Research Items

Prehistoric Lincolnshire. The first section of a survey of present knowledge of the prehistoric archæology of Lincolnshire by Mr. C. W. Phillips is published in the *Archæological Journal*, **90**. The county falls into well-defined geographical divisions, of which the most important are the marked oolite ridge called Lincoln Edge and the Wolds. There are two areas of low country, one, to south and east on the shores of the Wash, continuing round both sides of the Wolds, and the other, the Isle of Axholme, on the west side of the outfall of the Trent into the Humber. Although the geology of the lower grounds is not very conducive to prehistoric occupation, one of the surprises of the county archæology is the relatively considerable occupation of low-lying lands at several periods. There is little evidence of occupation of the county area in lower and upper palæolithic times. In the microlithic period two areas of exposure of sand show evidence of occupation, Risby Warren being regarded as the type-site of Great Britain for this period. In the neolithic period the discovery of nine, or possibly ten, long barrows on the Wolds has been one of the recent archæological surprises. The builders were Windmill Hill folk. Other neolithic objects, except finds in the neighbourhood of Grantham and at Risby Warren, belong to the Wolds. The distribution of Early Bronze Age objects is such as might be expected when intruders from the North Sea were making their way into the county by the Humber and the Wash. The distribution of beakers and daggers is entirely riverine, and there is evidence of only one landing on the coast. The destruction of round barrows owing to agriculture has been great. The majority stand on high ground away from the settlements. In the Middle and Late Bronze Ages the distribution of the population did not differ materially from that of the early period of metal, being confined mainly to the valleys. In the middle period the whole of Lincoln Edge from one end of the county to the other was occupied. A novel feature was the beginning of the concentration around Brigg, where a great dugout boat was found in 1886. Among gold objects found in the county two are important: a gold armlet, now lost, and a torc with Y-shaped section from the Isle of Axholme.

Pre-Conquest Mexico. In the fifth issue of *Ibero-Americana*, the publication of the University of California Press which is devoted to the study of material relating to the geography or ethnology of Central America in early Spanish records, Dr. Carl Sauer has reconstructed, so far as is possible, the distribution of aboriginal tribes and languages in north-western Mexico, thus supplementing, and in some instances revising, the linguistic researches of Swanton, Thomas and Orozco y Berra. The observations used are drawn from records dated between 1531, when Nuño de Guzman first entered the country, and 1768, when the Jesuits were expelled and the mission system began to come to an end. It is not possible to confine the study of pre-conquest conditions within narrower chronological limits, owing to the fact that while in the north Spanish influence was not felt until the end of the seventeenth century, in the south catastrophe overtook the native peoples at once. Indians from central Mexico settled the country, in part as a replacement of the native on the land, in part as a 'baboo class' intervening between the Spaniards and the indigenous population. Wars, in which they suffered from the attacks of both sides, and the exploitation of the mines, were alike disastrous to the sedentary Indians, while in Sinaloa and Nayarit aboriginal conditions are impossible to recover owing to the establishment of *encomiendas* (villages granted as private possessions to individuals) in the sixteenth century, the grantees making good any deficiency in the labour supply by the importation of labour from outside, in some instances negro labour, which rapidly brought into existence a mulatto population. It would appear that the Aztec migration myth, which asserts a widespread distribution of Aztec people and culture, rests on the fact that Aztec speech was introduced as a matter of convenience into non-Aztec areas by colonial settlers. The Aztec place-names quoted in evidence are in reality translations of indigenous names.

Characteristics of Tumour Cells. Prof. Warren H. Lewis summarises in "Some Characteristics of Tumour Cells" (News Bulletin, Carnegie Institution, Washington) the principal differences between normal and tumour cells. In the body, malignant cells show uncontrolled disorderly growth, lack of useful function, rapid cell death, transplantability from animal to animal, injurious effect on normal tissues and acid metabolism. The differences seen *in vitro* are: more granular cytoplasm, more refractive fat globules, smaller mitochondria, and no increase in neutral red granules. The nuclear membrane is thicker, nucleolar material increased and the nucleus itself appears to be more granular. The cells migrate more readily, and their shapes and general character in colonies help to differentiate them from one another and from the normal cells.

Life-Cycle of a Human Echinostome. Marcos A. Tubangui and Antonio M. Paseo (*Philippine J. Sci.*, **51**, 1933) have elucidated the life-history of *Echinostoma* (*Euparyphium*) *ilocanum*, a small human intestinal trematode discovered by Garrison (1908) in Manila. The life-cycle conforms to that usual for echinostomes. Two molluscan intermediate hosts are involved; in the first, a small fresh-water planorbid, are found the miracidium, sporocyst, redia and daughter-redia stages, and from the last-named the cercariæ escape and encyst in any of the common fresh-water snails which form the second intermediate host. The adult flukes were obtained by feeding encysted cercariæ from these snails to rats, a cat and two monkeys, and it is concluded that human infestations are brought about by consumption of raw or insufficiently cooked snails harbouring the encysted cercariæ. The limited geographical distribution of the fluke is explained by the observation that the habit of using raw snails as food is found only in the north-west provinces of Luzon, that is, among the Ilocanos, The various stages are described and figured.

Histology of Eye Mutants in *Gammarus*. A series of colour mutations in the eyes of the Amphipod *Gammarus chevreuxi* are well known to be inherited as Mendelian differences. Wolsky and Huxley (*Proc.*

Roy. Soc., B, 114, 364) have made a study of the histology and development of the eye in the various mutant types in comparison with the normal. Eye-colour mutants, such as red and no-white, differ from normals only in pigmentation, while such eye-structure mutants as albino and colourless show a structure which is markedly abnormal, the animals being blind. The genes for the latter class of mutants might be likened to timed bombs which completely derange the development of the eye and adjacent structures. The rate of development of the optic tract is slowed down and inhibited, especially in its distal portion, the retinular cells are deficient in number, they fail to arrange themselves in groups of five and soon degenerate, while the interstitial cells show signs of hypertrophy. The crystalline-forming cells fail to form normal cones. In explaining these results the following principles are utilised: (1) alteration in the rate of a differentiation process, leading to inhibition; (2) an intensity-gradient in the amount of inhibition; (3) development proceeding centrifugally in the optic tract; (4) struggle between parts, leading to failure of the retinular cells and multiplication of the interstitial cells; (5) effect of the nervous system. In the albino mutant, both the black melanin and red lipochrome pigments are absent because the retinulæ in which these pigments normally appear are suppressed.

Chromosome Structure in *Allium*. A detailed investigation of chromosome structure in *Allium*, by Prof. T. K. Koshy (*J. Roy. Micro. Soc.*, 53, No. 4), introduces several new conceptions. The work of several other investigators is confirmed in showing that the chromosome is a double structure throughout the mitotic cycle. Koshy goes further and shows that the chromomeric appearance frequently found in chromosomes is due to the close intertwining of two spiral chromonemata. He also finds that the spiral of the chromonema is reversed at the point of the spindle fibre attachment constriction. This is the point where the daughter chromosomes begin to separate in metaphase. But before this has happened, each daughter chromosome has undergone a split into two chromonemata. This is not a straight longitudinal split, but a spiral line of cleavage. At about the time this spiral cleavage appears, the two daughter chromosomes in which it occurs unwind from each other just before the anaphase. This unwinding proceeds from both ends towards the constriction where the reversal of the spiral takes place, this null point being regarded as a fulcrum. The anaphase and telophase chromosomes thus contain two spiral chromonemata owing to the spiral split in prometaphase. In late telophase the two threads are found to approximate very closely due to the elongation of the chromosomes, and their duality is thus obscured, but it reappears in the following prophase. These observations have significant bearings on various current views in cytology and genetics. They uphold the chromonema as against the chromomeric theory, and strongly support the generally accepted view that the anaphase and telophase chromosomes are double.

New Gentians. Capt. F. Kingdon Ward writes on "Some New and Rare Gentians" in the *Gardeners' Chronicle* of April 21. The wet zone to the south of the Great Wall of China provides a suitable habitat for *Gentiana stylophora*, *G. gilvostriata*, *G. setulifolia* and others, whilst the dry regions to the north of the Great Wall have other species. There is a further subdivision of the dry parts into forest and grassland, each with its own gentian flora, though some species are very widely distributed. The notes also include descriptions of several gentians introduced by Capt. Kingdon Ward from Tibet last year: *G. Waltonii*, *G. Georgii*, *G. trichotoma*, *G. filistyla*, *G. Wardii*, *G. sino-ornata* and *G. detonsa* are described, in addition to the three mentioned above. The Lhagu gentian, a mat-forming species, was found among the grassy slopes of the snow range at 14,000 ft., and promises to be a delightful plant if it can be introduced to cultivation.

Geography of Earthquakes. In a long article in *Matériaux pour l'Etude des Calamités* (No. 30–31, 1933) entitled "Die Anthropogeographische Bedeutung der Erdbeben", Dr. W. Severit gives a useful summary of the geographical distribution of earthquakes in recent times with special reference to the more destructive ones. A map shows the number of shocks during the last century. This part of the memoir is followed by a discussion of the effects on soil, drainage, climate, human distribution and the works of man. Finally, there is a study of the measures of prediction, security and relief. The whole is well documented, and may usefully serve as an introduction to the subject.

Wind Structure. As a result of the special inquiry into wind structure that was carried out at Cardington a few years ago, by the Airship Services Division of the Meteorological Office, Mr. C. S. Durst formed a novel theory of wind structure that explains many features shown on continuous records of the speed and direction of the wind such as those obtainable with the aid of the Dines' pressure tube anemometer. In addition to the rapid and irregular fluctuations of speed and direction that are regarded as the result of irregular eddies with axes inclined in all directions, caused apparently by the striking of air against obstacles, Durst found large excursions of the speed and direction pens, generally lasting 1–30 minutes and showing as a rule a rapid initial increase of speed followed by a gradual decrease accompanied by increasing small disturbances of the frictional type just described. There was abundant evidence that the initial squall corresponded with the arrival of faster moving air from a higher level, and that the whole phenomenon up to the beginning of another sudden increase of speed was associated with a local convectional circulation which he termed a 'cell', this circulation being superimposed on the general drift of the wind. Mr. Durst has recently discussed the anemograms from a number of places with anemometers having widely different exposures from this point of view (*Quart. J. Roy. Met. Soc.*, Oct. 1933). It is found that over the sea the frictional eddies are better developed in air of equatorial origin than in polar air, doubtless because the increase of wind with height is greater in the equatorial air, but that, given sufficient vertical stability in equatorial air over the sea, smooth-flowing air can persist with higher speeds there than over agricultural land.

Acuity of Vision. Kruysuyk and Zwikker (*Physica*, 1, 4, Feb. 1934) have published an account of experiments in which the acuity of vision was tested at different intensities of illumination, using as a criterion the recognition of small solid objects. These were

placed in effect at variable distances from the observer. The acuity of vision was tested for several observers in white and in monochromatic sodium light. The curves connecting intensity of light with acuity of vision slope upwards, following roughly a $\frac{1}{4}$ power law, and show in general a bending over (saturation effect) at high light intensities, but this effect is much more marked for some of the test objects than for others. For the lower intensities of illumination, the acuity at given intensity is much better for sodium light than for white light, but they tend toward the same saturation value. The acuity is considerably greater and the effort of discrimination is less for two-eyed than for one-eyed seeing.

Valve Amplification at Radio-Frequencies. A paper published by Mr. F. M. Colebrook in the *Journal of the Institution of Electrical Engineers* of February 1934 discusses the relative merits of screen-grid valves and three-electrode valves for amplification at frequencies of the order of a million cycles per second. Voltage amplification by means of tuned circuits and screen-grid valves is limited by conditions of stability and by the curvature of the amplification characteristic. In the reception of broadcasting in particular, this curvature of the characteristic may lead to a reduction in apparent selectivity due to cross-modulation, and an increase in background noise. This effect is illustrated in the paper by typical measured amplification characteristics. An analysis of a triode amplifying stage shows the possibility of securing inherently stable tuned-circuit amplification by using a buffer-valve stage to minimise the effects of the input impedance of the amplifying valve. A measurement of such a stage at a frequency of a million cycles per second gave results in agreement with theory and showed that an output of about 100 volts could be obtained without appreciable curvature of the amplification characteristic. Thus, although the three-electrode amplifying circuit may not be preferable to the screen-grid stage in all cases, it should facilitate reception at large power output with a minimum of audio frequency amplification. With this object in view, special emphasis is laid in the paper on the desirability of making a simple modification to the design of the standard receiving triode in order to reduce the capacitance between the grid and anode.

Emission of Electrons in Chemical Reaction. Denisoff and O. W. Richardson have published (*Proc. Roy. Soc.*, A, March) a further instalment of the work on the emission of electrons when gases at low pressure react with sodium-potassium alloy. A refined re-investigation of the reaction with phosgene has been made in order to determine the energy spectrum of the emitted electrons with considerable accuracy. The paper summarises the general conclusions reached by these and by the former experiments—it is found that the energy distribution is not Maxwellian, as was formerly suspected, but that the distribution curve rises to a maximum at a certain energy and falls nearly to zero at a certain maximum energy, E_m. Beyond this there is a very small tail, like that observed for the photoelectric effect. For the chlorine compounds studied, $E_m + D$ is a constant where D is the dissociation energy of the compound. The authors account for the distribution by supposing that the reaction between the metal atom and a chlorine atom to form a polar bond may be effected by a three-body collision in which a metallic conduction electron carries off the surplus energy of the reaction. The maximum energy E_m is thus the chemical reaction energy diminished by the work function of the metal. This result appears to agree with experiment.

Hydrazoic Acid. Most of the reactions of hydrazoic acid, HN_3, support the conclusion that it is an ammono-nitric acid :

$$HONO_2 + 2NH_3 = H-N=N\equiv N + 3H_2O$$

(Franklin, *J. Amer. Chem. Soc.*, March 1934). The potassium salt can be obtained by the reaction

$$KONO_2 + 3KNH_2 = KN=N\equiv N + 3KOH + NH_3.$$

The action of the acid on metals is in many ways analogous to that of nitric ("aquonitric") acid : the evolution of hydrogen reported by previous experimenters does not occur with zinc, iron, manganese, nickel and copper, the products being the metallic azides, nitrogen (previously mistaken for hydrogen), and ammonia with small amounts of hydrazine ; with magnesium (which also gives hydrogen with very dilute nitric acid), some hydrogen is also evolved. A mechanism of reduction of the hydrazoic acid is suggested. Hydrazoic acid does not dissolve gold ; it will do so (as well as platinum) if mixed with hydrochloric acid, and the "aqua regia" heated with the metal. The mixture of acids also slowly evolves chlorine on boiling. Ferrous azide is converted into ferric azide when heated with excess of hydrazoic acid ; hydrogen sulphide is 'nitridised' (rather than 'oxidised') to sulphur, and sulphur to sulphuric acid by hydrazoic acid, and a stannous salt can be converted into a stannic salt by a fusion reaction with sodium azide. Several organic reactions are also in agreement with this structure. It may be mentioned that there is physical and physico-chemical evidence besides the chemical evidence given in Franklin's paper, that hydrazoic acid and its salts have not the ring structure often given but a linear structure $H-N=N\equiv N$, or more strictly, $H-N=N\rightleftharpoons N$, as proposed originally by Thiele.

Stellar Photometry in the Infra-Red. A new type of photoelectric photometer, employing a cæsium oxide cell, has been described by J. S. Hall (*Astrophys. J.*, **79**, 145). It is only possible to use this type of cell for stellar photometry if it is cooled to about $-40°$ C. by means of solid carbon dioxide, in order to reduce the 'dark current', or current which flows when no light strikes the cathode. The colour curve of such a cell shows great sensitivity in the infra-red, and intensity measurements may be made at well-separated effective wave-lengths. A detailed description of the apparatus is given, as used in conjunction with the Loomis cœlostat telescope of the Yale Observatory. The Pleiades were used for calibration purposes, and colour observations made on 347 stars and on the variable star ζ Geminorum. The phases in the light-curve of this variable as observed in the infra-red are later than those observed in the visual, corresponding to the previously noticed phase difference between observations in the visual and the blue regions. An interesting suggestion is made as to the possibility of finding the absolute magnitudes of giant stars of later spectral types from accurately measured colour excesses, observed in this manner in the infra-red.