Some Chemical Aspects of Nutrition

THE thirty-fifth Bedson Lecture was delivered by Prof. J. C. Drummond on November 20 at Armstrong College, Newcastle-on-Tyne, on "Chemical Aspects of some Modern Nutritional Problems".

Prof. Drummond pointed out that animals are dependent on plants for certain compounds which they cannot synthesize themselves from potentially suitable material. Such compounds can be divided into two types: tissue-building stores, and what might be termed 'chemical lubricants', for example, vitamins and hormones.

Cystine is a good example of the former type. Animals cannot synthesize this important amino-acid even if provided with sulphur, in various forms, and closely related compounds not containing sulphur, for example, serine. However, they can use menthionine, and dithioldilactic acid, but not homocystine and cystineamine to replace a cystine deficiency. Persons suffering from cystinuria who are given menthionine excrete it as cystine only.

Vitamins A, B_1, C and D are examples of the second type. In dealing with the work leading to the synthesis of vitamin B_1, Prof. Drummond pointed out that alteration in the position of the methyl group in the pyrimidine ring leads to the formation of biologically inactive products.

Vitamin A has been shown to be a C_{20} compound closely related to the carotinoid pigments. Those carotinoids possessing a β-ionone ring and a suitable side chain act as precursors of the vitamin. β-carotene itself is probably quantitatively converted into it. It is remarkable that the molecule divides at the central double bond considering that polyene chains are usually susceptible to oxidative attack at various points. Certain birds can use xanthophylls as vitamin A precursors, whereas other animals cannot. This suggests that there may be more than one vitamin A.

Chemical studies of vitamin C (*l*-ascorbic acid) are fairly complete, and it is interesting to compare the antiscorbutic activities of various substituted ascorbic acids. *d*-Ascorbic acid is quite inactive, *d*-arabo-ascorbic acid possesses one twentieth the activity, while *l*-rhamno-ascorbic acid and dehydro-ascorbic acid are less active. The preparation of these synthetic products possessing activity raises the question of the possibility of the synthesis of compounds of greater antiscorbutic power than vitamin C.

Turning to vitamin D (calciferol), Prof. Drummond said that it is generally held that rupture of one ring of its sterol precursor takes place during irradiation with ultra-violet light. Vitamin D activity is not dependent on the presence of a double bond in the side chain. Recent work on the antirachitic substance produced by irradiation of 7.dehydrocholesterol and on the products formed when 7.dehydrostigmasterol and 22.dihydro.7.dehydrostigmasterol are similarly treated was reviewed. The relation between constitution and biological action is not yet clearly apparent. There are two views to account for the activity of the various compounds. Either it is necessary to provide substances capable of being broken down to simpler molecules, or compounds with the same carbon skeleton as vitamin D are required. The former gleans some support from the fact that compounds, very different in structure from those obtained from natural sources, are capable of producing œstrus. For example, *l*-keto-tetrahydro phenanthrene and certain dibenzanthrone diols have some activity. A more remarkable case is that reported by Prof. E. C. Dodds, who found that dihydroxydiphenyl is active.

The Part played by Skin-Friction in Aeronautics*

THIS paper, running to some forty-seven pages of closely printed matter, is a book in itself. It is illustrated by twenty-seven figures, and is in five parts; Part I deals with resistance due to skin-friction, on an empirical basis, the determinations of Froude and of the many workers who followed him being presented in the form of a logarithmic diagram, in which, as is usual, ordinates give values of the constant $\mathbf{C}_0$ (as in the expression $R = \mathbf{C}_0 \rho V^2 \times 2a$) and abscissæ give Reynolds' numbers from 10^2 to 10^{10}; these numbers, denoted by the symbol $\mathrm{N_R}$, cover the whole range from that proper to laminar flow, to that which obtains for ocean-going liners. The author points out that it is not possible to reconcile the wide variations in known data and gives a graph as indicating the probable minimum under ordinary average conditions. After a general discussion, an example is taken in the *Graf Zeppelin*; the hull resistance is calculated on the basis suggested by Froude in the case of ships; the horse-power is deduced for a flight speed of 80 m.p.h. and is in approximate agreement with that declared. A second example is given.

Parts II and III give in an abridged form the author's cyclic or vortex theory (sometimes referred to as the Prandtl theory) of sustentation, describing the two methods of treatment adopted by him in 1907 and 1914 respectively, and proving their quantitative identity. The criterion is shown to be the 'peripteral area' which defines the quantity of air handled by an aerofoil or the wings of a machine in flight. According to both methods the peripteral area is shown to be equal to 0·78 of the square of the span; that is to say, the area of a circle having a diameter equal to the span. From this the aerodynamic resistance may be calculated making use of the Newtonian principle of the equality of *force* and *momentum per second*. Parts II and III, though not directly concerned with skin-friction, lead up to Part IV, in which it is shown that the theory of

* Synopsis of a paper by Dr. F. W. Lanchester, F.R.S., read before the Royal Aeronautical Society on November 12.

sustentation has to be used in order to institute a comparison between theory and experiment. In Part II certain propositions which were first enunciated in the author's "Aerodynamics" are given.

Part IV, which contains the gist of the whole paper, is devoted to a comparison instituted between theory and recent data furnished by experiments conducted in the compressed air tunnel at the National Physical Laboratory (Aeronautical Research Committee: Reports and Memoranda, 1627). The essence of the matter is that prior to the installation of this tunnel, it was not possible to conduct wind channel experiments at high Reynolds' numbers such as apply in the case of full-scale machines, and it had long been known or at least suspected that there is a great difference between high and low Reynolds' numbers. The extent of the agreement (or disagreement) was a matter of conjecture. *It is demonstrated that complete reliance may be placed on the predictions of theory under conditions of high Reynolds' numbers.* The examples taken for the purpose of investigation are aerofoils R.A.F. 48, Clark *YH*, and Göttingen 387; the results are given tabulated and as plottings.

In Part V it is shown that in contrast to the agreement found over a range of high Reynolds' numbers (namely, about 2×10^6 and upwards) theory can no longer be considered reliable. For the full-scale glider or sail-plane where the Reynolds' number is in the region of $1 \cdot 7 \times 10^6$, agreement is still good, but when the same methods are applied to the investigation of model aerofoils and gliders the discrepancies are shown to be considerable. The reasons for this are discussed.

In the four appendixes the more important matters are: A relation is established between the gross weight of an aeroplane and the Reynolds' number; and three diagrams are given, by the aid of which the Reynolds' number may be ascertained prior to design, if the projected gross weight and the aspect ratio are given. In Appendix III reference is made to the region of instability or uncertainty in the relations of $\mathbf{C}_0$ to the Reynolds' number, illustrated by plottings due to Mr. G. Baker (1915) and Prof. Melvile Jones (*Rep. and Mem.*, 1199). Appendix IV is devoted mainly to the aerodynamics of flying at high altitude.

A Magdalenian Site of Southern France: The Cave of Isturitz*

IN continuation of the exploration of the palæolithic cave of Isturitz (Basses Pyrénées) by Dr. R. de Saint-Périer, of which the Magdalenian levels in the Hall of St. Martin have already been described (*Arch. Inst. Pal. Hum. Mém.*, 7; 1930. See NATURE, **128**, 988; 1931), the Magdalenian deposits of the adjoining Great Hall, or Hall of Isturitz, as it has been named, have now been excavated; and it has become possible to take a general view of the Magdalenian culture of the site as a whole.

The Magdalenian deposits overlie Solutrean and Aurignacian levels, which are now being examined, without the intervention of any sterile layers. It is evident that both the Solutrean and the Magdalenian tribes established themselves here without any independent stratigraphic formation taking place. Both halls were occupied at the time the earliest Magdalenian deposits were laid down; but it is apparent that the occupation of the Great Hall was both longer and more intense than that of the Hall of St. Martin. Hearths, however, in the Great Hall are less frequent. A further difference is that while engraved plaques are exceptional in the Great Hall, though there art blossoms into great richness, in the Hall of St. Martin such plaques are numerous.

Although the age of the Magdalenian is that of the older Magdalenian of the Pyrenees, it is not, even at the base levels, the oldest stage of that culture. As is shown by the character of the lance-heads and certain of the engravings, these lower levels belong to Magdalenian iii, corresponding to Marsoulas. Above this is the culture of Magdalenian iv; but only in the Great Hall are found the harpoons, of which the evolved character points to a later occupation.

The most important period of occupation is Magdalenian iv, of which the chief characteristics are: a cold climate fauna, in which the horse is predominant, but a few retarded forms such as *Rhinoceros tichorhinus*, *Ursus spelæus* and *Hyæna crocuta* survive; and a lithic industry which is small and of mediocre execution, the various forms being not clearly defined and many implements being made from irregular and bad flakes. Burins are dominant. The bone industry is abundant, especially in the Great Hall. Many used bones show little sign of preparation for their purpose. The bone objects include needles, lance-heads of diverse types, *bâtons*, etc. A large number of the artefacts have been treated under a single classification as 'perforated'. The prototypes of harpoons found in the Great Hall already show signs of evolution.

The art forms of this period are here fully represented. They occur indiscriminately from bottom to top of the deposits of the period without distinction as to the level in which they are found. As already mentioned, the art of the Great Hall is richly developed both in the naturalistic form and in the conventionalized decorative motives. The naturalistic art in both sculpture and engraving shows remarkable powers of accurate observation of animal forms; while the conventionalized designs are clearly based on an equally accurate observation of the natural forms from which they are derived. One remarkable piece of engraving on bone represents a scene between a man and woman, of which the pose and composition depict graphically an expression of intense desire on the part of the male. The head of the woman and the lower part of the man are missing. The artist appears to have intended to represent the woman as thickly covered with hair over a great part of her body.

The abundance of the examples of this art in the Great Hall must account for the fact that, although much of it is of the highest quality, as a whole it is uneven and the choice of material is sometimes bad. The inferior may represent trial and practice pieces.

*Archives de l'Institut de Paléontologie Humaine. Mém. 17. La Grotte d'Isturitz. 2: Le Magdalénien de La Grande Salle. Par Dr. René de Saint-Périer. Pp. 140+12 plates. (Paris: Masson et Cie., 1936.) 120 fr.