

Research Items.

POLYNESIAN RELIGION.—In *Bulletin 34* of the Bernice P. Bishop Museum of Honolulu, Mr. E. S. Craighill ~~Smith~~ has published an extensive study of the essential elements of the belief and practice characteristic of the ancient worship of Polynesian peoples, the result partly of three years' literary research, partly of five years' personal investigation in the different island groups of Polynesia. On analysis it appears that the religions of the various island groups at the time of their discovery were of a composite nature. An ancient foundational system is fundamentally related to the culture as a whole, and is most pronounced in the large island groups on the periphery, Hawaii, the Marquesas, and New Zealand. It is termed Indo-Polynesian because the sources are to be found in regions long dominated by Indian religious influence. Second in importance is the region in which Tangaloa was regarded as supreme being, a region nearer the centre of recent cultural evolution, namely, Samoa, Tonga, and the Society Islands. Later intrusions or borrowings come from Melanesia and America, the Melanesian coming by way of Fiji and Tonga, or by borrowings of Polynesian voyagers, the American by the borrowing of Polynesian adventurers who found their way to Mexico and Peru. The Indo-Polynesian religions show traces of ancient Indic, south-east Asiatic, historic Hindu, and Chinese influences. It may be that the fusion of the first three may have taken place in south-east Asia or Indonesia before they were carried to Polynesia, while the Chinese influences may have been brought in by stray Chinese Tan-kah-lo—seafarers of the river population.

'ELEPHANT HEADS' IN MAYA SCULPTURES.—Mr. J. Eric Thompson, Field Director of the British Museum Expedition in British Honduras, in an article in the *Scientific Monthly* for November, revives the question of the significance of the 'elephant heads' in the drawings of Maya sculptures at Palenque made by Waldeck at the beginning of the last century. While Waldeck unquestionably intended to portray elephants' heads and his treatment of the tapir is distinctive, Mr. Thompson points out that not only is Waldeck's accuracy in other matters not above question, as is shown by reference to Maudslay's work, but also he was strongly influenced by a belief in the Asiatic origin of American culture and that this might have influenced his interpretation of an indistinct original. As the originals have since perished, the question is beyond solution one way or the other by direct evidence. Mr. Thompson summarises the arguments for and against judiciously, but holds that even if the case for the elephant were proved, it would not support the diffusionists, though the attitude that America was never affected to any appreciable extent by Asiatic culture would have to be abandoned. Recent archaeological research has shown that of the essential elements in the culture for which 'diffusion' is claimed, agriculture and pottery-making antedate the elephants by at least a thousand years.

FUNCTION OF THE EPIGLOTTIS.—The epiglottis is a tongue-shaped cartilaginous flap situated at the anterior border of the larynx. It used to be thought that this structure acted as a 'lid' to the larynx, falling back over the laryngeal aperture in order to prevent ingress of food or liquid during swallowing. This view was shown to be erroneous by Stuart, who proved that during swallowing the epiglottis actually moves forward and does not fall back. Moreover, when the epiglottis in man is destroyed by disease, swallowing remains unaffected, and many animals do

not possess it yet swallow perfectly. Mr. V. E. Negus (*Jour. of Anatomy*, vol. 62, Pt. 1, 1927, p. 1) now suggests that the principal function of the epiglottis is to preserve the integrity of the olfactory sense (smell) when the mouth is open; it prevents entrance of air by the mouth by apposition to a long soft palate, thus compelling the inspired air to pass through the nose. The epiglottis is best developed in deer and antelopes, animals which largely rely on powers of scent for their actual existence, and in carnivores such as the wolf and lion, which are, therefore, able to open the mouth widely and yet to preserve undiminished the integrity of their powers of scent. In some instances the epiglottis may subserve a subsidiary function in respiration and in deglutition, but not in phonation, and song birds do not possess it.

COCCIDIOSIS IN CATS AND DOGS.—Justin M. Andrews (*Amer. Jour. Hygiene*, vol. 6, pp. 784-798, Nov. 1926) has studied the course of infection with *Isospora felis* and *Isospora canis* in cats. The incubation period is two to four days, and the duration of symptoms does not usually exceed a week. The prepatent period (from the administration of the oocysts to the appearance of the parasites in the faeces) is usually five or six days, and the patent period averaged about thirty days. There was some indication that the severity of the infection varied directly with the number of oocysts originally administered. One attack of coccidiosis seems to render cats and dogs non-susceptible to subsequent infection by the same organism. This immunity lasts for seven months, and probably for life. The author considers that *Isospora hominis* is peculiar to man, and that it occurs more frequently than has been reported.

THE LUMINOUS ORGANS OF WATASENIA.—G. Shima (*Proc. Imp. Acad. Tokyo*, July 1927) in a note on the nature of the luminous bodies of *Watasenia scintillans*, refers to the three classes of luminous organs present in this squid. In one of these, innumerable rod-shaped bacteria occur in the luminous cells, and in the other two classes of organs similar bacteria occur, though in fewer numbers. A pure culture—a colony—of the bacteria of the first organ when placed in a dark chamber was found to emit light of the same nature as that produced by the luminous organs of the live squid. The part of the luminous organ in which the bacteria occur gives a lipid reaction. The author points out that luminous bacteria have been recorded hitherto in the Myopsida, but now they are shown to be present in Watasenia, which belongs to the Cegopsida. In another cegopsid, *Enoploteuthis chumii*, the author has found similar bacteria in the luminous organs, which correspond to the second and third classes of organs in Watasenia.

THE NUCLEUS OF AMOEBA.—Monica Taylor, S.N.D., states (*Quart. Jour. Micr. Sci.*, vol. 71, Pt. 2; 1927) that long and careful examination of cultures has failed to reveal any trace of syngamy in the life-history of *Amoeba proteus*. Metcalf stated that the life cycle of this species may require a year for its completion, and this is substantiated by the present author. The development period during which the culture contains no adults or very few is followed by one during which the adults increase rapidly in numbers because of fission. The latter period may be prolonged almost indefinitely by sub-culturing, but without such interference it lasts almost six months. The nucleus of the young amoeba is disc-shaped, and consists of a karyosome more or less centrally placed

in a reticulum of nucleoplasm. Chromatin in varying amounts is present in this reticulum. The karyosome is a much more conspicuous object in the developmental stages than in the adult, possibly because in the latter the chromatin blocks under the nuclear membrane arrest attention. The deeply staining portions of the karyosome in both young and old amoebæ contain chromatin and the latter passes out at intervals to the nucleo-reticulum, gradually making its way to the periphery as the nucleus grows in size, so that in adults ready to form encysted young the karyosome appears to consist of a vacuolated reticulum of nucleoplasm. When the nucleus is fully adult the chromatin of the periphery becomes subdivided into patches, large and not regular to begin with, but later forming 'blocks.' These blocks are therefore bits of the karyosome which in turn give rise to the chromatin blocks that escape into the cytoplasm of the agamont and form the karyosomes of the agametes. The author concludes that the rudiment of the nucleus in a developing *A. proteus* is wholly karyosomic and remains so throughout the encysted condition.

THE THEORY OF SAND DUNES.—A new development in the theory of sand dunes is made by Dr. Vaughan Cornish in a recent paper on "Waves in granular material formed and propelled by winds and currents" (*Geographical Supplement, Monthly Notices, R.A.S.*, July 1927, pp. 447-467). It refers to waves in ridges, the crests of which are not level but undulating, with alternate peaks and saddles. Since the formation of these has been observed during a period of constant wind, the phenomenon cannot be regarded merely as a complication due to veering winds; it is a definite dynamical feature of the final stage of dune development in an unconsolidated material. It is natural to expect that collapse will occur, in a series of steep sand-waves transverse to the wind, if the current increases too quickly, and also that breakdown will take place first at special points, determined by accident; what requires explanation is the persistence of the peaks which remain after such breakdowns. Dr. Cornish finds evidence, from the form and size of the small ripples on the windward slopes of the ridges, indicating that over the windward face of the peaks there is a confluence of the winds towards the saddles, and that the convergence results in a spinning movement that increases the scouring action in front of the saddles. On the lee side of the ridge, the finer particles carried in the vortex may be deposited behind the peaks, though in some cases it was found that deposition occurred behind the saddles, the ground immediately behind the peaks being at a lower level.

CONTINUOUS X-RAY SPECTRA.—One of the outstanding problems in connexion with the production of X-rays, that of the origin of the continuous spectrum, has been studied by W. Duane in an investigation described in the September number of the *Proceedings of the National Academy of Sciences*. A modified Coolidge bulb was built in which the effective target was a small volume of mercury vapour at low pressure. This was excited by a homogeneous beam of electrons the energy of which was just insufficient to remove the *L* electrons, whilst the softer *M* rays produced were unable to pass through the mica observation window of the tube. The feeble intensity of the resulting pencil precluded the use of a spectrometer, and its average wave-length had therefore to be found by measurement of the absorption coefficient in aluminium. Quoting from one set of results, the average wave-length was 1.10 Å., whilst that corresponding to the applied potential was 1.04 Å., a difference of only 6 per cent. The conclusion drawn from these and similar data is that in at least a large number of im-

pacts the electron transfers the greater part, if not all, of its kinetic energy into radiation, and that the latter is nearly, if not exactly, monochromatic.

ELECTRIFICATION BY FRICTION.—In a communication to NATURE, Mr. W. A. Macky, of University College, Auckland, gives a preliminary account of his experiments on the effect of the pressure of the surrounding gas on the electric charge produced by rubbing together a metal disc 2 cm. in diameter and an insulating disc 3 cm. in diameter. The metal disc, of aluminium or steel, was connected to an electro-scope with a condenser in parallel and the readings of the instrument were taken on separating the discs after their flat surfaces had been rubbed together by rotating the disc of insulator. As the pressure of the gas was reduced, the readings of the electro-scope fell for discs of glass, sulphur, and ebonite, from 100 volts at atmospheric pressure to 2 or 10 volts at less than a centimetre of mercury, while for discs of silk or chamois, the fall was only to about 75 volts. Similar effects were found in air, oxygen, hydrogen, and other gases. (The author appears not to be aware of the work of McClelland and Power, or of the theory of Riecke.) When the insulator disc was of glass, any faulty insulation caused the reading of the electro-scope to increase to amounts of the order of 850 volts when the rubbings were repeated without the discs being discharged. This effect the author ascribes to the charge on the insulator disc leaking to the back surface and therefore not taking part in the withdrawal of the charge from electro-scope and condenser when the two discs are brought together. The electro-scope in consequence shows a residual charge, to which rubbing adds the normal charge, and as a result the total is increased.

SUPERCONDUCTIVITY.—Superconductivity was the name given by Onnes to the peculiar type of electrical conduction which is exhibited by certain metals at the extremely low temperatures obtainable by the use of liquid helium. He found that the electrical resistivity of certain metals as, for example, mercury, tin, and lead, decreases at first uniformly as the temperature is lowered. The resistivity then decreases less rapidly until the critical temperature is reached, when it suddenly drops to less than 10^{12} times its value at 0° Kelvin. It was also found that if the specimen at a temperature less than the critical temperature was placed in a magnetic field and the field was gradually increased, the resistance became normal at a certain critical value of the magnetic field. It was further found that if the specimen were immersed in a bath the temperature of which was maintained at a value somewhat less than the critical temperature, then when the current in the specimen was gradually increased, the resistance of the specimen suddenly became normal for a certain value of the current. In 1917, Silsbee made the suggestion that this critical current and the critical magnetic field were not independent phenomena. It is highly probable that the threshold current is that which produces a field equal to the critical magnetic field. Onnes and his associates did a large amount of experimental work the results of which support this hypothesis. In Scientific Paper No. 556 of the Bureau of Standards, Silsbee makes a detailed analysis of the experimental results got at Leyden. His results support the assumptions on which his theoretical work is based.

RADIO DIRECTION-FINDING.—The Department of Scientific and Industrial Research has issued a special report (No. 5) on radio direction-finding by Dr. R. L. Smith-Rose (London: H.M. Stationery Office; 1s. 9d.). It summarises the progress that has been made in this

direction during the last five years. A comprehensive survey of the subject is given and the results obtained during the last two years are included. A theoretical discussion on broad lines is also given. This proves the notable contribution which the study of direction-finding has made to the solution of the important problem of the propagation of radio waves round the earth. The explanation of the propagation of radio waves round the earth as merely a phenomenon of diffraction presents many difficulties. A partial explanation can be made by making the hypothesis of a conducting layer in the atmosphere. Eckersley showed that while the transmission of vertically polarised waves by the conducting layer was sufficient to explain the measured values of radio signal strength, it was necessary to assume that the down-coming waves at the receiving end contained a horizontally polarised component in order to explain the variations in the apparent bearings observed on direction-finders. Experiments strongly confirm this theory. As the result of the intensive research being carried out in various parts of the world on the propagation of radio waves, the mechanism of the actual deflexion from the ionised layer is rapidly being placed on a satisfactory quantitative basis. The author concludes that the appreciable errors which occur when using the direction-finder at night are caused by the down-coming waves polarised with the electric force horizontal. As a direct result of the theoretical analysis, a system of direction-finding has been developed in which the night errors to which all closed coil systems are apparently liable have been reduced to a negligible amount.

A NEW CATHETOMETER.—The cathetometer is a laboratory adjunct which the cost is usually much more impressive than the range of accomplishments. A pattern recently produced by Messrs. Casella, of 49/50, Parliament Street, Westminster, therefore disturbs a tradition. This instrument is not only strikingly versatile, but also, strangely enough, is being put on the market at a much lower figure (£26) than its more simple predecessor. The central vertical column, supported by a heavy flat tripod with adjustable feet, is present as in the earlier type, but the telescope carriage, instead of travelling thereon, rides upon two of the three vertical brass rods which form a sort of cage rotating about the central column. One of these rods is engraved with a scale of 1 metre divided into millimetres and readable by vernier to 0.05 mm. The carriage can slide freely or may be rigidly clamped at any height on the scale; it can also be adjusted by fine motion screws for height and level. Similarly, the cage can rotate freely, may be rigidly clamped to the central shaft, or may have its motion finely controlled. The central column has a head and levelling screw, so that the whole apparatus may be laid horizontally. In this position the apparatus will serve as a reading telescope for use with a balance or galvanometer, or it may be used as a comparator of length, either by means of its accessory mountings, for end gauges, or, by changing the object glass, for measures of length.

THE SURFACE TENSION OF MOLTEN METALS AND ALLOYS.—The surface tensions of molten tin, bismuth, cadmium, lead, zinc, and antimony have been re-determined by Yoshiharu Matuyama by a dropping method (*Science Reports*, Tohoku Imperial University, vol. 6, No. 5, June 1927, p. 555). At the melting points the values in vacuum for the six metals are: 59.1, 40.1, 67.9, 47.9, 80.0, and 37.5. The surface tension falls linearly as the temperature is raised, the values at 600° C. being for the first five about 51.6, 35.0, 60.2, 43.2, and 75.5. The constant in Eötvös equation

connecting the surface tension with temperature is found to vary from 0.9 to 1.2 for tin, bismuth, lead, and zinc. The method has been applied to the three alloy systems, cadmium-antimony, zinc-antimony, and lead-antimony. In each case the tension falls from that of the metal with the higher value to that with the lower on a fairly gentle curve, rapidly at first and later more slowly. In the two former systems, however, there are small breaks at compositions corresponding with the compounds CdSb and Zn₃Sb₂. The conclusion drawn is that these compounds do not dissociate completely on fusion.

THE CRYSTAL STRUCTURES OF AMMONIUM, POTASSIUM, AND RUBIDIUM COPRIC CHLORIDE DIHYDRATES.—In the September issue of the *Journal of the American Chemical Society*, S. B. Hendricks and R. G. Dickinson describe the results of an investigation of the crystal structures of the compounds R₂CuCl₄·2H₂O, where R represents ammonium, potassium, or rubidium. The study of salt hydrates and ammoniates by the methods of X-ray analysis is, in general, rendered difficult by their low crystallographic symmetry, and this case was no exception. Laue and spectral photographs were used, and their interpretation necessitated a very careful examination of reflection intensities. For each of the salts, the structural unit contains two R₂CuCl₄·2H₂O and is based on a simple tetragonal lattice. Each copper atom is immediately surrounded by two oxygen and four chlorine atoms, two of the latter being at a distance from the copper 0.75 Å. greater than the distance of the other two. Each alkali atom is surrounded by four oxygen atoms, four copper atoms and eight chlorine atoms. The inequality of the two copper to chlorine distances is naturally assumed to indicate that the copper exerts different forces on the two pairs of chlorine atoms, and this fact, together with the behaviour of these compounds in solution, seems to show that they are of the double salt rather than the complex salt type. In the case of K₂CuCl₄·2H₂O the dimensions of the structural unit were found to be $d_{100} = d_{010} = 7.45$ Å. and $d_{001} = 7.8$ Å.

A STUDY OF THE STRUCTURE OF THE SURFACE OF ORDINARY SOLUTIONS.—A long contribution on this subject describing work carried out by J. W. McBain and G. P. Davies has just appeared in the September issue of the *Journal of the American Chemical Society*. As compared with the large amount of data for films of insoluble materials resting on the surface of a solvent such as water, very little is known about the structure of the surfaces of solutions. The determinations of Donnan and Barker of the absolute adsorption of a substance from true solution at the air interface, using nonylic acid solution, are thought to be inaccurate, and an improved method is described. The adsorptions per square centimetre of surface of aqueous solutions of *p*-toluidine, camphor, and amyl alcohol are given, and these amounts are considerably in excess of those required for a monomolecular surface film. It is suggested that, in addition to a monomolecular film, there is an excess concentration in the immediate neighbourhood of the surface and chains of oriented molecules extend inwards into the solution. The authors point out that this conception affords an explanation of some other results. The numerical results obtained are in disagreement with Gibbs's formula, and the authors use the strict thermodynamic formula of Gibbs, taking into account all the components present, even the gas in contact with the surface. It is also considered essential to include terms not in the Gibbs equation in order to allow for the electrical effects which occur at all surfaces.