

Research Items

Food of the Maya Indians

THREE expeditions to Yucatan have established the fact that male Maya in the Chichen Itza area have a basal heat production averaging from five to eight per cent higher than the commonly accepted standards for white men living in the northern parts of the United States. At the same time, whereas natives of sub-tropical areas usually have a metabolism lower than northern standards, the metabolism of the Maya is relatively high and is combined with a low heart rate and low blood pressure. In view of the possibility of a relation of this condition to diet, a quantitative and qualitative study of the Mayan present-day diet has been undertaken by Dr. Francis G. Benedict, director of the Nutrition Laboratory, and Dr. Morris Steggerda (Carnegie Institution, Washington, D.C.: *Contrib. Amer. Arch.*, 3, 18). It was also anticipated that this investigation might throw light on the diet and food customs of the prehistoric Maya. In the remoter parts of Yucatan, the diet of the modern Maya is still almost entirely independent of white man's civilization. The basic food is maize, with its products, but beans, squash, chile and native meat are also eaten, with, on the sea coast, some sea-food. Seasonings, such as garlic, pepper, leaves, cloves and chile, play an important part. This diet is essentially the same as is recorded in literary sources for the period 1500-1700, and probably goes back to a much earlier date. Precise analysis of protein, fat, and energy content of many items in the daily diet and of daily meals were made. On the average, 73 per cent of the daily energy intake comes from maize. The daily protein intake per individual averaged 74 gm., low rather than high. The daily energy intake averaged 2,565 total calories, low as compared with the American labourer (c. 3,500 calories). The energy intake averaged only 66 per cent above the basal needs shown by measured basal heat production. The basal metabolism is not explained, and may be an environmental or racial factor.

The Electric Eel

THE electric discharge of certain fishes has often aroused scientific interest and popular curiosity, and of all electric fishes, the electric eel (*Electrophorus electricus*) is the largest, and develops most power. In their account of the electric discharge of this species (*Zoologica*, 22, 1; 1937), C. W. Coates and R. T. Cox summarize the earlier information and pay tribute to the accuracy of Faraday's observations of 1839 and 1844. They themselves have measured the voltages and speeds of propagation of the electric impulse along the body of electric eels, finding that an anterior point on the body is always positive to a posterior point. Peak voltages of the order of 300 and peak wattage of the order of 40 are about the maximum for eels exceeding 50 cm. in length. The velocity of the pulse along the body is between 500 and 1,000 metres a second, and the discharges commonly occur in trains of one minor member followed by three to six major members separated by intervals of about 0.005 sec. The release of the electric discharge is likened to the release of ordinary

muscular energy, and the discharge itself must be a cumulative effect of the activity of a large number of cellular elements, which may possibly be fully charged in the inactive state and are connected in series during the discharge.

Citrus Culture in Egypt

BULLETIN No. 44 (1936) of the Egyptian Ministry of Agriculture (Hort. Section) first published in 1924 and written by T. W. Brown, has been revised and brought up to date by Abbas el Sawy. It is a comprehensive treatise on methods of propagation and cultivation of citrus fruits, and should serve as a reliable manual for growers in Egypt with little previous experience of fruit growing. Citrus culture in Egypt has made rapid strides during recent years, the acreage under oranges and mandarines having risen from 6,215 acres in 1923 to 18,229 acres in 1934. In 1925, 7,375,297 kgm. of citrus fruits were imported, while in 1934 this was reduced to 897,808 kgm., and 2,867,469 kgm. of oranges and mandarines were exported. The information provided by the bulletin will undoubtedly prove an invaluable guide in this expanding industry. It is clearly written and contains information on all the cultural operations, including sections on budding and grafting and a critical account of the various rootstocks available. Every phase of the industry is dealt with from the preparation of the ground to the packing of the fruit, particular attention being given to irrigation and manuring. The latter half of the bulletin consists of an excellent catalogue of the numerous varieties of citrus fruits. This is very well illustrated, and the varietal characteristics are given in detail together with notes on the origin and history of the varieties.

Evaporation Records in the Netherlands

IN *Mededeelingen en Verhandelingen*, 39, 1936, Dr. C. Braak discusses evaporation records in the Netherlands and compares the results obtained with those for certain places in Germany and Switzerland. There are some very long records available in Holland, for example, at the Helder, but unfortunately insufficient continuity of method and lack of precise information about the earlier part of this record greatly reduces its value. For the period 1909-35, comparative figures are available for the evaporation from similar pans containing water at de Bilt and the Helder. The averages for the months of least and greatest evaporation are (1) de Bilt, 15 mm. in December and 133 mm. in July; (2) the Helder, 25 mm. in January and 158 mm. in July. A table is included giving individual monthly totals for de Bilt from May 1897 to December 1935, with a few gaps in 1902 and 1903. Figures for a number of stations with shorter records are compared; but it is concluded that the differences are caused more by variations of instrumental exposure than by climatic contrasts. Observations made with a floating pan in a pond near the Meteorological Institute, de Bilt, since 1932, are compared with similar observations made by Bindemann in a small lake north-east of Berlin (the Grimmitzee), and others made on the Yssel lake (the former Zuyder Zee) are compared

with figures relating to two Swiss lakes. The paper closes with a discussion of the values of the constant in a well-known evaporation formula which makes the evaporation proportional to the saturation deficit, allowance being made for the influence of temperature on the mobility of the water vapour molecules and for the influence of wind speed.

Origin of Cosmic Rays

IN the issue of the *Journal of the Franklin Institute* of April, Dr. M. C. Holmes of the West Virginia University puts forward a theory of a terrestrial origin for cosmic rays. This is based on the Debye water molecule having its positive end heavier than its negative, and in consequence in a gravitational field having its positive end downwards when free to move. Except in polar regions, where it may be frozen, it has its negative end upwards and provides the negative charge known to exist on the earth's surface. Any positive charge produced in the stratosphere by solar radiation will move down towards the earth's negative charge until it reaches the polar air currents of the troposphere, which will carry it towards one of the poles, where positive charges will accumulate. An electric field will be produced between these charges and the negative charge on the non-polar regions, which will supply the 10^9 volts required to account for the production of cosmic rays. Dr. Holmes considers further the application of the same principle to account for the banded appearance of Jupiter, the rings of Saturn and other planetary phenomena.

Reactions of Atomic Deuterium with Paraffin Hydrocarbons

IN addition to an investigation of the photo-sensitized reaction between methane and deuterium, an investigation of the interaction of atomic deuterium with methane, ethane, propane and butane for temperatures up to 310°C . has been carried out at Princeton University (Taylor *et al.*, *J. Chem. Phys.*, 5, 205; 1937). The nature of the reaction products and the extent of deuteration have been determined by two methods, a fractionation method and a thermal method. For methane, no exchange occurred below 200°C . and at 310°C . the exchange amounted to ten per cent. At temperatures above 27°C . ethane is decomposed by atomic deuterium yielding methane of high deuterium content, but the rate does not become measurable until 100°C ., and thereafter increases as the temperature rises. Both propane and butane are relatively slightly decomposed, the products containing a surprisingly large amount of highly deuterated methane. For methane it is impossible to decide between the mechanisms (a) $\text{CH}_4 + \text{D} = \text{CH}_3\text{D} + \text{H}$, and (b) $\text{CH}_4 + \text{D} = \text{CH}_3 + \text{HD}$ with subsequent reaction of the methyl radical. The C-C bond is readily split by atomic deuterium at room temperatures, presumably by either (a) $\text{D} + \text{C}_2\text{H}_6 = \text{C}_2\text{H}_5 + \text{HD}$ or (b) $\text{D} + \text{C}_2\text{H}_6 = \text{CH}_3 + \text{CH}_3\text{D}$; and of these, (b) finds greater favour because of the high deuterium content of the resultant methanes. Above 100°C ., deuteration of ethane becomes more pronounced and takes place at the expense of deuteromethanes. The experimental data further show that the deuteration of an alkyl radical occurs much more readily than deuteration of the hydrocarbon. Activation energies have been calculated and from these the bond energies for $\text{CH}_3\text{—H}$ and $\text{CH}_3\text{—CH}_3$ have been deduced.

New Mercury Vapour Discharge Lamps

ALL types of metal vapour discharge lamps require a series 'ballast' to prevent the current through the lamp rising to too high a value. In the *Engineering Supplement* to the *Siemens Magazine* of May, a description is given by J. N. Aldington and G. O. Stephens of the new low-wattage mercury vapour discharge lamps taking 80 watts and 125 watts respectively, which are now on the market. The ballast may be in the form of a choke coil or simply a filament which supplies useful light while limiting the current. The inner bulb of the new lamps is made of quartz. This substance can be operated at temperatures up to $1,000^\circ\text{C}$. without showing harmful discolorations. The quartz interior is mounted inside a lamp bulb of standard shape with a pearl finish. As is common with all types of high-pressure metal vapour discharge lamps, the new lamps require a few minutes after being switched into circuit before the full light output is attained. Under normal working conditions, the full light output is reached in approximately five minutes. When they are switched out of circuit, they require a period of three minutes before the arc will restrike. After this restriking period, full light output is attained in a shorter time. The radiation from the inner bulb is very rich in ultra-violet rays. For this reason, it is important that the lamps should not be operated if the outer bulb becomes accidentally broken. The inner surface of the outer bulb is coated with 'luminescent' powder; very efficient powders of this nature (both fluorescent and phosphorescent) are now prepared on a commercial scale. These powders are used to supply the red and blue light in which the mercury discharge is deficient.

Motion and Figure of the Moon

DR. H. SPENCER JONES has published a paper "The Mean Motion of the Lunar Perigee and Node and the Figure of the Moon" (*Mon. Not. Roy. Astro. Soc.*, 97, 5, March 1937) in which important conclusions are drawn regarding certain discrepancies in the observed libration results and those obtained by theoretical considerations. Prof. E. W. Brown's computations on the motions of the lunar perigee and node had neglected terms of the fourth and sixth order; these have now been taken into consideration. The motions of the perigee and node contain terms due to solar and planetary actions, the mass of the earth, the figures of the earth and moon, and a relativity correction. Accounting theoretically for all these except the figure of the moon, and comparing with observation, the residuals can be accounted for by the lunar figure. The well-known parameter f has been assigned various values by different investigators, and this has given rise to considerable speculation on certain discrepancies. If A , B , C , be the principal moments of inertia of the moon about its centre, f is defined as the ratio of $(B-A)/(C-A)$, and this can be determined, knowing the mean inclination of the moon's equator to the ecliptic, and also the amplitude of the moon's true libration in longitude. The former is known with considerable accuracy; the latter with less certainty. Dr. Spencer Jones now finds that $f = 0.68 \pm 0.09$, in good agreement with the values deduced from the librations in longitude. The value of the ellipticity of the earth is found to be $1/e = 296.08 \pm 0.95$, which is a little smaller than that obtained by Jeffreys, 296.38, who used the unrevised motions of the lunar perigee and node in his computations.