

Research Items.

A Benin Ivory.—In *Man* for January, Capt. T. A. Joyce figures and describes a carved ivory ewer from Benin recently presented to the British Museum by the Christy Trustees. The ewer is made of a section of elephant tusk covering an iron lining which is prolonged into a lip everted over the ivory jacket. An iron foot also everted has been added at the base. A wooden handle is fitted at the side, obviously a later addition, as it cuts into the carved design at the lower point of junction with the vessel. The entire exterior of the ivory is covered with carving in rounded relief. The ornament is arranged in two horizontal bands separated by a band carved in interlaced pattern. At the base of the ewer is a second band of interlaced carving. In the upper register is represented a catfish, a centipede, a frog, a two-headed bird, and a fish; in the lower an elephant's head, a crocodile seizing a fish, and a grazing antelope. The designs are excellent examples of the tendency towards symmetry characteristic of artists of all ages. The elephant's head is seen from above, the tusks and ears have been curtailed to fit the space, and the trunk is divided into two diverging sections, each terminating in a human hand holding a branch. The specimen is believed to be unique. It was probably carved soon after Portuguese power began to spread on the west coast of Africa in the sixteenth century. The shape of the ewer suggests European influence, but the artist has preserved his native style in all its purity. The ewer is 9.2 in. in height.

Ancient Coastal Cultures of Northern Peru.—The results of a second Marshall Field Expedition to Northern Peru in 1926 are described by A. L. Kroeber in vol. 2, No. 2, of the *Memoirs*, Anthropology, of the Field Museum, Chicago. The objective of the expedition was the coastal area between Lima and Nazca, and the aim to determine the cultural relations of the northern and southern Chimú areas and the cultural sequence within each. The cultural history of the northern Peruvian coastal area may be summarised as follows: (1) *Early Chimú* (formerly Proto-Chimú). This affords the first archaeological evidence for a well-developed culture of specialised type. No origin or formative period is known, and no attempt to connect it with Ecuador, Central America, or Mexico has proved valid. The people built terraced, small-topped pyramids, higher than any erected elsewhere in Peru. The dead were buried in rectangular chambers, in a variety of positions. Gold, copper, and their alloys, and perhaps silver, were melted and cast. Tin and bronze were unknown. The pottery was the highest achievement of any South American culture or people. (2) *Middle* or *Tiahuanaco* appears to be an overrunning of an intrusive culture, possibly people, from the highlands. It is represented at relatively few sites, and chiefly from its pottery, which is in fragments. (3) *Late Chimú*. Fundamentally an emergence of Early Chimú with increments. Now Chimú culture was no longer merely provincial, but extended far to the north of the old Chimú domain. Here it may have been ancient and hence spread south. At the moment of transition from prehistoric to historic, when the Incas conquered the Chimú area, the whole of the northern coast was under the influence of a ruler who lived at Chanchan. Pyramids were no longer as high as under Early Chimú, and had broad tops, which were used for interments. The custom prevailed of placing a small piece of copper in the mouth of the dead. Metal was abundant; but bronze articles were in a minority. In textiles, mountain wool gave

way to a preference for all-cotton fabrics. Pottery had settled into a syncretised style of little originality but facile elegance. The conquest of the Incas appears to have had little effect on Chimú culture, which indeed was externally prosperous and perhaps spreading up to the time of the Spanish Conquest.

Rice as Food.—Among the populations of various countries the value of rice as a foodstuff is receiving increasing recognition, with the result that the consumption is gradually gaining ground. Thus, in France, following an appeal by Prof. Achard on behalf of rice grown in the French colonies, the importation has recently risen by more than 30 per cent. In Italy, however, the cultivation of rice, far from expanding, is losing way, in spite of the fact that the soil and climate of certain districts are admirably suited to the production of rice of the highest quality. Moreover, although Italy could produce twice or thrice its actual consumption, very little rice is being exported. In an article published in the *Rendiconti* of the Royal Lombardy Institute of Science and Letters (Parts 11-15), Prof. Luigi Devoto points out that the experience of the past few years has fully confirmed the view that, when properly prepared, rice is of great value, not only to healthy persons, but also to patients suffering from infectious diseases, affections of the digestive organs, certain skin diseases, obstinate lack of appetite, hyponutrition, and a number of other complaints. In view, also, of the large amount of labour employed in the cultivation and marketing of rice, the question is one of considerable national importance at the present time, and Prof. Devoto emphasises the advantages that would accrue from more extended production and consumption of this commodity throughout Italy.

West Indian Fishes.—H. W. Fowler, in his paper, "The Fishes obtained by Mr. James Bond at Grenada, British West India, in 1929" (*Proceedings* of the Academy of Natural Sciences of Philadelphia, vol. 82; 1930), records eighty species, two of which are new, and several others are of special interest, since the fishes from this rich region are very little known. Figures and detailed descriptions are given of the two new species, *Ariomma bondi*, the first of this genus from the Atlantic, closely related to the Hawaiian *Ariomma lurida*, and *Malacoctenus bondi*, which is recognisable by its colour markings.

Polish Cladocera.—M. Ramuet has described the cladoceran fauna of the lakes in the coastal region of the Polish Baltic, "Untersuchungen über die Cladoceranfauna des polnischen Ostseeküstenlandes" (*Bulletin International de l'Académie Polonaise des Sciences et des Lettres*. Classe des Sciences Mathématiques et Naturelles, série 3: Sciences Naturelles (II.), N. 5-6, B. II., 1930). There are ten large lakes, from 3700 metres to 380 metres in length and 900 metres to 270 metres in breadth, and several smaller lakes of various kinds, some of which are in the neighbourhood of peat moors. The larger lakes have a moderately developed coast-line, and are without islands and deeply indented bays. A short description of each lake with notes on the flora is given, and in some cases the more important animals. Fishes abound in most of the large lakes and usually the bivalve *Dreissensia polymorpha* is found in large quantities. In the systematic portion a record is made of the species of Cladocera in each lake, which show a certain similarity and belong to a type characterised by the presence of *Diaphanosoma brachyura*, *Daphnia cucullata*, and

Bosmina longirostris. Seventy species in all are now known from the coastal regions of West Prussia, including those from the Polish coast-land and the Danzig Free Territory. The paper is well illustrated by photographs of the lakes themselves and their surroundings, and by line drawings of the *Cladocera*.

Musculature of the Larval Shrimp.—The report for 1929 on the Lancashire Sea-Fisheries Laboratory at the University of Liverpool, edited by Prof. James Johnstone and Dr. R. J. Daniel, contains papers on the hydrographic observations made during 1926–29 by Dr. Daniel; on the surface drift bottle experiments in the Irish Sea, July 1925–June 1927, by Dr. Daniel and Miss Mabel Lewis; and on the abdominal muscular system of the zoea and mysis stages of the shrimp (*Crangon vulgaris*) and their bearing on phylogeny, by Dr. Daniel. The hydrographical investigations have been carried out with the assistance of grants from the Ministry of Agriculture and Fisheries. Sea water samples were collected from the Irish Sea between Holyhead and Dublin, and at the same time drift bottles were liberated from the places where the water samples were taken. Dr. Daniel's work on the musculature of the larval shrimp is of much interest. Following his former papers dealing with the adult shrimp (*Crangon vulgaris*) and the mysid *Pranvus flexuosus*, in which work distinct differences were found in the muscles of the two species, the present paper investigates the larvæ of *Crangon*. Even in the first stage, the so-called zoea, the muscles are very like those of the adult, which fact might be regarded as direct evidence against its schizopod ancestry. A more probable interpretation is, however, that as the metamorphosis is much abbreviated compared with some of the more primitive Crustacea, such as most of the euphausiids, the development is compressed by the early addition of adult characters, and that during the larval period adult organs or characters as well as complete larval stages may be anticipated. The author is of the opinion that "it may be taken that the occurrence of adult muscular structure in the zoea and mysis of *Crangon vulgaris* is a further indication of this gradual suppression of complicated larval series in the higher Crustacea".

Root and Shoot in the Angiosperm.—Mrs. Arber has recently published in a more extended form (*New Phytologist*, 29, Dec. 1930) the discussion of this subject that she presented at the International Botanical Congress at Cambridge. From the point of view of formal morphology she concludes that stem and leaf should not be treated as discrete morphological entities, but that root and shoot belong to primary and equivalent morphological categories. She points out, in this latter connexion, that root and shoot alike normally give rise to other like units, the shoot producing lateral shoots, the root lateral roots. This conception of the morphological equivalence of shoot and root seems to meet with little difficulty in the dicotyledon, but the fibrous root system of the monocotyledon, often forming anew at each node and with no very permanent main system as a prolongation of the main axis, may raise a doubt as to whether this view is fully in accordance with all the facts. There are obvious difficulties in the way of extending this view to include the relations of shoot and root system in the Filicales. The paper contains an interesting review of various morphological facts, gathered mainly from the author's investigations of the Gramineæ, which bear upon the relation of leaf and stem. Thus, leaves terminal upon the axis are described from three genera of grasses. Axes with dorso-ventral symmetry are cited, as well as leaves with characteristically radial organisation.

Bathymetrical Work in the Baltic.—Various charts of the northern part of the Gulf of Bothnia show notable divergences, especially in deeper water. These are due no doubt to different interpretations of the soundings. With the view of obtaining a detailed bathymetrical chart of that part of the Baltic, it was surveyed with an echo sounder in the summers of 1927–29. The methods and results are described by H. Renqvist in *Havsforsknings Institutets Skript*, No. 68 (Bathymetric chart of the Bothnian Bay and the North Kvark). Several thousand soundings were taken and allowed the construction of a detailed map showing an extraordinarily uneven floor, a state of affairs that was overlooked in the deeper water when few data were available. Dr. Renqvist insists that many of the former discrepancies were due to soundings having been wrongly placed on the chart. On an irregular floor a slight error in position might well have a wide result. He claims that errors arise when a ship has to stop for sounding, for it is then difficult, without cross-bearings to land, to fix the true position, since the slowing down and restarting of the ship vitiate calculation of average speed and so of position. In echo sounding there is a uniform speed on the definite course throughout, and the shorter time occupied in taking such a line of soundings reduces the period during which one is unable to take bearings to the land. This also obviates sources of error.

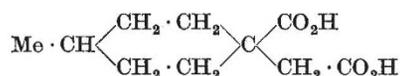
The Gas Equation.—In the issue of the *Physikalische Zeitschrift* for Dec. 1, 1930, Dr. E. Neusser, of the Vienna Technical High School, examines the experimental material available for hydrogen and carbonic acid gas in order to determine the variations with pressure and temperature of the two quantities a and b of van der Waals' gas equation. Observations of volumes at two pressures near together and at the same temperature are used to calculate a and b over as wide a range as possible. The units used are the litre, atmosphere, and gram molecule of the gas. In both gases a and b are found at constant temperature to decrease with the pressure, the curves for a and b being very similar. At constant pressure above the critical point both a and b increase with increase of temperature, while below the critical point there is a rapid fall of both a and b from their values for the gas to their values for the liquid. For the lowest temperatures for which the values have been calculated the decrease is of the order of 50 per cent. The curves given in the paper show why the attempts to modify the van der Waals equation to bring it into closer agreement with observations have met with so little success.

Aero-navigation by Wireless.—The difficulties which have to be overcome in navigating an aeroplane in a fog, which the light from a beacon cannot penetrate, seem at first sight to be almost insuperable. As it cannot remain at rest like a ship on the sea, it is sometimes forced to make a dangerous landing. In the *Proceedings* of the United States National Academy of Sciences for Nov. 15, Messrs. H. Diamond and F. W. Dunmore, of the Bureau of Standards, describe a method of landing in a dense fog. When flying overland two radio receiving sets are used. One is the usual set, which receives the radio beacon signals when flying between cities, and also spoken orders. For landing at the proper angle, a short-wave receiver is used, the signals having a wave-length of 3 metres. The aeroplane flies midway between waves coming from two beam antennæ. When the aeroplane is steering in the correct direction, the amplitudes of the vibrations of two reeds on the pilot's board are equal. When it moves to the right or the left of the true course, this is shown

at once by one of them having a larger vibration than the other. A somewhat similar arrangement, using lower power and a smaller loop antenna, is used to give the pilot the direction of the runway on which he is to land. The pilot knows when he is approaching the boundary of the field on which he intends landing, as he hears a special signal in the headphones which gets louder as he approaches the field but disappears completely when he is directly over the antenna, which is placed on the edge of the field. To tell the proper angle at which he is to glide, high-frequency signals are directed along a narrow beam. The line of greatest signal strength is along the axis of the radio beam, and at a short distance away it drops considerably. The pilot should hit the axis of the beam and then start to drop, keeping the signal strength constant, the approach to the transmitter compensating for the greater distance from the axis. This gives very approximately the proper landing curve; the instrument indicates whether he is flying too high or too low. A vertical pole antenna and a horizontal doublet antenna fixed on the aeroplane are used to receive the landing system signals.

Determination of Reducing Sugars.—Schuette and Terrill, in the December number of the *Journal of the American Chemical Society*, describe experiments on the use of cupropotassium carbonate solution, first proposed by Soldaini in 1876, in the determination of reducing sugars. They investigated four types of solution and show that it is doubtful whether Beyer's form of the solution can be used as a selective reagent for levulose, as has been asserted. The effects of varying the experimental conditions were fully studied and mathematical expressions described.

Strainless Ring Structure in Cyclohexane.—In a communication to the Editor, Dr. Muhammad Qudrati-Khuda, of Presidency College, Calcutta, states that he has found evidence of a 'strainless ring' structure in cyclohexane. He has discovered that 4-methylcyclohexane-1-carboxy-1-acetic acid,



is capable of existing in four stereoisomeric modifications. The stabilising of these forms is attributed, as in decalin, to a restraint of the internal rotatory movement of the carbon atoms, brought about in this case by substituting heavier groups for some of the hydrogen atoms of cyclohexane. A fuller account is to be published shortly.

Molecular Iodine.—The separation of two forms of molecular hydrogen (both being represented by the formula H_2) has naturally raised the question of whether other diatomic gases can be similarly treated. From its band spectrum it would be anticipated that this should also be possible with iodine, and an attempt on this substance, which appears to have been partly successful, is described by R. M. Badger and J. W. Ormiston in the December number of the *Proceedings of the National Academy of Sciences*. The method adopted was photochemical; only one form is excited by exposure to the green line of mercury ($\lambda 5461$), and this can then be removed by a reaction with hexene. After a prolonged treatment, evidence was obtained that the residual iodine molecules had different fluorescent properties from the original mixture of the two forms, but the amount of separation which had been effected was evidently not large. The reasons for this are not clear, but the authors consider the

method sufficiently promising to be followed still further.

Specific Heats and Entropies of Metals.—The specific heats of thallium, calcium, and magnesium from 10° to 200° abs. have been determined by Clusius and Vaughan, whose results are given in the December number of the *Journal of the American Chemical Society*. The extrapolation to absolute zero could be made with some certainty, and thus the absolute entropies calculated. The results for the atomic heats were higher in the case of thallium and lower in the case of magnesium and calcium than those of previous workers. Whilst in the case of calcium (which was found difficult to free from hydrogen), the atomic heat curve could be very approximately represented with a single Debye function, this was not possible with thallium, the θ value of which decreased below 17° abs., nor with magnesium, the θ value of which increased appreciably below 30° abs. A more rapid decrease of atomic heat than is to be expected from the T^3 law has previously been observed only with copper and tungsten. The vapour pressure constants are calculated from the results. Although the error is of the order of 25 per cent, it is claimed that it agrees very well with that given by the usual statistical formula (0.443 and 0.493), the entropy of magnesium vapour at 1 atm. and 25° being 35.29 units determined empirically and 35.51 from theory.

Entropy of Hydrogen.—Recent progress in the development of statistical mechanics and the discovery of the two forms of hydrogen molecule foreseen by the wave theory have made it necessary to revise carefully the calculation of the entropy (or free energy) of hydrogen from spectroscopic and other data. This question is dealt with in two papers by Giauque in the December number of the *Journal of the American Chemical Society*. In the first of these a considerable simplification is introduced into the method of calculating the free energy from spectroscopic data. Every state is assumed to possess the same statistical weight: the statement that a certain state has an *a priori* weight of three means that the state is really three states which have been grouped together for simplicity of calculation, having so nearly the same energies that they are affected in nearly the same way by temperature but really individual states in a statistical sense. Previous calculations are shown in some cases to be in error. A simple new derivation of Reiche's well-known equation

$$S^\circ = R[\ln Q_T + T \cdot d \ln Q/dT]$$

is given and it is believed that this equation will hold for all states, including multiplicities due to nuclear effects such as spin. When the necessary atomic or molecular levels are known, Q may be calculated. In the second paper the author considers the case of hydrogen, on the basis of recent data (*NATURE*, Mar. 22, 1930, pp. 462-463), and "the numerous misunderstandings which have arisen concerning the effect of nuclear spin on the entropy of hydrogen" are cleared up. A new calculation of the heat capacity of hydrogen, without assuming rigidity of the molecule, is given. The absolute entropy of hydrogen at 25° C. is found to be 33.98 cal. per 1° per mol. This, however, is not the value to be used in combination with $\int C_p \ln T$ for other substances, since an entropy of mixing must be subtracted on account of the existence of ten kinds (one para- and nine ortho-) in the solid. A detailed discussion of this point is given, and it is concluded that, whilst some uncertainty may remain as to the effect of nuclear spin on other substances, no reasonable doubt exists as to the value of the entropy of hydrogen.