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THE FOOD FACTOR AS A CAUSE OF HEALTH AND DISEASE DURING CHILDHOOD,

OR

THE ADAPTATION OF FOOD TO THE NECESSITIES OF THE GROWING ORGANISM

BY
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Teaching which conforms to Nature is true, for Nature is Truth.

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THE FOOD FACTOR AS A CAUSE OF HEALTH AND DISEASE DURING CHILDHOOD, OR THE ADAPTATION OF FOOD TO THE NECESSITIES OF THE GROWING ORGANISM.*

By JOSEPH E. WINTERS, M.D.,
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At what age should a child be given food other than milk? Milk contains from seven to fourteen times less iron than the other articles of food. Although the other mineral constituents of the milk are present in the same proportion in which they are contained in the tissues of the child at birth, iron is present in mere traces only. The infant enters the world with a supply of iron in the liver and to a smaller extent elsewhere, which has been stored during intra-uterine life. The child gradually draws upon such store for the manufacture of the blood-coloring matter, which lasts until its digestive organs are prepared to digest food other than milk. The small amount of iron in milk is insufficient for the growth of the child, hence the high percentage of iron in the organism at birth. Late weaning, or the too prolonged use of milk as the exclusive food of a child artificially fed, causes anæmia. This is the first pathological condition which we mark as arising from failure to modify the diet of a child at the proper time. The chemistry of milk, the physiological chemistry of the child, and the physiology of the digestive organs denote that such change should be made at a fairly definite time.

*Read before the New York Academy of Medicine, January 16, 1902.

From the seventh to the tenth month, according to the degree of development of the child and the advancement of dentition, the ferments which digest farinaceous substances are present in sufficient quantity to indicate that a change of food should be made. The rapid development and the functional activity at this time of the glands which secrete the diastasic ferments make it wholly manifest that nature intended that milk should be supplemented first by farinaceous food. The chemical composition of the various farinaceous foods determines at once which one of these has the highest physiological value. Oatmeal is rich in all the constituents which are essential for the growth and development of the child at this age, and is peculiarly rich in proteid, fat, and mineral matters. Oatmeal is amongst the richest in iron of the vegetable foods, and contains more iron per 100 dried parts than beef. Proteid is present to the extent of about 14½ per cent.; fat 10 per cent.; mineral matters 2 per cent.; starch 30 per cent. Of the total nitrogenous matter, 94 per cent. is in the form of proteid, and therefore available for tissue-building. Owing to the large amount of cellulose or woody fiber in oatmeal it is indigestible unless this is removed by straining. By careful cooking and straining it is one of the most digestible foods there is. A tablespoonful of oatmeal jelly may be added to every second bottle at first, then every bottle, and later the amount may be gradually increased to two ounces in every bottle. In the summer months it is sometimes necessary to use barley gruel (from the whole or pearl barley) instead of oatmeal. Barley is poor in fat, proteid, and iron, as compared with oats. It is seldom wise to *begin* the use of farinaceous food with a child during the warm months, as it is prone to cause fermentation and diarrhœa.

Milk, supplemented by cereal gruels, should, with

exceptional instances, constitute the child's food until the end of the first year. Soft boiled or poached egg mixed with bread crumbs from stale bread may be added to the diet at the beginning of the second year. Egg contains much proteid, fat, and mineral matter, especially salts of lime, phosphoric acid, and iron. The nuclein of the yolk of egg contains phosphorus and iron in organic combination. As mineral matters are most easily absorbed where they form part of an organic compound, the iron and phosphorus in the yolk of egg easily enter the blood. The fats in the yolk of egg are the same as in butter, and have the same nutritive value as these. Their presence in the form of an emulsion in the yolk makes them very easily digested. The great richness of yolk of egg in fat, in lime salts, and in organic compounds of phosphorus and iron makes it a peculiarly valuable food for a young child. The nutritive value of egg is due almost entirely to proteid and fat. Of these there are of proteid 14.8 per cent., and fat 10.5 per cent. To begin with, only a small portion of one egg should be given twice a week, gradually increasing the amount until the entire egg, soft boiled, is taken at a feeding. Later this may be given two or even three times a week.

During this period the child may be allowed a dry crust of stale bread twice a day. A hard crust is highly digestible, and is a good thing for a child as soon as it has the teeth with which to chew it. The labor of the jaws which is involved in eating a piece of hard crust develops the masticatory organs, and especially the jaw bone. If the jaw is imperfectly developed, the teeth are crowded and imperfectly developed, and dental caries is inevitable. Decayed first teeth cause septic conditions of the mouth, and frequently lead to enlargement of the cervical lymphatics, which may become tubercular, and the whole system may thus become infected. Much digestive

disturbance is unquestionably due to the same cause.

Disuse of the jaws starves the areas supplied by the maxillary arteries, as these vessels are not fully developed. The mechanical stimulation of chewing leads to the outpouring of a salivary secretion richer in diastatic power than the secretion coming without stimulation. These several matters should not be overlooked, it seems to me, in the feeding of children, particularly in these days, when it is customary for the medical profession to direct that all food should be scraped, minced, chopped, strained, etc.

The child may also be given stale bread broken in milk, by way of furnishing variety to its food. Bread is one of the most nutritious of foods. Three-fifths of it consists of solid nutriment, and but two-fifths of it water. There are but few foods of which the same can be said, and it is not true of any animal food.

At the end of fifteen months, a child (when normally developed) is getting whole milk, oatmeal or barley, a soft-boiled or poached egg twice or sometimes three times a week, a dry crust of stale bread twice a day, and perhaps a little bread and milk.

For the best results and the least disturbance of digestion, cereals should be given without sugar. Sugar has a strong affinity for water, and a large amount of water is required to hold it in solution. Water for this purpose is extracted from the capillaries of the mucous membrane of the stomach, thus interfering with the blood supply for the gastric secretions, causing a retardation of the digestive functions. This is the reason why digestion is delayed and deranged by sugar and all sweet desserts. The large amount of water that is required to hold sugar in solution is the explanation of its causing constipation, and of its interfering with all the secretions; just as in diabetes there are unrelievable constipation, dry, eczematous skin, and more or less diminu-

tion of the secretory functions, so in children in whom sugar is a large factor in their diet are all these perversions of the vital functions met with.

Fruit may be given now, and sometimes much earlier. Orange juice and prune pulp are the first fruits for a child. When there is constipation, these are allowable very early in infancy. Every means, however, should first be tried to overcome this by adjustment of the diet, before resorting to fruit juices. Fruit juice should be independent of and about an hour before a meal.

You must have become impressed with the fact that I have been directing foods rich in proteids, fat, carbohydrates, and mineral matters. It is on physiological grounds solely that such foods are recommended. Feeding of children comprises the nursing period (breast or bottle), a transition stage, just spoken of, and a third or final period, which we are about to consider. It is this final stage which is found most perplexing. Just here the physician finds himself utterly rudderless in the feeding of a child. What has been written about it is diametrically opposed to the teachings of chemical physiology. Experience proves it to be erroneous.

Choice of food adapted to the wants of the growing organism necessitates a clear understanding of metabolism.

Many look upon metabolism in a child and an adult as identical, whereas they are quite diverse. Metabolism in an adult is using up and renewing the materials of which the body is composed, and covers but a minor and comparatively unimportant part of that process in a child. In a child materials are being stored for fresh growth. Storing for future needs is the paramount desideratum in the diet of a child.

For this reason, certain constituents are required

in relatively much larger proportions in a child than in an adult.

The bony framework requires little or no repair in an adult, hence earthy salts are unimportant in an adult as compared with their grave necessity in a growing child.

Fat is essential for cell growth in a child, and as we shall see later on, may be properly classed as a tissue-former during the period of rapid growth of the nervous system and of the skeleton.

Carbohydrates may be largely dispensed with or substituted for in an adult. In a child they are necessary in order to meet the large demand for heat and energy, and thus to protect and shield from oxidation the proteids and fats that these may be stored for future needs. Muscular deposit and growth are not possible without an abundance of the shielding carbohydrates in the diet of a child.

At this age, too, food must be selected with reference to its influence on the development and functions of the digestive organs.

The excessive fear of indigestible food which prevails so extensively often leads to actual debility of the intestinal muscular walls. The muscular wall of the intestines becomes atrophied like every other muscle, if it has not work to do. We must see, therefore, that the diet of a child does not lack bulk for the mechanical stimulation its presence gives to the intestinal movements. The intestinal secretions exert no chemical action on the proteid constituents of the food, but play a great part in the digestion of the carbohydrates. During the period when the intestinal follicles are developing and increasing in functional activity, these functions should be stimulated that they may attain their full development. For the complete development of this function and of the muscular walls of the intestine, carbohydrates and vegetable food should

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enter largely into the diet during growth and development.

In an adult, food serves two great purposes in the body, the supply of materials for the repair of the tissues, and, secondly, as a source of energy which can be converted into heat and nervous and muscular work. In a child there is necessity for materials for another supreme purpose, viz., the structure and development of new parts.

If we are to proceed in complete accord and follow out readily and clearly what we have before us for consideration, we must start with the proper groundwork. I beg to remind you, therefore, that the essential elements of food are of five chief classes, viz.:

(1) The nitrogenous, the chief of which are the proteids found in animal food, cereals, and certain vegetables; (2) The fats; (3) The carbohydrates; (4) Mineral elements, of which the salts of lime, potash, soda, and iron are the chief; (5) Water. The repairing of the structures in an adult can be performed by the proteids and the mineral constituents, and by these alone; all the classes can and do supply energy and heat.

For the perfect development of the growing structures in a child, proteids, mineral elements, fat, and carbohydrates are required in relatively larger proportions than in an adult. These will be considered seriatim.

Nitrogenous Matter.—No formation of tissue can occur without proteid. An animal fed only on non-nitrogenous food, such as fats and carbohydrates, will inevitably starve to death in time. Protoplasm, the vital constituent of every individual cell, contains nitrogen; fats and carbohydrates contain no nitrogen; therefore, none of the tissues of the body can be made from these non-nitrogenous foods. Nitrogenous matter is essential to every vital process; no cell growth can occur without it.

The voluntary muscles in man constitute about 42 per cent. of the total body-weight; in the new-born child, 23.5 per cent. Proteids are the material from which muscles are built up, and proteid in large amount must be supplied to a child for the development and growth of muscular tissue alone. It is equally necessary for the proper development of the other structures of the growing organism. The importance of a sufficiency of proteid can hardly be exaggerated. Much of the feebleness, flabbiness, and pallor, and the stunted, ill-developed bodies one so often sees in children are no doubt due to a lack of it.

We have thus conclusively demonstrated the essential necessity of an abundance of proteid in the diet of a child.

Mineral Ingredients.—Food must contain certain mineral or inorganic as well as organic principles. Mineral constituents are necessary for the building up of the child's body, and a lack of them will produce the same evidences of malnutrition and of imperfect development as deficiency of proteids. *The mineral portions of bone are permanent*, and require little or no repair in an adult, hence the great importance of a relatively larger supply of these elements in the body of a child.

Proteid forms the vital constituent of the cells of every tissue of the body. The nuclei of these cells are rich in phosphorus, iron, and variable amounts of mineral salts. No formation of cells for fresh growth can occur without phosphates and other mineral salts; they are necessary to every tissue: salts of lime and magnesia for the bones; phosphate of potash for the muscles; phosphates and potash salts for the corpuscles of the blood; and chlorides and soda salts for the plasma.

As physiological physicians, however, we must not regard these constituents as mere mineral elements.

The mineral matters of the food, to be properly assimilated, must be in their natural condition, which is that of organic combination with the proteid substances. Animals in which milk alone is a sufficient food die of inanition if the mineral substances are extracted, and the result is the same if these elements are added to the caseine, fat, and milk-sugar, the organic combination being broken up. In the breaking up of the organic combination or destruction of the chemical union between proteids and mineral substances is to be found the sole etiological factor of scurvy in the artificial preservation of foods by heat.

In raw milk, egg, cereals, and certain fresh vegetables, mineral salts are all found in organic combination, ready to enter the blood and to be assimilated by the various constituent parts of the organism.

The inorganic tissue-builders, like the proteids, are concerned in building up the child's body, and any deficiency of them will produce much the same symptoms as deficiency of proteids. The symptoms produced by a lack of these are often mistaken for a deficiency of proteids, and meat juice, scraped beef, etc., given, with the result that disease of the nervous mechanism, and of the blood, is super-added to the existing morbid phenomena.

Fat.—Fat commands an immeasurably more exalted place in the diet of a child than in an adult. Fat serves as fuel to maintain the temperature of the body at the necessary standard, the heat being converted into force and energy for every action and function of the organism.

77.5 per cent. of the heat lost to the body is by conduction and radiation and evaporation from the cutaneous surface. The surface of a child is relatively three times as great as that of an adult. The larger the cutaneous surface relative to the size of the body, the greater is the amount of heat lost by conduction, radiation, and evaporation. This rela-

tively large and rapid heat loss in a child makes an ample supply of the chief body fuel, fat, an absolutely indispensable condition.

Fat is a tissue former in a growing child.

Bone marrow, brain, and nerves are the tissues which are richest of all in fat.

Brain tissue contains	8 per cent.	fat.
Nerves contain	22 per cent.	fat.
Marrow of bone contains	96 per cent.	fat.

These tissues are all increasing in weight and functional activity with marvelous rapidity, the brain doubling its weight during the first two years of life. In these structures the child is laying down a large amount of tissue rich in fat, and a child whose diet is deficient in fat rapidly loses vigor, and is extremely prone to suffer from anæmia, laryngismus stridulus, convulsions, and later, bronchitis, and a tendency to catarrhal affections of all mucous surfaces. In this connection it should be remembered that the chief seat of the formation of the red blood corpuscles is the red marrow of the bones, especially of the bones of the skull and trunk, and of the ends of the long bones of the extremities.

If a child's food is deficient in fat, the bony structures develop slowly and imperfectly, dentition is delayed, and a later manifestation is rickets with anæmia. In the diet of a child, fat plays some part in the formation of young tissue which cannot be performed by any other food constituent. Abundance of fat should be the main characteristic of the diet of infancy and early childhood. A child of five requires half as much fat as a man doing moderate work.

To provide materials for repair, for the secretions, for the generation of heat and energy, and in addition for making the new tissues of the growing structures, a child requires proteids, mineral matters, fat, and carbohydrates, in larger proportions than an adult.

The mineral ingredients must be in organic combination with the proteids. Milk, farinaceous substances, especially oatmeal, bread, and egg, not only contain these food elements in eminent proportions, but they exist in organic combination. These are pre-eminently the physiological foods of early childhood.

The peculiar value of carbohydrates to a child will receive due consideration when treating of flesh foods.

Flesh Food.—At what age should a child be given animal food other than milk and egg? The time when meat should be given to a child turns on its influence upon metabolism. Meat and meat preparations are characterized by the large amount of nitrogenous matter which they contain. Nitrogenous matter markedly increases the metabolism of the body; and it increases the metabolism not only of the nitrogenous, but also of the non-nitrogenous constituents as well.

Beef contains from 20 to 21 per cent. of nitrogenous matter, therefore four times the amount that is present in milk, and about double the amount contained in the principal farinaceous substances. Of the total nitrogenous matter in meat, 15 per cent. is present in the form of extractives. Meat extractives have no nutritive value. They are not tissue-builders; they are not oxidized in the body, and therefore are useless as sources of heat and energy. These extractives excite the nervous system, and may act injuriously on the young child by over-stimulating the nervous system, by taxing the organs of excretion, and by stimulating unduly metabolism.

Of the total nitrogenous matter in beef, only 5 to 6 per cent. is in the form of proteid, and therefore available for the two main purposes of food—tissue building and the production of heat and energy and work.

The proteids may be divided into those of animal

and those of vegetable origin. There does not appear to be any essential difference between these two classes. Vegetable proteid is equal in nutritive value to animal proteid. Somewhat less of the proteid of vegetable food is digested and absorbed than that of animal origin. This is largely due to the envelope of indigestible cellulose, to woody fiber, and other indigestible materials, rather than to any peculiarity of the proteids themselves. This may be overcome by soaking in water overnight, careful cooking, and straining. With such care in preparation, the proteids of cereals are absorbed as perfectly as those of animal origin.

The body possesses the power of converting any vegetable or animal proteid into the proteids which are contained in its solids and liquids. Vegetable proteid is just as valuable as animal proteid for the construction and repair of the body, and for the supply of nitrogenous material as the active principle of the secretions, and is free from the crystalline extractive bodies, which exist in meat in the proportion of 15 per cent.

The excess of proteid and extractives contained in flesh foods acts as a stimulus to some reflex nervous machinery through which metabolism of all tissues is hurried on. In a child combustion is relatively greater than in an adult for two reasons—first, the smaller organism having the relatively larger surface carries on a more rapid metabolism per unit of body-weight; second, the metabolism of the growing parts of the body is from $2\frac{1}{2}$ to $6\frac{3}{10}$ greater than that of the parts already formed.

The proteids and extractives from flesh foods stimulate the normally active metabolism of a child, and prevent storing of the tissue-builders. Over-stimulation of metabolism by an excess of animal food interferes with laying on flesh—fat or muscular flesh. Carbohydrates are easily oxidized, and their oxida-

tion serves to protect the proteids and fats from consumption. The shielding from oxidation of these requisites for the growth and development of new structures is a matter of profound value and consequence to a growing child. Carbohydrates and fats by their sparing action increase the store of proteids. A child increasing its capital of flesh tissue should have proteid-sparing food in abundance, and food which stimulates metabolism should only be given in such quantity as is necessary for the actual requirements of the system's daily needs.

The brain appears to require nitrogen, which can only be obtained in a concentrated form from animal sources. Highly nitrogenized food is a nervous food, valuable where bodily energy and intellectual capacity must be assured without taxing the digestive organs.

Muscles do their work upon carbohydrates; a child, with its unceasing, acrobatic, muscular feats, should have an abundance of that food which is regarded as the most valuable source of muscle-energy, and the sensitive nervous system should not be stimulated by a nervous food.

One of the most unfortunate, wholly unconsidered, ill consequences of an early and liberal meat diet is the disrelish it creates for the physiological foods of childhood—cereals, vegetables, milk.

A child that is allowed a generous meat diet is certain to refuse cereals and vegetables. Meat, by its stimulating effect, produces a habit as surely as does alcohol, tea, or coffee, and a distaste for less satisfying foods.

The foods which the meat-eating child eschews contain in large proportions certain mineral constituents which are essential to bodily nutrition and health, and without which the processes of fresh growth and development are stunted. This brings us to the kernel of our subject.

The chemical processes in the organism are dependent upon alkaline-reacting tissue-fluids.

In the combustion of flesh foods (proteids) in the organism, sulphuric acid is formed, and death may be caused by a lack of alkaline bases necessary to neutralize this acid product.

The function of every individual cell, the nutrition of every tissue, the perfect consummation of every chemical process in the organism is dependent upon alkaline-reacting tissue-fluids, which alkaline reaction is due to alkali-carbonates.

These alkaline bases are also of great importance as constituents of certain secretions, such as the saliva, the pancreatic and intestinal secretions, and for the transportation of carbonic acid in the blood, that it may be removed from the system.

For the processes of fresh growth, for the construction of bone, muscle, etc., mineral constituents are likewise required in large proportions.

For the supply of alkali-carbonates for the tissue-fluids; for the alkalinity of the blood and the numerous secretions which are poured forth in almost incalculable quantities during every twenty-four hours; for the transportation and elimination of carbonic acid from the system; to neutralize the sulphuric acid formed in the combustion of the proteids; for the passage of the proteids from a soluble to a coagulable state, and for the organization of the proteids; for the supply of the large amount of minerals needed for the growth of the bony framework, and for the muscles of the growing child, alkaline bases must be introduced into the system in large amount.

These mineral constituents cannot be introduced into the system in an assimilable form except in organic combination with an albuminous molecule, and are only found in organic combination in sufficient proportions to meet the large demands in a

child in certain vegetables and cereals which obtain them direct from the soil as provided by nature.

A lack of these mineral constituents will not only cause all vigor and vitality to dwindle and die out, but indeterminate disease processes supervene in consequence thereof.

I have met with cases in which every tissue of the body was in a state of suffering; the capillary circulation of every organ deranged; every secretion disturbed and altered; a general disease of every part, all arising from a deficiency of the normal food constituents, chiefly the mineral elements.

In numerous cases in which all the means that our art could devise had been employed, not only with lamentable failures, but with deplorable effects, I have had the happiness of seeing this universal morbid state remedied promptly and permanently by adjustment of the diet to the necessities of the growing organism—supplying the starving tissue-cells with proper food constituents in an assimilable form.

We should, moreover, acknowledge the value of vegetable food in the construction of the coloring matter of the blood. There exists an interesting relationship between the blood-coloring matter and the vegetable-coloring matter, and vegetable food is probably the chief factor in the production of blood-coloring matter. Long ago Bunge affirmed that plants constitute the normal supply of iron to the body. Oatmeal is among the richest in iron of the vegetable foods, and, according to Boussingault, contains more iron per 100 dried parts than beef. Spinach and apples likewise contain a great deal of iron.

The urine in children is considerably richer in uric acid and ammonia than the urine of adults. The elimination of uric acid and ammonia diminishes promptly with the use of vegetable food.

Salts of the vegetable acids which are so abundant

in vegetable food become oxidized in the body to carbonates, and the bases thus derived tend to alkalize the urine. From this follows the familiar fact that the urine of herbivorous animals is alkaline, and that human urine may become alkaline when a vegetarian diet is maintained.

The present drift of teaching is to direct beef or beef-juice as food in fulsome quantities to very young children. An infant of ten months is ordered half an ounce of beef-juice daily, and this is increased to three ounces a day by the twelfth month. Scraped raw beef is given with equal lavishness to a child of eighteen months. Medical writings have propagated and popularized this unfortunate error.

The evil fruit, the pathological consequence of this unphysiological and abnormal feeding, is to over-stimulate the delicate nervous organization, with undeveloped controlling centers and almost completely developed sympathetic nerves; to tax the system with incompletely burned, merely charred, excretory products; to render the urine, which in the young child is normally highly acid, abnormally so; and in its train, incontinence of urine, rheumatism, chorea, rheumatic tonsillitis and torticollis, night terrors, urticaria, angio-neurotic œdema, and finally, from poisonous excrementitious products, anæmia, acute convulsions, and petit mal.

There is more so-called nervousness, anæmia, rheumatism, valvular disease of the heart and chorea at the present time in children from an excess of meat and its preparations in the diet than from all other causes combined.

Physiology and physiological chemistry make it unquestionably clear that meat should not be given in early childhood. Experience demonstrates and proves the accuracy and the value of physiological teaching.

The ever-active, muscle-laboring, growing child,

with its rapid heat loss, should have an abundance of cereals, vegetables, and milk in its diet, to meet physiological requirements.

Children in whom meat is a large factor in their diet have not the robustness and vigor, the freedom from attacks of ill-health, witnessed in those who have meat but sparingly. A disproportion of animal food in the diet of a child, by overstimulation of metabolism, leads to imperfect tissue-nutrition, delicacy of constitution, and irritability and peevishness of disposition; the resisting powers of the organism are impaired; the susceptibility to disease heightened. Meat juice should not be given to a healthy child before two years old, and then in quantities not to exceed half an ounce to one ounce three times a week. The healthiest children are those who have meat every second day only, up to the age of five and six years.

Suitable adaptation of the different food constituents to cover the large demand for heat and energy, and for the storing of proteids, minerals, and fat for *future needs*, is the paramount consideration in the diet of a child.

An abundance of carbohydrates is essential to the growing child, as the stored energy which is thus supplied protects the circulating albumins from undue destruction. There must be sufficient fat and carbohyhrates in the food to cover the large demand for heat, energy, and nervous and muscular work, that the proteids may be protected and stored. Muscular flesh deposited during growth is permanent, and lasts as long as life itself; whereas muscular flesh built up by forced exercise in an adult is lost as soon as the exercise is discontinued.

Foods rich in carbohydrates and fat, along with a moderate proportion of meat, will be the ones on which the most abundant and most lasting deposition of flesh—fat and muscular flesh—is to be assured for

future and far-distant needs. Such foods are to be found in oatmeal, cornmeal, cream of wheat, hominy, rice, potato, bread, and other farinaceous substances, egg, vegetables, and milk, with a minimum of flesh food. These foodstuffs are at the same time rich in potassium and other salts, which latter resemble those of the blood, muscles, and bone, and which are essential to health; and to the normal reaction of the secretions, while flesh food contains only mere traces of potassium.

Conclusions.—Nature, or, to be specific, chemistry, physiology, and chemical physiology, have furnished unerring guides for the feeding of children.

The time when and what farinaceous substances should be given is wholly evident.

Meat juice is contraindicated in very young children, owing to its exciting effect on the nervous centers, and the loading of the system with extractives which tax the excretory organs.

During all the years of early childhood, meat and its preparations should be given only sparingly on account of their overstimulating metabolism, but chiefly for the reason that they create a distaste for cereals, fats, and fresh vegetables, thus depriving the system of materials needed to shield the proteids from oxidation that they may be stored for future needs, and of the necessary mineral salts which vegetables obtain direct from the soil.

In a child, with its relatively large cutaneous surface and correspondingly rapid heat loss, the large demand for calories must not be covered by proteid to any considerable extent, otherwise there is a lack of deposition of proteid—or of muscle growth. Increasing quantities of carbohydrates and fats in the food decrease proteid metabolism; a more lasting deposition of proteids for future needs is thus brought about.

To provide the mineral constituents necessary to

maintain the normal reaction of the fluids of the body when these elements are being appropriated in large proportions for the growth of bone, muscle, etc., vegetables which obtain these elements direct from the soil must be consumed in fairly liberal proportions.

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