Similarly it is probable that the alcoholic disorders which occur in persons with the epileptoid constitution could be shown to link up with epileptic psychosis proper.

It is important to realize in this connexion that the constitutional factor in the exogenous psychosis does not merely effect a slight variation of the symptomatic picture in accordance with the patient's personal peculiarities—this would follow as a matter of course—but that it is an essential determining factor in the very structure of the psychosis, a factor which does not merely colour the symptomatic picture but which determines the whole course and termination of the disease. The psychological reasons for taking to drink vary in accordance with a person's constitution; the alcoholic disorder with which he is faced is correspondingly different, and the prognosis is different. These considerations also affect our approach to the biological and eugenic aspects of alcoholism. Since, according to Pohlisch, alcoholic delirium, in contrast to the other alcoholic psychoses, seldom occurs as a familial disorder and frequently crops up in constitutionally healthy individuals, it should be regarded as of less serious import than the other psychoses when we are called upon to advise in matrimonial problems.

Influence of the Constitution

Constitution plays no less important a part in the determination of the reactive neuropsychoses, psychogenic conditions, psychoneuroses, hysteria, obsessional neurosis, and paranoid states. Although we are frequently able to cure them by psychotherapy we must never forget that successful psychotherapy just as often depends on problems of personality-structure as on experience and environment. The structure of personality is in its essence constitutional and inherited. In our treatment we exert a formative influence on it. Often external experience is not so much the real cause of a neurosis; it is rather a flame which ignites the inner typologically determined mass of conflicts within the personality. Practical psychotherapy has shown us that in the origin of the neuroses definite constitutional elements play a part—for instance, minor developmental arrests, especially those occurring during puberty and in the immediate post-pubertal period.

In hysteria, for example, the constitutional predisposition is by no means limited to what is generally termed "nervousness." Certainly all hysterics exhibit autonomic nervous anomalies; their reflex and semi-reflex reactions are highly labile and are easily deflected. But this is not the whole story so far as the specific hysterical predisposition is concerned: there are innumerable people with a labile autonomic nervous system, but few necessarily consult a doctor, and among them only a small number are hysterics.

Furthermore, in hysterics our methods of investigation reveal a mass of minute constitutional sexual anomalies which, if we regard the personality in cross-section as it were, appear as stigmata at the level of physique and character. These anomalies are perhaps even more conspicuous if we regard the personality, so to speak, lengthwise—that is, as a life curve—when they become clearly apparent as developmental checks and uneven rhythms in the pubertal and post-pubertal periods. It is these anomalies which form the other half of the constitutional predisposition to hysteria mentioned above. It is noteworthy, however, that extreme degrees of developmental arrests such as are associated with endocrine disorders and generalized infantilism do not as a rule give rise to hysteria; the more usual resultant picture is one of more generalized psychological inferiority uncomplicated by psychic conflicts. However, it is these *partial* "infantil-

isms" and "juvenilisms" which give rise to endopsychic tension and ambivalence and prepare the way for conflict formation, in that they weaken a person's resistance to the effects of traumatic experiences and situations.

These constitutionally predetermined irregularities of development are apt to lead to conflicts with the outside world and its demands that cannot be resolved in the way in which a normally constituted individual would take them—that is, in his stride. Hence the constitution creates its own conflicts in relation to experience, to which it then, in turn, reacts pathologically. Here again the diagnosis of inherited predisposition in neurosis by no means impedes our practical work and our therapeutic success. On the contrary, it increases our ability to recognize the chief foci of endopsychic conflict and the means by which they can be overcome. So far as mental hygiene is concerned prophylaxis by means of eugenic measures applies less to the neuroses. On the other hand, the recognition of the constitutional elements in psychogenic disorders offers wide possibilities for prophylactic treatment by way of the medical-educational training of the personality.

THE PHYSIOLOGICAL BASES OF NUTRITION *

BY

STUART J. COWELL, M.B., F.R.C.P.

Professor of Dietetics, University of London

It would not be fantastic to claim the greater parts of the fields of biochemistry, physiology, pathology, and clinical medicine as the legitimate province of the modern science of nutrition. As our knowledge of fundamental living processes increases, it can be seen more and more clearly how chemical and physical changes are not only responsible for determining the normal physical development and the maintenance of the organism in a state of equilibrium with its environment, but are equally associated with those special reactions to environmental stimuli which we recognize as signs of diseased states. This well-recognized conception implies that development, the maintenance of health, and the disturbance of health depend on the orderly or disorderly function of metabolic processes which can legitimately be held to imply, respectively, perfect or imperfect states of nutrition. It is conceivable, or rather probable, that with further advances in knowledge most of the diseased states which we now recognize will be definable in terms of definite disturbances of metabolism or nutrition. The scope of the B.M.A. Section of Nutrition would under these conditions be wide enough to cover a large part of the field of medicine; and indeed it is already capable of so doing, as the President of this Section was able to prove for us in his opening address last year. For practical convenience, however, at the present time it seems politic to limit the sphere of our interest mainly to those nutritional processes which are known to be more or less directly related to the intake or absorption of food. In regard to the subject under discussion to-day, for example, it would be within the scope of the title to include the physiology of respiration and excretion, muscular exercise, personal hygiene, and so on. Actually all the formal contributions to this discussion will be concerned with dietary constituents and their contribution to nutrition.

* Read in opening a discussion in the Section of Nutrition at the Annual Meeting of the British Medical Association, Belfast, 1937.

Awakening of Interest in Nutrition

When I was honoured by receiving an invitation to open this discussion the title had already been chosen, and it was clearly the wish of the officers of the Section that the opener should expound the views of modern experts on the dietaries considered likely to promote optimal physical development and maintenance of health among Western peoples—views which have recently been crystallized by a representative committee appointed by the Health Committee of the League of Nations. This is not the occasion for detailing the history of the inception of this committee of experts, but we may be permitted to remind ourselves of the developments which led ultimately to the publication of the committee's practical recommendations.

There is no doubt that it has been the more accurate knowledge of nutritional processes gained from the study of experimental animals in the laboratory which has been primarily responsible for the awakening of interest in the problems of human nutrition. Following the lead of such animal experiments, it has been shown that the general principles which have emerged from the laboratory are on the whole applicable to human beings. Some years ago it was clear to those who were actively engaged in this work that the knowledge which had already accumulated ought without delay to be made available for the securing of better nutrition for the masses of mankind. The recent world-wide trade depression, with its accompanying unemployment and poverty, provided the opportunity for interesting large sections of the world's populations in the question of nutrition and malnutrition. Government departments began to be conscious of the fact that they had some responsibility in the matter of encouraging the people entrusted to their care to secure for themselves and their families the largest measure of health and well-being which right feeding could give them. In the meantime the Health Department of the League of Nations had been interested in the application of the newer developments of the science of nutrition to the problems of feeding human beings, and was busy collecting information regarding the relation between nutrition and states of health and disease, and regarding the existing evidence of malnutrition among different races of mankind. The resulting admirable report by Aykroyd and Burnet rightly attracted a considerable amount of attention, and did a good deal towards preparing public opinion for the conclusions of the special committee of experts which the League of Nations appointed to consider the practical question of recommending diets calculated to secure good nutrition in human beings. The first report of this committee was published in 1935 under the title of our present discussion; the report was revised and re-issued in 1936. This final version will be the main theme of my contribution.

Practical Aspects of the Nutrition Problem

I propose to limit my observations, as the League committee has done, to certain practical aspects of the problem of human nutrition. The main questions I wish to discuss are: What can we hope to accomplish by any dietary recommendations that we may feel justified in making?; and, What diets are most likely to secure the desired effect?

Only tentative answers can be given to these questions: we cannot always wait for full knowledge before planning a course of action. The primary aim in making any dietary recommendations is, except possibly in rare instances of medical emergencies, to secure the best

possible state of nutrition which a suitable combination of foods can bring about. The term "best possible" is used rather than "optimal" for the reason that hereditary defects, previous disease, or deleterious environmental factors may prevent a perfectly good diet from exercising its full nutritive effect, as we shall no doubt learn from the contributions of Dr. Brock and Dr. Spence. The fact that so many private individuals and official committees have of late considered it advisable to make dietary recommendations implies that in their opinion the state of nutrition of a considerable proportion of our existing populations is not as satisfactory as it might have been under the influence of an ideal dietary. And there is much evidence to support this opinion. There is, for example, no doubt that the physical development of very large numbers of our children could be improved by better feeding during the whole period of growth. The milk-feeding tests which have been carried out in many different countries have shown that the mean rate of growth of any large group of children can be accelerated by regular supplements of this valuable food. Sufficient time has not yet elapsed for information to be available regarding the ultimate effect of such accelerated growth in the final state of development. The experience of most of those who have been engaged in controlled feeding work with laboratory animals has been that diets which promote the most rapid growth in early life maintain the animals in the most vigorous health in adult life. It is, however, interesting to note that Dr. Hayward of Cornell University found he could prolong the life of rats by stunting them in early life, a result apparently in direct contradiction with the experience of Professor Sherman, whose rats survived to old age better when they were given diets which promoted the most rapid rate of growth.

The skeletal development of children could without doubt be improved by better feeding. While the propaganda of the last fifteen years has resulted in a considerable diminution in the incidence of the grosser manifestations of rickets, there are indications that minor skeletal defects due to suboptimal bone calcification are still common. Of equal or even greater importance is the fact that the development of the teeth is undoubtedly handicapped in the majority of our children by suboptimal nutrition in early life. The relation between diet and the development and maintenance of sound teeth is of paramount importance, and I shall refer to it again in a few moments.

Before leaving the question of diet in relation to development I would draw your attention to certain less gross effects of faulty nutrition in the matter of physical development. Under this category might be included the failure of the haemoglobin-producing mechanism caused by iron deficiency in childhood. As far as is known this nutritional fault is completely reversible, but there is evidence that other faults may not be completely reversible—for example, the abnormal development of the gingival epithelium in young dogs, described by M. Mellanby as arising from deficiency of vitamin A. This made them susceptible to pyorrhoea in adult life even if adequate supplies of vitamin A were given for long periods after growth had ceased.

Effects of Suboptimal Diets

The extent and perfection of physical development is not the only benefit to be expected from proper feeding. The question of the maintenance of a state of health and full vigour is becoming more and more widely recognized as one in which right feeding must occupy a prominent

position. There is no time for me to go fully into the various ways in which suboptimal diets may affect the health. Frank deficiency diseases due to a low intake of mineral elements and vitamins, and possibly good protein, are by no means rarities in the British Isles. In many parts of our Empire they are far too common, as is now being made abundantly clear by the investigations which are taking place in Ceylon, India, Africa, and Australasia. How far minor degrees of specific deficiencies are responsible for lessened vigour and vitality, and lowered resistance to infections and degenerative diseases, is still largely a matter of conjecture, but steps are being taken to fill in this gap in our knowledge. Clinical and biochemical tests are now being used—for example, in an attempt to recognize the earliest signs of deficiency of vitamins A, B, and C—and the results may enable more accurate estimates to be made of the effect of suboptimal diets on the general state of health.

Questions which have attracted a great deal of attention and which still require much further investigation involve a more exact understanding of the relation between faulty nutrition and infection, including the response to established infections of an acute and chronic nature as well as the incidence of infection. There is much evidence that common diseases and disorders of the alimentary tract may be related to faulty feeding, though the mechanisms by which they are brought about remain obscure. The subject of dental caries deserves special mention. Though there is still much dispute as to its cause, all are agreed that it should be largely controllable by suitable feeding, and the kinds of diets advocated by the protagonists of the opposing views concerning its aetiology are not in practice very different. Further investigation is obviously desirable, but in the meantime it should be possible to reduce enormously the amount of dental decay in the next generation by securing as perfect a state of nutrition from the pre-natal period onwards as existing knowledge will permit.

Steps to Secure Improved Nutrition

This very sketchy outline of some of the results which might be expected to follow a general improvement in the state of nutrition of the masses of mankind must suffice for the moment. Our President gave us last year a much fuller and more complete account of the relation between faulty nutrition and disease. Time compels me to turn now to a consideration of the steps which should be taken to secure the desired improvement in the state of nutrition. The main lesson we have to learn from the fundamental research work of the present century is that optimal nutrition depends on the liberal supply in the diet of every food component which cannot be manufactured in the body from some other constituent of food, as well as on an adequate allowance of calories and utilizable nitrogen. The term "liberal" which I have just used in reference to the supply of essential food constituents was deliberate. In some quarters there is a tendency to assume that an adequate supply of these constituents is one which prevents the appearance of gross signs of deficiency diseases, whereas there is plenty of experimental evidence to show that improved states of nutrition can be secured by increasing the intake of such constituents above the level at which mere protection from recognizable deficiency symptoms occurs.

Though man's requirements of many of the vitamins and mineral elements can be stated to-day with a fair measure of confidence, he would be a rash man who would attempt to devise synthetic diets containing

measured quantities of all known food constituents and guarantee that perfect nutrition would follow their consumption. We are not in a position yet to define the exact chemical composition of an ideal diet, and it is surely wise, therefore, to guard against any possible deficiencies by including in our ideal diet liberal supplies of those foods which experiment and experience have shown to be most likely to contain any unsuspected essential constituents, as well as those foods which have already been shown to be rich in essential food factors.

Not only should the ideal diet consist of suitable quantities of the right kinds of food, but the foods of which it is composed should be produced under conditions which ensure that it is richly supplied with the essential constituents it ought to contain. This applies to foods of both animal and vegetable origin. More and more information is coming to hand regarding the variations in the concentration of important dietary constituents in foods produced, transported, and stored in different ways. It is obviously not safe at present to assume that a diet is adequate in every respect if it contains the bare minimum of essential components calculated from chemical or biological assays carried out on foods produced or kept under varying conditions. The wise course is to include in our ideal diets liberal supplies of those foods which are to be relied on to secure the necessary quantity of essential food constituents.

Practical Recommendations

This brings us to practical recommendations for securing optimal nutrition. We shall lay stress on the provision of a liberal supply of foods rich in vitamins and in mineral elements, especially calcium and iron in an assimilable form—that is, foods which have lately received the name "protective." This is the essential feature of the diets recommended by the League of Nations Commission. Its corollary is a corresponding decrease in the amount of inert if not actively harmful foods such as refined sugar and cereals. Adequate provision of calories and protein is by no means to be neglected, but in our own country this is not such a pressing problem. The protective elements of our diet can most easily be secured by increasing the consumption of milk, especially safe liquid milk, and other dairy products, all kinds of vegetables, especially green vegetables including salads, eggs, fat fish, and liver. In a diet planned on these lines the proportion of cereals will be reduced. The question of the relative merits of refined and whole-grain cereals was not treated at all exhaustively by the Commission, who supported the proposal that part of the cereal eaten should be lightly milled. It seems possible that the best practice would be so to increase the proportion of starch eaten in the form of vegetables, especially potatoes, that a comparatively small amount of cereal would be eaten, of which the bulk should be lightly milled so as to increase in the total diet the quantity of B vitamins and assimilable iron.

Diets for Children

The Commission rightly stresses the extreme importance of providing the best possible diets throughout the whole period of growth. This is, of course, one of the reasons why the diet it recommends for pregnant and lactating women contains such a large proportion of protective foods. There is no need to dwell on the special dietary requirements of mothers, since this question was fully discussed at yesterday's meeting. But a few words must be said regarding the proposed diets for children. Their special feature is the high proportion of the total energy

value contributed by protective foods, which is largely due to the inclusion of a liberal allowance of milk throughout the whole period of growth. The diets for children between the ages of 1 and 3 contain rather more than three-quarters of their total calories in the form of protective foods: those for children between 3 and 7 contain rather more than two-thirds, and this proportion is diminished in the pre-adolescent age to rather less than one-half. This insistence on a high proportion of protective foods is really the essence of the scheme for securing good nutrition. It runs directly counter to the attitude not infrequently adopted in some quarters that as long as a diet contains enough of the essential food constituents to prevent symptoms of deficiency diseases there is no point in worrying about its make-up.

There was recently published by Mr. Rowntree in his book *The Human Needs of Labour* a dietary scale, "representing a standard below which no class of worker should be forced to live," for a family of man, wife, and three children under 14. I made a rough analysis of this diet, and calculated that even if each child received more than his share of the protective foods in proportion to his man-value equivalent, less than one-quarter of his food intake would be derived from such protective foods—and even then more than half of the protective foods would be composed of cheap cuts of meat and condensed skim milk. It is true that even a diet such as this compares most favourably with diets consumed in many parts of the world. To take just one instance, Dr. Aykroyd has recently carried out a survey of diets in South Indian villages. Among the poorest group the diet averaged 1,664 calories per unit of man-value, and 95 per cent. of the calories were derived from cereals. The children forced by poverty to live on such diets showed only too frequently gross manifestations of deficiency diseases and general malnutrition, while the children brought up on the diets suggested by Mr. Rowntree might escape without immediate obvious symptoms of food deficiency other than slight indications of rickets, poorly developed teeth susceptible to decay, and a general physique below their potential optimum. All who have tried to put into practice the modern principles of nutrition, whether on experimental animals or children, would agree, I think, that it is worse than useless to lay down as a standard any diet which is likely to produce imperfect development and suboptimal states of nutrition. It is true that mere pious expressions concerning the make-up of the ideal diet will not enable the poor to buy the food best calculated to promote perfect nutrition. Fixing a dietary standard which approaches the ideal for promoting good nutrition at least draws attention to the urgency of the practical problem of trying to bridge the gap between the ideal and the actual, whereas an admittedly low standard merely encourages complacent individuals and authorities to continue their policy of *laissez-faire*.

Our discussion is concerned with the physiological, not the economic, bases of nutrition, and it would be out of order for me to pursue further the sociological and political implications of dietary standards. It will suffice to remind you that the Health Organization of the League of Nations is deeply concerned with the economic, agricultural, and political problems involved in attempting to supply a sufficiency of health-promoting foods for the populations of mankind. Our own Government Departments are already tackling the same problem, and a perusal of the first report of the Ministry of Health's Advisory Committee on Nutrition will show that these practical aspects of the situation are receiving serious attention.

THE ROLE OF HETEROPHORIA IN BINOCULAR DISHARMONY WITH SPECIAL REFERENCE TO AIR PILOTAGE*

BY

WING COMMANDER P. C. LIVINGSTON,
F.R.C.S.E., D.O.M.S., D.P.H., R.A.F.

Consultant in Ophthalmology, Royal Air Force

To confine this paper entirely to the domain of the air would be like writing the final lines of a book without considering the framework of the first chapter. The condition that we style heterophoria must be age-old, but the contest for mastery of the air is, within practical limits, an event of our generation. Racing through space does not itself produce heterophoria, but heterophoria may severely affect safe aerial manœuvre. Therefore let us consider first the part that heterophoria may play in binocular disharmony upon the ground. Furthermore, let us confine ourselves to this condition, ignoring at once all other visual states that are so wont to wriggle into the picture, such as squints of small degree, transient diplopias that are so often the precursors of insular sclerosis, and pareses and paralysees of the ocular muscles.

Symptomless and Symptom-producing Heterophoria

We cannot have discord where there is no rivalry. The processes of evolution have so shaped the visual pathway that only some check in the maze of development, or some unreasonable assault through the demands of modern life upon the binocular function, can create a symptom-producing situation. We may speak of heterophoria under two headings: (1) inherent (slight; marked); (2) acquired. Leaving out all questions of refractive and pathological states, the one great predisposing cause of inherent heterophoria is *dominant macular reception*. This may occur without rivalry, in which case symptoms as opposed to signs do not arise in later life; or it can be present in a slight degree (in this case with rivalry), thus creating a potential source of trouble, according to the visual destiny of the individual.

Heterophoria may be acquired at any stage in life from school age to the presbyopic period, either superimposed upon a dominant macular reception of slight degree or arising as a condition primarily induced by the circumstances of everyday life. To differentiate the one from the other is sometimes a matter of a little difficulty. In this the age of onset of symptoms helps. The man who has *acquired* heterophoria without the influence of an inherent condition tends to complain of ocular discomfort early in the process. So strong has been his binocular conception that he is awake to the first falter. There is another approach to the problem—namely, by an examination with the stereoscope of the binocular reception rate, and also the appreciation of depth. On the stereoscope such a case will demonstrate rapid alternation with those charts designed for the examination of simultaneous binocular perception, will readily appreciate simple depth, and will proceed to give a good account with the more exacting charts. All this is in direct opposition to the *acquired* heterophoria with an inherent foundation. It is a natural corollary (in these cases) that symptoms are proportionate to the primary strength of the binocular chain. Much that can be labelled heterophoria diagnostically is quite symptomless, and is the outcome of a strong inherent tendency.

* Read in opening a discussion in the Section of Ophthalmology at the Annual Meeting of the British Medical Association, Belfast, 1937.