The Oliver-Sharpen Lectures

ON

**THE FEEDING OF NATIONS: A STUDY
IN APPLIED PHYSIOLOGY.**DELIVERED BEFORE THE ROYAL COLLEGE OF PHYSICIANS
OF LONDON, JUNE 3RD AND 5TH.

BY

E. H. STARLING, C.M.G., M.D., F.R.S.

(Abstract.)

PROFESSOR STARLING remarked that although man's first care had always been to provide his daily bread, the science of dietetics was of comparatively recent origin, and the problems involved were at first tackled exclusively from the standpoint of the individual. In a few instances only were the results utilized for practical purposes connected with society as a whole or with large sections of the community. The provisioning of a nation was regarded as an economic question to be solved by the laws of supply and demand. It was not until the great war broke out that any of the nations awoke to the fact that efforts to provision a community would be disastrous unless based upon physiological principles.

Early Errors.

The Germans were the first to realize this, but even in Germany the first steps were taken by a voluntary association of scientific experts. In this country little heed was paid to scientific considerations until the submarine campaign seriously limited our facilities for shipping and importation. Had not the contingency of a food shortage been foreseen by the chief organ of science in this country—the Royal Society—so that a whole array of facts were at the disposal of the Government so soon as it had been convinced of the need for action, this country might have fared ill.

The Royal Society's Committee.

At the very beginning of the war the Royal Society had founded a Physiological War Committee to make recommendations to the Government on any question involving physiological principles, and in 1915 a subcommittee was entrusted with the examination of all questions affecting food. This subcommittee, largely on the initiative of Dr. Waller, first undertook an examination of the probable position in enemy countries; upon this two reports were presented—in 1915 and 1916. The subcommittee concluded that a predominant factor of the German economic situation was likely to be a shortage of available fats and oils, and pointed out the necessity for the most stringent limitation of imports of fats into Germany. Since the armistice we have learned how true these predictions were, and how much might have been saved in the duration of the war if our statesmen had recognized the all-important part to be played by real restriction of the importation of foodstuffs into Germany.

The subcommittee then estimated the food supply of the United Kingdom, and compared this with the requirements of its inhabitants. They suggested as means of economy a higher recovery of flour in milling, less meat production, increase in the manufacture of cheese at the expense of butter, use for food of materials employed in brewing and distilling, and the diversion of certain quantities of material used for stock feeding to human use. All but one of these recommendations were ultimately adopted and enforced by the Government.

The Factors to be Determined.

It was not until the appointment of Lord Rhondda as Food Controller, in June, 1917, that scientific principles obtained their proper place in the determination of policy. From this time onward the Royal Society Committee acted practically as a scientific consultative committee in all matters of food supply. When, towards the end of 1917, it was decided to pool the resources and supplies of all the allied countries, it became necessary to create an international scientific organ; to this end an Inter-Allied Scientific Food Commission was called into being, and met for the first time in March, 1918. The work of this commission, in continuation of that done for domestic

purposes in the United Kingdom, fell under three heads: (1) The actual requirements of the population; (2) the provision of the necessary food, whether by production at home or by importation; (3) the distribution of the food so obtained equitably.

Professor Starling explained the method by which a provisional answer to the first of these questions was obtained, utilizing the data published in the recent report on food requirements of the Royal Society's Committee (reviewed in our issue of March 22nd, 1919, p. 349). He concluded that the average consumption per head in the United Kingdom remained almost stationary during the war and little below that of peace time. The estimate for before the war was 3,410 calories per man, for 1916-17 it was 3,357, and for 1917-18 it was 3,377. No greater testimony could be given to the efficacy of food control based upon scientific knowledge.

Effects of Restricted Food Supply.

Professor Starling next dealt with the effects of a restricted food supply, and adverted to the excess mortality and evidence of generally lowered resistance, especially to tuberculosis, which obtained in Germany in the later years of the war. These observations when they affect a whole nation to such a degree of intensity, naturally attract the attention of all, but they should serve to impress upon us the evil economic effects on the productivity and health of a nation which must result so long as we allow so large a percentage of our population as was the case before the war to live in a state of permanent under-nutrition. Rowntree's data suggested that the mortality amongst the very poor in York was almost twice as high as amongst the best paid sections of the working classes. A nation able to provide for its members with such brilliant success during a European war with a submarine blockade ought to be able to prevent a recurrence in peace of the conditions which disgraced sections of our urban population.

Man, Animals, and Cereals.

Professor Starling then dealt with the composition of foodstuffs on the lines of the Food (War) Committee's recent report. Turning to the provision of food, he showed the wastefulness of animals as energy converters from the point of view of the human consumer, but remarked that the necessity of providing fat was the real physiological justification for the use of animals for the production of human food. In handling the position the German authorities made serious mistakes; their capital error was to permit the maintenance of the large stock of horned cattle, which in June, 1917, actually exceeded the number in 1913. Large quantities of vegetable food and of food which might have been utilized by man were wasted in the mere maintenance of cattle and pigs without any production of meat or fat. The ill-fed cattle deteriorated in quality, their working powers diminished, the milk supply became less and less, and there was a fat famine throughout the land. In this country the risk of a similar position coming about had to be faced. It was dealt with on other lines; more cereals were diverted from stock animals to man, and only one-third of what was available for feeding animals, other than working horses, was provided. Even here the deeply rooted instinct of the farmer to maintain his live-stock created difficulties, and had not the armistice been declared we might have had yet greater cause for complaint as to meat supplies. An important means of securing obedience to scientific principles was the fixing of cereal and meat prices in such a way that, for instance, pork production was made less remunerative than the selling of barley.

Method in Rationing.

Passing to the question of rationing, he said that the key of the problem was the provision of sufficient calories by diversion of food from animals to man, and the assurance of equitable distribution. If all foodstuffs are rationed, the attempt to secure equitable distribution must fail, because the average requirement will be too much for some individuals, too little for others; feeding at a common table, these differences adjust themselves; where individuals are rationed they do not. This explains why all systems of complete rationing have failed hopelessly. It is imperative to leave free some important and complete food which is within the means of all classes of the population, so that each individual can buy of it according to

his desire, and satisfy that part of his calorie needs not covered by the rationed articles. It was the view of the Royal Society Committee that bread must at all costs remain unrationed—a view which ultimately prevailed. The Cabinet determined that if the various measures of diversion from animals and increased production failed to provide enough bread, then carloads of cereals were to enjoy priority over all other shipping, whether of men or munitions of war. At the same time the bread was made sufficiently unattractive—but without diminishing its wholesomeness—to prevent its wasteful consumption, and efforts were made by propaganda and otherwise to reduce the consumption of cereals by providing other foods which might take their place, especially potatoes.

Order of Preference in Importation.

The maintenance of free purchase of bread demanded a strict adjustment of the importation programme, and the Royal Society Committee assigned the following order of preference:

1. A sufficient amount of cereals should be imported as breadstuffs to avoid rationing and to serve as an elastic reserve for the energy needs of the country, and all cereals in the country should be reserved as breadstuffs to meet the full demand for these.

2. A minimum of 16 oz. of fat should be provided a head a week, taking into account not only the meat fat and margarine, but also the fat contained in milk, wheat, and other foods available. In order to bring up the fat of the food to this amount the necessary quantity of bacon, fat meat, and oil seeds must be imported and the home supplies conserved by limiting the use of fat for industrial purposes.

3. A minimum supply of sugar amounting to 8 oz. a head a week must be supplied. Up to these figures, which the Committee regard as minimal, the import of food into this country should take preference of all other claims on shipping.

4. Any tonnage then available for supplying this country with food should be utilized to bring the meat ration up to 2 lb. a head a week.

With the exception of a temporary shortage in fats during the early part of 1918, which incommoded our population but was not attended by any noticeable ill effects on health and efficiency, the United Kingdom was the only nation in Europe which could maintain that no man, woman, or child had to go hungry or leave his or her hunger unsatisfied on account of war conditions.

Croonian Lectures

ON

THE SIGNIFICANCE OF THE CEREBRAL CORTEX.

DELIVERED BEFORE THE ROYAL COLLEGE OF PHYSICIANS
OF LONDON, JUNE, 1919.

BY

G. ELLIOT SMITH, M.A., M.D., F.R.C.P., F.R.S.,
PROFESSOR OF ANATOMY, UNIVERSITY OF MANCHESTER.

LECTURE I (*Abstract*).

The Evolution of the Cortex.

IN the first of the series of Croonian Lectures on the significance of the cerebral cortex Professor Elliot Smith defined the aim and scope of his task as an attempt to discover how the cerebral cortex acquired its distinctive powers as the organ of intelligence.

Dr. Henry Head's researches have provided a new vision of the significance of the brain, and have thrown such a brilliant light into some of the darkest corners of cerebral structure and function as to compel every investigator of the nervous system to re-study the results of his own investigations with the aid of this new illumination. The activity of the thalamus is the physiological process which is expressed in consciousness by a crude awareness to contact, heat, cold, and pain, and the affective aspects, the pleasantness or unpleasantness, of these experiences, whereas the cerebral cortex endows these basic functions with spacial qualities, intensity and relativity. Dr. Head's recognition of this fundamental distinction makes it incumbent on those who are investigating the problems of

the evolution of the brain to inquire into the means by which the cortex acquired its powers of memory, of discrimination, and of spacial reference. The fact that these epicritic attributes are especially associated with the neopallium, which is found in its fully developed form only in the mammalian brain, suggests an inquiry into the nature of cerebral function in vertebrates other than mammals, and into the circumstances which brought the neopallium into existence.

The cerebral cortex was evolved from that part of the brain which originally was little more than the receptive centre for impressions of smell and the instrument for enabling the sense of smell to influence the animal's behaviour. Unlike all the other sensory tracts, those which convey impulses from the olfactory organ reach the cerebral cortex directly—that is, without passing through the thalamus. From a psychological point of view, therefore, the sense of smell occupies a unique and distinctive position. It represents the germ of all the higher psychical powers, or, perhaps it would be more accurate to say, the cement that binds together the elements out of which the powers of the cerebral cortex, as the repository of the impressions of past experiences, the organ of discrimination and appreciation of space and time, are developed.

In the primitive vertebrate behaviour is dominated by the sense of smell. It is the means by which the animal finds its food and determines its qualities, by which it recognizes friends or enemies, sexual mates or rivals. Smell is possessed of affective qualities which endow it with a direct meaning such as is not associated with either of the other two "distance receptors" (Sherrington), vision and the eighth-nerve-sense. In the primitive vertebrate living in the water smell is much more nearly akin to taste than it is in man and the land-living animals. When such an animal perceives the odour of food it is really getting a foretaste of the consummation of the reaction, when it captures the food and actually tastes it. Throughout the whole of the anticipatory phase it is under the influence of olfactory sensations, and a series of events, covering the whole period of anticipation and consummation, is linked together by the affective tone of smell into one experience, which includes the germ of memory and of spacial and temporal appreciation. But the sense of smell itself conveys only the vaguest indications of spacial relations. An animal attracted by a scent circles around until it comes within visual range of its quarry; then the eyes convey more precise information as to its position in space and as to its movements. Such visual information is almost entirely devoid of affective tone, of psychological meaning, which it acquires secondarily from the sense of smell. But it is biologically useful, because it enables the creature to steer its course more directly and accurately to the object of the pursuit; and for this reason it is the optic receptive centre, the tectum of the mid-brain, which in the primitive vertebrate is put into direct connexion with the motor nuclei and directs the movements of the animal. The sense of smell starts the reaction; the sense of sight directs it; the vestibular mechanism (the cerebellum) provides the apparatus for effecting the co-ordination of muscles without which the orderly movements of the whole body would be impossible.

In the course of the pursuit of its prey, when the animal is led by the sense of smell and is controlled by its dominating affective tone, the information collected by all the other sensory mechanisms is added to and woven into the tissue of the complex experience. Hence these other senses acquire a meaning and a share in the psychical activities which constantly increases in importance throughout the vertebrate series, until it culminates in the vast mental powers of man, in which smell plays a humbler and less obtrusive part, although still one of imperious importance.

In the following lectures the attempt will be made to explain how these wider powers were acquired, and the part played by the thalamus and the hypothalamus in this process.

THE United States Public Health Service estimates that more than 7,000,000 persons in the United States are infected with malaria. In the South the ravages of typhoid fever, tuberculosis, hookworm, and pellagra taken together do not equal those of malaria.