metals also play a small part, but all these are contained in an average diet.

I believe that somewhere in the balancing of mineral salts lies the solution of the cancer problem. They are the great controllers of cell activity. Much research work has been carried on incriminating sodium chloride, calcium, and potassium ratios and even phosphorus intake. I believe that the most important mineral salt from this point of view is potassium. The curious thing is that potassium is antagonized by sodium. If you start your breakfast with a kipper, then eat salt bacon and take salt with your egg, you will probably eat so much salt that you will drive out the potassium of your body. Just as pernicious

anaemia is being cured by liver, so cancer may one day be prevented and cured by an equally simple means. Then it will be that the so-called fallacies and delusions of quacks and scare-mongers will be answered by an "I told you so," which may at last shake off the hard shell of intolerance in the medical profession.

It seems too simple to define water-soluble vitamins as vitamins which are soluble in water, but the truth of this fact escapes those who would seek to take them. Why soak vegetables and fruits in water, discarding the water, and losing the water-soluble vitamins and the mineral salts? Why boil or stew them, destroying the remainder? Eat raw cabbage, turnips, carrots, cauliflower, etc. Such vegetables are amazingly appetizing if they are picked when young and are eaten raw in a finely shredded state. We have already seen the vital importance of the mineral salts. Vitamins B and C are no less important. They prevent bleeding, skin diseases, constipation, even some types of insanity, so eat vegetables and fruit *raw* and learn to taste the flavour of these things for the first time in your life.

MENTAL HEALTH

by

ELIZABETH SLOAN CHESSER, M.D.

CHAPTER IV

Mental Health

THE human mind is a territory of eternal interest and infinite possibilities. Poets and philosophers, with the intuition of genius, have told us in immortal songs and prose, through hundreds of years, what modern research in psychology is confirming day by day.

Shakespeare's insight into the unconscious mind and human behaviour provides us with material for the study of the human mind which would last us a lifetime. In the New Testament we find the great truth that love and kindness best help in the solution of human unhappiness. Modern psychologists speak in different ways the same story—the danger of hate and fear to the soul, the healing quality of love. We must be friendly to each other, we must "contribute" to life, we must encourage poor sick-souled men and women.

Therefore, let us study the mind and how it works, so that we may be helped to understand ourselves and others. "The path of life, men say, is hard and rough. Only because we do not know enough. When science has discovered something more, we shall be happier than we were before." All scientific knowledge, even a little knowledge, is valuable if it helps men and women to think

away from hate and strife towards the ideal of brotherhood and peace.

I should advise anyone interested in the human mind to study the anatomy of the nervous system. The local butcher will always supply a sheep's brain, and a book on elementary physiology will give a great deal of useful information. We note that the brain is a semi-solid organ, enclosed in membranes or envelopes, which lies inside the skull.

The dura mater, or hard membrane, has probably remained more or less adherent to the skull of the sheep, but the pia mater can be seen as a delicate membrane, something like the thin membrane lining the inner aspect of the lip or the surface of the eyeball. It shows tiny blood-vessels, and it can be peeled off the surface of the brain.

The human brain resembles an immense peeled walnut, showing convolutions over its surface. The anterior part of the brain which lies behind and within the forehead has to do with the intellectual faculties. In the sheep this part is not conspicuous for its breadth and height, but, after all, a sheep need not consider the world in any but simple fashion.

The lateral aspects of the brain are concerned with locomotion, and the posterior section with sensation—sight, hearing, etc. All over the surface of the brain are grey cells, associated with each

other and with nerve fibres, which, like telephone wires, are transmitting messages to and from the grey matter all the time, so that we think and walk and eat, we love and hate—in a word, we live.

Upon the quality and quantity of this mysterious grey matter on the surface of our brain convolutions depends the type of human beings we are. Curious is it not, that this small layer of grey matter may so vary that one man is a "moron" with little intelligence and no wits, another a scientist like Sir Oliver Lodge or a surgeon like Sir William Arbuthnot Lane, a third a Robert Burns or Shelley, a fourth a criminal homicidal maniac who should never have been born. The study of mental hygiene is the basis of many other studies, leading from the application of our knowledge of psychology to the training of babies and again to a better conception of politics and international relationships.

We study ourselves by introspection. We study other human beings by observation of their voices, gestures, behaviour, their "reactions" to different situations, as well as by what they say. Mental processes are concerned with ideation—thinking; cognition—knowing; conation—striving; affect—feeling; volition—will. The "libido" is the striving activity of the personality, asleep or awake. We all strive towards happiness and satis-

faction. The study of mental hygiene should help us towards our goal.

The "self" consists of the conscious mind which is concerned with the world of reality and a large area called the unconscious. Psychologists emphasize that the unconscious contains all our memories, even racial memories, and repressed images and emotions.

The unconscious is the source of the inspiration of the poet, artist, and musician. Conflict in the unconscious is one cause of neurosis, and neurosis is a failure to adjust to the world, to solve our problems. Emotional instability, a sign of neurosis, arises very often from bad "conditioning." A stimulus from without arouses certain emotional responses, and it is essential that from the earliest years, human beings should be conditioned to courage and love, not to fear and hate.

There are 3,000,000 people in Great Britain with nervous disorders, some of which are due to faulty training, wrong conditioning in early life.

Health, both mental and physical, influences successful living. Those who awaken every morning feeling alive, interested, appreciative of the life without and the life within, are fortunate.

Healthy blood corpuscles, a sound gall bladder, and a happy appendix all influence the brain and that part of it which "thinks."

The ancients recognized different health types. Consider for the moment two of them, the

Sanguine and the Melancholic. The first type will be the more "successful," in the sense that sanguine people live easy, happy lives and attract friendship and affection. The liverish melancholic man may be a potential genius, but what is the good of success if it is to be associated with chronic malaise?

Achievement—let us admit what is self-evident—depends to a considerable extent on inherited brain pattern. There are stocks which produce a high average of fine intellectual men and women, and there are stocks which, through mental inferiority, show, generation after generation, a large percentage of fools, criminals, and defectives. Nurture or environment is, of course, very very important in affecting habits, disposition, sentiments, and character.

The best anyone can do with regard to environment is to promote a healthy and happy attitude to life. Everyone has his own standard of success, but those who are "well brought up" are more likely to live successfully in face of the adversity and disappointments everybody experiences sometimes. It is curious when one thinks of it, how much happier and more successful we could all become in one day if we could change our hypercritical, self-pitying, gloomy attitude to life—a difficult achievement, but not impossible.

It is no easy matter to feel friendly to all our neighbours. If we were brutally truthful we could

acknowledge that we hate the sight and sound and smell of one or two (interesting subject, unconscious smell). At the same time, the parent who wants worldly success makes her children at least polite.

Rudeness, so fashionable in these days, costs many a fortune and not a few friends. Thackerary advised persons "commencing" the world to praise everybody. "Never be squeamish," he says, "but speak out your compliment both point-blank in a man's face and behind his back when you know there is a reasonable chance of his hearing it again."

But surely flattery must be subtle to gratify intelligent people. "Never lose a chance of saying a kind word"—that is better. To speak kindly of people makes us like them more, and, whether we regard success from the worldly or a higher point of view, the more sincere friendships we form the more successful life will become.

With the passage of the years, memories and experiences become part of us. They are said to be "transmuted" into feeling. Because of this "feeling" we react in a certain way to whatever happens to us in the home, office, shop, or university. For that reason it is essential to gain for ourselves and for our children useful experience, good emotional memories which will be serviceable to us and to society.

The most valuable part of Dr. Adler's *Individual*

Psychology is the way that he emphasizes the importance of service and co-operation. We are all striving for power, striving towards a goal of superiority, and we are healthy minded if our desire for power is realized in socially useful activities. The individual is a unit of society, and is happier if he is in harmony with society, friendly with his family and his friends, friendly with the world.

Every physician hears frequently the complaint of the misfit; he is lonely, discouraged, hopeless. Dr. Adler has always stressed the need for "encouraging" unhappy child delinquents, difficult children. One is bored, very often, by the misunderstood husband who is sometimes a philanderer, and bored also by the constantly complaining wife, but there can be nothing but pity for the child who feels lonely, criticized, inferior, and unappreciated.

We all feel inferior. Those who enjoy good mental health try to overcome, as much as possible, this sense of inferiority by work and effort—that is, they compensate through reality. Some try to escape by fantasy and day-dreaming through the precious hours of life, "imagining" themselves in whatever their goal of life may be. This is perhaps love and marriage with a perfect mate, or achievement in the world of films, literature, politics. Building castles in the air, those lovers of fantasy are doing, when they

should be making the beds or studying for an examination.

There are day-dreams which are of value to the individual and to society. The engineer, the scientist, and the artist dream, and then work forth their dreams into achievement. Fantasy, in moderation, helps most of us through difficult hours. Consider for a moment this matter of escaping through dreams from painful reality. Day-dreaming is less harmful than alcohol or drugs. Films and novels and other methods of escape may instruct and educate.

The person who is occupied, who has certain tasks and hours of necessary work, is less likely to indulge in futile day-dreaming. Occupation would seem to be essential to mental health. Fears and complexes may be so deeply embedded in the unconscious mind as to require treatment by a physician skilled in psychology, able to bring to consciousness forgotten—that is, repressed—fears and humiliations.

The "remembering" helps to purge the mind; in lesser fashion a good talk with an understanding listener who can be sympathetic and constructively critical helps us to solve problems instead of thrusting them away from us into the subconscious, taking refuge in illness, neurosis, as an excuse or an escape from responsibility. "If I am exhausted or have a headache" says the

neurotic, "I cannot be expected to do this uncongenial thing."

To attain to mental health it is necessary to pass from selfishness to self-reliance and unselfishness. Life demands something from us all, and if we are to achieve harmony and some measure of happiness and self-satisfaction that is worth while, we must cultivate self-knowledge and self-discipline and think more of the needs and rights of other people. In a sense it means changing from the attitude "What am I getting from life?" to the higher level of "What am I giving to life?"

Tolerance, equanimity, imperturbability—are these not excellent ways of facing the difficulties, tribulations, and burdens of living? Nothing is so difficult as it seems at first sight. Most of the ills of the flesh are preventable, from cold in the head to melancholia. Let us, therefore, determine to utilize all the knowledge we have inherited and acquired towards attaining health and happiness.

When the race becomes educated the doctors will be utilized to *prevent* disease in great halls and gardens of healing, where swimming, sunlight, and mental training will be included in a comprehensive scheme of education of mind and body for successful living.

So many people are only half alive, moaning and groaning through this "festival of life," who might have been trained to live happily and

healthily. Universal teaching of psychology and physiology is long overdue.

The imbecile ignorance of people about mental and physical processes is responsible for a vast deal of sickness and ennui, which is sickness of the mind or soul.

The cultivation of interest is a good health maxim. Let us cultivate understanding, sympathy, simplicity. Human nature is not invariably attractive nor interesting, let us admit. If, however, we wish to be happy we must have appreciation for goodness and kindness when we meet them, and face with a thankful heart every manifestation of truth and beauty, which philosophers through the ages have told us are the supreme realities.

What says Socrates? "One man finds pleasure in improving his land, another his horses; my pleasure lies in seeing that I myself grow better day by day."

FOOD, HEALTH, AND CHARACTER

by

ELIZABETH SLOAN CHESSER, M.D.

CHAPTER V

Food, Health, and Character

THE war against ill health is an admirable thing. Nobody should be complacent so long as children are ill-nourished by bad food. It is not to be tolerated that adolescents died of preventable disease, and that people in middle life permit themselves to get ugly, obese, and lazy. With few exceptions, we deteriorate and decay at the period of life when, if the laws of health and hygiene were better understood and obeyed, we should be in our prime at sixty. The New Health Society is waging a great war, and Sir William Arbuthnot Lane, who has done so much for England, is its Brigadier-General. The Society is fighting for the maintenance of youth, the prevention of ill health, and the conservation of both mental and physical energy. It might be said, "What has food to do with character?" A great deal. What we eat, in a sense we become. Is it not a fact that overfed, gluttonous old gentlemen are irritable, rigid-minded, intolerant of new ideas? Children improperly fed become intractable and cantankerous. So the question of food is very important and we know more about food values than was known twenty or thirty years ago. How does food affect health

and character in the nursery? Is not the child fed on excess of fat or excess of carbohydrates very often difficult? The spotty, fractious child fed on excess of sugar, rice, tapioca, and rusks may be metamorphosed into an angel of sweetness and beauty by change of diet to vegetable soups, fish, chicken, roast apples, and junket. For lack of good food we have millions of people suffering from malnutrition and deficiency diseases. We have mind as well as body affected adversely by overfeeding. The majority of people do not live the full and interesting lives they might, and are more or less satisfied to be half men, half women. How far is this undesirable state of affairs due to the food they consume? Because of our ignorance of food, rickets is to some extent the heritage of every child in the land. Rich men's rickets, as well as poor men's rickets, is to be found in many homes; the children of the rich are not necessarily better fed than the children of the poor. We can see the stigmata of deficiency food diseases in every public school in the United Kingdom. The New Health Society is doing useful work in teaching people elementary but important things about food, and repeating them over and over again. Milk is a perfect food although if taken in infancy for too long a time, it causes anaemia. Why cannot we have free milk—an allowance for every person in the country, whether duke, cook, or necessitous mother? This

might be called Socialism, but is it not rather common sense? If every family had regular, nourishing and yet simple meals it would make for health and character, and do away with illness due to malnutrition and self-poisoning through too frequent and excess of food. A little starvation at times is a good thing for everybody: the majority of people who can afford good food suffer from auto-intoxication, intestinal fermentation.

Food supplies material for growth, and is the source of heat and energy. It is transformed by digestion into materials which can be absorbed into the blood; converted, it is the blood and cells of which our bodies are composed. Proteins or nitrogenous foods are very necessary in early childhood when growth is rapid, when the long bones and muscles lengthen day by day; so that eggs, fish, fowl, meat, cheese, and milk, which provide a large proportion of nitrogenous material, must be supplied liberally. A child of five eats half as much as a grown person, and an adult is said to require daily 4 oz. of protein, 3 oz. of fat, and 13 to 16 oz. of carbohydrate (sugar and starch).

The best fats for children are provided by cream and butter. Young people love butter, and they usually dislike fat of meat, which is unappetizing and difficult to digest. Suet pudding and dripping are other sources of fat which will be

found useful. Children are very active, expending energy all the time, and fats and carbohydrates are sources of energy; thus sugar is an important article of diet in childhood. The ideal sugar is derived from honey in the comb, because it is natural sugar, untouched and unspoiled by civilized man. When it is not obtainable, parents and those in charge of school dietaries should be careful to buy cane sugar.

Carbohydrates are useful foods, and they are less expensive than proteins and fats, but there is a danger of giving children an ill-balanced diet with excess of starch and sugar—for example, potato, bread, rusk, cake, biscuit, rice, tapioca, cornflour, all of which are starchy foods. The too fat child, the little boy or girl who is subject to attacks of colds and catarrhs, the irritable, complaining, peevish toddlers are often the victims of excess of carbohydrates.

Food affects character and temperament; the overfed child's brain is nourished with blood full of toxins (poisons) derived from fermentation of excess of food in the intestine. These cause irritation of the brain cells with a liability to nerve storms and convulsions.

Fruit and vegetables provide the roughage so essential in preventing constipation, the most evil of all bad habits, which begins in early childhood, and is the root cause of half the ill health in the community, mental as well as

physical ill health. Fruit and vegetables supply us also with mineral salts, which are necessary for the blood and digestive juices. If children's diet is deficient in iron and calcium, for example, anaemia and rickets, with defective development of bone and muscle, assuredly follow.

Oranges and apples are perhaps the most valuable fruits we have. Young school children can perfectly well eat an orange and an apple a day, and when these are out of season bananas, plums, garden berries, prunes, melons, fresh pineapples, will give variety and vitamins also. I approve of fresh salads for quite young children; tomatoes, in season, are especially valuable. I think some day we shall have flower salads.

Vitamins may give many surprises in the future. At present we know comparatively little about them. We are told that they are substances of unknown chemical composition, and that they are found in fresh foods—in milk, butter, fruit, salads, green vegetables, meat, fish, fowl. If we supply children with plenty of milk, butter, fruit, salads, and if, in the winter, we give cod-liver oil also, we can be fairly certain of maintaining an ample vitamin content in the diet.

The amount of food given to children depends not so much upon their age as upon their weight, general development, and individual require-

ments. My experience is that children like good vegetable soups, or fish soup with milk stock, or potato soup. They prefer potatoes cooked as they ought to be, in their jackets, and they like dainty puddings served with fruit and cream. I would give three meals a day, with intervals of four and a half hours between them, and I would make the menus varied and full of surprises.

It is worth remembering that about a twentieth part of the solid part of us is mineral. We obtain our mineral salts from food. The growing plant absorbs them from the soil under the influence of light, and man and other animals obtain them from vegetable produce or from carnivora which eat herbage. Let us remember that flesh food, i.e. muscle of animals, contain these salts in very small quantities, and yet they are essential to life and health. They consist of a chemical combination of an acid and a metallic substance, and the chief mineral substances are salts of iron, calcium or lime, phosphorus, iodine, soda, potash, and manganese. Everybody knows that lack of iron in the blood is associated with anaemia and lack of oxygen in the body, because the red corpuscles —composed mainly of iron—carry the oxygen from our lungs to every cell in our bodies. Every second 7,000,000 red blood corpuscles have to be made, and every day a new supply of iron is necessary for health.

According to Dr. Belfrage, one of the greatest authorities on dietetics, we need a quarter of a grain of iron per day to preserve the health of the red corpuscles. The best iron foods are whole wheat, yolk of egg, and meat, especially liver, which is being used so much in the treatment of anaemia at present that liver and bacon is no longer an inexpensive dish. But it is popular with young people, perhaps because the need of iron and fat is greater in youth when brawn and brain are rapidly developing. Boiled or poached egg with spinach is a typical iron-giving dish, and peas and beans and turnip tops, and indeed most fresh garden produce, give sufficient supply of iron for the blood.

We have heard a great deal about calcium in recent years, and whilst we know that insufficient calcium or lime is not the only cause of rickets, diet deficient in calcium produces rickety bones and nervous disorders in animals. People who suffer from easy bruising and those whose teeth are soft and liable to decay are usually deficient in the intake of calcium. In such people, wounds bleed easily and freely, and the extraction of teeth may be associated with an alarming haemorrhage. It is said that we require fifteen grains of lime daily. Whilst cow's milk does not contain iron, milk and cheese are rich in calcium. If, in the nursery, each child were given a pint of milk—even skimmed milk—and two ounces of

cheese daily, with green vegetables, he would be receiving sufficient lime for growth and development. A feeling of general malaise is one symptom of insufficient inorganic calcium in the blood.

One of the most important glands in the body is the thyroid, situated in the neck, and iodine is essential to its function. Without iodine, goitre or swelling of the thyroid will occur. Insufficient thyroxin means that combustion or burning up of the food is interfered with, and this is one cause of obesity. We must give the thyroid its iodine, and here again fresh vegetables are necessary if we are to have the daily half-grain of iodine essential to life and health. Lettuce, green peas, radishes, tomatoes, carrots, turnips, and potatoes are all sources of iodine.

Potash and soda are found in fruit, green vegetables, and milk, and these minerals have to do with the counteraction of waste and must be eaten freely by the "good livers" of the world who enjoy meat and sweet dishes. The commonest soda mineral is salt, which is necessary for digestion, but we can have too much of a good thing. If we take an excess of salt it is immediately excreted, but in kidney affections and "goutiness" excess of salt is apt to pass from the blood to the tissues, where it attracts fluid to itself, thus producing oedema or fluid swelling. That is one reason why a saltless diet is recommended for the obese.

In kidney affections, obesity, and gout, the habit of adding large quantities of salt to the food is to be deplored. Ordinary water is useful from many points of view, and most people require a minimum of two pints in twenty-four hours.

We are all supersensitive to certain foods. We may dislike eggs, and have a bilious attack if egg is (even without our knowledge) in a dish. We may be supersensitive to strawberries or to peas or beans or fish. Such supersensitiveness is present from early childhood and similar to supersensitiveness to feathers, or fur or cats, which in some people induces asthma.

Apart from sensitization, children may dislike intensely dishes which they have been compelled to eat when they were feeling ill or when they had no appetite. The sight of the same food will induce nausea for years after, so that it is cruel to force children to eat food they refuse. Let them take plain bread and butter instead, or, if they prefer it, go hungry till the next meal. The child has as much right as we have to "antipathies."

CHILD PSYCHOLOGY

by

JANE LORIMER HAWTHORNE

M.B., CH.B.

CHAPTER VI

Child Psychology

Fear

One of the most distressing emotions of early childhood, and one which we must try to anticipate, is fear. It is sometimes destructive, and it has no value as a disciplinary measure.

The evidence of fear may appear at a very early age, indeed during the first few months. There are two conditions which give rise to fear, the reaction being unmistakable in so young a subject. The first is seen where the baby, unable to move about, is entirely dependent upon his mother or nurse. The youthful and inexperienced mother is sometimes awkward and uncertain in her way of handling her first-born, and he is instantly aware of this. He has never yet been dropped, but instinctively he fears the possibility, hence the frightened screaming which the little mother fails to understand.

I remember a delightful old "nanny" who had been one of the family for more years than we cared to count. Her one drawback as a baby's nurse was that she had become too plump and babies always screamed continuously while she dressed and undressed them. She had practically no "lap," with the result that the child

always knew that he was in danger of rolling off her knees. As soon as he was able to move about, crawling or walking, and to achieve his own security, all fear of his "nanny" vanished, and he became her devoted slave.

A strange sequel followed this later in life. As the child grew up he became quite a famous climber, but no one knew what agonies of fear he experienced every time he reached higher altitudes, and especially when he stood on the verge of an abyss or chasm. On the eve of a very important and dangerous "climb," he consulted his psycho-analyist and the result was entirely satisfactory as he never again experienced the fear of falling into a depth.

Another example of a mother's unconscious effect upon her baby. She was a great, strong woman, who at the time of this occurrence had a baby of eight months old. One afternoon, having put the child to bed, she left the house to find an outlet for her superfluous energies. She found what she wanted in a fight with a neighbour. On returning home she picked up her child and breast fed it. Shortly after the child became very ill and died, the cause being certified as acute poisoning through the mother's milk.

Another form of discomfort and anxiety, which the young baby resents loudly and emphatically, is the lack of support to his head. Many young mothers complain that they are terribly afraid of

baby's neck and head; the neck feels so weak and "wobbly," and they don't know how to support the relatively heavy weight on the head. It is fear of the unknown that paralyses the mother, and yet there is really no reason why every prospective mother should not have opportunities of gaining experience in mothercraft. There are schools for mothers, and classes on infant care, where quite valuable experience can be gained, and at very little expense. There are also schools for fathers which are doing good work, but are not quite so imperative at this early stage.

Lack of support, then, is one of the two causes of fear in the infant. The other is any sudden loud noise close at hand. Please note it is a *sudden* loud noise. In the average home there are many *loud* noises and many *kinds* of noises, but a healthy infant will take no notice of these, and will sleep through a perfect tornado of sound, remaining entirely calm and contented even if awake.

A fearless child is a healthy child. Recognizing this fact, how carefully should a mother choose the maid with whom 50 per cent of his life is spent. How frequently we see the puny baby, ill-nourished and full of dread, showing his anxieties in that pitiful little wail with which we are all familiar. So small a matter as irregularity in feeding may produce pain, and the child, unconsciously realizing the link between the taking of food and this unwelcome sensation which we

call pain, will refuse food until, with an improved schedule, the memory of this particular cause and effect is wiped from his mind by a happier experience.

It is of great importance that the mother and nurse should guide the child most carefully in its attitude towards cause and effect. It is foolish as well as harmful for the nurse to teach the child indignation or resentment towards some inanimate object, such as the floor, when the child has hurt himself by falling. How often does one hear an unwise nurse slap the floor and repeat again and again some such silly statement as "Naughty floor, bad floor, to hurt baby!" What can a child learn from such training? Nothing of value. But unmistakable evidences of maladjustment to life follow only too quickly.

It is almost unavoidable that a child should gain its lessons in fear in the home, but this is not altogether undesirable, because it allows the mother to study the development of the child under her own eyes and without interference from any other source. Here, as elsewhere in life, prevention is better than cure, and the understanding mother will do her best to provide an atmosphere and surroundings where the child can learn and develop with a minimum of pain which is almost always avoidable.

Darkness is often a very cruel punishment meted out to a young individual, who is frequently

unaware of having committed any fault. The modern child has little fear of the darkness itself, because he has had better training, also he has had more reasons given him and he has been shown in a scientific fashion that darkness, in itself, cannot produce pain nor does it hide anything productive of harm. It may take a long time for the mother to complete this lesson that in darkness there is no fear. This is one of the earliest and most valuable lessons which ought to be learned in the first six months of life. Its importance cannot be exaggerated because subconsciously the child will transmute his knowledge of fearlessness into all other positions in life.

There is never any justification for punishing a child by means of pain—that is, by smacking or threatening—because no young child is capable of realizing the why and wherefore of such an infliction. In the old days when corporal punishment was the order of the day, the father almost invariably announced that the punishment he was inflicting on his child hurt him much more than it did his victim. Perhaps he really did believe this, but the present-day youngster will find it difficult to credit the statement, especially when his whole emotions were summed up in the word "resentment."

There is a form of discipline which unfortunately parents have used freely and thoughtlessly, but which, in almost every instance, is productive of

fear. This is what can only be described as discipline by threats. One finds it in every class of society; amongst educated people the child is threatened with lack of education unless he will make use of his opportunities, by lack of position unless he applies himself to his studies, and also he is threatened with his parents' displeasure unless he is willing to conform to the rules which his father lays down, and which have sufficed for an earlier generation.

The younger child is threatened with punishment, with being sent to bed supperless, with having some long-anticipated pleasure cut out. All this is productive of an acute sense of unfairness, and the child feels that the father is taking unfair advantage of their relative positions. He now regards his father with fear because of his ability to enforce all that he threatens. Under such circumstances it is impossible to build up a sense of comradeship or equality, and instead of the child looking upon his father as a friend to whom he can turn in all his difficulties, he is thrown back upon himself and his meagre experience of life.

Bedtime

In many homes, bedtime is the most disturbing part of the whole day. It is often very difficult at this time to get prompt obedience from the children. Seven o'clock strikes, and mother an-

nounces that it is bedtime. No notice is taken of this, unless perhaps some older child looks at the clock to verify the statement that it *is* seven o'clock. Five minutes pass, and again mother issues her orders. If she sounds rather determined, some child will probably say, "All right, mother, we're just coming!" but will make no attempt whatever to do so. After a third order is issued another child will beg and whine for a little longer time, and, when refused, will slowly and unwillingly pick up his toys, taking as much time as possible in putting them away. Then follows a general coaxing, persuading, and crying, asking for supper, asking for a drink of water, until at last, mother's strength and patience becoming exhausted, *father* has to be called upon the scene. A lively five minutes follows! Then a rush upstairs, without even a good-night kiss. Mother is entirely upset, father is out of temper for the whole evening, the children are excited and suffering from a sense of resentment, and as the result of all this, sleep is difficult to attain, and when it does come, is restless and unrefreshing.

This is all quite unnecessary; a little thought and a little determination on the part of the mother will change it, and bedtime can be made a happy preparation for a night of perfect rest and recuperation.

It is a good rule to make, that during the hour before bedtime the parents should join with the

children in quiet games or, better still, in reading aloud from some book interesting to them all. The wisdom of setting aside this one hour when children and grown-ups may meet on common ground will be apparent to all. Everyone is on an equal footing, there are no rules to be obeyed, and the children have complete freedom to express themselves.

It is natural that the children should be unwilling to leave the warm, bright room downstairs, with all its interests and amusements, but the habit of obedience is so necessary to the successful training of the young character that the parents, even though reluctant to enforce this discipline, must do so for the sake of the future.

We cannot stress too strongly the importance of the last thoughts at bedtime. If the parents recognize this they will do much to ensure a happy and harmonious atmosphere at this hour. One cannot, of course, make rules which apply to all children indiscriminately, but it is undoubtedly desirable that measures should be taken to ensure that children go to sleep with happy and peaceful thoughts in their minds. Otherwise, difficulties will certainly arrive, and sleep will be disturbed in various ways. Sometimes this may take the form of night terrors; sometimes fits of crying, the cause of which cannot be discovered; sometimes again, in a young child, by the habit of bed-wetting as the result of tears

and excitement before being put to bed. I have found it a good rule to keep a particular book for the bedtime hour, and to read from this book to the children after they are in bed, but sitting up. As soon as the reading is finished, the children will lie down, and promptly, as well as happily, prepare themselves for sleep. It is a very good preparation—this filling the child's mind with thoughts of something beautiful, as well as attainable. Twenty minutes should be sufficient to produce this atmosphere of harmony in every child, and the resulting night will be quiet and healthful both for mother and children.

Many children seem to be unable to sleep without some kind of light, even if only a small one. The cause of this may not be understood, especially in the case of a child whose early life has been spent apart from its mother. On their reunion she may feel that a bad habit has been formed, and that the child must be "got out of it," but I would advise such a mother to hesitate before attempting to cure a condition, the cause of which is unknown to her. After all, there is no real harm in giving way to some little weakness, such as the above, and an understanding mother will soon find that love and gentleness and belief in the child will overcome any difficulties.

The Untruthful Child

It is very rare indeed to find a young child who is really untruthful. What appears to be untruth is, in most cases, merely a way of expressing oneself, and it must be always remembered that the imagination of the average child is more powerful than that of any grown-up person.

Unfortunately this degree of imagination begins to wear off when the child is criticized by its elders. When a child really *does* tell lies, in most cases it is due to fear—fear of being punished—fear of finding itself in a difficult position—fear of being ridiculed—fear of losing the love of some person, almost always someone older than itself. These fears, of course, arise from a lack of understanding, not so much on the part of the child, but misunderstanding on the part of the "grown-up."

Of course there is another type of child to whom these remarks do not apply. This child is one who desires above all things to be the centre of attraction and interest. This is gained by telling a surprising story in which he pictures himself as the hero of some position, which he could not possibly achieve at this particular age. I have often had experience of children who will spin a tale which is apparently true in all its details; for example, some article of value in the home is missing and the whole household is interrogated—the other children—the domestics—in fact every-

one who could possibly be associated with the loss. The child, of course, denies vehemently all knowledge of the missing article; again and again he persists that he knows nothing about it, and then, having worked up an atmosphere of excitement and bewilderment, he suddenly confesses that he has got rid of the article in some startling way. He weeps and sobs and expresses his sorrow and his desire to confess, and feels thoroughly satisfied with the impression he has made. It then very often happens that the missing article is found in some place which is completely out of his reach, and he remains branded as an unmistakable little liar.

Parents find a position of this kind very difficult to deal with. Frequently they come to the conclusion that the child must be punished, that in some way the enormity of his fault must be impressed upon him, and for a considerable time he is not allowed to forget that he has done something shameful.

Jealousy

Jealousy in the home is love gone astray; but jealousy proves that love still exists, otherwise there would only be indifference. The jealousy of a child is often seen when a second baby arrives and appears to take the place of the first-born in the mother's affection. Few people realize how

much a young child *can* suffer under these circumstances, and the older people simply look upon the child as having a "nasty temper" which prevents her "loving her sweet little baby sister."

It is wrong and dangerous to punish a child for this so-called jealousy. Such treatment will only emphasize the sense of injustice which begins to form in the mind of the child, and a deep resentment is felt towards the parents, who, up till the arrival of the newcomer, have showered every attention and expression of love and care upon her. It is lack of thought on the part of the parents which brings about this deplorable situation, and it is of immense importance that the real position be recognized before a worse develops. A mother will soon understand, once her attention is drawn to the obvious unhappiness of the older child. She has only to put herself in its place and the whole situation becomes clear. It is so easy for a mother to take her child into partnership and to make her feel that *together* they will watch over this helpless little newcomer, who can do nothing for herself, and is therefore entirely dependent upon her sister and her mother. In giving the child this sense of responsibility, and allowing her to learn by example that the weak must always appeal to the strong, her resentment will disappear and its place will be taken by the desire to serve that which is dependent upon her.

It would be well to remember that *all* children are sensitive, even those who appear sullen and defiant. It is just this type of child, apparently reserved and silent, who is acutely sensitive. In many instances, the child has been so hurt and bewildered by a lack of understanding on the part of the parent that she instinctively feels the necessity for some form of self-protection, hence the shield or barrier of silence which she places between herself and the rest of her small world of "grown-ups."

The wise mother will not allow this to go further as it will be increasingly difficult to regain the confidence of this unhappy little soul. The sense of neglect and indifference makes the child feel that there is nothing for it but resentment and dislike. The mother who remembers the difficulties of her own childhood cannot be hard upon her children, who do not yet understand the meaning of the word "jealousy."

Jealousy is an ugly emotion, but it will not help matters to say so. The child is already overburdened with the difficulties which surround her. She has lost her sense of proportion and there seems no one to whom she can appeal. The parents who were once so proud of her, now transfer their devotion to the younger baby, unconscious of the fact that there is a most unhappy and lonely little child under their own roof.

The remedy for this unfortunate situation is for the mother to show her child how much she depends upon her for help in all the innumerable duties and additional work which the new baby brings about. It is wonderful how much real assistance the little one can give her mother provided that she is made to feel that her help is genuinely required and appreciated. All the unhappiness disappears and the atmosphere of the home becomes one of harmony and peace. The little one has learnt her first serious lesson of life—that service for others brings contentment.

THE TEETH: HOW THEY COME AND WHY THEY GO

by

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CHAPTER VII

The Teeth: How They Come and Why They Go

It may be truthfully said that a clean mouth is essential for the maintenance of health. But we cannot have clean mouths if the teeth and gums are diseased.

It is by no means sufficiently realized what immense harm can be done to the body by a septic condition of the teeth and what an enormous amount of dental disease is actually in our midst. Roughly 90 per cent of adults in this country have some form of teeth trouble. But appalling as this may sound, dental disease is also rife amongst the children of our race.

Forty-five per cent of children have decayed teeth on reaching school age, and in 14 per cent of these the trouble is severe. Decayed teeth are usually tender, and as a consequence the child bolts its food, and indigestion and its effects on the growth of the body follow.

Now I shall try to explain as clearly as possible how our teeth come and why they go. And to grasp this it is necessary to know something of the general structure of the teeth.

A tooth is mainly composed of a mass of tissue called the dentine or bone, which surrounds a cavity containing the soft tissue (pulp) that

supplies the nutrition. The portion of the tooth sticking out into the mouth is covered with enamel, and the portion embedded in the bone with cement. The tooth is not fixed in the bone like a nail in wood, but springing from the root to the bone is a membrane which acts as a kind of sling. This prevents jars and allows a certain amount of movement. The gum is not attached flush to the tooth but tucks down and forms a shallow trough round the tooth (important to remember, because it is here that pyorrhoea starts).

The twenty milk teeth and the germ of the first permanent molars are already formed at birth, and there is rapid growth during the first year. The first temporary, one of the lower front teeth, may appear at any time between five and eight months. There is considerable variation within the normal, and a mother should not worry if the child does not cut a tooth at six months. If, however, no teeth have appeared at the end of the first year, it may be a sign of rickets, and the child should be taken to a doctor.

The growth of the temporary teeth is usually completed between two-and-a-half and three, and rapid formation of the permanent teeth has been going on all the time.

At any time after five years, the first permanent molars, one on either side, upper and lower, at the back of the mouth, make their appearance. These are the most important teeth in the head.

Between six and twelve the permanent teeth replace the temporary and four new big teeth appear at the back of the mouth, to be followed by wisdom teeth about the age of twenty-one.

This, then, is how the teeth come. Let us now consider why they go.

The two principal diseases of the teeth are Decay (caries) and Pyorrhoea.

Decay is due to food lodging between and on the teeth. The hard part of the tooth is gradually destroyed by acids formed from certain foods, especially starches and sugar, and the soft part is then broken up by the action of germs. The decay, if left untreated, spreads to the pulp cavity; the pulp dies and an abscess may form around the end of the tooth.

The prevalence of decay in the present day is due to the altered character of our foodstuffs. These are softer and require less mastication, the fibrous element has to a great extent been removed and the carbohydrates—that is sugars and starches, from which the acid is formed—are more fermentable than the foods in general use in former generations.

Foods made from starches cling about the teeth, while the sugars are readily dissolved and find their way into every crevice. The most harmful foods are soft biscuits, bread made from roller-milled flour, and sweets.

Experiments have shown that children who eat

sweets in large quantities will return from school each term with a plentiful supply of fresh and generally rapid caries, but when the eating of sweets is stopped the amount of fresh caries quickly declines. People who dislike sweets and sweet things invariably have teeth above the average.

Pyorrhoea is caused by the food which lodges in the trough between the gum and the tooth. The food ferments there, and destroys the soft tissue, and a "pocket" is formed where more food collects and putrefies. Eventually all the tissues which hold the tooth together waste away and it falls out.

By no means all the diseases usually attributed to septic teeth can be justifiably termed a direct result. But sepsis of the mouth is undoubtedly a contributing factor to many diseased conditions of the body.

The sepsis acts in two ways:

(1) The poisonous matter is being continually swallowed with the saliva, and in time this leads to trouble in the whole of the digestive track. Chronic indigestion is often due to this cause.

(2) The diseased teeth often affect the surrounding bone, and the poisons are absorbed through the blood-stream and may affect the various tissues and organs.

A condition of general ill health may follow, or a certain weak tissue may suffer before others that are stronger, or a part already diseased may be

prevented from recovery because of the poison in the blood-stream flowing to it.

How can we prevent all the trouble connected with faulty teeth?

The important thing to remember is that both decay and pyorrhoea are caused from food clinging about the teeth. The obvious course, then, is to keep the teeth clean. This should be done by both natural and artificial methods. The natural one is to eat food that does not cling about the teeth. Efficient mastication is the best toothbrush of all. Eat food that requires mastication and avoid soft, pappy diet.

This I know is a counsel of perfection and is very difficult to follow in conjunction with our modern methods of preparing food, but if you must have starches and sugars, try to end the meal with something that is not starchy. An apple is often advised, but an apple after every meal is not within the means of all. It should not be difficult, however, to finish a meal with a piece of lettuce or any kind of fresh green vegetable food with stringy and cleansing properties. Above all things do not take biscuit and milk food before going to bed.

Another point to remember is correct breathing. Always breathe through the nose, as breathing through the mouth causes the gums to become inflamed, and also increases the number of germs in the mouth.

If care is taken with children in these matters their teeth will become all the stronger and more likely to resist possible attack.

The second line of defence lies in artificial cleaning.

It may not be possible to use a toothbrush after every meal, but a good swill with clean water will go a long way to get rid of the food debris. Never go to bed without cleaning the teeth. Your brush should be small with not too many bristles, and not too stiff. The upper teeth should be brushed downwards and the lower upwards—in other words up and down instead of crosswise. Do not brush the gums. Some people imagine they should do this till the gums bleed, but this means removing their soft cover and rendering the tissues more liable to infection.

The spaces between the teeth should also be cleaned carefully each night by a piece of dental floss-silk.

It is a good plan to visit a dentist twice a year. If a tooth has commenced to decay it can easily be treated. And further, a periodical removal of the "tartar" on the teeth is most essential if the mouth is to be maintained in a healthy condition.

Remember above everything that the surest method of prevention is keeping the teeth clean.

THE CARE OF THE EYES

by

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CHAPTER VIII

The Care of the Eyes

ALL advances in the practice of medicine tend towards the deference of active curative measures to those of prevention, and of the special branches of the art, ophthalmology occupies a prominent place in this advance of treatment. Herein lies the gist of my subject—the demonstration of preventive measures and common-sense principles of visual hygiene. The neglect to observe already generally accepted dicta appertaining to the care of the eyes has frequently manifested itself in consulting and hospital practice, occasioning both surprise and concern: however, through the media of the general practitioner, the Public Health services, and improvement of the general standard of education, there is a definite diminution in the incidence of such self-neglect.

I am adamant in impressing upon you the extreme necessity for the very early treatment of eye trouble, for it is no exaggeration to state that 60 per cent of the blind in this country might have been in possession of useful vision if only timely aid had been sought. When pathological changes involve structures as delicate as those of the eye, every moment lost is to be regretted, since the eye is a very specialized organ and its essential

tissues are incapable of recovery and reformation if disease is allowed to progress to any degree without intervention. Time and time again I have been amazed that patients, even of good education, have allowed one of their most precious possessions to fade until sheer necessity has brought them to the consulting-room. The delay occasioned is sometimes due to apprehension on the part of the patient, who may be fearing a sad verdict; it is sometimes the result of sheer self-neglect; and thirdly, it is possibly because the sufferer has become a victim of the quacks and charlatans who abound professing the cure of the ailment by an easy though usually expensive method. Bereft of vision and of riches, a patient presents himself, sadly realizing the folly of having delayed properly directed and efficacious treatment.

It is of course axiomatic that a maximum standard of visual efficiency can only be obtained if due care be continuously given from childhood, and indeed I am in accord with those authorities who ardently stress the importance of ante-natal care of the expectant mother, for among other reasons many eye disorders possess hereditary characteristics.

Hereditary Eye Diseases

The subject of ophthalmology in its relationship to heredity is both vast and entrancing, but the

scope of my address is such that it is impossible to deal with it in an extensive manner. Of the groups of eye disease which may be designated under this heading I will confine myself to dealing with Myopia, or short-sightedness, and secondly, the effects of heredited venereal disease upon the eye tissues.

Myopia.—Short-sightedness is an eye affection which merits far more care and attention than is bestowed upon it by lay folk, perhaps because it is not generally appreciated that it is a lesion in which hereditary factors play a great part. When confronted by a case of myopia, I have been impressed with the fact that a history of the same trouble is frequently elicited from other members of the family. I recall examining a family of six, consisting of the parents and four young children, who were all very short-sighted. The parents' defective vision had been grossly neglected and the affliction had been transmitted. It is well to bear in mind then that there may exist an inherent tendency to short-sightedness and that with the appropriate treatment—which may mean the wearing of spectacles, the minimizing of eye work, attention to general health, and working in good illumination—a great deal of that inherent tendency is partly, or even completely, overcome.

Venereal Disease.—Venereal disease is accountable for more blindness than any other infection or degeneration of the eyes, for 50 per cent of the

total number of the blind in Europe owe their affliction to heredited venereal disease, and 20 per cent become blind in their first year of life. Gonorrhoea is the more active agent than syphilis, the latter producing its effects later and more assiduously. It is stated that in spite of active treatment only 50 per cent of eyes recover completely, but this figure is too high.

(*a*) *Gonorrhoea.—Ophthalmia Neonatorum*, which is invariably due to gonorrhoea, may be defined as "a purulent discharge occurring from the eyes of an infant, commencing within twenty-one days of birth." Fortunately not all cases are so due, but any discharge occurring within this period must be regarded as such until the diagnosis has been completely eliminated by the ophthalmologist and bacteriologist. Until then it is imperative to institute treatment for gonococcal ophthalmia so that no time be lost. Otherwise severe inflammation of the eye tissues of the babe will result in subsequent perforation of the eyeball, and so blindness ensues. Prophylaxis in the treatment of this disease has been the greatest boon to humanity, for since the inauguration of preventive methods at birth the incidence of disastrous *sequelae* has considerably diminished. Immediately after birth the eyes are bathed with mercury perchloride solution 1 : 6,000 strength, and a drop of 1 per cent of silver nitrate solution is instilled in either eye. This simple preventive treatment invariably

destroys the specific organism and thereby the risk of inflammation supervening is considerably minimized, but should it still occur the virulence is greatly lessened. An examination of the records of children brought to the Queen's Hospital for Children in London shows that during two months only one case was suspected and that was subsequently proved to be negative. This is adequate evidence of the extreme value of prophylaxis in its relationship to heredited venereal disease.

(*b*) *Syphilis.*—Inherited syphilis may not affect the eye for some years, and all its tissues can be so attacked. Indeed the eye symptoms and signs may give us the first indications of inherited syphilis. A haziness of the cornea which is the transparent area in the front of the eye can be produced and is called *interstitial keratitis.* This haziness later gives place to complete opacification which prevents the entry of light, while small newly formed blood-vessels can be seen coursing over the previously clear area. However, it is amazing and gratifying to watch the disappearance of these signs, provided of course that they are not too advanced when anti-syphilitic treatment is instituted. The majority of these cases have other syphilitic stigmata such as defective teeth, deafness, evidence of bone or joint disease and imbecility, but it is unusual for these accompanying conditions to disappear too. When the optic nerve is involved the condition is grave, for

blindness invariably ensues. The great problem of prevention and treatment of venereal disease still presents itself, but the thorough organized attack of medicine to-day bodes well, I think, for future generations. The ravages of these diseases are abundantly manifest. I have mentioned the conditions of syphilitic keratitis and syphilitic optic nerve lesions to illustrate that while one type of the disease reacts satisfactorily to treatment another leads to blindness.

Care during Childhood

The care of the eyes should begin at birth and should continue uninterruptedly throughout life. Practically speaking a child's future—education, livelihood, the appreciation and enjoyment of the beauties of creation—depend upon the preservation of good eyesight. In spite of all the distress and discomforts that attend a faulty vision or a loss of sight, many children are yearly deprived of this faculty simply through neglect to observe the common laws of hygiene. Reckless exposure of the child's eyes to light, pernicious school influences, and many other violations of the laws of hygiene in regard to the eyes are responsible for some of the diseases in our midst.

A child requires change of scene and amusement and for this reason it is unwise to keep a little one confined to the play-room day after day;

for remember that the health of the eye is directly dependent upon the health of the general system. During the period a child attends school the eye tissues have not fully developed, so that it is essential that surroundings give of the best in lighting and hygiene, and that the amount of eye work will be of the minimum.

Unless there be exceptional circumstances of domestic utility or necessity, children should rarely be permitted to start school life before they have reached their sixth birthday. Few are sufficiently developed or sturdy enough to endure either mentally or physically the discipline and exactions of application and study before that age. The parents and teachers of the child, as soon as its school life commences, should have definite authoritative knowledge of the visual conditions. No young one, in my opinion, should be permitted to commence studies until the child has been subjected to a careful ocular examination and all defects so discovered have been corrected. Such tests are of paramount importance, for the correction of detected errors enables him to enter upon school life on equal terms with his fellows, which would not have been the case had the visual deficiency not been so recognized. In years past too many scholars have been adjudged backward and stupid by reason of undiscovered defective vision alone. We must consider, moreover, a group of children who are able to pass

school tests for vision without difficulty, but who are still very badly in need of correcting lenses. They are only able to do this by the expenditure of a greater amount of muscular effort. These children may be without symptoms until later in life when a serious error develops which might well have been prevented had their eyes been properly cared for early. The routine examination of children's eyes is a project which should be encouraged on every possible occasion, and by such means many disasters may be averted early in life and sight preserved.

Eye Strain

I will now proceed to enumerate some of the signs and symptoms of eye-strain in adults. This is the most common eye disorder which brings patients for consultation. It is characterized by a complexity of symptoms—dimness of vision for close or distant objects, sometimes both, pain in the eyes, headaches and attacks of dizziness. The eyes feel heavy and tired and frequently look inflamed. These symptoms may be due to what is termed a refractive error. That is to say, the mechanism whereby the eyes form an image on the retina is at fault. On the other hand, the faulty focussing of objects can occur when the refractive system is normal and it is then due to organic disease which will be discovered on examination. Approxi-

mately 60 per cent of patients consulting me for eye-strain have headache. Usually pain over one or both eyes is significant, and pain in the temples and top of the head is frequently originated by eye-strain. The time of the occurrence of the head pain will often establish a connection between it and ocular exhaustion. Thus a morning headache may be induced by the prolonged use of the eyes the previous evening, or headache may arise in the evening after some hours at the desk. Dizziness is due to a variety of causes, but that directly consequent upon ocular disorder is a well recognized clinical entity.

I have been impressed by the frequency with which these symptoms are complained of by young men and women who have, within a short time of consultation, commenced the wage-earning stage of their career. The causation falls into two groups. In the first group we recognize that the changed conditions of the patients' existences exemplified by the longer hours of physical and mental application, frequently spent wholly in artificial illumination, the change from an outdoor to a sedentary occupation, assumption of responsibilities, and the anxiety to maintain or improve their wage-earning capacity are all influences which may accentuate the symptoms of eye-strain previously obliterated by the corrective influences of a less artificial mode of life. In the second group there has been no pre-existing eye defect to

precipitate the symptoms of eye-strain, but the focussing apparatus of the eye, as the direct result of additional physical and mental stress, has lost tone. Clearly, for the first group lenses must be prescribed and the patient warned of the consequences of neglecting to seek periodic examination until the abnormality has been fully compensated for. The treatment of the second group is much simpler, and usually it is found that with the minimizing of eye-work, and attention to general health, the ocular symptoms soon disappear. It may, therefore, be thought expedient that with this type of worker, if an element of doubt exists as to visual efficiency, the opinion of an opthalmic surgeon should be sought and any defects so discovered, corrected. This will enable the individual to enter upon a career on equal terms with his fellows and so fit him, as far as sight is concerned, for the competition he must encounter.

A very common cause of eye-strain in adults occurring for the first time about the age of forty-five or fifty is presbyopia. It is equally common in both sexes and manifests itself by inability to see near objects clearly. Thus, reading a newspaper will present difficulty, or threading a needle may be troublesome. It is due to a lack of elasticity of the lens of the eye so that its focusing power is diminished. This form of eye trouble can be completely relieved by prescribing appropriate

lenses and is in no way pathognomonic of serious eye disease.

Another frequent cause of eye-strain in adults is produced by excessive eye work. It is no uncommon occurrence for a patient to come to me complaining that the eyes are becoming weaker and the symptoms alarming. An analysis of their story reveals that the eye tone is being dissipated by excessive use of these delicate organs. Such patients frequently seem astonished when one points out that their symptoms are produced only by their own folly: that the eyes need rest just as other organs of the body do, and of course when they use their eyes within normal and sensible limits their symptoms disappear.

The Industrial Worker

Let us now consider the care of the eyes of those engaged in the vast productive occupations, having as yet confined ourselves to the individual. It is commonplace that the social conscience of to-day is considerably more sensitive than that of fifty years ago, and the development of industrial welfare and public health administration must be ascribed, in part at least, to this factor. Economic considerations are, however, the proximate cause of the increased interest which the large-scale employer exhibits in the social well-being of his staff. Conditions of labour in the last century were such that

an employer was involved in practically no loss in consequence of imposing a physical strain which impaired the earning capacity of the employee, since replacement could be effected quickly and inexpensively. The advent of machinery has nowadays made it necessary to provide a highly disciplined labour team, any change in the personnel of which must, undoubtedly, effect a loss to the employer. It follows that one of the primary functions of industrial administration is to maintain a permanent labour force, with a high and constant standard of efficiency, in order that production may be as economic as possible. This is especially important where the particular form of labour imposes strain upon the visual structures.

First, I strongly advocate the attachment of a medical staff to industrial establishments employing numbers of people, encouraging immediate consultation of the staff although the trouble be slight. For it is readily accepted that with the advent of maintained and improved general health of the individual the incidence of serious eye disorder has, during the past two decades, definitely diminished. To this I will make further reference later.

To prevent or at least to minimize the danger of ocular injuries we must first inculcate in those exposed to these risks lessons of heed and caution, and undertake educational campaigns dealing with the care of the eyes. It is incumbent upon the

employer to possess every form of safety device which is adapted to his industry. Injuries to the eye are, unfortunately, very common. Notwithstanding the anatomical protection afforded the eye by the bony orbital margin and the eyelids, its position is exposed and the eye thus liable to serious accident, of all cases of blindness 16 per cent are consequent upon external injury. The nature of eye injuries is manifold, but the commonest lesion occurring in the course of employment is that resulting from a foreign body becoming embedded in the front of the eye. Frequently this accident is due to sheer carelessness and a willingness on the part of the employee to take unnecessary risks. Flying fragments may strike the eyes of those working upon abrasive wheels such as buffing and grinding wheels, or in the chipping or cutting of metal and in the use of burred tools. In sand blasting and in spraying operations there is a similar risk. The one great protective measure against such an injury is the wearing of goggles, and yet it is surprising how loath workers are to adopt this simple measure. They complain of the weight of the goggles upon the face, and sometimes fear that, should an accident occur, the glass front will be driven into the eye. In one factory I investigated the histories of goggles damaged as the result of accident, and in every case the goggles performed their function —the eyes of the wearer were saved.

Artificial Illumination

I have now to consider the question of artificial lighting, since if this be ill-adapted, or inadequate to the specific requirements of those working in the area illuminated, will inevitably produce symptoms of eye-strain. Man is the product of outdoor environment. We should realize we have not lived indoors long enough to alter fundamentally our eyes, evolved under certain outdoor distributions of light and brightness and under certain intensities of illumination. When natural lighting is absent every effort should be made to ensure that it be approximated by artificial lighting. Until a few years ago producers and distributors of light, like crabs, approached their objective backwards, for millions were spent without thinking of what was needed by the consumer, the eye. In the past, lighting systems were not considered apart from utilitarian, structural, or architectural considerations. Fortunately these conditions have changed for the better and continue to do so almost daily.

The fundamental principles underlying artificial illumination are that it must give a steady, unflickering light of sufficient intensity, but with complete absence of glare, and that there be proper disposition of light, with regard to the eye, of the object and the observer. Also, the illuminated room must be pleasing in appearance

and appeal to the aesthetic taste. There can be no standardized arrangements of lights to give the best effects, because every area and every use to which an area is put makes different demands.

Proper illumination, both natural and artificial, has a distinct commercial value on the output of work. Placed under the most suitable conditions of illumination, the employer will find that his workers show far less tendency to ocular fatigue, with a concurrent increased rate of output, and furthermore a higher standard of general efficiency will exist than when a less favourable illuminating state obtains.

Relationship of Eye Disease to General Disorders

Mention has been made of the relationship between the health of the eyes and general fitness. The eye is part, and a very important part, of the general organism and participates with many, if not all, of the various disorders which affect the body. To keep in mind the dictum, "The eye is not in the body, but is of the body," helps one to maintain the proper perspective in ophthalmic treatment, since a rational line of treatment of eye disease can only be evolved from a comprehension of the general disturbances of the human frame. The interpretations of the eye specialist are therefore much wider than may be expected. By

reason of the particularly intimate association of the eye with the nervous system, there is scarcely any affection of these structures without ocular implication, and the first symptoms to appear are, more often than not, *ocular*, so that the ophthalmologist is frequently the first to discover the existence of brain or spinal-cord disease.

A doctor can judge of the state of the blood-vessels and circulatory system by the feeling of the pulse, timing its rate, measuring the blood-pressure, and listening to the heart sounds. The eye specialist by means of the ophthalmoscope possesses an additional diagnostic aid, for with it he can actually observe the blood-vessels themselves in the eye, and their state of health will be in accord with that of the body. The patient can be warned of the evidences of insidious disorder before other positive signs are manifest and for which treatment can be immediately inaugurated as the result of the eye examination alone.

Experience has shown that certain organs are capable of harbouring harmful germs where they may lurk, until perhaps resistance against infection is lowered and then their influences become manifest. These nooks of infection may be present in the teeth, tonsils, in the air sinuses of the nose, in the intestinal tract and the genito-urinary system, and one or more of these structures may require investigation and treatment in order to produce a cure of eye disease.

Cataract, a disease only too well known to the layman, may be taken as an example of disordered constitution producing changes in the organs of vision, for the trend of modern opinion is to regard that type which comes on in old age as being due to alterations in the whole organism rather than to any local or mechanical cause. With regard to sex, in an analysis I carried out from the reports of cases admitted to the Eye Ward of Guy's Hospital, there were in thirteen years 514 cases, 258 males and 256 females. This reveals strikingly how evenly the condition of senile cataract is distributed between the sexes, and is in keeping with other figures which show that both sexes are equally prone to fall victims to eye disease as the result of general constitutional disturbance.

Arterio-sclerosis, congenital and acquired venereal disease, diabetes, diseases of the heart and nervous systems are amongst the many causes for humanity seeking the aid of the ophthalmic surgeon. Happily, the methods which now obtain of arriving at an early diagnosis of general constitutional disorder, improved technique in treatment, and the hygienic conditions existing which help, expedite, and maintain a patient's recovery are all factors full of import in lessening the frequency of eye troubles.

Conclusion

I will enumerate the salient features:

(*a*) The importance of seeking early consultation when the eye structures are involved because of the delicacy of the visual apparatus which may be permanently impaired if disease be allowed to progress to any degree without intervention.

(*b*) There exists a hereditary factor in the causation of eye disease.

(*c*) The care of the eyes begins at birth and should continue uninterruptedly throughout life.

(*d*) Proper illumination has an important economic value.

(*e*) A maintained state of good health usually means preservation of the visual faculties.

THE PROBLEM OF SPEECH DEFECTS

by

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CHAPTER IX

The Problem of Speech Defects

I HAVE always understood that a lecturer must know everything about his subject, so I had better begin by telling you that I do not know everything about stammering and I am quite sure that no one else does. What I want to do is to tell you what I have found out as a result of a life-long interest in stammering and kindred subjects. I want you to realize that it has been very aptly called a problem. I am not giving you the solution to this problem, because I do not know it; I am going to try to tell you how far I have got towards a solution.

What is stammering? We all know what it sounds like, but what is it? If you ask most medical people what stammering is, they will tell you, quite rightly, that it is lack of co-ordination between the brain and the organs of speech. That sounds very well, but it leaves you just where you start! If your watch stops and you take it to the watchmaker, and he tells you that there is lack of co-ordination between your watch and Greenwich time, you will naturally ask for some more definite diagnosis. Perhaps he will tell you that the mainspring is broken; that is very often the cause of a watch stopping. As an illustration may I suggest that a stammer is the breakdown

of the mainspring of speech. All the mannerisms, twitching, grimaces, and other unfortunate habits that stammerers develop may be compared with wheels of the stopped watch. The broken mainspring is the cause of the stopping of all the wheels; so with stammering all the tricks follow the breaking of the mainspring of speech—the breakdown of the voice tone.

Whatever its particular form, stammering is always a cessation of vocal tone; therefore I say, "Train the larynx; train the voice tone." When I first came to London fifteen years ago to give my whole time to the problem of stammering, I went to the British Museum, and I found that about thirty books had been written about stammering; of these I was able to find and purchase about twenty. Some of these were privately printed, and were merely propaganda about establishments where stammering sons of rich men were made welcome in return for big fees. I remember one very famous establishment where facilities were given for hunting and shooting and some speech training was taught! Another such establishment specialized in theatrical performances by the pupils, and parents were invited down from time to time to hear the entertainments and went away duly impressed. I can imagine a fond mother returning to her home and telling her husband that Jack could not only speak now, but that he actually took part in a play; that he did stammer

rather badly when she arrived, but that was very likely due to excitement at seeing her. What the parents did not know was that nearly all stammerers are fluent when on the stage! But to return —all the books which I was able to obtain which gave any solid advice were unanimous in this advice, "Keep the tone going."

Now see how this is corroborated by the well-known fact that all stammerers, if musical, can sing fluently. The explanation is easy—when singing all the attention is concentrated on voice tone. When you sing, you not only think of your voice, but you think of the particular note you mean to sing and you think of the exact time value of that note. In other words, you have a complete plan of action, absolutely cut and dried, and your mind being concentrated on tone production, all trace of stammering disappears.

Now view this problem from another angle. Any observant person will agree that 99 per cent of small children stumble over words—in other words, they stammer—when they are mastering the more difficult words and double consonants. Anyone will agree too that the typical rhythm of a child's speech is staccato. By the time children are seven years old nearly all of them have mastered comparatively fluent speech; but one per cent, the nervous child, highly self-conscious, becomes conscious of the liability to stumble, anticipates further failure, and the more he

anticipates failure the more he fails till he has developed a "vicious circle" and becomes a nervous stammerer.

That, by this time, it is a nervous complex is proved by the fact that any stammerer can speak or read when alone in a room, but is liable to stammer as soon as someone else enters it. Then there are stammerers who stammer more with certain people than with others; this is obviously more than half a nervous disorder, but it has grown out of a careless speech habit in the first place.

Now, if I have outlined what a stammer really is, and many years of experience convince me that I have done so, we are confronted by the problem of what is to be done about it: is it to be treated as a nervous disorder, or is the stammerer to be taught to speak all over again?

Treatment by suggestion is frequently completely successful *for a time;* the stammer disappears absolutely, but only too often it all comes back again after a few weeks or months. The reason for this is that treatment by suggestion leaves the rapid, staccato speech with the clipped vowels which are always associated with stammering, so that the stammerer cured by suggestion is a perfect subject for a relapse.

If, on the other hand, we treat the stammerer through voice production, we make a stammer impossible, because we have corrected all the

typical tricks of the stammerer. He is now speaking slowly instead of quickly; he is now stressing his vowels instead of clipping them; he is now speaking "legato" instead of "staccato." Instead of the light, hesitating tone, he is now speaking firmly, and I can imagine nothing more calculated to cure a stammerer's "nerves" than to hear the sound of his own firm voice and speech that sounds full of confidence. After many years' experience I can assure you that success is absolutely certain if the stammerer will study speech from the angle of voice production, just as he would if he wished to learn to sing.

Granted then that we are going to work on these lines, I want to stress the close connection between speech and song. We are not bi-vocal; we have only one larynx with which we speak and sing. The stammerer must work on the lines of singing; what he can do when he is singing, he can do when speaking, if he concentrates on voice tone.

Now I want you to turn your attention to the close connection between speech and song and to think of the way in which music, especially church music, has grown out of speech. In the old days, when churches were lofty and were built of stone instead of iron, the problem of audibility presented itself. It was found that the low pitch used in speech did not carry well enough, so the monotone was invented; out of it grew the

old plain song with its later development—the Gregorian chant. So I think you will agree that we are justified in linking speech and song as closely as we can.

Now will you think of the differences between average speech and average song, remembering that I contend that these differences should not exist if the speaker aims at the best and highest standard.

Think of the rhythm to be heard in any song, and compare this with the lack of rhythm, in the average spoken sentence, yet there is no reason why speech should not be rhythmic. Compare the continuity of tone heard in song and contrast it with the lack of continuity of tone in the speech of a stammerer and, in a less degree, in average speech. Again, compare the depth of tone heard in a song and the lack of tone in the voice of the average speaker; yet without depth of tone the words of a speaker have much less weight. A firm and full tone gives an impression of authority and certainty and is an important factor when one man has to control several. Lastly, and most important of all, think of the comparatively slow pace of a song and the rapid gabble of the average speaker. For teaching and explanation it is essential to speak slowly, because the speaker is giving out predigested matter and is presenting his subject from a fresh angle to his audience. Unless a lecture is delivered slowly it is waste of the time

of the speaker and audience. In this connection I would remind you of the splendid example set by the Prince of Wales, whose speeches are easy to follow, because he speaks slowly and uses very short phrases, thereby giving his audience time to absorb each idea before he passes on to the next one.

I hope I have been successful in persuading you that a stammer is a nervous trick that has grown out of a careless habit of speech, and that the most certain method of correction is to re-educate the speech on the lines of voice production and rhythm, always remembering that there should be no hard line between song and speech, but that nearly all that applies to song should apply to speech.

If you agree with me, then the stammerer must seek help from an elocutionist, but I want to stress the point that it must be real elocution, not the smattering of stage-craft with exaggerated consonants which generally passes for elocution. There are too many schools of elocution granting diplomas to pupils, who cannot speak the English vowels sounds and do not even know them or how many there are! This is bad enough, but such schools very often undertake to correct speech defects, although they have not any of the knowledge needed for such work.

In southern educated English there are twenty-four vowel sounds; there are eleven simple

sounds, heard in the words: seat, pig, leg, can, boot, foot, hop, ark, cord, hurt, and cut. There are ten diphthongs, or double vowels, heard in the words: tale, hair, home, tune, night, loud, hoist, hear, moor, and beard. Lastly, there are three triple vowels, heard in the words: cure, tower, and fire.

I hope you will agree with me that the beauty of spoken English depends upon the perfect pronunciation of these vowel sounds, that speech rhythm depends upon understanding and using these vowels. You must admit that all musical tone heard in speech will be heard in these vowels (there is practically no tone in consonants), and that all individuality will be in the vowel sounds in which the voice tone of the speaker is heard.

If I have been at all successful in proving my contention you will agree that careful study of vowel sounds is essential for anyone who aims at rhythmic speech, and that such study is the stammerer's one and only hope of a permanent and thorough cure of his disability. Another aspect needs some explanation. I am constantly asked if I think special breathing exercises are needed; only the other day I was asked this question by a well-known athlete! I ask you, how could a man, able to play in first-class rugby football, be short of breathing power for speech? I am quite aware that many others who undertake remedial elocution concentrate upon breath-

ing exercises, but I stick to my opinion that they are unnecessary, and I will tell you why.

I admit that a stammerer is very often short of breath and consequently unable to finish a short phrase until he has taken another breath, but the reason why he has not enough breath is that he has wasted it by letting it escape too quickly through his larynx. Test it for yourselves; take a breath in and *breathe* it out again—even a trained singer cannot make this outgoing breath last more than four or five seconds. Now take a breath in and sing it out on an easy note and you will find that it will last for twenty seconds without any effort. From this we see that it is a matter of vocal-cord resistance, not a matter of a big breath being taken in. If the vocal cords are brought together properly, there will be no question of shortage of breath. Now you may say, "How are we to know whether we have got our vocal cords approximated correctly?" It is only a matter of voice tone. If the tone is firm the cords *are* firmly approximated. Test it once again. Make a "breathy" note and notice how quickly you have finished up your supply of breath: the reason being that your cords were not quite together and so a lot of breath was escaping without producing its share of voice tone. I need hardly add that the advice so often given to take a deep breath only increases the difficulty, because it makes it harder to control the vocal cords.

Perhaps some of you are thinking that it is all very well for me to say that if you think of firm tone your vocal cords will come firmly together, but why should they! I would ask you to remember that singing is a matter of muscular movements just as much as throwing a cricket ball. In the latter case the athlete thinks of the completed action—in his mind he pictures the ball going into the wicket-keeper's hands—and, if his picture is accurate, his muscles will respond automatically. Exactly the same applies to the voice; *if the vocal tone has been mentally pictured the muscles will automatically give that tone.* Remember this is proved by the stammerer's ability to sing! So the stammerer must think of firm and full tone all the time.

Now you will be saying quite justly, "If it is as simple as this, why is not success always 100 per cent assured on this system?" Now we come to the psychic aspect as it concerns us. Many stammerers do not want to lose their disability; I am thinking of the athletic son of a business man; as long as his stammer lasts it is his protection from office life which he dreads, and enables him to go on giving all his time to lawn tennis which he likes! I have found this again and again among school boys who find an escape from work through a stammer! I have also found patients who are not good "mixers"; they prefer solitude; for such people a stammer is a protection from social

intercourse. It is essential to be quite sure that the patient wants to lose his disability, otherwise failure is quite certain.

Now we must think for a moment of those who want to be cured but cannot take the plunge; they think a changed voice will be conspicuous.

I want to make it quite clear that I teach exactly the same voice control to actors, public speakers, and stammerers. I do not teach a trick to cure a worse trick, I teach musical rhythmic speech, pleasant to listen to and easy to hear.

It is essential for the stammerer to work positively instead of negatively; he must work to develop good voice tone for its own sake, because it is the best way to speak; he must give up trying not to stammer, which is merely negative and would have proved effective long ago if it was any good at all. It is not too easy, believe me; when a stammerer has been trying not to stammer for some ten or more years, it needs a lot of courage, a lot of grit, to abolish that idea and switch the mind over to a positive train of thought—to develop correct voice tone, correct speed, and to speak smoothly and evenly.

Stammerers who will follow this advice in full, without compromise, can be certain of complete cure, *but they must do the work*; the best teacher in the world can only tell them what to do, he cannot do it for them.

Here is my advice for all stammerers.

Speak slowly, firmly, and evenly all the time.

Slowly—because if a thing is worth saying, it is worth saying slowly.

Firmly—because if a thing is worth saying, it is worth saying as if you mean it and as if you have a personality.

Evenly—because without smoothness there is no music in speech, and an impression of excitability is given.

All the time—because the real problem is to develop a new and correct habit in place of an old and incorrect one.

BLOOD-PRESSURE

by

LEONARD WILLIAMS
M.D.

CHAPTER X

Blood-Pressure

WHEN, with an airy wave of her hand towards her heart, Mrs. de Vere Tompkin of Peckham announces that she has "got blood-pressure," she means you to understand, not that she is in pain, but that she is in the fashion. Also, though she knows it not, she is expressing a simple physiological truth; because if she did not have blood-pressure, she could have no circulation of the blood, and without a circulation there would be no such thing as Mrs. de Vere Tompkin of Peckham. What she really implies is that she has got unduly high blood-pressure.

Now in order to understand the full significance of this lady's pathetic suffering, we must recapitulate briefly a small portion of the story of the circulation of the blood. The blood circulates through all the tissues of the body by means of an organ called the heart, which is at once a force pump and a suction pump. Now this pump forces the blood into the arteries, and the force is exercised not only along the arteries but sideways, from within outwards. That is what is meant by blood-pressure—the force which the circulating blood exercises upon the conduits. Now it is perfectly obvious that if the force of the

heart pump remains equal, the strain exercised upon any given blood-vessel would depend upon its calibre, that is to say the size of the tube, whether it is as thin as a needle or as thick as your little finger. The arteries in the body are so constituted that they contract or dilate to order. That is commonly seen in blushing and flushing. The arteries in the face dilate and become filled with blood to produce the red colour with which we are familiar. The opposite condition of sudden pallor is due to contraction of the arteries in the same area. From these instances it will be obvious that the size of the blood-vessels in the face is a matter which is under the control of the nervous system. We blush because we are shy, which is a nervous matter, and we suddenly blanch because we are frightened, which is also a nervous matter. The whole intricate map of the blood-vessels in the body is thus under control of the central nervous system situated in the brain and spinal cord, which is the same thing as saying that the blood-pressure is under control of the nervous system. If the nervous system ordains a contraction of the blood-vessels all over the body, then the pressure rises. If it ordains a relaxation of the blood-vessels all over the body, the pressure falls.

The blood-pressure in the body is measured by an instrument just in the same way as the temperature of the body is measured by an instrument

called the thermometer, and you can no more tell—even approximately—the blood-pressure in a person at a given time without an instrument than you guess his temperature without a thermometer.

The normal blood-pressure of an individual is said to be that individual's age plus one hundred. This means that, the person of twenty should have a blood-pressure of one hundred and twenty, a person of forty a blood-pressure of one hundred and forty, a person of fifty a blood-pressure of one hundred and fifty, and so on. This is not strictly correct, but it usually serves as a roughly accurate guide up to the age of fifty. Nobody should have a blood-pressure of over a hundred and fifty, ever—I mean a permanent blood-pressure of over a hundred and fifty. It is to be remembered—and this is a matter which requires much emphasis—that the blood-pressure in a perfectly healthy individual may vary within very wide limits. A young man, for example, say of five and twenty, who is perfectly healthy in every way, if he engages in athletic sports, will have a high blood-pressure during the time he is so engaged—running a race, sculling a boat, riding a horse. In all these activities the pressure will rise, and it will fall again rather below its original figure until a period of rest has stabilized the mechanism. If we take a person and raise his blood-pressure deliberately, as it is possible to do, say by a cold bath, the rise of pressure causes

a feeling of stimulation and well-being. The arteries contract, the blood-pressure goes up. If the blood-pressure is raised in a person with perfectly healthy responsive arteries, then a reaction comes and everything returns to normal. If, however, you take a man well past middle age, whose arteries are beginning to wear out, and you raise his blood-pressure, especially if you raise it suddenly, as by fright, any weak spot which he may have in the walls of his arteries will probably give way, and a haemorrhage result. Haemorrhages from such causes as this occur from the nose, into the eyes and into the brain. On consideration it is obvious that a person with high blood-pressure may bleed from anywhere, provided that his arteries have weak spots in them somewhere. When arteries are weakened in the brain, sudden haemorrhage may have very dramatic results. Haemorrhage into the brain causes what we know as a fit of apoplexy, which is liable, when it does not kill, to leave paralysis on one side of the body. The sound resilient arteries of young, healthy people will stand an enormous amount of strain without giving way. But when one's arteries are badly treated, as they are liable to be in the case of the ordinary civilized town dweller, they gradually deteriorate and when they deteriorate they gradually contract and harden and ultimately raise the blood-pressure.

The main factors in raising blood-pressure are poisons circulating in the blood, acting on the walls of the vessels in such a way as to impair their elasticity. Once an artery begins to lose its elasticity it is in a fair way to raise the blood-pressure. Arteries are contracted by certain poisons derived from food, drink, tobacco, and self-indulgence generally. Mrs. de Vere Tompkin of Peckham need not, therefore, pretend that having high blood-pressure conjures her into the magic circle of patricians, because in nine cases out of ten, high blood-pressure is the result of ignorance, stupidity, and obstinacy in matters of health.

The typical high-blood-pressure man is about fifty years of age, with an aldermanic abdomen, loud voice, aggressive manner; competent, efficient, prompt. His undoing comes from the fact that he has a vigorous digestion, and is, therefore, not warned that his way of life is harmful. He does not believe in the "nonsense those damned doctors talk about diet and so on." He belongs to the yellow ribbon brigade, whose motto is: "You eats what you likes, you drinks what you likes, you smokes what you likes, and you don't care a damn for nobody." One fine day a heated argument in a foetid atmosphere on a full stomach causes him to faint. His tight collar is loosened, and he is carried, breathing heavily, on to a sofa. If he survives, he is found to be paralysed down

one side, and his work in this world is done. Such a man is not altogether to be blamed, because all the time that he has been poisoning himself, his blood-pressure has been gradually rising and he has been feeling extraordinarily well. That is the worst of high blood-pressure. It gives you no warning. It creeps, and the victim is usually envied by his friends. Here let me quote Dr. Norris's well-known description of high-blood-pressure men. "They work hard and play hard; they have great vitality and have rarely been ill. . . . They are hustlers who do things against time and get them done. They cannot idle and never relax. They are the people of action and decision who shoulder great responsibilities and are in no small measure responsible for the seething urgency of our life to-day. They are the analogue of the one-horse shay, sturdy to the end, which comes with a crash."

Now let us contrast this picture with one showing the opposite extreme in blood-pressure—unduly low pressure, also called hypotension. This means that the arteries are relaxed. The victim of this condition has no energy, no joy in life. His friends say he was born tired. With him, it is always bedtime. In this case, as in the other, poisons have been at work. In the first case to contract the arteries, in this case to relax them. Some poisons cause contraction, some cause dilatation, and the same poisons will produce

different and even opposite effects in different persons at different times. But it is to be remembered that any departure of this kind from the normal, whether it be too high or too low, is not due to the inherited peculiarities of aristocratic ancestors, working on highly strung constitutions, but a stupid, vulgar, and self-indulgent mode of life, in direct contravention of the simple laws of clean and wholesome living. Over-clothing, foetid atmospheres, over-feeding, over-indulgence in butcher's meat, concentrated sweets, cocktails, and cigarettes, these are the things which are the true forerunners of evil.

Now let us turn for a moment from this unlovely picture and consider some of the variations of blood-pressure in perfectly healthy people. Blood-pressure rises during sleep. The reason for this is that the blood is particularly viscid, that is to say much thicker, during sleep than it is during the waking hours. This is because it is only during sleep that food is delivered to the expectant tissues. You know that all food taken into the mouth must ultimately find its way into the blood. However uncompromisingly tough and solid your beefsteak may seem, you must realize it has to be liquefied before it can be utilized by the economy. When liquefied, it passes into the blood and can only be passed out of the blood again for use in the tissues while we are asleep. That is why loss of sleep causes such rapid emaciation. The

insomnia of fashionable folk is a provision of nature to prevent food getting into tissues which are already overloaded with nutritious material. Nine people out of ten, who claim your sympathy because they are martyrs to insomnia, deserve not sympathy, but castor oil. Fasting is a certain cure for most cases of sleeplessness, but it is not a popular one.

As I have already indicated, the application of cold to the surface of the body, as by a cold bath, or a sudden draught of cold air, will always raise the blood-pressure. It is a protective mechanism, partly to prevent the blood from being unduly chilled. High altitudes, that is to say the air of high mountains, especially snow mountains, will always raise the blood-pressure, sometimes in an exaggerated manner. It is not wise for people, whose arteries are beginning, through age, to lose their elasticity, to go suddenly to high altitudes. The rise from the plains should be gradual. An altitude of six thousand feet and over is not desirable for those past middle-age unless the objective is approached by degrees. Then there is that curious unanalysed factor in the keen, dry climate of the east-coast stations of England, such as Margate, Cromer, and Scarborough, that we call "bracing," which always gives rise to a raised blood-pressure. All we know is that a bracing place is bracing because it raises the blood-pressure. Why it should raise the

blood-pressure has not yet been definitely ascertained. Bracing places such as Margate certainly give a sense of well-being, which is very definite and lasting. The opposite state of affairs, called a relaxing climate, is to be found along the humid south-west coast of England, and of these places, Bournemouth may be taken as typical. Bournemouth is relaxing, because it relaxes the blood-vessels and causes the blood-pressure to fall.

The most common cause of a moderate rise of blood-pressure is keen interest, mental excitement, and emotion. Even where this gives no pleasure except fixed attention it causes a slight but definite rise in the pressure. The degree of raised pressure produced by such a cause is usually very agreeable, so agreeable, indeed, that people will do all kinds of deplorable and cruel things in order to obtain the thrill which a sudden rise of pressure produces. The term "thrill" is commonly used to express dramatic situations in novels or on the stage. The term is a perfectly good one, because the thrill is a physical thrill, caused by the sudden contraction of the arteries and its influence upon the nervous system. The people who crowd round a street accident, do so, not out of curiosity and a desire to help, but purely for the sake of the physical thrill of the high blood-pressure produced by unusual or dramatic sights. There are certain people who take a wicked pleasure in saying things which hurt other

people's feelings. There is no word for this villainy in the English language; but the Germans call it *schadenfreude*. These people say and do spiteful and catty things in order to obtain the thrill of watching their victims writhe, and the desire for such thrills becomes a sort of craving, like morphia or drink. Thrills are the result of high blood-pressure, and it is people who usually suffer from low blood-pressure who most enjoy the thrills thus produced.

Of such are the moth-eaten maiden aunts, who come out of boarding houses to go to church, and live in dignified constipation on the vicar's smile. They are wicked old devils who find their principal pleasure in provoking pain in others.

When the philosopher tells us that most of our pleasure is in the anticipation, he speaks a physiological truth. When we look forward to a thing, our blood-pressure rises and we experience the thrill which gives so much pleasure.

Of all the causes of a suddenly raised blood-pressure, a loud noise is certainly the most potent. The reason is that noise produces fear, and fear rules the world. If standing on Westminster Bridge you were to see the Victoria Tower suddenly collapse without any sound, you would be surprised, but you would not be frightened. If, however, the collapse were accompanied, as it would be, by a terrific and deafening din, you would be alarmed and would want to run away.

This reaction to noise comes to us from our quadruped ancestors, and with us is now perfectly automatic. The effect of the noise is to raise the blood-pressure and rush the blood to the muscles in order to prepare and engine them for action—for fight or flight. In the presence of a sudden noise, you feel you must act, you cannot be quiet, you want either to run away from the noise or to fight and punish the cause of it. Noise impels us all to movement of some sort. Now all these sudden changes are the result of high blood-pressure. When you are "emotioned," as the French say, by anger, most people shout and gesticulate, which enables them to work off the effects of the thrill. If they are unable to work off the effects of the thrill by muscular action they suffer physically as well as mentally—physically by a rapidly beating heart and feelings of collapse. The manner in which noise of an agreeable kind will kindle emotion and raise blood-pressure is well seen in the case of a military band. Music will transform weary soldiers into new men, not only ready to fight, but capable of so doing.

Let us now return for a moment to our friend the bald fat man of fifty, and ask (*a*) if he could have avoided being what he is and (*b*) if he can do anything now to be saved. The answer to the first question is obviously that he could have avoided all his troubles if he had been properly instructed from the very outset. But it is to be

remembered that if he had lived a physiologically, godly, righteous, and sober life from the beginning, and had succeeded in keeping his blood-pressure reasonably low, he would not have been the energetic, efficient, and successful man that he was.

There is always something to be said in favour of the idea that the true philosophy of life is to live "all out" on the top note, and to disappear early, with a pop; as against the quiet, respectable, boring backwater beach of a long uneventful life. A "short life and a merry one" appeals, in theory, to many people. The trouble is, as a rule, that you cannot ensure the merriment. It is in truth usually conspicuous by its absence. The "short life" man is a wretched and querulous invalid long before he dies.

To the question as to whether anything could have been done for our friend if he had been caught and admonished, say a year before he had his fit of apoplexy, the answer depends entirely on the state of his arteries at that date. Some people inherit good arteries, some people inherit bad arteries. One American writer says the man with bad arteries had been supplied, for some unknown reason, with bad tubing, tubing that is, which gives way and perishes sooner than it ought to do. There is an old saying that a man is as old as his arteries. That is perfectly true, but it is true more especially in dealing with any question of blood-pressure. Some people may say

that it ought to be possible to cause contracted arteries to relax. Well, that depends on the stage in which you catch the trouble. If you can catch it in the early functional stage, then you may do a great deal by altering the habits from over-eating, over-clothing, cocktails, and tobacco towards the simple, pure, and wholesome life advocated by the New Health Society. If the contraction of the arteries is in a degenerate structural stage, then no good can come of interference. The most that you can hope to do is to check the progressive deterioration. Any attempt to meet the trouble by drugs will certainly do incalculable harm.

There is a story told of a Bishop, who was asked the meaning of the word orthodoxy, and he replied: "Orthodoxy is my doxy, heterodoxy is the other man's doxy." Well, my own particular doxy in this matter is doubtless rather a long one, but it can be reduced to very simple proportions under three heads. But I wish to emphasize that this is really my own particular doxy, and any condemnation which it may call forth should be reserved for my own head, and no attempt should be made to implicate any other members of the Council of the New Health Society.

This, then, is my doxy—avoid tobacco in any form; avoid butcher's meat (the stalled ox and fatted calf are unwholesome brutes); avoid refined sugar. The crude chemical, which we call white

sugar, is divorced from the bland substances with which it is associated in nature, the substances, whose presence renders it acceptable to the human stomach and whose absence causes irritation and digestive troubles. These are negative points: the positive side of my doxy is perfectly expressed in the nineteenth verse of the sixth chapter of Paul's first Epistle to the Corinthians. "What? Know ye not that your body is the temple of the Holy Ghost which is in you."

SECRETS OF GOOD HEALTH

by

SIR W. ARBUTHNOT LANE

BT., C.B.

CHAPTER XI

Secrets of Good Health

In order to become familiar with the factors upon which the New Health Society bases its existence it is necessary to realize that we bear a simple mechanical relationship to our surroundings and that any change in this relationship necessitates a corresponding change in our anatomy.

This is a most important law, perhaps the most important law as regards the evolution, health, and well-being of the human race, though it applies equally to the animal kingdom.

Its truth can be demonstrated in the clearest manner possible by the study of the characteristic changes which take place in the skeletons of men who spend their lives in laborious occupations.

Unfortunately, it is also true that any change that develops to meet the altered mechanical relationship of the individual to surroundings during a single lifetime tends to shorten life.

That the skeleton represents the crystallization of lines of force is shown by the redeposition of bone along such lines in a fracture, when the fragments are displaced on one another. It is clear, therefore, that pressure produces definite changes in the form and function of the bones,

and in the form and function of existing joints. It also produces new joints.

As in all the changes that the skeleton undergoes to help the labourer to meet his special or abnormal mechanical relationship to his surroundings, the object is to enable him to perform his very heavy work with a minimum expenditure of nerve and muscle energy. This is borne out by a study of various laborious occupations.

We are all familiar with the coal-heaver, who takes on his back from a cart a sack of coal weighing two hundredweights, which he carries and, bending forward his trunk, deposits the contents in a hole in the pavement. The result of the constant transmission of pressure through the bones of his trunk is that the spine becomes converted into a rigid shelf, and the chest becomes more or less immobilized. Should this man get bronchitis or pneumonia he will put up a poor fight, since the fixation of his chest necessitates his depending on his diaphragm and abdominal muscles for expelling mucus from his bronchial tubes.

A coal-trimmer is a man who stands in the hold of a ship, and as the coal is thrown down in a heap he, by means of a long shovel, distributes it uniformly. To do this he must twist his trunk very forcibly in order that the load he takes from the front of him shall be thrown to his left, behind him and then away to the right. The torsion on

his spinal column must be tremendous. As a result of this he cuts through the arch of his fourth lumbar vertebra, and makes a loose joint between the bodies of the fourth and fifth.

Before proceeding further it is necessary to consider another law which is both most interesting and important. It is that, without the exercise of pressure or strain, when it is advantageous to the altered mechanical relationship of the individual or his surroundings for an old mechanism to be modified or an entirely new one developed, such a change takes place.

An example of the formation of an entirely new mechanism in accordance with this law is shown by the skeleton of an aged shoemaker. Those who have observed a shoemaker at work notice that as he pulls the thread forcibly through the leather this movement is associated with a twist of the head. This is so generally recognized that in mechanical toys representing the movement of the shoemaker in sewing, this twist of the head forms a part of the sequence. To avoid the waste of energy requisite to meet the abrupt twist, and clearly without any action of pressure or strain, an entirely new mechanism is developed. A pillar of bone grows up from the lateral mass of the atlas and forms a joint with the under-surface of the occipital bone. This forms a most effective economical structure.

Up to this point we have been dealing with the

consideration of the bony skeleton and the changes which it presents under varying conditions, which are sufficiently obvious for you to grasp the manner in which our body behaves when exposed to certain physical forces. The next step is not so easy to demonstrate, but if you have followed my reasoning so far, I think you will have no difficulty in grasping the new situation.

From time immemorial the native living under normal conditions has been in the habit of evacuating from the large bowel a quantity of material at an interval after each meal. The infant is nursed by its mother for about two years or till it is able to eat the food of the community, since in savage life there are no artificial foods which can replace the breast milk of the mother. She, because she is a normal well-developed animal, is able to, and does provide her infant with the food that is alone efficient for perfect health and development. The process of evacuating the bowel after each meal, performed more frequently in infancy and less frequently in later life, when the meals are less numerous, continues throughout the whole life of the native, so long as he remains normal and is not contaminated and deteriorated by associating with the white man. Consequently, his diet and drainage are perfect, and he does not suffer from any of the troubles and diseases which result in a state of civilization. He dies from different diseases, the vast majority

of which can be eliminated by hygienic methods and by sanitation.

You therefore realize that the end of the large bowel or colon was evolved to contain only a proportion of the products of digestion, that proportion varying with the number of meals. To effect this reflex evacuation of the material in the bowel it is essential that the food taken be of such a nature as not only to afford nutrition, but also to contain such important ingredients as are capable of stimulating the nerve and muscle mechanism in the whole intestinal tract into activity. This is a fact that has been thoroughly recognized and studied by expert dietitians.

The principles which we have found governing the mechanical relationship of the body to surrounding objects apply equally to the soft structures inside the body.

Therefore, when in civilization the automatic action of the bowel is controlled by the parent who insists that, with the cessation of the use of the napkin, the child shall have, if possible, a single action a day at a stated time, the end of the large bowel, which was constructed to contain only a proportion of the products of digestion, must in future accommodate the material which has collected during twenty-four hours.

To meet this abnormal physical condition nature attempts to avoid the dilation and elongation of the end of the large bowel, which would

result inevitably in a very considerable interference with its mechanism. Just as in the case of the fractured bone, nature crystallizes bands which shorten up the mesentery of this portion of the bowel and finally secure and fix it in the back of the wall of the abdomen.

In this manner the balance of the twenty-four hours' excreta is contained in the bowel proximal to its control by acquired bands. The accumulation in the proximal bowel gradually increases in amount since only a portion is expelled with each motion. The overloading of the large bowel with material tends to produce its elongation and dilatation, and again nature attempts to meet this altered mechanical relation by the crystallization of lines of force at points where the bowel sustains the greatest strain.

In the case of all these bands which control the mobility and function of the bowel, the passage of material through these fixed sections is rendered progressively more difficult. This is particularly true of the kink which forms very early in life, at which period, as was realized in the recrystallization of the skeleton following fracture, the changes are most rapid and extensive. To this particular kink I gave the name of the "first and last kink." The first because it is the earliest to develop and the last because it is the lowest of all the kinks. As you will realize later, this kink is a perfect Pandora's box and is the prime factor in the pro-

duction of all the diseases peculiar to a state of civilization.

The areas which become fixed and obstructed by acquired bands readily become inflamed, because of the forcible thrust of material through them by the use of irritating purgatives, and late in life, when the resisting power of these inflamed areas becomes sufficiently deteriorated, they afford a perfect soil in which the cancer organism can secure a foothold and thrive. For this simple mechanical reason cancer is infinitely more frequent in the end of the large bowel than in any other part of its length. It is most important, therefore, that you should realize how the mechanical factor plays such an overwhelming part in the production of cancer in the large bowel, and that if there were no such thing as a kink of the large bowel there would be no cancer.

What is the mechanical effect of the accumulation of an excessive amount of material in the large bowel upon the effluent of the small intestine which discharges into it?

It results in the stagnation of the contents of the small intestine which by its excessive weight exerts an abnormal pull in the erect posture on the fixed end of the duodenum, which is the syphon trap of the intestinal tract. This strain angulates this portion of the bowel and obstructs its effluent. In the meantime the stomach con-

tinues to force its contents into the duodenum, which distends, since the muscle which controls the outlet of the stomach will not permit of regurgitation.

In consequence of the over-distension of this syphon trap the mucous membrane of that portion which is least supported by surrounding structures becomes gorged with blood and bleeds. Later it ulcerates, and this ulcer may become so deep as to perforate the wall of the duodenum and prove fatal. Nature, always struggling to meet the varying mechanical relationship, does what it can to relieve the over-distension of the duodenum and reduces the pumping capacity of the stomach by permitting its contents to accumulate in it and to dilate it correspondingly.

It is because of this beneficent action that duodenal ulcers never become chronic and, therefore, do not form a suitable nidus for cancer. On the other hand, the stomach is practically a bag with an upper comparatively fixed crescentic margin and a lower very mobile larger curvature. When over-distended the strain is exerted upon and about the centre of the comparatively unyielding upper margin. Because of the strain experienced by the mucous membrane in this situation, it gorges with blood which may exude freely from it. Later it ulcerates, and as there is no means by which the body can overcome the excessive strain in this situation the ulcer becomes

chronic and affords a very suitable medium in which cancer can obtain a foothold and thrive.

So far we have discussed the mechanical changes which have resulted from the presence of the first and last kink, or in other words, from a block of the effluent from the cesspool in the drainage scheme of the body. Having considered the several mechanical changes which result from the development of a defect in the end of the drainage scheme, we will now investigate the effects which organisms produce in the material that is allowed to accumulate and stagnate in the entire digestive system. I would remind you that digestion of food takes place in the stomach and small intestine by means of chemical agents and ferments; that any organisms which are swallowed with the food are destroyed in the normal stomach by the gastric juice. Consequently, the food which is being digested in the small intestine is sterile and contains no deleterious organism.

Such material as is no longer of use for nutrition is carried into the larger bowel or cesspool of the gastro-intestinal tract, where it is dealt with by the bacillus of the colon, whose function it is to break it up.

Fluid is absorbed from it in proportion to the period during which it remains in the large bowel. If the contents of the bowel are evacuated after each meal the motion is soft and like thick porridge in consistence. If, on the other hand, it is

allowed to remain for an abnormal length of time, more and more water is absorbed from it till it may form hard lumps.

Therefore, you realize that the character and consistence of the motions vary with the efficiency with which the large bowel performs its function of accommodating and transmitting its contents.

If material consisting of organisms and of the products of their action on food residues are allowed to remain for an excessive time in the colon it becomes irritating to the mucous membrane, which manifests its irritation as inflammation. To this the term colitis is applied. The extension of this infection to the appendix, which, being a blind worm-like structure, readily collects infectious material, is consequently more likely to produce serious symptoms of an inflammatory nature than any other portion of the large bowel. You readily realize how inflammation of the appendix—"appendicitis"—is frequently the first subjective evidence to the patient that his drainage scheme is in a thoroughly unhealthy condition. Too often the removal of the appendix is regarded as being alone a sufficiently effective means of meeting the general infection of the bowels.

Following on the over-distension of the large bowel by the material which has accumulated, stagnated, and decomposed in it, and the consequent damming up of the food in process of digestion in the small intestine, organisms readily

extend from the large bowel into the contents of the small bowel for a variable distance. In proportion to the number of the organisms, and also with the varying type of the organisms, infection takes place not only of the contents but also of the mucous membrane lining this section of the digestive tract. Infection of the bowel may extend along the duct of the gall bladder and cause the development of gall stones, or along the duct of the pancreas and produce degenerative changes which result in diabetes.

From the infected food contents of the small intestine there are absorbed into the circulation a greater quantity of organisms and toxins than the liver can deal with and the kidneys eliminate. In consequence the blood flooded with these deleterious matters is distributed to every tissue in the body.

The liver and kidneys with the thyroid and other organs suffer from the excessive strain to which they are exposed and present symptoms which are classified as diseases.

Every tissue and organ in the body undergoes a degenerative change in proportion to the degree of contamination of the blood, and such degeneration renders them susceptible to the invasion by organisms, such as tubercle, rheumatism, rheumatic gout, and finally, when the process of degeneration has become sufficiently advanced, cancer finds a soil in which it can grow

and flourish. It is necessary to urge that cancer never affects a healthy organ, and that to avoid its incidence it is essential that your organs shall be healthy. The tissues of the brain, eye, ears, hair, skin, etc., all react to the infection of the material upon which they must depend for their nutrition and the manifestations and expressions of this poisoning are regarded as disease.

We must remember that we die through the defects in our gastro-intestinal tract, or in other words, we dig our graves with our teeth.

In the avoidance of constipation diet is the deciding factor. Dietetics, in the modern sense of the word, is a comparatively new science. Until about ten years ago doctors and medical scientists directed but little interest and attention to the food requirements of the human body. It used to be thought that so long as the dietary provided so many calories or food units and contained a certain amount of fresh vegetable or fruit, then all would be well. Dietetics was a simple, straightforward matter, to be left to the discretion of so-called common sense. It was regarded as a subject beneath the dignity of the medical profession, and doctors left their training schools with the scantiest knowledge of nutritional theory and practice. With complete accuracy dietetics might then have been described as the Cinderella of the biological sciences.

Happily for the welfare of humanity, in the last

decade there has been a revolution in the attitude of the medical profession to the study of diet and all that pertains to it. The science of nutrition has come into its own and its vital significance in determining the welfare of the individual and the nation is being realized as never before—not only by physicians, but also by statesmen and legislators. Dietetics has at last emerged from obscurity and it can be safely asserted that no other branch of physiological science is claiming more attention from research workers all over the world than the science of food in relation to health and disease. In the nineteenth century the great French bacteriologist, Pasteur, discovered the nature of germ infection and *infection* became the master-word of pathology. To-day, it is not infection but *nutrition* which has become the master word, and more and more it will become so as our knowledge of the intimate relationship between diet and disease becomes more complete.

As is inevitable during the birth of a new science there has arisen a great mass of theory which has led to a deal of confusion in the minds of interested people concerning the rights and wrongs of diet. Like psychology, dietetics is a subject in which every intelligent person should be interested. What we eat and how we eat it is our everyday concern. Unfortunately, medical journalists, quick to lay hold of what is novel or unusual, have presented to the public innumerable theories of diet,

which in our present state of knowledge must be ranked as not proven. The "man (or woman) in the street" is apt to seize upon some theory which specially appeals to him and with unjustified enthusiasm develops into an ardent devotee of the new idea of which he becomes the proselytizer. It is in this way that the dietetic faddist arises (and no subject is more capable of creating faddists than diet), and so we have cults of people who eat no salt, drink no milk, never take starch with fruit, and endless other strange practices.

In the midst of all this apparent confusion, what is the intelligent and conscientious person to do? It is a perplexing dilemma. If we are to listen to all the so-called authorities we would seem to be in great danger of dying a lingering death from starvation! On the other hand if we listen to none we would be certain of an equally unpleasant fate! How are we to avoid an untimely demise in the welter of dietetic fact and fancy?

Now it is beyond a shadow of doubt that inadequate knowledge of the first principles is the real cause of so many people going astray in the field of dietetics. In spite of a popular belief to the contrary, these principles are by no means difficult to grasp. As I have observed, there has been much complicated and elaborate talk about scientific dietetics of late, but the fact remains that a reasonable understanding of the elementals of dieting, plus the application of common sense,

are quite sufficient to guide any person to nutritional safety. There are many people who lose their sense of perspective in all matters pertaining to diet. They fail to see the wood, because of the trees, and they lose themselves in insignificant details while ignoring the main principles. It is admitted that there are some fine points in the food problem, but the averagely healthy person need not unduly worry over these. A few sensitive individuals may find the combination of starch and fruit in one meal disturbing to their digestion, but the possible harm is infinitesimally small as compared with the constant over-eating of animal-flesh foods, or concentrated starchy and sugary foods. It is surely foolish to be excessively scrupulous in avoiding the little dietetic sins while gaily committing the really serious ones. A sense of proportion is just as necessary in the realm of diet as it is in all other human affairs.

To clear the air I will briefly enunciate certain of the basic principles of human dieting. If these are fulfilled in a common-sense fashion there need be no cause for anxiety as far as nutrition goes. A balanced dietary should be our aim. Quite simply this means that we must eat foods which supply the body with heat and energy: such foods include starches, sugars, fats, and animal products. Also, we must have building and repair foods, and these are obtainable from animal and vegetable proteins, but it has to be kept in mind

that meat, fish, milk, and eggs provide certain essential elements not found in vegetable proteins. That is why the former are described as first-class proteins.

We need, too, a supply of mineral salts and vitamins—indispensable elements which are found in a great many foodstuffs, but most abundantly in uncooked green vegetables, fresh fruit, milk, butter, and whole grain cereals. No single foodstuff (other than milk), is a complete food for a human being, and so the incompleteness of one food requires to be made good by some other kind. In other words, we must partake of a mixed dietary. Actually, all the nutritional requirements of the body can be met by a dietary of milk, cheese, eggs, butter, wholemeal cereals, fruit, and vegetables. Animal flesh is *not* an absolute essential of the human dietary.

Where most people are apt to go wrong is in the "balancing" of the various items of the dietary. They eat too much of one and too little of another food, and so upset the bio-chemistry of the body. We may divide foods into the acid formers and the alkali formers, and as all the tissues of the body are naturally slightly alkaline it is obvious that the consumption of the alkali foods should be greater than that of the acid foods. Diminished alkalinity of the tissues renders them prone to numerous disorders of health. Milk, fruit (including the acidic lemon, which in

the body laboratory is burnt to form an alkali residue), and vegetables are alkali producers, while meat, eggs, and the cereals are acid producers. Fruit and vegetables vary in their acid neutralizing powers, but the most valuable in this respect are lemons, raisins, carrots, spinach, parsnips, and beans. Clearly, then, to ensure the necessary alkalinity of health, an abundance of milk, fruit, and vegetables in relation to animal flesh and cereals should figure in the well-balanced dietary. In addition, the alkali-producing foods will provide ample amounts of roughage to facilitate bowel action and vitamins and mineral salts to ensure efficient functioning of all the body cells.

Time prevents further discussion of these basic principles of nutrition, and I will now turn my attention to some of the common faults of dieting. Over-consumption of concentrated starchy food is one of the most prevalent dietetic sins of modern times. Too much sugar intake strains the sugar-controlling mechanism of the body and disturbs the chemistry of the blood. In children the ill effects of this are most marked, but they are also serious in the case of adults. Modern medical opinion holds that over-consumption of sugar is to a large degree responsible for the prevalence of diabetes, obesity, catarrhal infections, high blood-pressure and dyspepsia. Also, in so far as sugar tends to spoil the appetite

it leads to an insufficient intake of fats, fruit, and vegetables. It is a common experience that the sweet-eating child is very liable to "colds," catarrhs, and constipation.

Excessive animal-flesh eating is the next most common dietetic error. A great many people have the idea that meat is strengthening and that they cannot do a hard day's work unless they have had a large ration of butcher's meat. Actually, as I have already indicated, eggs, milk, and cheese are *adequate* substitutes, and animal flesh is no more "strengthening" than these foods. Apart from diminishing body alkalinity, excessive meat eating tends to increase intestinal putrefaction, and may lead to severe intestinal self-poisoning. Extreme moderation in meat consumption should be the rule. Healthy persons, free from constipation, may eat meat—but *once* a day only and with not infrequent omissions. Those who suffer from constipation or dyspepsia would do best to avoid animal flesh altogether.

Let me now briefly give some attention to a number of dietetic taboos, which from time to time are fashionable. For the most part these taboos are backed up with semi-scientific arguments. For instance, it is often asserted that starch and fruit are not to be eaten at the same meal—presumably because the free acid of the fruit would interfere with the digestion of starch, which requires an alkaline medium. Well, it may

be that some few people cannot tolerate this combination of foodstuffs, but to make it an irrevocable dietetic principle is quite unjustifiable. The digestive apparatus is not a test tube, plus some chemical reagents. At the same time it would be bad physiology to start a complete meal with fatty or oily foods, for these would definitely restrict gastric secretion and retard the digestion of the meal. The common practice of commencing a meal with a little clear soup, on the other hand, is quite sound, as this will gently stimulate the secretory activity of the stomach.

Exclusion of common salt from food is another taboo which has had some popular favour. No doubt there is a grain of truth in this idea, as excessive salting of food can be harmful through irritating the delicate membranes of the mouth, throat, and stomach. Certainly, most natural foods contain salts, but cooking processes tend to cause their diminution, so that the addition of a little salt at table cannot do harm to a healthy person. Limitation of the amount of water intake is yet another recent veto which has claimed some support from those who are given to fads. It is difficult to imagine any reason, scientific or otherwise, for this and the idea appears merely to be foolish and perverse.

No doubt there are numerous other strange dietetic fancies, but it is sufficient to indicate that the intelligent person should always be sceptical

of any dietetic habit which cannot be reconciled with the fundamental principles. There will always be fashions in diet as there are in clothes, but dietetic fashions can have unfortunate repercussions on health, and should always be suspect. There must be individual variations in diet, admittedly, for we are not all constituted alike and one man's meat may be another man's poison. Yet the basic rules of dieting remain and are our infallible guide. Dietetic fads and fancies readily assume epidemic form, but the best protection is a knowledge of the elemental laws of human nutrition.