tion of the extraordinary deep-sea genus Hexacrobylus, hitherto known but imperfectly from a single specimen discovered by the *Siboga* expedition, but now elucidated by five well-preserved specimens dredged by the *Investigator* from 1912 fathoms off Ceylon. In *Hexacrobylus indicus*, which the author regards as an aberrant Molgulid, the body is ovate and covered with delicate hairs; the branchial aperture is a wide transverse slit, ventral in position, and surrounded by six many-lobed tentacles, which collectively resemble thick, prominent, warty lips; the branchial siphon is nearly as large as the trunk itself; the branchial sac is scarcely distinguishable from the œsophagus, and is imperforate and destitute of stigmata, endostyle, and dorsal lamina; the gonads are symmetrically developed on both sides of the body, and the ovaries and testes have separate ducts: though differing from the *Siboga* species, it agrees with it in those features which separate it so widely from all other Ascidians. Another interesting new genus is Monobotryllus, which, though a simple Ascidian, is most closely related to some of the holosomatous compound Ascidians.

Colonel Stephenson's paper, which treats of Oligochæta collected mainly in southern India and Ceylon, though largely anatomical and systematic, is dignified by much instructive comparison and criticism. Twenty species and five varieties are described as new, among them a Pontodrilus from Ceylon remarkable in its habitat, far from the sea, at an elevation of 6200 to 7000 ft. Two new genera are defined, namely, Erythræodrilus from Bombay, apparently related to the Madagascar Howascolex; and Comarodrilus a Megascolecine from Cochin, in alliance with Woodwardia.

Part vi. of vol. xi. of the Records contains three papers of more than common interest. Dr. James Ritchie gives an exhaustive description of *Annulella gemmata*, a remarkable new Hydroid discovered by Dr. Annandale in a brackish pond at Port Canning in the Gangetic Delta. It is a minute form, solitary and usually attached, but also freely locomotive. Its attachment is by a "basal bulb," which alone is invested by perisarc, and is regarded as something between a basal disc and a hydrorhiza. Its tentacles, which are of extreme length, have the cnidoblasts concentrated in whorl-like rings, the cnidoblasts being almost identical with those of Hydra. The usual methods of propagation seem to be non-sexual, but Dr. Annandale, who kept specimens alive, states that minute medusæ are liberated. The non-sexual methods include longitudinal fission, transverse fission of the basal bulb, and the detachment of remarkable planula-like buds.

Dr. Annandale contributes an account, biological and systematic, of sponges parasitic on Indian Clionid sponges. Ten such parasites are reviewed, along with five Clionid hosts, the greater part of the collection being furnished by a few ounces of Madreporarian coral. The methods of attack and defence are discussed very fully. Among assumed methods of protection observed in certain Clionids inhabiting great depths, where the inorganic conditions of life may reasonably be supposed to be constant, is the production of gemmules.

Mr. F. H. Graveley's copious and well-ordered notes on the habits of insects and other Arthropods must be greatly commended. In addition to recording many original observations of behaviour, courtship, breeding, etc., particularly of that retiring group the Pedipalpi, the author has extracted references to multifarious observations published, mainly in Indian journals and in books relating to India, by other writers.

RECENT ECONOMIC ENTOMOLOGY.

THE economic importance of the Coccidæ ("mealy bugs" and scale-insects) is very great, especially in warm countries. It is satisfactory to see, therefore, the first part of an extensive monograph on the Coccidæ of South Africa, by C. K. Brain, published as part 2 of vol. v. of the Transactions Royal Soc. S. Africa (Cape Town, 1915). This contains a general introduction to the study of the family and detailed descriptions of the genera and species of the Pseudococcinæ, Ortheziinæ, Coccinæ, Monophlebinæ, and Margarodinæ. The systematic work has been done with great care, a notable feature being the charts demonstrating in the case of each species the range of variation in the lengths of the antennal segments; the illustrations—photographs and drawings—fill thirteen plates. The author has spared no pains to enlighten his readers, but it was scarcely necessary to include in his glossary the information that "ovum" means "an egg," and "transparent," "so clear as not to obstruct vision."

The *Bulletin of Entomological Research*, vol. vi., part 4, lately issued, contains, as usual, several noteworthy papers. Prof. G. H. F. Nuttall and Mr. C. Warburton describe briefly, with clear illustrations, thirty species of ticks from the Belgian Congo, and point out the importance of each as a carrier of disease. Mr. C. H. T. Townsend, of the U.S. Department of Agriculture, establishes—in reply to some recent sceptical criticism—that Phlebotomus is truly the infective carrier of the Verruga parasite. Dr. G. A. K. Marshall describes, with excellent figures, some weevils injurious to various cultivated plants in India. The highly useful *Review of Applied Entomology* has just commenced its fourth volume, and the first summary in the medical and veterinary series directs attention to the existence of the British and Irish sheep-fly (*Lucilia sericata*) as a pest in the southern United States, together with *Phormia regina*, on the authority of Messrs. F. C. Bishopp and E. W. Loake, in a paper published in the *Journ. Econ. Entom.*, vol. viii., No. 5.

Literature on the common house-fly continues to accumulate rapidly. Mr. R. H. Hutchinson (U.S. Dept. Agric., Bull. 345) contributes same interesting observations on the "Pre-oviposition Period" of the insect, with a view of estimating the value of fly-traps for reducing the numbers of eggs and larvæ. He finds that the term of the female's life before egg-laying varies from 2½ to 23 days, "most of the records falling on the fourth, fifth, sixth, ninth, twelfth, and fourteenth days after emergence."

The larval trombidiid mites known as "harvest bugs" are too familiar as a well-nigh intolerable pest in some localities. Mr. Stanley Hirst (*Journ. Econ. Biol.*, vol. x., No. 4) gives a careful description of this larva under the name of *Microtrombidium autumnalis*. He also describes a Japanese species, *M. akamushi*, which carries the germ of a disease known as "river fever."

In a Technical Bulletin (No. 21) of the Michigan Agricultural College Experiment Station, Mr. Geo. D. Shafer continues the account of his investigations as to how "contact poisons" kill insects. Such gases as sulphuretted hydrogen, hydrocyanic acid, and the vapours of carbon disulphide, benzine, or paraffin affect insects when actually taken up by the tissues, where their presence seems to prevent oxygen assimilation. This result is due to the harmful effect of such gases and vapours on the enzyme-like bodies—reductases, catalases, and oxydases—which are functional in insect tissues. The contact poisons are believed to affect the activities of these enzymes to an unequal degree, thus disturbing their normal balance.

A paper of exceptional value and interest, on the morphology and biology of the green apple aphis (*A. posni*), is contributed by A. C. Baker and W. F. Turner to the Washington *Journal of Agricultural Research* (vol. v., No. 21). This is the "common apple aphid" in North America, as well as in these countries, and the whole life-cycle is passed on the apple. Very full and careful descriptions of the structure of the various forms are given by the authors, who, in the course of their season's work, examined no fewer than 75,000 specimens. Stages in the embryonic development are described, from which it appears that the embryo, after five days' growth, has a long resting period through the colder season of the year, lying in the centre of the winter egg. Of all the results obtained, however, the tracing of the succession through the spring and summer of a number of forms derived from a single stem-mother is the most important. Among the daughters of the stem-mother there may be one winged insect, and interesting "intermediates"—virgin females with rudimentary wings—appear together with the usual winged and wingless aphids. Sexual individuals may appear in the eleventh generation from the stem-mother, the earlier ones appearing as brothers and sisters of parthenogenetic females. The authors believe that temperature is by far the most important factor in determining the appearance of the sexual insects.

A paper by J. R. Malloch, on Chironomidæ and other Diptera from Illinois (Bull. Ill. State Lab. Nat. Hist., vol. xi., 4), is noteworthy because the systematic descriptions of the midges and flies are accompanied by detailed, well-illustrated accounts of the larvæ and pupæ of many genera of Mycetophilidæ, Asilidæ, Bombilidæ, Syrphidæ, and other families. G. H. C.

CHILIAN METEOROLOGY.[1]

ALTHOUGH Chile, in common with other South American countries, has suffered greatly from the conditions brought about by the European situation, the large budget of memoirs recently issued by Dr. Knocke shows little, if any, restriction in the work of the Central Meteorological and Geophysical Institute during 1915. No. 13, part i., of the Meteorological Year Book gives *in extenso* the tridaily observations carried on at thirty stations during the year 1913, the data comprising barometric pressure, air temperature humidity, wind direction and force (the latter both in Beaufort and by anemometer), cloud, rainfall, evaporation, and exposed temperatures.

In No. 15, part ii., of the Meteorological Year Book the data are summarised in great detail from records kept at fifty-two stations, daily, monthly, and annual abstracts being given. As the stations cover more than 35° of latitude, and range in altitude from 4 to more than 3500 metres, all varieties of climate are to be found among the records. The warmest station, apart from Easter Island in the Pacific, was Arica, mean temperature 19·4° C. (66·9° F.), and the coldest Punta Arenas, 6·3° C. (43·3° F.). The absolute maximum was 38·3° C. (100·9° F.) at San Felipe, lat. 32° 40′ S., height 635 m., and the absolute minimum −8·0° C. (17·6° F.) at Punta Arenas. The effect of the cold Humboldt current in keeping down the temperature is well shown in the data for Arica (lat. 18½° S.) and San Felipe, the mean daily maximum values at the latter station on the mean of the year being 1·7° C. higher than at Arica, 14° nearer the equator, and situated at sea-level. A comparison of the temperature data from Ollagüe, at a height of 3695 metres, with those from Iquique shows a fall of 1° C. for each 323 m., both stations being close to lat. 20½° S.

Great variations in the mean amount of cloud are to be found, the mean annual values ranging from 0·9 at Calama in the north to 8·8 at Evangelistas, near the Pacific entrance to Magellan Straits. At the former station there were 327 clear days (cloud amount less than 2) and not a single cloudy day (cloud amount more than 8), while at Evangelistas only 2 days were clear and 305 cloudy. It is of interest to note that at the island of Juan Fernandez the barometric indications are very frequently an index of those taking place twenty-four hours later on the Chilian coast in about the same latitude.

No. 14 gives the daily rainfall recorded at 112 stations for the year 1913, arranged in parallel columns, thus exhibiting the distribution of the rain throughout the whole length of the country. The wettest station was Cape Raper, lat. 46° 49′ S., long. 75° 36′ W., with 4607 mm. (181·38 in.), the values for December being interpolated. At Calama and Copiapó in the north no rain fell, and ten other stations, all to the north of 30° S., had less than an inch. Hourly rainfall values are given *in extenso* for seven stations. From these records it is seen that torrential rains are uncommon, there being only two instances of more than an inch (25·4 mm.) falling in an hour, the maximum hourly fall being 40 mm. at Contulmo.

We are glad to see that in No. 16 Dr. Knocke continues to give hourly values of all the elements, the station selected in this instance being Los Andes, situated at the foot of Aconcagua, at a height of 820 metres, where the Chilian section of the Transandine railway begins. Los Andes enjoys an admirable climate—cool in summer and temperate in winter. Although 300 metres higher than Santiago, the mean temperature is slightly higher, while peaches and walnuts flower a fortnight earlier than in the Chilian capital. No. 17 of the memoirs contains the hourly values for the year 1914 of the principal climatic elements at Santiago, including earth temperature and the electric conductibility of the air observed once daily by means of a Wulff electroscope.

R. C. M.

[1] Instituto Central Meteorológico y Geofisico de Chile, Santiago, Dr. W. Knocke, Director. No. 13, "Anuario Meteorológico de Chile, 1913." Pp. 339. No. 14, "Medidas de agua caída en 1913." Pp. 71+plates. No. 15, "Anuario Meteorológico de Chile." Segunda parte. Pp. 134+plates. No. 16, "Valores horarios de los elementos meteorológicos en Los Andes, 1911 y 1912." Pp. 81+plates. No. 17, "Valores horarios de los elementos meteorológicos en Santiago, 1914." Pp. 91+plates.

THE MOVEMENTS OF THE EARTH'S POLE.[1]

MORE than a century ago it was shown by the mathematician Euler that if the axis round which the earth was rotating were not coincident with the axis of figure, which latter in the case of a spheroidally flattened earth is the shortest axis that can be drawn, the axis of rotation will revolve about the axis of figure in a period which, upon certain assumptions, can be precisely predicted. The time of one revolution of the pole of rotation around the pole of figure depends only upon the shape and degree of elasticity of the earth. In Euler's days the supposition that the solid earth had any appreciable elasticity was so far outside the range of experience that it was not considered by him. He calculated the period of the polar rotation on the assumption that the earth was perfectly rigid, and showed that this period would be about 305 days.

If we determine the latitude of a point on the

[1] Discourse delivered at the Royal Institution on Friday, May 19, by Col. E. H. Hills, C.M.G., F.R.S.