UNUSUAL FOODS FOR HUMAN CONSUMPTION

IT has been estimated by M. Sorre[1] that, of the two million known species of animals, only fifty have been domesticated and normally contribute to the food supplies; and that, similarly, out of the quarter of a million known vegetable species, only about six hundred are cultivated by man. J. De Castro[2], in discussing the figures, has contrasted the limited range of foods used by the inhabitants of Europe and North America with the vast number of native plants which contribute to the diet of primitive peoples. These observations received full support at a conference organized at Bedford College, London, on October 18 by the Nutrition Society when, under the general title of "Unusual Foods for Human Consumption", a series of seven papers was presented. Dr. R. B. Hawes acted as chairman of the symposium, which attracted some two hundred members and guests.

During the morning session, consideration was given to three types of unusual foods: Dr. W. A. P. Black spoke on "Seaweeds and their Value in Foodstuffs"; Dr. J. Ramsbottom on "Mushrooms and Toadstools"; and Dr. W. S. Bristowe on "Insects as Food".

In the first paper, an account was given of the uses of seaweeds in different parts of the world, and it was evident that investigations carried out during the past decade, in Scotland and elsewhere, have made important contributions to our knowledge of the chemical composition of different species and have also provided valuable information regarding methods for the efficient harvesting and processing of marine vegetation. Dr. Black surveyed, among other matters, the production from seaweeds of substances of nutritive value which are now finding a place in food manufacture.

The report on the edible fungi directed attention to their widespread use in many countries of continental Europe where, in contrast to the position in the British Isles, the fungi are regarded not as relatively expensive luxuries but as important vegetables, eaten both in the fresh state and also, during the winter months, in preserved forms.

Insects, etc., are not normally held in high esteem in Europe; but it was clear from Dr. Bristowe's review that, in Siam, Indo-China and in certain parts of India, spiders are regarded as normal items in the diet and that in many other countries insects of different types are used as minor foods. Dr. Bristowe gave an account of his personal experiences in Asia, where he was able to follow local dietary customs.

The contrast between the European town-dweller and the inhabitants of other regions was frequently demonstrated in the afternoon sessions of the symposium, when reviews were given by Dr. H. M. Sinclair on "The Diet of Canadian Indians and Eskimos"; by Dr. G. H. Bourne on "The Food of Australian Aborigines"; by Dr. F. Aylward on "The Indigenous Foods of Mexico and Central America"; and by Dr. B. M. Nicol on "Protein in the Diet of the Isoko Tribe of the Niger Delta".

These papers all revealed the ingenuity of man in making full use of the local plants and animals, and in becoming master of his environment. Certainly, of the Australian aborigine, it may be said that, in terms of food, nothing living is alien to him—the caterpillar and the moth, the frog and the kangaroo, are trapped by appropriate but effective methods and eaten with relish. Similarly the African tribe examined by Dr. Nicol was shown to be catholic in taste; snails, frogs and crocodiles, as well as a variety of plant foods, have their place in the diet. Dr. Nicol's paper revealed the difficulty in making satisfactory dietary surveys in areas where the ordinary staple foods are supplemented, perhaps at irregular intervals, through hunting, shooting and fishing. These occasional supplements make important contributions to the diet.

A similar difficulty in making dietary surveys was experienced in Mexico and Central America where, as reported by Dr. Aylward, the inhabitants preserve dietary traditions that go back into prehistory. Examples were given of methods of food preparation which, although long in use, have only recently been shown to have a sound biochemical basis. Thus the Indian is able to use certain varieties of plants which are poisonous in a raw state, by methods which involve a preliminary grating followed by cooking, a technique which is now known to be effective in destroying toxic components such as the cyanophoric glycosides. Recent scientific investigations have also revealed the advantages of the traditional method of making the tortilla, the daily bread of the Indian; the whole maize is treated with lime, and thus the mineral content of the final product is increased and the danger of widespread dietary calcium deficiencies diminished[3].

By comparison with the inhabitants of tropical and semi-tropical regions, the Eskimos live on a much more restricted diet, especially during the long Arctic winters. Dr. Sinclair showed how the Eskimos have successfully adapted themselves to an unfavourable environment so as to obtain a diet normally adequate in calories and in both major and minor nutrients. Contrary to reports from other northern areas, the groups examined did not eat excessive amounts of fat.

The discussion of the papers ranged over many topics. Dr. H. E. Magee, for example, stressed the importance of quantitative considerations. A food constituent such as vitamin B_1 present in very small amounts in a staple food may be of great value because of the relatively large amounts of the staple eaten per day; on the other hand, a minor or occasional food is of value when it contains a high proportion of one or more accessory factors.

Mr. A. L. Bacharach, commenting on the Mexican tortilla, directed attention to the war-time controversies in Great Britain relating to the addition of calcium carbonate to National flour; it would appear that we had belatedly followed the good example of the Indian.

Other speakers, drawing on their experiences overseas, gave further examples of unusual food habits, and the symposium as a whole reflected the newer 'global approach' to nutrition; the fundamental biochemical investigations of the past half-century, carried out mainly in Europe and in North America, provide the basis for the approach to the nutrition problems on all continents, yet there is clearly much to be learnt from well-established food habits in Africa and elsewhere, in that primitive peoples in many areas have succeeded in reaching good dietary standards.

The papers given at the conference (which will be published in the *Proceedings* of the Society) may be regarded as a continuation of earlier symposia on Colonial problems[4] and on nutritional conditions in prisoner-of-war camps in Asia[5]. They should serve a useful purpose in providing information regarding the actual and potential food supplies of under-developed areas, and in this way should assist in furthering the work being carried out on these topics under the auspices of the Colonial Office and other national and international agencies. FRANCIS AYLWARD

[1] Sorre, M., "Les Fondements de la Géographie Humaine", 1 (Paris, 1947).
[2] De Castro, J., "Geography of Hunger", 36 (London: Victor Gollancz, 1952).
[3] Aylward, F., *Nature*, **168**, 1100 (1951).
[4] Symposium, *Proc. Nutrit. Soc.*, **5**, 1 (1946).
[5] Symposium, *Proc. Nutrit. Soc.*, **5**, 107 (1946).

APPLICATIONS OF COMMUNICATION THEORY

TWO years ago, during September 26–29, 1950, a symposium was held in London of a group of some hundred and twenty men of diverse scientific interests —communication engineers, mathematicians, physicists, biologists, psychologists and others—all of whom were concerned in one way or another with the concept of the communication of information (see *Nature*, **167**, 20; 1950). The meeting was prompted by the recognition of the importance of recent developments in the theory of communication which revealed, and gave promise of clarifying, connexions between previously largely unrelated fields of research concerned with different aspects of the processes by which living organisms convey information. The purpose of the symposium was to afford the opportunity for a discussion of the nature of this recent work and of its potentialities in various branches of science.

It was decided that there should follow in due course a second symposium having the more limited objective of examining what of practical value had resulted from the application of this theoretical work to the problems of electrical communication, and this second meeting was held in London in the Lecture Theatre of the Institution of Electrical Engineers, during September 22–26. The participants on this occasion were mainly practising communication engineers, though other interests were well represented, and they were even more international than those who attended the earlier symposium. The two hundred and seventy present included ninety visitors from sixteen countries abroad. The chairman of the opening session was Sir Noel Ashbridge, retiring director of technical services of the British Broadcasting Corporation.

In the opening address, Prof. Willis Jackson referred to the two distinct, though closely interrelated, sides of the recent theoretical work: one, the theory of the representation of signals, that is, the analysis of signals into the basic elements—the 'alphabet'—in which it is intended to communicate; and the other, the statistical theory of communication, that is, the application of probability theory to the communication of these elements. Prof. Jackson remarked on the value of the theory in affording means for the quantitative comparison of different transmission systems (different forms of modulation and coding); on the progress being made in the development of techniques for the extraction of signals from a noisy background; and on the considerable activity which it had stimulated in studies such as the analysis and synthesis of speech, the improvement of speech recognition in noisy conditions, the possibilities of compressing the band-width required in speech and television channels, the mechanism of hearing, etc. He remarked that communication theory has perhaps achieved little as yet in the last-named fields, but that to make a reproach of this would be on about the same level as pointing out that Carnot and Kelvin did not invent the gas-turbine. A basic theory is a compass rather than a vehicle, and there is little reason to doubt that, in this case as in others, it will be supported in due course by the inventive imagination on which progress largely depends.

Prof. Jackson then directed attention, in the absence of the author, to the "Summary of Communication Theory" which Dr. D. Gabor had prepared for the benefit of the participants. In this paper Dr. Gabor discussed the parts played, in the development of the theory of communication, by classical Fourier analysis, its modification by treating time as a 'running' variable and the application of probability theory to signal data; and he detailed, in terms based mainly on the work of Dr. C. E. Shannon, the principal concepts, theorems and results concerning the two aspects of the modern work, signal analysis and the statistical theory of communication, mentioned above.

The first two days of the symposium were devoted mainly to problems concerning the detection of signals when mixed with noise, and served to emphasize that the detector must be regarded essentially as giving a probability distribution rather than a precise, error-free, extracted signal. A paper by P. H. Blundell suggested that it is not permissible to regard the whole of this (*a posteriori*) distribution, in the mean, as a rate of information, since at any instant during the communication it cannot all be used. This argument aroused considerable discussion which served to clarify some important misconceptions. Prof. Z. Jelonek followed with a summary of the results of a comparative study of various modulation systems in which he had calculated their respective theoretical rates of transmission of information. This paper, and an allied one by Prof. S. Goldman (United States), demonstrated the quantitative value of the statistical theory, and revealed the limited practicable scope which is available for improvement in the methods of modulation now in use.

New contributions to the theory and art of pulse modulation were made by F. de Jager (Netherlands) who described a one-unit code system of pulse-code modulation to which he had given the name "delta-modulation"; by C. W. Earp, who discussed a possible modified form of pulse-code modulation, which he called the "ambiguous index system"; by H. W. F. Groenewout (Netherlands), who gave the results of an investigation of distortion in pulse-code modulation systems; and by Dr. D. M. MacKay, who raised an interesting problem concerning the transmission of neural impulses.

Allied to these papers were others by R. H. Barker, who dealt with the important problem of the group synchronization of binary digital systems, and by Drs. A. E. Laemmel and D. A. Huffman (United States), who discussed the construction of codes, the former of error-correcting codes involving the