

Research Items.

NORTH AMERICAN INDIAN STATISTICS.—A study of the population of America north of Mexico, which was begun by the late Mr. James Mooney as a contribution to the "Handbook of American Indians," but grew beyond limits suitable for that publication, has been published as No. 7, vol. 80, of the *Smithsonian Miscellaneous Collections*. It was still incomplete at the time of the author's death in 1921, but was sufficiently advanced to warrant publication. The territory is divided into fourteen areas. The figures show the relative strength of the tribes and an approximate estimate of losses and gains, with notes on the causes, epidemics and other, responsible for the decline. In the North Atlantic States, including New York, New England, New Jersey, and Pennsylvania, as well as part of Quebec, at the time of first colonisation, about 1600, the Indians probably numbered about 55,000. They are now reduced to about 22,000, of which number about 18,000 are Iroquois. In the South Atlantic States—Delaware, Maryland, Virginia, and the Carolinas—leaving out the Cherokee territory, there are not to-day twenty full-bloods keeping their own language, though there are about 1000 mixed bloods. It is estimated that in the early seventeenth century they numbered 52,000. Decline was noted so early as 1607. In the Gulf States the numbers have fallen from 114,000 to 62,700, though this latter figure includes large numbers with white admixture. Of the remaining regions the largest decrease is shown in the southern plains, where the population has fallen from 41,000 to 2861, and in California from 260,000 in 1769 to 18,797 in 1907. The figures for the whole area, including Alaska and Greenland, are: early figure, 1,153,000; latest figures, 406,000. The early figure, it will be noted, includes the first estimate or calculation for each area, but is not composed of synchronous figures, some belonging to the seventeenth century, others to the eighteenth or even early nineteenth centuries.

ANTLERS CARRIED BY FEMALE DEER.—Except in the case of the reindeer, it is the exception for the female of any species of deer to carry antlers. Interest, therefore, attaches to three recent records, collected by Joseph Dixon, of such abnormality in the case of the Rocky Mountain mule deer (*Jour. Mammalogy*, vol. 8, 1927). Other accounts of horned does in this species have been given by woodsmen and hunters, but though heads were occasionally preserved, the authenticity of the statements could not be tested. The present records come from one general region. In each case the antlers were well developed, but although all the deer were shot about the same season of the year, two had clean, hard, regularly forked horns, while in the third the antlers were gnarled and malformed and remained in full velvet. The last was evidently an old individual, and in this case senile degeneration of the ovaries may account for the abnormality, but the others were young individuals, and "there was no evidence noted that would lead one to believe that their reproductive organs were aberrant." It is a pity that opportunity was not taken to settle the questions aroused by the abnormal antler development, by critical examination of the reproductive organs.

NORTH AMERICAN SHORE BIRDS.—The United States National Museum has issued at intervals a series of volumes describing with great thoroughness the life-histories of related groups of wild birds frequenting the sea or inland waters. The seventh and latest of the series, by A. C. Bent, describes the "Life-histories of North American Shore Birds"

(*Smiths. Inst., U.S. Nat. Mus., Bull. 142*). Under the head of each species the author has collected all the essential information regarding its migrations, breeding range, courtship, nesting, behaviour, plumages, and so forth, so that to each of the forty-one species of waders described in this first instalment, goes the goodly allotment of an average of some 8½ pages of print. To the British reader the volume is of special interest, since many of the species are migrants familiar on our shores during the winter months, and others nest in Great Britain as well as in North America; moreover, the group dealt with includes some of the most remarkable of migrants, 'globe-spanners,' which range from the Arctic almost to the Antarctic circle.

FISH MORTALITY IN FRESH WATER.—Major R. B. Seymour Sewell, in his "Investigations regarding an Epidemic of Fish Mortality in the tank in the Indian Museum Compound" (*Jour. As. Soc. Bengal*, vol. 22, 1926, Art. 25), gives a general account of the mortality of animal life in the tank on Feb. 16 and 17, 1926. The mortality among the fish is for the most part confined to the members of the carp family, which respire through the gills only. Post-mortem examination of fishes indicated that death was primarily due to asphyxia, either from insufficient oxygen or from excess of carbon dioxide in the water of the tank. A gas analysis of the surface water, taken on the morning of Feb. 17, showed 8.3 c.c. of carbon dioxide, 3.2 c.c. of oxygen, and 13.8 c.c. of nitrogen at N.T.P. per litre. Thus the percentage of carbon dioxide in the deeper layers of the tank must have been very near the lethal concentration of 10 c.c. per litre, especially as there was no wind and an insufficient temperature gradient to create a circulation in the tank. Hence it would appear that the epidemic was due to a rise in the carbon dioxide content, assisted by a reduction in the amount of free oxygen, both changes being brought about by the meteorological conditions. It is suggested that either by periodic introduction of water weeds and green algæ, or by circulating the water by artificial means or by treating the water with lime, such occurrences of mortality in tanks may be prevented. Dr. B. Chopra (*ibid.*, Art. 26) records that the fishes in the Indaw River in Upper Burma die in large numbers three or four times a year. This is said always to follow a heavy fall of rain on the hills, the water of which is collected by the Namtig stream. During the rainy season the Namtig brings down an exceptionally large quantity of water, some of which forces its way up the Indaw. The deadlock caused by the upstream of Namtig water and the downstream from the lake, brings about the fish mortality. Death is probably due to the water being fouled, preventing respiration. In spite of the periodic mortality every year, the stock of fish living in the river does not appear to be affected.

VARIABILITY IN CYCLOPS.—Z. Koźmiński (*Bull. Internat. Acad. Polonaise Sc. et Lettres*, Classe des Sciences Math. et Nat. B, No. Suppl. I., 1927) records in 114 pages and 19 plates detailed observations on the variability of Cyclops of the *strenuus* group. 640 specimens from varied sources were examined, carefully measured, and compared. He concludes that within the group *strenuus-insignis* four species are distinguishable—*scutifer*, *vicinus*, *strenuus*, and *insignis*, for which and for their *formæ* he provides full diagnoses, and adds notes on their ecology, local and seasonal variations, and on their geographical distribution.

THE DIGESTIVE ENZYMES OF A HOLOTHURIAN.—E. Sawano has investigated the digestive enzymes of a holothurian *Caudina chilensis* (*Sci. Reports Tohoku Imp. Univ.*, Sendai, Japan, vol. 3, No. 2, January 1928), and finds evidence of the presence of lipase, butyrase, amylase, invertase, maltase, ereptase, tryptase, and rennet. Examination for cellulase, lactase, pepsinase, and tyrosinase yielded negative results.

ERYTHRÆA SCILLOIDES.—This small but beautiful plant is one of the species selected for descriptive treatment in *Curtis's Botanical Magazine*, vol. 152, Part 2. Its chief interest lies in the fact that it is one of the latest additions to the flora of Great Britain, having been noticed for the first time on the cliffs at New Port Bay, Pembrokeshire, South Wales, in 1918. The nearest other localities in which it is found are in the Cherbourg Peninsula, and in the Monts d'Arré in Brittany. The species, one of the Gentian family, is described very fully and critically, and illustrated by a hand-coloured and lithographed plate.

MILDEW ON COTTON GOODS.—Various species of *Aspergillus* responsible for a large proportion of the cases of mildew on cotton goods have been worked out and identified by George Smith (*Jour. of Textile Institute*, vol. 19, No. 3). The forms have all been isolated in pure cultures in the laboratory, and the morphology and characteristics of each species are described. Species of *Aspergillus* described in this paper are divided into two conventional groups: first, those which have been identified as causal agents in actual cases of mildew damage of yarns and cloths; and secondly, forms which have been found to occur commonly as spore infections on commercial yarns, but have not so far been found growing on cotton goods. It is considered that the presence of living spores of such species on cotton constitutes a probable source of trouble. For each species or group, the variations in dimensions and colonial characteristics recorded are those noted in the actual strains isolated from cotton goods, and are not necessarily so wide as those cited in systematic works on the Aspergilli. In all, seventeen species are described, of which only one, *A. effusus*, has not been otherwise encountered on cotton goods.

THE FOCAL DEPTH AND ORIGIN OF EARTHQUAKES.—As the late Prof. Omori showed, the distance of the origin of an earthquake from a neighbouring station is given by the duration of the preliminary tremor recorded there. If the distance of the epicentre is also known, it is a simple matter to calculate the depth of the focus. Mr. K. Suyehiro, of the Earthquake Research Institute, Tokyo, has recently determined the focal depths of 17 earthquakes, all of them with epicentres less than 100 km. from Tokyo (*Proc. Imp. Acad.*, Tokyo, vol. 4, pp. 41-44; 1928). He finds that the earthquakes fall into two classes, the focal depth ranging in one from 25 km. to about 50 km., and in the other from 55 km. to 95 km. These earthquakes were also recorded by a new form of seismographic analyser recently erected in the laboratory of the Institute. The instrument is strongly damped and its period is adjusted to agree with the usual period of vibration (0.3 sec.) of the ground below. As the instrument after disturbance rapidly comes to rest, it is easy to detect the number of separate shocks in an earthquake. In the first class, each earthquake shows several groups of waves, in one case as many as eleven, while those of deeper origin had only one or two groups. This seems to suggest that, in the upper and more brittle layer, the initial movements start in succession or in different places; while in the lower stratum, a single movement as a rule takes place throughout the focus.

POSITIVE ION KINETICS.—The curious fact that some positive ions suffer very few effective collisions in passing through a gas has been confirmed by G. P. Harnwell in an investigation described in the April number of the *Physical Review*. The experimental tubes used were very similar to cylindrical thermionic valves, but the ordinary filaments were replaced by small troughs containing material which emitted the ions of potassium or of cesium when it was heated. For speeds corresponding to accelerating potentials of fifteen hundred volts or less, the singly charged atoms of these two elements produced no detectable ionisation of the five gases that were studied. The free paths for transfer of kinetic energy proved to be many times what would be expected from the kinetic theory of gases, when the impinging particles were treated as elastic spheres, and although a closer agreement between theory and experiment could be obtained by an appropriate assumption about the force of attraction between ions and molecules, the similarity of the phenomena to those found with protons of comparable velocities, where the fields are presumably less complex, seems to indicate that there is some fundamental explanation that is valid in both instances. The analogous Ramsauer effect for slow electrons has been already accounted for by the wave mechanics.

THE MEASUREMENT OF CAPACITANCE.—Maxwell's method is the one that has been most commonly used for the absolute measurement of capacitance (capacity). It was first used by J. J. Thomson in 1883, who proved the accurate formula for computing the capacitance. In a valuable paper by H. L. Curtis and C. Moon, of the U.S. Bureau of Standards (No. 564), a very thorough investigation is made of the accuracy of the method, and an appreciative account is given of the work of preceding investigators. In order to determine experimentally the accuracy that can be obtained, two independent Maxwell bridges were set up and used to measure the same capacitance. The bridges were entirely distinct, using different resistances, galvanometers, and batteries. A rotating commutator was used on one bridge and a vibrating commutator on the other. With the former the balance was made by adjusting the speed and determining the frequency of the charge and discharge by means of a chronograph. With the latter the adjustment was made by a resistance and by determining the rate of vibration of the commutator by comparison with a pendulum. The experiments extended over several months, various anomalous results having to be investigated. The final value of the capacitance as found by the first bridge method was 0.249236, and by the second 0.249242. This shows a difference between the results of 2.5 parts in 100,000. The authors conclude that even with excellently designed and carefully adjusted apparatus, there may be an error of 3 parts in 100,000 when measuring a capacitance of 100,000 by Maxwell's method. They recall that Glazebrook showed in 1890 that the method was not suitable for measuring any condenser which had absorption, that Orlich was the first to point out the importance of earthing the bridge, and that Russell showed that ballistic galvanometers when used with a mutual inductance do not always integrate correctly.

THE VOLUMETRIC ESTIMATION OF SULPHURIC ACID.—In the *Chemiker-Zeitung* of April 21, Dr. O. Nydegger directs attention to the fact that the benzidine method of estimating sulphuric acid deserves far more attention than is usually paid to it; he claims that if properly carried out the errors due to the appreciable solubility of benzidine sulphate in water and to its tendency to adsorb benzidine hydrochloride, can be reduced to a maximum of 0.5 per

cent. Investigation has shown that the presence of small quantities of iron, nitric acid, and other substances in the solution have no effect upon the results, so that the method is particularly suitable for the rapid estimation of sulphur in iron pyrites.

THE BUDDE EFFECT WITH BROMINE VAPOUR AND AIR.—In 1871, Budde observed that chlorine expands on exposure to light, but later workers have claimed that this effect does not take place with dry chlorine. An investigation of the Budde effect with mixtures of pure bromine vapour and air is described by E. Brown and D. L. Chapman in the *Journal of the Chemical Society* for March. Their results indicate that mere removal of water from such mixtures has no detectable influence upon the increase of volume which occurs on exposure to light. This conclusion is not in agreement with recent work of Ludlam, and also Lewis and Rideal, who state that no Budde effect can be observed with bromine vapour which has been thoroughly dried.

SPECTRUM OF THE GLOW OF PHOSPHORUS.—The spectrum produced by passing a discharge through phosphorus pentoxide vapour was recently investigated by H. J. Emeléus and R. H. Purcell (*Jour. Chem. Soc.*, 788; 1927), who found that it partially corresponded with the ultra-violet band spectrum of the glow of phosphorus. R. C. Johnson has pointed out that these measurements also correspond below 3000 Å. with the band spectrum of the singly ionised oxygen molecule, and it therefore appears possible that the ultra-violet emission from glowing phosphorus is due to oxygen. In view of the fact that ozone is produced at the same time, this suggestion is of considerable interest, and the available evidence is discussed by Emeléus and Purcell in the *Journal of the Chemical Society* for March. They conclude that, owing to lack of sufficient knowledge of the spectra concerned, the origin of the spectrum of glowing phosphorus must still be regarded as unsettled.

AN ATTEMPT TO PREPARE TRIATOMIC HYDROGEN.—According to a number of investigators, hydrogen can exist in an active form which is said to be capable of reducing certain elements, such as sulphur and nitrogen, to their hydrides, and, unlike monatomic hydrogen, is not completely destroyed by passage through glass wool. Wendt and Landauer claim that its formation in a closed system is accompanied by a decrease in pressure, and this observation has led to the assumption that this active form is triatomic hydrogen. In the *Journal of the American Chemical Society* for March, H. M. Smallwood and H. C. Urey describe a series of experiments to produce this substance. The methods employed include the combustion of oxygen in hydrogen, the passage of hydrogen over heated metals, and the effect of corona and vacuum discharges on hydrogen. The latter method was investigated in great detail, but it was found to be impossible to obtain a product which would definitely reduce sulphur to an appreciable extent. The experiments all gave negative results, and it is suggested that previous workers have failed to carry out adequate blank tests. Smallwood and Urey conclude that the existence of triatomic hydrogen has not yet been established, and that if it does exist its preparation is very difficult.

GASES IN BRASS INGOTS.—The work described in a paper, read at the spring meeting of the Institute of Metals by G. L. Bailey, on "The Influence of Gases on the Soundness of Brass Ingots," consisted in the production of ingots of brass and bronze which were treated, prior to pouring, with nitrogen, hydrogen, and sulphur dioxide and were then allowed to solidify over a fairly wide range of time. It was shown that a

bronze containing 5 per cent of tin was very nearly sound after treatment with nitrogen, except in the case of the ingot poured in the warm, dry, sand mould. With more rapid chilling the rate of solidification played no very important part. Ingots of the bronze through which hydrogen had been bubbled were slightly less sound than those which were treated with the nitrogen, except in the case of the most slowly cooled ingot, which contained again about 10 per cent of cavities. Brass containing 30 per cent of zinc proved to be practically completely sound after both the nitrogen and hydrogen treatment, except, again, in the case of the slowest cooling in dry sand. Sulphur dioxide rendered the casts only very slightly more porous. It is concluded that whatever be the conditions of casting, 70:30 brass is not liable to unsoundness due to gases. The spherical cavities, of varying size and unequal distribution, frequently found in brass ingots, are attributed not to the evolution of dissolved gas, but to the mechanical entrapping of gases within the mould during pouring. This view is supported by the fact that the use of low casting temperatures is followed by an increase in the number of spherical cavities, and that with very low casting temperatures large cavities of entrapped air can be produced. The results suggest that molten brass has very little solubility for gases. Even, however, if such gases are occluded, it appears that they will remain in solution after solidification. Very slow rates of solidification, however, cause the casting to be unsound, but probably for other reasons connected with the dressing of the mould.

THE ACTION OF FUSES.—It is well known to electricians that if the current through a carbon arc is increased, the length of the arc being kept constant, then, at a certain value of the current, the arc suddenly begins to hiss and there is a sharp drop in the voltage and a sudden rise in the current. If a graph of the voltage and the current is drawn, there is a discontinuity in the curve. For values of the current between definite limits it is impossible to maintain an arc of a given length. In a paper by P. D. Morgan, read to the Institution of Electrical Engineers on Mar. 22, on the rating of fuses, a somewhat analogous phenomenon was described in connexion with the melting of fusible wires. For example, in one of the experiments tinned copper wires No. 19 S.W.G. of given length were fixed in succession between two terminals, and the times taken for them to melt with given currents were observed. It was noticed that when the current was greater than 70 amperes, the wire always melted in less than 30 seconds; but when the current was not greater than 69.3 amperes, the wire always took at least five minutes to 'blow.' For currents lying between these somewhat narrow values there appear to be two times of operation, the short time being less than 30 seconds and the long time never being less than four minutes. For smaller values of the current the curve connecting the 'blowing' current and the time of operation is a perfectly definite 'smooth' curve. Similar discontinuities were noticed over the whole range of wires tested. The phenomenon is due apparently to the oxidation of the wires. Above a certain temperature, oxides form quickly on the surface. These have a better emissivity than the bright wire, and the improvement is so appreciable that the temperature of the wire actually falls. This fall in temperature is accompanied by a change in brightness which is clearly visible to the eye. There is a decreased resistance, and since the current is maintained constant, a consequent fall of potential across the ends of the wire. Suggestions are made for improving the methods in use for rating fuses.