

Research Items.

ANCIENT ROCK-SCULPTURES IN THE LIBYAN DESERT.—A journey of considerable geographical interest across the southern Libyan Desert from Bara to Bir Natrun in Dongola Province is described by Mr. D. Newbold in *Sudan Notes and Records*, vol. 7. At an early stage of the journey, the author witnessed the departure of the Kababish on their great seasonal migration, when the tribe moves some 20,000 camels and 150,000 sheep and goats to the "gizzu" or grass country for six months. Evidence of early occupation of the country crossed was abundant, including cairns, pottery, some of which was afterwards identified as Meroitic, a small brick pyramid at Abu Sofian, and a find of five glauconite implements of neolithic type. Rock sculptures were first found at Zobat el Hammad, where drawings roughly incised on boulders showed tailed and phallic men, elephants, giraffes, ostriches, oryx, cattle, and several other animals which could not be identified. At Um Tasawin on the return journey, the cliffs, even in the most inaccessible positions, were found to be engraved with innumerable figures of cattle, giraffes, elephants, oryx, and other indeterminate animals. There were also a number of human figures, some tailed, some armed with bows, a few phallic and one steatopygous. At Abu Sofian, two groups of pictures, obviously of the same date and "school," were within a day's march of one another. Here the drawings were incised on round boulders, and were very numerous. Camels are shown literally in hundreds of drawings; giraffes and ostriches still appear; but the cattle dwindle in numbers, while the elephant is not represented and the bowmen give place to men armed with spears and carrying shields. The absence of the camel at Tasawin and el Hammad suggests that the drawings there cannot be later than the first century B.C. They may be the work of the Southern Libyan Tamahu, the ruling caste in Ethiopia in the Meroitic period, and might be dated any time from 300 to 750 B.C. or even earlier. The Abu Sofian groups are obviously later, as shown by the presence of the camel, but must equally be the work of Libyan artists, and are probably between 1500 and 2000 years old. The archaeological evidence as a whole supports the theory of continued migration into the northern Sudan of desert peoples of the west and north-west from the earliest times, and the introduction thence of a Hamitic element into the riverain populations, which is still strongly marked.

SEX-TRANSFORMATION IN BIRDS.—Crowing hens have long been known, but the first case of the complete transformation of a hen which had laid eggs into a functioning male was described by Crew in 1923. Gatenby and Brambell (*Journ. of Genetics*, Vol. 14, No. 2) have added to the list of less complete transformations. They describe a white Leghorn hen which developed the comb and wattles and part of the behaviour of a male. This was accompanied by a great accumulation of fat on the viscera, together with the presence of testicular tissue. Apparently in birds such transformations only take place from the female, which is the heterozygous sex, to the male. The writers discuss the relation of such cases to the chromosome theory of sex determination. Cunningham (*Sci. Progress*, Jan. 1925) has also discussed the problem of the sex characters of birds in its general bearings on the Lamarckian theory and other questions. He refers to the condition in certain breeds of fowls in which the cocks are henny-feathered. Morgan showed that the castration of such cocks causes the development of the normal cock-feathering.

Punnett suggested that the hen-feathered condition of the cocks in these breeds is due to the presence of a non-sex-linked factor which causes the testis to develop a hormone suppressing cock-feathering, which is normally produced only by the ovary. Cunningham proposes an explanation of this condition based on the assumption that non-disjunction of the sex chromosomes has taken place, so that in a heterozygous Sebright Bantam hen, the sex chromosomes would be WZZ and not WZ. The test of this hypothesis by examining the chromosomes would be extraordinarily difficult because of the large number and variable form of the chromosomes in the chick. Morgan considered that his castration experiments removed the necessity for a theory of sexual selection or Lamarckian inheritance to account for somatic sexual characters. Cunningham points out certain objections to this view and emphasises, for example, that the pad of a frog's foot is not merely a by-product of a hormone producing some other character, but is definitely related in position and structure to the use to which it is put.

OOGENESIS IN A CENTIPEDE.—S. D. King (*Sci. Proc. Roy. Dublin Soc.*, xviii, pp. 29-36, 2 plates, Nov. 1924) records observations on oogenesis in *Lithobius forficatus*. Yolk-formation in the oocytes takes place by extrusion of particles (the fate of which has not yet been determined) from the central nucleolus, and later by fragmentation of the nucleolus, the particles of which, after proliferation, grow into the definitive yolk-spheres. The Golgi bodies and the mitochondria do not take any direct share in yolk-formation. The mitochondria are at first diffuse, but become concentrated in the early stages of growth, when they form in the oocyte several clusters, some of which proliferate very rapidly, giving rise to round bodies which are not comparable to the yolk-nuclei of ascidians or to the mitochondrial masses described in the oocytes of insects. Later the mitochondria become evenly distributed in the cytoplasm. The Golgi apparatus behaves in the usual way; in the youngest oocytes it is concentrated, but later spreads through the cytoplasm and breaks into fine granules.

SEASONAL CHANGES IN THE WATER OF PONDS.—Messrs. W. R. G. Atkins and G. T. Harris (*Sci. Proc. Roy. Dublin Soc.*, 18, pp. 1-21, Nov. 1924) compare the seasonal changes in the hecoplankton of two fresh-water ponds with alterations in the solutes, and show that in each pond there is a vernal rise in P_n followed by a period of stagnation with lowered P_n . In one pond this condition persisted until the autumn, but in the other—Staddon reservoir—it was succeeded by a period of high alkalinity lasting until October. These changes are associated with the spring increase in plankton and the development of masses of floating algae in the reservoir. In both ponds the supply of phosphate is exhausted in spring and this sets a limit to the further growth of algae, but phosphate increases again in winter, partly by regeneration and partly by the inflow of water rich in phosphates. It is highly probable that lack of phosphate, rather than of nitrate or of ammonium salts, limits the plankton in fresh water as it does in the sea. The rapid increase in plankton in the spring is associated with the increase in light rather than in temperature.

CULTIVATING A PLANT "VIRUS" IN VITRO.—Peter K. Olitsky, of the Rockefeller Institute of New York, has a note in *Science* for December 26, pp. 593-4, which will attract the attention of plant pathologists. In experimental work with the mosaic disease of

tobacco, he has drawn about 0.01 c.c. of the juice from infected plants, by careful technique with sterile pipette, etc., and inoculated this into a medium consisting of the fresh aqueous extract, prepared from carefully selected tomato plants free from mosaic. The medium then, in seven to ten days, showed "a faint, uniform, translucent, almost imperceptible haze." No microscopic technique revealed definite formed elements in the medium, but as the result of dilution by subcultural methods, the conclusion is reached that at dilutions far beyond that at which the original 0.01 c.c. of virus containing sap would still be active, successful inoculation of the disease could be achieved. These results are particularly interesting as being obtained with the virus of tobacco mosaic, upon which Allard carried out his well-known experiments showing the filterable nature of the virus, and its highly resistant nature to heat and ordinary precipitants, etc. The more detailed account of these experiments that is promised will be awaited with interest.

SILVER LEAF ON RHODODENDRONS.—Mr. A. D. Cotton has a record in the *Gardeners' Chronicle* of February 14 of the appearance of silver leaf upon rhododendrons in cultivation in Great Britain. The characteristic silvering of the foliage is missing, but after removal of the dead and dying branches, fructifications of *Stereum purpureum* developed upon the stumps. The disease seems to spread very slowly in the wood of the rhododendron, but there seems little doubt that in some of the cases observed by Mr. Cotton the organism was acting as a parasite and responsible for the dying back of the branches. Now that attention has thus been directed to the attack, doubtless other growers of rhododendrons will pay special attention to signs of dying back of branches in rhododendrons.

VARIATION IN BLUE-GREEN ALGÆ.—In a paper on variation and species in Cyanophyceæ, Mr. W. B. Crow (*Journ. Genetics*, vol. 14, No. 3) describes observations and cultures of these organisms and draws a number of interesting conclusions. The cell structure in this group of unicellular and filamentous algæ is very simple, there being no true nucleus or karyokinetic division, and sexuality is also absent. Mr. Crow correlates the continuous variation with these features. The systematic differences are shown to be similar to those variations produced by changes of environment in cultures. The characters of the group are regarded as belonging entirely to the kind called by Gates organismal, the absence of karyogenetic or Mendelian characters being correlated with the absence of nuclei and sexuality. Various parallelisms in variation with Isokontæ and other groups of algæ and fungi are also pointed out, and the general constancy of the forms when grown artificially is emphasised. Such studies are valuable for comparison with the genetics of higher organisms.

THE ORIGIN OF THE CYCADS.—English botanists, remembering the caution with which that veteran palæobotanist Dr. D. H. Scott now speaks, will read with some scepticism the confident pronouncement with which the address of Prof. C. J. Chamberlain, chairman of Section G of the American Association for the Advancement of Science, commences (*Science*, January 23). Prof. Chamberlain is quoted as saying that "the widest gap in the evolution of plants used to be the one between the ferns and seed plants; but the researches of the past thirty years have bridged the gap so completely that the two groups are now separated only by the artificial definitions of the taxonomist." None is better qualified, however,

than Prof. Chamberlain to discuss the salient features of structure and distribution in the Cycadales; and with reference to the deficiency of our knowledge of their fossil history, there will be general agreement that at the present day a study of distribution of a group in geological times may often be a study of the distribution of the enthusiastic and trained palæobotanist. In exemplifying this thesis Prof. Chamberlain pays a well-deserved tribute to the productive labours of the American palæobotanist Prof. Wieland.

SURVEY WORK IN NORTHERN CANADA.—The Topographical Survey of Canada is pushing its work farther north every summer and has parties at work in the barren lands and the northern islands of the Arctic Archipelago. Some notes in the *Journal of the Dominion Land Surveyors Association* by Mr. G. H. Blanchet give a preliminary account of the drastic changes in the map that accurate survey is making in regions relatively so accessible as the Great Slave Lake and the upper part of the basin of the Coppermine River and Backs River. The position and extent of Lakes Clinton-Colden, Aylmer, Mackay and de Gras up to the present have figured on maps chiefly from hearsay reports. Last summer Dominion surveyors found them very much out of position and corresponding but little with previous notions. The party found the outlet of the upper Coppermine River from Lac de Gras, but was unable in the short season to go down the valley. Another paper in the same publication notes the beginning of surveys in and around the new station of the Canadian Mounted Police in Ellesmere Land, Devon Island, and Ponds Inlet.

THE PROBLEM OF ATMOSPHERIC ELECTRICITY.—The issue of the *Physikalische Zeitschrift* for January 1 is a Jubilee number of 92 pages. It contains an account of the life and work of Georg Hirzel, by whom the *Zeitschrift* was planned and founded in 1899, with Profs. Riecke and Simon of Göttingen as editors. The issue also contains an account by Dr. R. Seeliger of the report on the fundamental problem of atmospheric electricity made by Prof. Hans Benndorf to the meeting of the German Scientific and Medical Association at Innsbruck. The variation of electrical potential with height in the atmosphere and the electrical conductivity of the atmosphere itself imply a flow of electric current to the earth, which for the whole earth amounts to about 1000 amperes. To explain how this current is maintained has been the problem of atmospheric electricity for some years. It has, however, been reduced to insignificance by the larger problem raised by the measurements of Dr. L. A. Bauer, who finds that the lines of magnetic force on the earth's surface necessitate a current of about 3 million amperes. Prof. Benndorf ascribes this current to β -rays from the sun too swift to produce ionisation of the atmosphere.

DIRECTIONAL QUANTIFICATION IN A MAGNETIC FIELD.—Prof. W. Gerlach describes, in the F. Paschen "Festschrift" of the *Annalen der Physik* published in January, an improved apparatus for studying spatial or directional quantification, and so measuring the magnetic moment of the atoms of metallic vapours. With copper, silver, and gold, the vapours of which are monatomic, the magnitude of the shift of the atomic stream in a magnetic field shows that they behave exactly as single quantum atoms, or more generally, as atoms with an apparent (effective) moment of one magneton, should do according to the theory. Thallium vapour is also monatomic, but the magnetic effect in this case is much smaller. There is no magnetic effect for lead or tin, though lead vapour

is monatomic and the same is probably true of tin vapour; this is partly due to the low temperature employed, though it was high enough in the case of tin to have enabled ± 0.5 of a magneton to be observed. Bismuth and antimony vapours consist wholly or partly of molecules and multiple molecules; a definite theoretical explanation of the results is therefore impossible for these metals. Nickel vapour is monatomic; the experiments show that in the normal state the atom has a magnetic moment of several units; 0 and $\pm i$ magnetons (i about two) have been proved certainly; apparently there are also atoms with still higher moments. The result of the magnetic analysis is rather complicated, and it is hoped that it will be possible to obtain a more complete analysis of the plates for this metal. There were considerable experimental difficulties in the case of iron, and the appearances expected from a consideration of its spectrum could not be obtained in the plates.

THE X-RAY ABSORPTION BAND HEADS OF NICKEL AND OF ZINC.—A method of determining the wave length of an X-ray absorption band head is described by Dr. W. Walter in the *Zeitschrift für Physik*, December 31. An X-ray tube is used, giving a line spectrum with numerous lines, one of which lies as near as possible to the wave length of the band head to be measured. When the X-rays are passed through screens made of the element to be investigated, lines corresponding to longer wave lengths than this show no absorption, while those corresponding to shorter wave lengths are strongly absorbed. In the case of nickel, the following table gives the estimated intensities of three lines, photographed directly, and after passing through nickel filters *b* and *c*.

Line.	$\lambda \times 10^{11}$ cm.	Intensity.		
		<i>a.</i>	<i>b.</i>	<i>c.</i>
Ni β	1497.03	10	10	10
W α'	1484.52	8	5	2
W α	1473.48	50	8	1
Thickness of filter, mm.	0.0000	0.0095	0.0163

Ni β is not absorbed by nickel, since its wave length is greater than that of the band head, which according to Kossel's theory must have a wave length a little smaller than that of the K γ line of nickel, 1485.4×10^{-11} cm. The W α' line satisfies this condition, and it will be seen that its behaviour agrees with its lying in the band head, since the relative change of intensity caused by the filters is considerably less than in the case of W α , which lies well inside the absorption band. Duane and Hu give 1489.0 for the position of this band head, which is clearly much too large. Similar results were obtained for zinc, though in this case the X-ray tube employed gave no line which agreed so closely with the position of the band head as in the case of nickel. The difference between the value obtained and that of Duane and Hu is considerably greater for zinc than for nickel.

NEW SYNTHESIS OF UREA.—Dr. K. C. Bailey, in the Proceedings of the Royal Dublin Society, November 1924, describes a new synthesis of urea from carbon dioxide and ammonia. The mixed gases, preferably in the ratio 4 : 1, are passed at atmospheric pressure through the annular space between two concentric tubes, the outer, quartz, tube being heated to 500-700°, and the inner, glass, tube being

kept water-cooled. The yield increases with temperature up to at least 700° C.

OXY-CELLULOSE.—In the *Journal of the Textile Inst.*, vol. 16, No. 1, January 1925, Constance Birtwell, Douglas A. Clibbens, and Bert P. Ridge publish as Part I. of "The Chemical Analysis of Cotton" a comprehensive study of oxy-cellulose. As the result of carefully controlled oxidation of cotton with mild oxidising agents, they are able to analyse the different results of such agents upon cotton cellulose, and they point out that two main types of oxy-cellulose should be distinguished. In one type, the product resulting from oxidation shows great affinity for methylene blue and high retentive power for alkalis; this type of oxy-cellulose is not chemically altered by boiling in dilute alkali. The other type of oxy-cellulose has enhanced reducing properties, best measured by the weight of copper reduced under standard conditions. This type loses entirely its chemical characteristics as an oxy-cellulose on boiling with dilute alkali, losing abnormally in weight at the same time; it is afterwards indistinguishable chemically from pure cotton cellulose, though the physical properties, *e.g.* tensile strength, may be altered. Which type of oxy-cellulose is produced predominantly during the technical process of bleaching depends chiefly upon the acidity or alkalinity of the hypochlorite solution; on the alkaline side of the neutral point the product tends to be of the first type, with high absorption of methylene blue and low copper number; on the acid side the type with high reducing power is obtained.

FLOW AND RUPTURE OF METALS DURING CUTTING.—The report of the Cutting Tools Research Committee of the Institution of Mechanical Engineers, read on January 23 by Dr. W. Rosenhain and Mr. A. C. Sturney, contains an account of experiments made to determine the behaviour of material in the vicinity of the edge of the cutting tool, and is illustrated with several unique photomicrographs of cross sections taken through chips in process of formation. By using a simple type of cut and varying only two factors, namely, depth of cut and top-rake angle, certain definite regularities of behaviour have become manifest. According to the conditions of cutting, the separated metal takes the form of three distinct types of chip: (*a*) the "tear" type, in which rupture of the metal occurs by the formation, well in advance of the nose of the tool, of a tear or crack tending to run inwards from the periphery of the stock. Since such a tear cannot progress very far, a succession of fresh starts are made by the tool, and the surface of the work is left in the form of rough projections, each of which probably corresponds to successive shearing of the chip. (*b*) When the conditions are changed by either reducing the depth of cut or increasing the top-rake angle, or both, the ultimate result is the formation of the "flow" type of chip. (*c*) Intermediate conditions produce an intermediate type called the "shear" type, since it is formed mainly by a process of shearing on a plane making an angle of roughly 30° with the direction of motion of the tool. So far as the present investigation goes, it indicates that the best results in cutting in regard to the removal of the maximum amount of metal per unit distance of tool travel, the least irregularity of surface, the closest agreement between intended and actual depth of cut, and the minimum wear of tool, are obtained by using a top-rake angle a very little smaller than that at which the heavily deformed zone before the nose of the tool just disappears, in conjunction with the greatest depth of cut which still allows the formation of the flow type of chip.