Research Items.

Hawaiian Temples.—In the course of a study of the archæology of Kauai Island, Hawaii (*Bull.* No. 80, Bernice P. Bishop Museum), Dr. Windell Clark Bennett describes the various types of *heiaus* (temples), of which there are traces, and discusses their uses and affinities. To-day only their foundations survive. Temple forms are influenced by two factors. Many old temples were remodelled by later chiefs; and the temple architect was a priest whose business it was to study the forms of old *heiaus* and design new ones, incorporating features which seemed to him the cause of the success of important *heiaus*. A great confusion of forms and features was the result. The principal types in both small and large *heiaus* are those (1) with open platforms, (2) walled enclosures, (3) terraced platforms; each of these in the group of larger *heiaus* having several subdivisions. In function the *heiaus* fall into five general classes: (1) The sacrificial *heiau*, called by various names, but chiefly *luakini* and *pookanaka*. (2) The agricultural *heiau*, for which one of the commonest names was *heiau hooluulu*. Its purpose was to induce rain, increase the crops, and fulfil any other purpose useful to agriculture. (3) Fishing shrines, *hoa*, located along the shore and used in sacrificing to the fish god in order to increase the catch of fish. (4) The *pohaka o kane* or family *heiau*, for private prayer or worship. (5) Miscellaneous *heiaus*, including a great variety of *heiaus* built by lesser chiefs and priests for such purposes as circumcision, aid in child-birth, impelling love, paying debts, surf riding, hula dancing, and tapa making. To-day the purpose of the *heiaus* is little known and the information given is likely to be faulty. There seems to be no connexion between the functional and descriptive classifications.

Malaria in South Africa.—An important survey of the distribution and conditions of spread and of control of malaria in the Transvaal and Natal has been carried out by Prof. N. H. Swellengrebel ("Report on Investigation into Malaria in the Union of South Africa, 1930–31". Union of S. Africa: Dep. Pub. Health, Pretoria, 1931). Of some twenty species of anopheline mosquitoes met with in these two countries, only two, *A. costalis* and *A. funestus*, are of practical importance as vectors of malaria, because they alone enter into such close contact with man that they become infected; this fact much simplifies anti-mosquito, and particularly anti-larval, measures. Interesting details are given of the distribution of various species of anopheline larvæ that may occur in the collections of water met with on an average farm. The prophylactic use of quinine and screening from mosquitoes are found definitely to reduce the incidence of malaria, judged by the 'spleen rate'. Thus the spleen rate among children was 88 per cent in unscreened farms and 44 per cent in screened ones, even though these measures were far from perfect. Recommendations are made for the control of malaria, and include the formation of an administrative control unit and a research field station, instruction of school teachers and of future farmers' wives in the principles of hygiene and anti-malarial measures, promotion of the sale of quinine by the Government, and a system of medical examination of recruited labour before acceptance, so that malaria carriers may be detected and excluded.

Starch Digestion in Silkworms.—It is widely believed that the nutrition of herbivorous insects depends chiefly upon the carbohydrates, starch especially, of their food substances; and in regard to the silkworm it has even been recommended that the nutritive values of mulberry leaves might be determined by the iodine reactions of the leaves. Osamu Shinoda shows that in one race of silkworm ("Hasegawa-Shimpaku") starch is not digested at all (*Annot. Zool. Japon.*, vol. 13, p. 117; 1931). Since the sugar content of the leaves is too low to sustain the life of the larva, whence does it synthesise the carbohydrates? Apparently from proteins, in the presence of desamidase, which is shown to exist in the blood of the fifth instar larvæ experimented with. Another significant discovery was that the wall of the hind-gut was impermeable to glucose, and this leads the author to suggest that the symbiont hypothesis of hind-intestinal organisms in various xylophagous insects (for example, the protozoa of termites, or bacteria of lamellicorn beetle larvæ) requires many more confirmatory experiments.

The Permeability of Protoplasm to Water.—The rate of contraction of the protoplast in a cylindrical plant cell, such as the filament of *Spirogyra* provides during the process of plasmolysis, proceeds so regularly and symmetrically that the volume alterations of the protoplast with time can readily be measured. The velocities thus obtained must either be determined by the rate at which the external solution is penetrating the cell wall, or by the rate at which the solvent, water, is leaving the protoplast. In *Die Naturwissenschaften*, July 24, 1931, Bruno Huber shows that good grounds exist for regarding the velocity of such volume changes as a measure of the permeability of the protoplasm to water. When such measurements are extended over a wide range of biological material, it is evident that the living protoplast has a characteristic water permeability, very different in different objects, in different species, or even in different tissues of the same plant. In a study of the cells of the stem hypodermis of *Majanthemum bifolium*, it appeared that the permeability of the protoplast for water was 10,000 times as high as for cane sugar, 600 times as for potassium nitrate, and 120-140 times as for urea. These data supply interesting quantitative evidence for the 'semi-permeability' of protoplasm in which, as Lillie expressed it (*Amer. Jour. of Physiol.*, **45**, p. 406; 1918), "a high degree of semi-permeability . . . appears to require a high degree of impermeability to water".

Genetics of Japanese Morning Glory.—The genetics of the Japanese Morning Glory, *Pharbitis Nil*, has been studied entirely in Japan, during the last twenty years. The species shows much variation in flower-colour and pattern. In a paper by Yoshitaka Imai (*Jour. of Genetics*, vol. 24, No. 2) twenty-one genes affecting flower-colour have been studied. There are three different types of white, as well as purple, magenta, duskish tinged, speckled, rayed, flecked, etc. Flecked and duskish are two mutable genes. The former shows much variation and may give rise to self-coloured bud-sports. Normal plants derived by seed from the normal part of a mosaic flecked plant are in part homozygous normal and in part heterozygous for flecked. Some 'fringed' flowers also arise, which are found to be periclinal chimæras. Duskish gives about one per cent of mutations to the normal blue, and also certain variegated types which vary widely.

Carboniferous Bellerophons.—A memoir by Dr. J. Weir on the "British and Belgian Carboniferous Bellerophontidæ" (*Trans. Roy. Soc.*, Edinburgh, **56**, 1931, pp. 767-861, pls. i.-ix.) completes the history of this group of Palæozoic gasteropods in the British

area. The forms from the Ordovician and Silurian have already been described by Cowper Reed, and those from the Devonian by G. F. Whidborne in monographs published by the Palæontographical Society. Dr. Weir recognises 78 species and varieties of Bellerophontids in the Carboniferous belonging to 7 genera: *Bellerophon*, *Waagenella*, *Bucaniopsis*, *Patellostium*, *Tropidocyclus*, *Zonidiscus*, and *Euphemus*.

Quaternary Ice Margins (North Sea).—Prof. J. K. Charlesworth has published and described a valuable map of north-west Europe, showing the successive positions of the Quaternary ice-margins in the region of the North Sea (*Proc. Roy. Irish Acad.*, **40**, B (4), 1931, pp. 67-83). It is concluded that the Elster and Saale glaciations of Germany and Holland correspond to the older drifts of the British Isles. At the period of the Saale glaciation the ice-sheets were united and their margin over the North Sea cusp-shaped. The Newer Drift of the British Isles is equivalent to the Brandenburg stage of the Continent (or possibly to the Warthe stage). At this time the British ice was separate from the Norwegian ice and formed a piedmont mass over the western part of the North Sea. The Highland glaciation is of the same age as the Finiglacial stage of Fennoscandia; both were local in their distribution and bordered by the late-glacial sea. The new reconstruction, the first to be attempted by a British geologist, corrects certain errors in two of a series of maps recently published by Antevs to show the extent and distribution of the Quaternary ice-sheets in different parts of the world (*Bull. Geol. Soc. Am.*, **40**, 1930, pp. 631-720).

Curvature of Island and Mountain Arcs.—In NATURE for Nov. 15, 1930 (vol. 126, p. 787), an account is given of Dr. N. Kumagai's investigation of the form of the Japan islands arc. Prof. T. Terada has recently continued the subject, taking other insular arcs and several mountain ranges (*Earthq. Res. Inst. Bull.*, vol. 9, pp. 144-150; 1931). The island arcs belong to four groups, those of the Pacific Ocean, the West Indies, the Atlantic and Indian Oceans. The results are plotted by taking the latitude of the middle point of the arc as abscissa and the radius of curvature of the arc as ordinate. The diagram is divided into three regions by two straight lines drawn from the origin. The Pacific and West Indian groups lie in the middle region, a result that is of some interest, as the West Indies are usually cited as belonging morphologically to the same type as the Pacific islands. The Atlantic and Mediterranean groups lie in the sector of smallest radius of curvature, and the Indian Ocean group in that of largest radius. In the middle section, and to some extent in the others also, the radius of curvature increases with the latitude. A second diagram shows the corresponding relations for mountain-ranges, and it is worthy of notice that the European mountain arcs fall in the same zone as the Atlantic and Mediterranean island arcs, while the Asiatic mountain-ranges lie, like the Pacific islands arcs, in the middle zone.

Electrification of Coal Dust.—When, in ventilating a coal mine, air containing small quantities of coal dust in suspension is drawn or forced through metal ducts, it is found that the whirling action of the air on the dust is capable of electrifying the dust, and that the electric charges generated are communicated to the metal ducts. If these ducts are highly insulated, they may be raised in electrical potential sufficiently to cause sparks to pass from the ducts to surrounding objects. A research carried out by Messrs. S. C. Blacktin and H. Robinson, of the Safety in Mines Research Board, and issued as Paper No. 71 (London: H.M. Stationery Office, 6*d*.), shows that in order to get such sparks as would be sufficient to cause an explosion of firedamp in a mine, the insulation of the metal ducts has to be so good that under actual mining conditions it would only exceptionally be reached, and the chance of an explosion being produced by this cause is correspondingly small.

Generalised Thermodynamics.—Many attempts to derive the second law of thermodynamics from statistical theories have been made, but particular interest is attached to that given by Prof. G. N. Lewis in the July issue of the *Journal of the American Chemical Society*. The method differs considerably from those of classical thermodynamics and of statistical mechanics, and from a single postulate it is shown that the laws of thermodynamics and the laws of fluctuations are derivable as a generalised thermodynamics. The partition of a quantity x between two (or more) independent systems is made to depend on what are defined as specific probabilities, the ratio of which, for any two partitions, is postulated as dependent solely on the nature of the two systems and on their respective contents. The definition of temperature, entropy and its relation to fluctuations, and thence the general equations of thermodynamics, follow mathematically. Prof. Lewis considers that his postulate constitutes the first really valid statement of the second law of thermodynamics, and his deductions are certainly very interesting and rigorous.

Prediction of Isotopes.—The *Journal of the American Chemical Society* for August contains two papers dealing with the above subject. In the first, by H. L. Johnston, an arrangement which is a kind of periodic table is used, the atoms being arranged in order of isotopic mass numbers. The atoms are first arranged in four main types: the $4N$ type, with atomic weights exactly divisible by four, and regarded as composed of N alpha-particles; the $4N+1$ type, containing one free proton; and the $4N+2$ and $4N+3$ types, containing two and three free protons. A further classification is carried out, based on the number of 'free' electrons in respective nuclei, the numbers at the heads of columns representing nuclear electrons in excess of $2N$, which may be arbitrarily taken as nuclear electrons outside α-particles. Atoms experimentally observed and reported are shown, and possible but hitherto undiscovered atoms are indicated. The latter include Sr^{84}, Zr^{88}, Pd^{104}, Cd^{108}, Te^{120}, A^{38}, Ca^{42}, etc. Aston has directed attention to an isobaric triplet of mass 96, and the table predicts triplets of masses 77 and 124. Certain regularities in the table are emphasised as possibly having significance with respect to structural relationships within the nuclei. The second paper, by H. C. Urey, uses the plot of numbers of nuclear protons and electrons as co-ordinates, as proposed by Barton. The known nuclei lie on this diagram between two lines of slopes 2 and 1·61, there being well-defined clusters, each possessing an approximate centre of symmetry. The pattern from Li^6 to A^{36} is taken to indicate that all possible nuclei in this region are known, or unknown ones very rare. Between A^{36} and Cu^{63} there is a low density of points and irregularity, which seem to indicate unknown nuclei. A parallelogram pattern for these higher nuclei indicates many unknown nuclei. The structure of the nucleus is then considered on the lines of the hypothesis that it consists of helium nuclei, internal binding electrons, external protons, and external electrons, and it is shown that the isotopic isobars Io^{230} and UY may be expected.