

## Research Items.

**Salmon Fishery in California.**—The development of the use of water-power in Great Britain and its preliminary, the impounding of lakes and damming of rivers, are bound ultimately to have an adverse effect on the salmon productivity of the country, and that probably in spite of the best safeguards which can be agreed upon. The lesson of the Sacramento and San Joaquin Rivers in California, the first rivers there to be fished for salmon by white men, is a plain one. Since 1874 the fishery has produced 205 millions of pounds of salmon (says *California Fish and Game* for January), and now, in an endeavour to keep up the stock, as many as 100,000,000 young salmon from hatcheries have been planted in a single year. Over-fishing is apparently one cause of the decline, but a factor, scarcely less important, is the cutting off of the spawning grounds by dams. An important investigation of the spawning beds has just been completed, and this has necessitated observations of obstructions in the streams and of the workings of fish-ladders and screens. The survey has determined that, as near as can be calculated, there were, in 1928, 510 lineal miles of stream in which salmon might spawn, as compared with the 6000 miles before the dams were constructed. It is estimated that 80 per cent of the spawning grounds in the Sacramento and San Joaquin river systems have been cut off by the obstructions of dams, both power and irrigation. The salmon fishery in California is now at the point when something must be done, and at once, in order that it may be preserved for future generations to enjoy.

**An Amphibious Centipede from India.**—At the Indian Science Congress, B. Bonnell described the finding of a Geophilid in loose soft mud in the mouth of the Cooum River, Madras. The specimens were obtained in July 1928 when collecting polychæte worms, *Marphysa* and *Lycastis*, in the bed of the river in brackish water. It was found that the centipedes could withstand immersion in water for nearly twenty-four hours. The other amphibious centipedes recorded are *Limotenia maritima* and *Schendyla submarina* on the shores of the Mediterranean and on the Atlantic coast of Europe, and *Pectiniunguis americanus* under seaweed, driftwood, etc., on the shores of the Gulf of Mexico. The author suggests that amphibious centipedes may be more widely distributed than these records indicate.

**The Mammals of Ceylon.**—Since a provisional list of the mammals of Ceylon was published in 1923, many new forms have been discovered in the island, and new facts have been brought to light regarding distribution. Accordingly W. W. A. Phillips contributes a new check list, in which the names, scientific and native, and the range of each species and sub-species are recorded (*Spolia Zeylanica*, vol. 15, p. 119; 1929). The mammals have increased in number to ninety-eight species and sub-species, and even the bare list brings out some interesting features. Ceylon may be broadly divided into three climatic zones, the low-country dry zone, comprising the northern half of the island and possessing a fauna closely resembling that of the Indian mainland; a low-country wet zone; and a central hill zone. Each zone has a fauna differing in many respects from that of each other zone, and in many cases the forms found in any zone are peculiar to it and are not found in the remainder of the island.

**Rhizopoda of the North Sea and Baltic.**—Dr. L. Rhumbler (*Die Tierwelt der Nord- und Ostsee*,

Lieferung 13, Teil II. a, "Amœbozoa et Reticulosa") describes the Amœbozoa and the Foraminifera of these regions. Although marine amœbæ are very common they are still little known. It seems extraordinary that only one species has been described which was actually living in the North Sea, and this one is a parasite in the diatom *Biddulphia sinensis*. Free-living amœbæ have been found by Rhumbler and Gruber in aquaria filled with North Sea water—*Amœba comminuens* and *A. crystallina*—and in aquaria filled with Baltic water from Kiel six species, including *A. crystallina*, have been described. Three of these are well known in fresh water. Many of the small amœba-like organisms found in the sea are most probably phases in the life of certain Foraminifera. In the sub-order Testacea only five species are known in the sea water and these mostly from aquaria. Amongst them is the interesting *Trichosphaerium sieboldii*, which has an alternation of spore formation with a gamete-forming phase. On the other hand, the order Reticulosa is rich in species. The Foraminifera have always been specially studied. They are easily collected and the shells are varied and beautiful. Two species of the sub-order Nuda are included, and a member of the genus *Labyrinthula* not yet identified has been found commonly in the sea-water aquaria of Heligoland. All the rest belong to the true Foraminifera. There are useful keys for the identification of species, of which there are about 200 in the area, chiefly from the North Sea and western Baltic, the eastern part of the Baltic being poor in these little organisms.

**Possible Molluscan Hosts for Cercariæ in the Shan States.**—The occurrence of schistosomiasis in coolies from Yunnan at a hospital in the Northern Shan States, and the fear of the possibility of the spread of the disease from China into Burma, led to a survey of the molluscs of the Northern Shan States with the view of ascertaining if any known carriers occurred in the region. This survey was conducted in November 1926–January 1927, under the direction of Dr. H. S. Rao, of the Zoological Survey of India, and his report on "The Aquatic and Amphibious Molluscs of the Northern Shan States, Burma," has now been published (*Rec. Indian Mus.*, vol. 30, pt. 4). It is a very careful and thorough systematic account, admirably illustrated, of the 48 species of mollusca (including 29 forms, races, and varieties) met with, of which one genus, *Ekadanta*, and 21 species and forms of gastropods, are described as new. So far as the occurrence of schistosome cercariæ and of the known carrier-snails was concerned, the results of the survey were negative, but the adaptive, if not the specific host of *S. japonicum* occurs in the Shan States, and the constant stream of Chinese coolies which comes in from adjacent infected Chinese provinces is more likely than not to carry with it the insidious parasite. A thorough survey of the frontier districts at all seasons hence seems to be desirable.

**Tropisms and Sense Organs of Lepidoptera.**—Under the above title, Dr. N. E. McIndoo, of the U.S. Bureau of Entomology, has written an excellent illustrated article which appears as Smithsonian Miscellaneous Collections, vol. 81, No. 10 (1929). It is well known that many phases of insect behaviour are still unexplained and, in turn, behaviour is largely the result of tropic responses. In this paper Dr. McIndoo brings together the available information on the tropisms and sense organs of Lepidoptera, and includes the results of his own special studies on the

codling moth. Certain tests carried out with larvæ of this insect indicated that, when in the first instar, their eyes are photopositive and they search freely for food, but they are apparently not aided by their senses until within a few millimetres of the food. Larvæ in the fifth instar sometimes acted indifferently to light, but generally were weakly photonegative. Older larvæ when ready to spin their cocoons are strongly photonegative: they react positively to gravity and to thigmotropic stimuli, whereas the younger larvæ behaved in an opposite manner in relation to these three types of stimuli. Change in tropisms, therefore, brings about great differences of behaviour. The author believes that those sensory structures, termed by him 'olfactory pores', which are widely scattered on the bodies and appendages of both the moths and their larvae, are receptors of smell.

**Proteolytic Enzymes in Green Malt.**—The attempt to identify the proteolytic enzymes of plants with systems like the tryptic and peptic types of animals has been criticised by C. K. Mill and K. Linderström-Lang (*Compt. Rend. Lab. Carlsberg.*, 17, 1-14; 1929), who prefer to characterise the plant enzymes by the nature of the substances they affect. In green malt, for example, they distinguish only two enzymes of the proteolytic type, a protease (pH optimum 4.3) and a peptidase (pH optimum 7.6-7.9), the action of which on dipeptides is greatly inhibited by phosphates.

**Ocean Surface-Water Temperatures.**—Means of accurate and quick recording of surface temperatures of the ocean are described in a paper by Sir Frederic Stupart and Messrs J. Patterson and H. G. Smith in *Bulletin* No. 68 of the National Research Council (Washington, D.C.: National Academy of Sciences). The most effective instrument was found to be a mercury-in-steel thermograph in which the bulb was heavily plated with copper and inserted in the intake of the steamer's condenser. The recording part is of the usual thermograph pattern and is fixed between two ribs of the ship. The trace never showed any signs of vibration. The apparatus was tried on North Pacific and equatorial steamer routes. So far, the most numerous data have been obtained from the North Pacific. A study has been made of departures from normal of North Pacific water temperature, with the view of discovering if any correlation can be found between variations in water temperature and the weather of western Canada. A fairly definite correlation has been established, especially in winter, between the temperature of the water and the intensity of the Aleutian atmospheric low pressure area. When the temperature gradient is large the pressure is low, and this means increased oceanic winds with higher temperatures on the Canadian seaboard. However, when the temperature gradient of the water has its normal maximum in summer, the Aleutian low is not marked, so that other factors must be involved.

**Superconductivity of Thorium.**—The issue of *Die Naturwissenschaften* for May 24 contains a short note from Prof. W. Meissner, in which he states that he has succeeded in obtaining metallic thorium in the superconducting state. The specimen experimented upon was a single crystal, 12 mm. long and 3 mm. thick. When cooled in liquid helium its electrical resistance was at first a little less than two per cent of its resistance at 0° C. The transition took place at about 1.4° absolute, and at 1.3° absolute the resistance had fallen to less than 10<sup>-4</sup> of its value at 0° C. Thorium becomes a superconductor at a lower temperature than any other metal which it has yet been found

possible to obtain in this peculiar condition, the lowest transition temperature previously recorded being 2.1° absolute for the gold-bismuth eutectic. Prof. Meissner suggests, however, that silicon may become superconducting at some temperature below 1.2° absolute.

**The Carbon Molecule.**—Dr. R. C. Johnson and Mr. R. K. Asundi have contributed an interesting paper to the July number of the *Proceedings of the Royal Society* on the diatomic carbon molecule which exists in the discharge tube. Two years ago, before the guidance afforded by recent developments of the theory of band spectra had become available, Dr. Johnson had suggested, in connexion with an analysis of the fine structure of the well-known Swan bands, that these arose from a molecule with the same empirical formula as acetylene (C<sub>2</sub>H<sub>2</sub>). Since then, evidence, which is largely summarised in the present paper, has been accumulating that carbon (C<sub>2</sub>) and not 'acetylene' is the true emitter, and this view is now endorsed. In addition, it has been found possible to extend the previously described so-called high-pressure bands of carbon into the ultra-violet and infra-red, and it has now been shown that both these and the Swan bands represent transitions to a common final state. Dr. Johnson also discusses the discharge conditions under which C<sub>2</sub> molecules are likely to be found, and states very clearly and with some extension Mulliken's theory of the structure of this form of carbon.

**Aggregation of Small Particles.**—A very remarkable instance of the aggregation of small particles has been described by H. S. Patterson, R. Whytlaw-Gray, and W. Cawood in their paper on the structure and electrification of smoke particles which appears in the July issue of the *Proceedings of the Royal Society*. An azo-dye, *m*-xylene-azo-β-naphthol, was volatilised on to a slide. At first a mixture of red supercooled spherical droplets and closely packed crystalline aggregates was formed. Then, on standing, some of the crystalline particles proceeded to develop hair-like tails which were both long and extremely tenuous. As the tail grew, the crystal aggregate diminished in size, and in addition surrounding droplets evaporated, until in the final stages of the rearrangement there were in many cases only the hairs left. The latter were sometimes as long as 0.15 mm., and when a crystalline head still remained, the tail dwindled away from a thickness of the order of 10<sup>-4</sup> cm. near the head to probably less than 10<sup>-5</sup> cm. at the other end. No substance other than this particular azo-dye has yet been found to show the effect on any comparable scale. Two good microphotographs of the hairs are reproduced in the paper, and in both the hairs would, in absence of further description, probably be taken to be dirt on the slides.

**Dust in New York City Air.**—An article by Dr. E. E. Free in the *New York Times* of June 30 describes tests made of the air in New York, in April and May last, to determine the degree of smoke pollution, and the number, size, and character of dust and soot particles in the air at different heights above the street level. The instrument used was the Owens' dust counter. Ultra-violet radiation was examined by a spectroscope. The greatest number of particles counted in any sample was 910,000, the lowest 250,000 per cub. ft. It is stated that rain greatly decreases the dust in the air and that the chief source of dust appears to be domestic fires. The heaviest rain never reduces the dust content of the air to zero, and a heavy downpour was less efficient as a dust remover than a thin, long-continued drizzle. The quantity of dust at any place

is governed chiefly by wind direction. An important fact brought out was the decrease of dustiness above street level, so that at about 200 ft. up the dust was reduced by 25-50 per cent. The New York dust was found to consist chiefly of grains of soot, averaging 1/20,000 of an inch diameter. It is assumed that these are removed from the air by settlement after aggregation into larger masses. This is not supported by evidence, and the removal of the particles from the city by the wind does not appear to have been taken fully into account. A discrepancy is indicated between the results of these tests and others made by the Carrier Engineering Corporation. The latter indicated some 2000 tons of solid matter in the air above the city, while the tests described indicated about 4 or 5 tons. It is stated that, from the middle of October to about the middle of April, no measurable trace of ultra-violet radiation reaches even the tops of the buildings in mid-town New York.

**A New Valve Effect.**—An important new effect in thermionic tubes is described by K. H. Kingdon and E. E. Charlton in the June number of the *Physical Review* (p. 998). It had been found that hot filament tubes containing a trace of caesium vapour could act as very sensitive detectors of radio signals under certain conditions, and a more detailed investigation showed that this was not being brought about through curvature of the characteristic curves. It was ultimately found that what was apparently occurring was that the caesium was being ionised at the surface of the filament and then accumulating in the positively charged state near the region of minimum potential which surrounds this electrode, where it modified the space-charges in such a way as to increase the electron current to the grid and anode. The ions have a natural period of vibration about the surface of minimum potential, and when acted upon by an alternating electromotive force of the same frequency, are set into resonant vibration; being then more diffusely spaced, they exert less control on the electron current, which is thus reduced. The calculated and observed periods of the ions are of the same order of magnitude. In a further note by K. H. Kingdon (p. 1075) it is mentioned that a similar effect can be produced by ions generated by electronic impact between the grid and anode, and that their response is sufficiently selective to permit of the resolution of separate rectification peaks for each of the isotopes of neon and argon.

**Determination of the Chemical Constituents of Petroleum.**—The Bureau of Standards of the U.S.A. is co-operating with the American Petroleum Institute in an investigation for the separation and identification of the constituents of petroleum, and the apparatus and methods in use are described by E. W. Washburn, J. H. Bruun, and M. M. Hicks in the March issue of the Bureau of Standards publication, *Journal of Research*. Details are given of a number of stills of various types, and an interesting part of the paper deals with molecular stills, first used by Brønsted and Hevesy for separating the isotopes of mercury. An apparatus for the combustion analysis of hydrocarbons up to  $C_{100}$  is also described, the accuracy of determination of both carbon and hydrogen being about  $\pm 0.05$  per cent. It has been found possible to carry out the distillation of petroleum at high temperatures without cracking, provided that all air is excluded. A note is included in the paper directing attention to the fact that the danger of poisoning from mercury spilled in laboratories is probably very small owing to the rapid contamination of the mercury surface with oil or grease.

**Locomotive Performance.**—Mr. E. C. Poultney, in the *Engineer* for July 5 and 12, discusses the comparative efficiencies of two American locomotives—one of the Pacific 4-6-2 type and another of the Atlantic 4-4-2 type—working under varying conditions of speed. In the same journal in 1924 Mr. Poultney dealt with the boiler efficiency and cylinder efficiency of these engines, but in the present articles he treats of the complete locomotive, taking into consideration the combined efficiency of the unit as a whole. He first considers the mechanical efficiency or the power absorbed by the engine in moving its working parts; he shows how fuel consumption is related to power, and gives the fuel and steam rates per dynamometer horse-power and their relation to speed in miles per hour. Other sections of his articles are devoted to superheat and thermal efficiency, boiler efficiency, cylinder efficiency, and, finally, locomotive performance. Each section is illustrated by curves for the two engines, and in a table he gives some interesting figures of the Pacific engine working at varying speeds with a constant cut-off and at constant speed with varying cut-off. In the first instance, the engine was run at speeds rising from 120 r.p.m. to 320 r.p.m., the I.H.P. ranging from 972 to 2290; the efficiency at the same time fluctuating between 5.96 per cent and 7.61 per cent; in the second instance the engine speed was kept at 240 r.p.m., but the cylinder cut-off altered from 20 per cent to 50 per cent. Here the lowest locomotive efficiency was 4.56 per cent and the highest 6 per cent. Comparing the two locomotives when being used under the best conditions for economy in the use of the heat units available in the fuel fired, the Pacific engine showed a decided superiority over the Atlantic engine.

**Rating Electric Lamps.**—During the last twenty years considerable progress has been made in the standardisation of electric lamps. Formerly it was the custom to buy lamps rated as 8, 16, 32 . . . candle-power. We now buy lamps according to the electric power they require; for example, 10, 20, 30 . . . watt lamps. It may be argued that what a consumer wants to buy is a device to give light and not a device which takes a specified amount of power. This is recognised by the manufacturer. It is much easier to measure electric power than it is to measure candle-power, and the ratio of the two in different types of lamps is known approximately and is often given. It is certainly much easier to rate lamps by the power they take and it can be done more accurately. We think, however, that the approximate candle-power should also be marked on all lamps. Naturally, if the rated watts proceed by decimals, the rated candle-powers do not proceed by decimals, and the differences between them vary according to no simple law. In an official specification published in March last by the U.S. Bureau of Standards, the amounts of the tolerances permitted both from the rated electric power and from the rated light-giving efficiency are given for electric lamps with tungsten filaments. With a 40 watt lamp, for example, the candle-power per watt may vary from 7 per cent below to 7 per cent above the standard efficiency. The corresponding admissible power variation from the standard is 5 per cent. In another official American specification for miniature lamps, issued at the same time by the Bureau of Standards, we find that the average life of miniature tungsten filament lamps for flash-light service varies from 5 to 14 hours, and for automobile service it varies from 100 to 360 hours. The life of a lamp is supposed to be finished when the light it gives has fallen by a definite percentage from its initial value.