

swept off his or her feet by uncontrolled animal passion. Before and after, reason holds sway, and they bitterly and clearly recognize the nature of their transgression: the later developed association centres and mind go down before the storm; the older are but discharging their normal function.

In psycho-analysis, again, the brain is kept quiet as far as any brain can lie quiet; this gives an opportunity for any dominant feeling or thought in the primitive brain to come to the top, and stimulate the higher centres; what was before an ill-defined, vague feeling now becomes a conscious thought. Probably in the term "unconscious" are included and confused two different and separate processes—one the general functioning of the primitive brain, the other those repressed thoughts and emotions associated with the later brain, which are inconsistent with the general trend of our education and morals. Many of the latter may be the result of stimuli from the primitive brain; and it should also be remembered that many stimuli from the primitive brain may be quite consistent with our education and morals—witness hunting.

Our primitive brain is analogous to the simian hand; but we have added many more convolutions to the simian brain to form our brain than we have added muscles to the simian hand to form our hand, and perhaps we have lost some, as we have lost the grasping muscles and shape of the foot.

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*Diet according to Symbiosis.* By H. REINHEIMER.

ACCORDING to the late Sir William Bayliss, a leading physiologist, the vitamins, which the plant alone knows how to manufacture, are a kind of chemical messengers (hormones). "They are obtained from the plant, and are particularly abundant in fresh green vegetables and fruit." . . . "Their precise mode of action is still unknown, but in their absence normal growth and function is impossible and certain diseases make their appearance." Hence the normal growth of the animals depends upon stimulations and influences directly derived from the plant kingdom. The evolution of the animal is in large part directed by the plant, which is also saying that it is cosmically directed, in virtue of those terrestrial and solar influences which the plant purveys. But it is also saying, in a most important sense, that all organic evolution is directed by the amount of mutuality existing between the kingdoms and what this involves in bio-sociality. If the vitamins are, in Sir William's words, "obviously a kind of chemical messengers," then we must consider them as the hormones of symbiosis, as

“messengers” of health—the diametric opposites of the alkaloids, the vegetable poisons which are of appalling efficacy in the physiological economy of the animal. By symbiosis I mean not parasitism, not commensalism, but definite, almost deliberate, mutual adaptation for the purpose of mutual service, on the part of living things, nearly always of different orders of creation, broadly, that is, between the plant and the animal (“Norm-symbiosis”).

Dr. R. McCarrison is another physiologist who declares that the vitamins resemble the hormones, and he shows that vitamins influence markedly the production of hormones. He furthermore says that the similarity of action may be demonstrated by many facts. He also states that vitamins are one link in a chain of essential substances requisite for the harmonious regularization of the chemical processes of healthy cellular action. If this link be broken the harmony ceases or becomes discord, as it may cease or become discord if any other link be broken. “Vitamins provide cells of the body with power—one might almost say, the will—to work.” Evidently there is a momentum for honest work in the strenuous plant, and this momentum communicates itself to the symbiotic animal. Many instances of this kind could be adduced. What is more, as I have shown elsewhere, symbiotic systems push each other on unceasingly, until we get a kind of compound urge of progressive evolution, emanating from symbiosis, which urge I have denoted “sybiogenesis.”

It is evident that Nature knows no difference between physiological and biological inter-relations, that she maintains biological symbiosis by the same means as are employed to maintain internal symbiosis. On the “symbiotic” interpretation of hormones, vitamins and alkaloids, we get a perfectly rational panoramic explanation of the whole field of related phenomena.

A word of warning is required, says Sir William Bayliss, against those advertisements of preparations which speak of vitamins as though they were a species of drugs. They are normal constituents of certain foods, and careful tests have shown that as much is to be obtained from an egg or an orange as from some ten shillings-worth of the best commercial product. All of which shows that we shall fare best on a simple natural dietary and by relying upon natural remedies. Sir William tells us about the good effects of sunlight in curing certain diseased conditions, such as tubercle and rickets. Here, too, it seems that some chemical messengers have been produced in the skin by photo-chemical reaction and have been carried by the blood all over the body. But the production of such “messengers” depends upon the quality of pigments present in the system, and particularly in the skin; and these pigments,

in their turn, go back to plant pigments. They are primarily introduced by the ingestion of plant-food. There is thus good reason to think that much depends upon the biological adequacy of the food—the material from which the body is built up.

When, acting as carnivores, we kill animals in order to eat their voluntary muscles, which we call meat, we travel in the direction of what I have termed a “tape-worm adaptation,” *i.e.* one of wrongful substitution of proteins for other substances more important to high specialization. Muscle is not normally or legitimately built up by eating other muscles, but by eating vegetable carbohydrates and vegetable proteins, which have, of course, to be supplemented by legitimate exertions towards the obtaining of those rewards. Man is made for work. If we fail to build up our body on biologically legitimate principles, we cannot wonder at a wrongful substitution of one substance for another, nor at a multiplicity of other similar evils. It has been found that vegetable protein, derived from beans, peas, rice, wheat, nuts and cereals generally, whilst it is digested as easily as animal protein, resists *colon bacillus* changes much better than animal proteins. The *Bacillus coli*, says Dr. Leonard Williams, who ascribes a great number of maladies to intestinal stasis (*Brit. Med. Journ.*, June 16, 1923), is, like ourselves, changing its character according to its diet. “When stuffed with devitalized flesh-foods it becomes quarrelsome and poisons its host, but when fed on live carbohydrates, which are enabled by a rational dietary to reach it in an insoluble envelope of cellulose, it becomes lamb-like and assists its host in disposing of enemies.” In other words, we have it in our power, by the choice we make of food, to turn associated organisms—our animate environment—into symbiotic helpers, or, in the alternative, into pathogenic, *i.e.*, parasitic enemies. The temptations which we put in the way of our own cells by wrong diet are sufficient to account also for the parasitic character of the cancer-cell. The colon bacillus may be viewed as a part of us, despite its autonomy. And if this bacillus can thus be spoilt in character by the temptations which we set before it, we may conclude that the same may happen to other more essential parts of us, namely, to our cells and tissues. They, too, are not without some autonomy, however limited, and they, too, can be spoilt by the temptations offered in the shape of biologically unsuitable food. As I have stated in an article on “Symbiosis and Disease” (*Psyche*, April, 1923), in answer to the question what is the reason for the disloyal behaviour of the cancer-cell, which acts as a parasite on the rest of the body, there are (a) evil communications, (b) temptations, (c) somewhat paradoxically, starvation. The evil communications are provided by the organism

itself, in obtaining food feloniously, *i.e.*, by short cuts, causing it to become more or less debauched and to transmit like influences to its members. The temptation is provided by the appearance in the tissues of superabundant nutrition, which, so far from prompting to gregariousness and high forms of association and integration, lures the tissues into the path of biological anarchy; and the starvation is due to the fact that, surfeit notwithstanding, vital food constituents fail to be elaborated. Hence the craving for such ingredients, which can be appeased only by unsymbiotically invading adjoining normal tissue.

Here I might well interpose Dr. McCarrison's experience of "physiological" cannibalism amongst animals deprived of vitaminous food, since it tallies with my observations. Says he: "Fowls will consume their own feathers or those of their neighbours, although supplied with abundance of deficient foods. The habit is one of the most outstanding symptoms of avitaminosis in these birds. I have known them kill one of their number and eat portions of its body, impelled to cannibalism by the instinct which prompts them to make good the food deficiency. Deficiently-fed rats may behave in the same way."

Instead of a flesh diet, Dr. Leonard Williams recommends an intensive vitamin dietary—in other words, one obtained in Nature by symbiotic cross-feeding.

As regards, more especially, diabetes, it presents a case of failure of due oxidation and use of glucose. The general metabolism has become perverted by wrongful substitution in diet. It is a concomitant of this particular form of perversion that the famous "islands of Langerhans," tiny glands in the pancreas, fail to do their duty. They no longer secrete their customary ferment, which normally breaks down the sugar of the blood. They have lost their power of normal functioning in proportion as the organism proceeds with abnormal feeding—abnormal adaptation. To correct this "intolerance" of the body to carbohydrates, "insulin," an extract made of animal glands, is now to be injected into the blood-stream.

Now one of the workers in that field, Dr. J. B. Collip, has informed *Nature* (April 28, 1923) that he has found that the effect of plant extracts on blood-sugar is identical with that produced by "insulin." This discovery, in my opinion, goes a long way to show that the beneficial effects of the internal secretions are essentially due to substances yielded by symbiotic plants—a matter I have stressed in a chapter on "The Bio-Economics of Internal Secretions" in my book on *Symbiosis: A Socio-Physiological Study of Evolution*.

Dr. Collip tells us that his former prediction is now coming true,

namely, that wherever glycogen occurs in Nature, an insulin-like substance is also being found. On putting the idea to the test he obtained positive results with clam tissue and with yeast. Hence he thought that if yeasts contain an insulin-like hormone, other plants may also contain it—a reasoning which is well on the way of my own, namely, that everything that is of fundamental value as chemical power goes back to the plant. Dr. Collip applied to the higher plants, and he found extracts from tissues of a variety of such had a remarkable effect upon the blood-sugar of rabbits. The effects of certain plant extracts upon the blood-sugar of depancreated dogs were also studied. Extracts made from onion tops, onion roots, barley tops and sprouted grain, green wheat leaves, bean tops and lettuce—a motley list of representative mammalian food-plants—were found to produce marked hyperglycæmia in normal rabbits. The day following the administration of an extract of green onion tops to a depancreated dog with a blood-sugar of 0.190 *per cent.*, a blood-sugar of 0.090 *per cent.* was observed. Hence Dr. Collip claims to have discovered a new “plant hormone,” to which he gives the name “glucokinin,” *i.e.*, one which assists the digestion of sugar. May it not be that the prevention of diabetes lies in the adaptation to a well-balanced vegetarian dietary, one which, on biological grounds, we may expect to supply not only the right raw material, but also the right hormones to deal with it?

There are two American workers, W. Thallimer and Margaret C. Perry, who claim some credit in discovering the effect of plant extract on blood-sugar, and in *Nature*, August 4, 1923, they give us the benefit of their experience. Their study in connection with insulin led them to the conception that carbohydrate metabolism is performed by an oxidizing ferment mechanism. This theoretical conception induced them to test vegetable material known to contain oxidases and peroxidases for oxidizing substances having an insulin-like action. They found that the juice of potatoes injected intravenously is apt to reduce the blood-sugar. They believe that their and Collip's theory dovetail. Like Collip, they express the view that a storehouse of food (glycogen, starch, etc.) and a ferment for the metabolism of this food are necessary wherever growth occurs in vegetables.

Parenthetically I would remark that Prof. N. Bernard, in studying symbiosis between orchids and fungi, found glycogen to be present upon the peculiar clusters formed by the threads of the fungi. These clusters occur when the fungi live in symbiosis with orchids; but they are absent when the fungi live free, *i.e.*, parasitically, in Nature. The clusters seem to facilitate mutual

exchange of substances, and there can be no doubt that symbiosis is both a means of, and a powerful inducement to, the storing of useful material, and to the elaboration of appropriate ferments by the highly specialized partners. Thallimer and Perry declare that their study has led them to the tentative suggestion that insulin, which is apparently not itself an oxidase or peroxidase, only indirectly stimulates or activates oxidizing ferments in the tissue-cells to act upon glucose, whereas *vegetable extracts contain active oxidizing ferments, which act directly* when injected into the animal (italics mine).

Read this in conjunction with the view expressed in certain medical quarters that it may be better in the future to administer insulin by the mouth, and it will not appear a far step to the proposition that by means of symbiotic cross-feeding we shall be able to prevent disease instead of having to cure it.

I am of the same opinion as Sir Arbuthnot Lane with regard to the prevalence of cancer. He stated in a letter to the *Times*: "Nature has provided us with a most definite evidence as to the cause of cancer, or, rather, as to the circumstances in which cancer does or does not occur. In native races in their normal surroundings cancer and the intestinal conditions which precede it are absolutely unknown. In civilization cancer and the associated intestinal conditions appear for the first time and are most prevalent. We believe that they are increasing with great rapidity, exacting a steadily increasing toll of human life. If the native is removed from his normal surroundings and habits and becomes a member of a civilized community, he is affected by cancer and the associated intestinal conditions with the same frequency as the white man with whom he lives. Indeed, the prevalence of cancer in the native varies directly with the degree of civilization in which he is thrown."

In an article on "The Relation of Faulty Nutrition to the Development of the Epithelioma contagiosum of Fowls," *British Medical Journal*, August 4, 1923, Dr. McCarrison shows that a certain state of faulty nutrition and of deranged metabolism favours the entry into the body and the activity of an invisible virus possessing the specific quality of inducing epithelial new-growths. It is conceivable, according to him, that substances possessing growth-inducing qualities may be evolved from the tissue-cells themselves under conditions of slow disturbance of nutrition, in a manner comparable to the evolution of such during the process of autolysis of cells. My point is that the possibilities of this kind are the greater the more the organism is addicted to the habit of "in-feeding," *i.e.*, of building up its body on biologically inadequate material.

In his book on *Studies in Deficiency Diseases*, McCarrison, who is impressed with the vast importance of the food factor in the causation of disease, tells us that deficient foods are in practice usually ill-balanced foods, and that the effects of avitaminosis are bound up with mal-adjustments both in quality and quantity of other essential requisites of the food. To him the ideal diet is a "well-balanced food of good biological value and rich in vitamins of every class." The vitamins, according to him, are not foods in the sense of tissue-builders or producers of energy. Their function in the animal economy is still incompletely understood. Certain it is that they are obtained from the vegetable kingdom. Plants alone appear to possess the power of synthesizing them. Man and animal derive them directly or indirectly from plants. Persons receiving too few vitamins are living in a state of potential morbidity, which may be converted into one of actual disease by a variety of factors that further exhaust the metabolism. McCarrison has seen that when the food is deficient in vitamin and excessively rich in energy-bearing elements, profound abnormalities take place. Biologically speaking, this is what I mean by the ill-effects of a divorce from symbiosis: there is a loss of proportion, of orientation; the animal is no longer under the only control that is of avail in progressive evolution, namely, the control of norm-symbiosis.

Fruits, according to McCarrison, as sources of vitamins, rank high, whilst their content of organic acids and indigestible vegetable constituents—gums, waxes, and cellulose-like carbohydrates—gives to them an added value in promoting the excretory processes of the kidneys, and in maintaining the functional perfection of the gastro-intestinal tract. We should add to this the fact, established by Richet and his school, that fruits and vegetables have never been known to give rise to "alimentary anaphylaxis"—the dietary equivalent of serum disease, whilst flesh foods often produce the same distressing symptoms upon body and mind as are known frequently to result from a direct introduction of protein poison into the blood. No wonder McCarrison declares: "There are no more important ingredients of a properly constituted food than raw fruits and vegetables, since they contain vitamins of every class, recognized or unrecognized." . . . "I have written of three vitamins, because three are known, not because it has been proved that there are only three. But whether there be only three or legion, they will be found to exist—and this is the important point—in the foods made in Nature's laboratory, in quantities and in combinations adequate for the due digestion and assimilation of the natural food-stuffs with which they are associated in Nature."

Although the contrary is foolishly believed by the masses, in

reality it is flesh foods which impose the greatest burden on the metabolic resources of the body, and which depress the functional capacity of the endocrine regulators of the metabolism. McCarrison shows that excess of fats in the food causes serious trouble. It keeps the protein and carbohydrates so low as to produce anæmia and other disorders of malnutrition. Add to this the fact that many cancers are known to originate from fatty tissue, and the further one that surgeons operating for cancer are always particularly intent upon removing every scrap of fat to be found near the source of trouble, and it is clear that to be encumbered, as we usually are as a result of a flesh diet, is one of the gravest risks we run.

McCarrison has perceived what was long known to me as an outstanding fact—that the early departures from health, “the early evidences of disease,” in his own words, are due to transgressions against nutritional law.

We should remodel our biology so as to adjust it thoroughly to the fundamental fact of our dependence upon the plant, in accordance with “norm-symbiosis”—the partnership between plant and animal on the grand scale of Nature.

Pathogenic organisms, says McCarrison, when present in the body during the period of its subjection to faulty food, contribute their share to the general morbid result; but the beginning is always made, the susceptibility always caused, by transgression against nutritional law. “Under conditions of food deficiency, the presence in the bowel of pathogenic micro-organisms may determine the character of the morbid states initiated by the food deficiency, and even impart to them endemic or epidemic character. In these circumstances the ætiological significance of the underlying food defects, which has permitted the unhampered action of the pathogenic agent, may be obscured.” In other words, nothing but mischief can result if our food is inadequate. But adequate food is that which is proportioned both in a physiological and a biological sense. Food that is biologically inadequate for us may be food adequate for scavengers.

The dietary habits of our people, according to McCarrison, form a sad tale to tell: “Fresh fruit is a comparative rarity, even on the tables of the rich. Green vegetables are scanty, and such as there are, are often cooked to the point of almost complete extraction of their vitamin-content and salts. White bread has largely replaced wholemeal bread.” . . . “Meat is at best but poor in vitamins, and its value in these essentials is not enhanced by freezing and thawing. Sugar is consumed in quantities unheard of a century ago, and sugar is devoid of vitamins which the cane-juice originally contained. The use of stale foods, involving the



introduction of factors incidental to putrefaction, is the rule, that of fresh foods the exception." In India he has found that the European patient "cannot digest vegetables or fruit," and never touches them. He says, "Hindhede concludes that the principal cause of death lies in food and drink," and adds, "Few will be disposed to doubt the justice of this contention in the face of an experiment so unequivocal" (as that made in Denmark during the war, when the cereals and potatoes were taken from the distillers so that they could not make brandy, and given to the people, as a result of which the death-rate dropped as much as 34 *per cent.*). He says further: "My own experience provides an example of a race, unsurpassed in perfection of physique and in freedom from disease in general, whose sole food consists to this day of grains, vegetables and fruits, with a certain amount of milk and butter, and goats' meat only on feast days (the people of the State of Hunza, in the extreme northernmost point of India). They have in addition to grains—wheat, barley and maize—an abundant crop of apricots. Amongst these people the span of life is extraordinarily long. Their case shows that the enforced restriction to the unsophisticated food-stuffs of Nature is compatible with long life, continued vigour, and perfect physique." McCarrison concludes that with increasing knowledge of nutritional problems it has become apparent that our dietetic habits need remodelling, and that education as to what to eat and why to eat it is urgently necessary. Ever since 1899 I have published in the same sense.

There has been other evidence recently showing that the poisoning effects of excessive protein diet can be mitigated by the substitution of appropriate vegetable food in the diet. Dr. Gladys Hartwell has shown that by feeding mother rats with tomatoes, carrot juices and potatoes, she can prevent the evil effects which an excessive protein diet usually has upon offspring. It was thus demonstrated further, as I have pointed out elsewhere, that a diet which apparently is a boon to the individual may in reality be a curse to the species—in other words, that it is in the long run the biological adequacy of the food which counts.

Prof. V. H. Mottram has made the following remarks in connection with Dr. Hartwell's experiments: "The amount of vitamin B necessary for ordinary growth, and for reproduction, is by no means enough when the mothers are on a dietary rich in protein, and are nursing young. If this is true for human beings, the nursing mother who is taking a 'nourishing' diet, rich in protein, should take a large amount of vitamin B or rather vitamin B-containing foods as well. Nothing is more noticeable nowadays than that the rich and middle classes cannot nurse their own children, whereas

working classes often succeed admirably in that function on a much poorer diet. Can it be that the former class take too much protein and too little vegetables and fruits, which supply vitamin B in proportion? ”

So Dr. Monckton Copeman has found that by excluding food-stuffs of animal origin, or at any rate those containing animal fat, he was able to formulate a dietary beneficial to patients suffering from cancer.

He does not object to a little fat of vegetable origin, and he supplied the fat solubles from such articles as lettuce and watercress. All of which testifies to the superior value of symbiotic cross-feeding—the best and most comprehensive way of summing up the whole matter, for we know as yet far too little of the vitamins to express the benefit of this or that food in terms of these. All we do know with certainty is that the plants manufacture the vitamins. But even the plants must, in accordance with socio-physiological law, cease to produce beneficial substances when subjected to habitual predacity by animals.

The evidence regarding the superiority of symbiotic cross-feeding is, indeed, on due collation, quite overwhelming.

The animal food consumed by man represents, as a writer pointed out in *Nature*, December, 1923, vegetable food converted by stock into “meat.” “It is desirable to know,” says that writer, “the extent of the waste involved in this process of conversion.” We have as yet far too little realized that Nature sets her face against waste of this kind, and that the results of such transgressions against economic and biological laws must inevitably be disease and degeneration.

The *British Medical Journal* stated May 19, 1923, “Health depends on obedience to law, but this law must be intelligently understood, and should be voluntarily obeyed. Social conditions must be improved in the future, but the individual must also be educated to a social consciousness, and a happy blending of socialism and individualism offers a prospect of true evolution. Obedience to the moral law is the only way to a medical Utopia.”

This is good sense. I would merely add that the “moral” will have to include the “bio-moral” law, for it is our duty to accommodate ourselves legitimately, not only to our fellow-men, but also to other creatures, the existence of which is indispensably interlinked with our own. In the long run this is a vital matter, although in our narrowness of outlook, in our love of irresponsibility, we have hitherto overlooked it. What is more, compliance with the law of biological reciprocity will react favourably upon the mutual relations between men and between nation and nation.