dogs, and other domestic animals in various parts of the world.

For the medical or veterinary practitioner, who cannot be expected to be an expert in every branch of science as well as in his own art, it is of the highest importance that the scientific knowledge of the ectoparasites that are likely to disseminate diseases should be brought together and summarised in such a manner as to be accessible to those whose vocation brings them into contact with these pests. Exhaustive monographs of the various blood-sucking invertebrates are of the greatest practical as well as scientific value. The work under review is the first attempt to deal in this manner with ticks, a somewhat repulsive group of arachnids which has attracted the special attention of but few professed naturalists, and of which the literature, though considerable in bulk, is extremely scattered, and much of it inaccessible. Consequently, experts on this group have been rare, and the identification of a species has often been a matter of extreme difficulty.

The main results of the labours of Prof. Nuttall and his colleagues will be to collect together all references to works dealing with ticks, and to give accurate descriptions, accompanied with illustrations, of every valid species of tick in such a way that it will be possible for anyone in any part of the world to identify a tick, of a species already known, by aid of this monograph. The undertaking is therefore one which, if successfully carried out, will fill a great gap and render an important service.

The first two instalments of the monograph are before us. Part i. contains the bibliography of ticks, which covers 68 quarto pages of references. The bibliography is printed only on one side of the paper, so that those who wish to keep it up to date can cut it up and make a card-catalogue of it. Part ii. contains two sections, the first dealing with the classifications of ticks, the second with the genus *Ixodes*, Latreille, 1795, of which fifty-one valid species are recognised. Following the descriptions of these species, of which all but two are accompanied by illustrations, are notes on the geographical distribution, on doubtful species, and on the biology of *Ixodes*, and a synonymic list of condemned and doubtful species, together with a list of the collections in which the types are to be found.

A detailed criticism of this work could only be undertaken by an expert writing for experts. We note, however, that the bibliography seems to contain a great many references to works, ancient and modern, which are little more than literary curiosities, and it would, we think, have been useful to separate the chaff from the wheat by indicating in some way those references which advance the scientific knowledge of the group and are to be taken seriously. For our part, we are sceptical as to the utility, in a work of this kind, of references to the opinions of Aristotle, Pliny, and Moses. The fact that the ancients believed ticks to be without an anal aperture may be an interesting "tit-bit," but it is not of much value, scientific or practical, to those who wish to study ticks at the present day. The illustrations are good and very clear, and the work seems singularly free from misprints. Prof. Nuttall has a curious fancy for using inverted commas, in some cases not for quotations, apparently, but for familiar expressions, such as "rattled like peas" or "put in the way of finding their food"; if these are quotations we do not recognise them, nor are we put in the way of finding their source.

A work of this kind tends, by aiding investigation and discovery, to hasten the advent of the period when it will itself be out of date. It makes it easy for anyone to collect ticks, to identify them, and to discover and describe new species; hence long before it is completed it will probably require supplements. The study of these parasites, interesting not only to the practical man, but also to the naturalist, as remarkable instances of adaptation to a mode of life which is peculiar, if to ourselves unpleasant, will be greatly advanced by the publication of this monograph; and both classes of investigators will owe a debt of gratitude to the labours of Prof. Nuttall and his collaborators for raising the scientific knowledge of ticks to a plane in which rapid progress is rendered possible in the future.

SEISMOLOGY AT THE BRITISH ASSOCIATION.

WE have before us the sixteenth report of the Seismological Committee of the British Association. There may be reasons why this particular report should be known as No. 16, but for those interested in seismological literature such a title may be misleading. As a matter of fact, this association has published fifty-two annual reports about earthquakes, some of which, like those by the late Robert Mallet, are reference works for all who are students of seismology. I direct attention to this matter as an indication that Great Britain has not been behind in investigations relating to earth physics. In certain directions it is far in advance of many others.

The first fact to be gathered from this report is that the British Association, in its endeavour to make a seismic survey of the world, enjoy the cooperation of about sixty stations, which are fairly evenly distributed over the surface of our earth. It is remarkable to note that colonial Governments, and particularly cable companies, have established observing stations on many oceanic islands, as, for example, at Cape Verde, Ascension, St. Helena, Fernando Noronha, Mauritius, Seychelles, Cocos, Fiji, and other places. On March 28 this year the Legislative Council of Bermuda passed a "Seismographic Act" enabling the Board of Public Works to purchase and maintain instruments for recording earthquakes. Other colonial Governments have taken similar steps; whilst the English Government gives direct assistance to an International Association which has its headquarters at Strassburg. An item of considerable interest in the report refers to Double and Multiple Earthquakes, about which we read the following:—

"Attention has frequently been drawn to the fact that an earthquake as it radiates may cause a collapse of strata which is in an unstable condition, and thus give rise to one or more secondary disturbances. The great earthquake of Lisbon in 1755 gave rise to secondary shocks in England, Ireland, and probably in many other countries. In the volume containing Physical Observations made in the Antarctic Regions in 1902-3, published under the superintendence of the Royal Society, p. 92, I gave illustrations of secondary earthquakes the genesis of which corresponded in time with the arrival of two particular phases of primary disturbances. That the third phase or the large waves of a seismic disturbance as they travel round the world, causing the crust of the same to rise and fall like a raft on an ocean swell, should give rise to one or more secondary disturbances is not surprising. Farther than this, any of the latter which may be *greater or less* than their parent may in turn become the originator of farther settlements. *One megaseism may therefore cause a relief of seismic strain throughout the world.*"

Of multiple earthquakes a number of illustrations are given. If the interpretation put upon them is correct, it means not only a help to those who wish to analyse seismograms, but a considerable advance in our knowledge of what is taking place beneath our feet. A shake in one place means a shake in many, and it may be added that the *foci* of these are probably in that region where cooling is taking place most rapidly.

In another section of the report we read about the "Synchronism of seismic activity in different regions." For example, it is found that during the last 300 years the times of activity in Italy, although separated from each other by irregular intervals, have varied between five and twenty years, and that these dates of activity in Europe closely corresponded with dates when there had been marked activity in Japan.

Under a section headed "Megaseismic Frequency" we see that between the years 1899 and 1909 there had been 508 world-shaking disturbances in winter months and 468 in summer months, which practically means that there are as many large earthquakes at one period of the year as at any other.

In connection with seismological work, measurements have been made of the deflection of the vertical by the tidal load of the Solent. At Ryde, close to the sea front, it was found that a 10-foot tide caused a deflection of

0.85". At Bidston, two miles from high-water mark, a similar tide caused a deflection of 0.2". From these observations inferences have been made bearing on the selection of sites for an observatory, the difference in elasticity of different types of rock, and other matters.

Reference is also made to tidal-load experiments carried out in Pennsylvanian railway tunnels, and to observations made by Mr. J. J. Shaw with horizontal pendulums in collieries in the Midlands.

Following this are catalogues of strong shocks which have occurred in the United States of America, Peru, and Chile, together with epitomes of unpublished notes relating to destructive earthquakes received from Secretaries of State of the Foreign, Colonial, and India Offices. All these will be of use, not only to the seismologist, but also to the man of business.

Lastly, we have a peculiar catalogue, probably the first of its kind. For want of space it only refers to the five years 1899-1903. For these years it gives all the world-shaking earthquakes, whether they originated on land or beneath an ocean. The times at which each disturbance originated, and the latitude and longitude of its epicentre, are specified. Dual or multiple earthquakes are linked by brackets, and the positions of origins are shown on a map. Inasmuch as this catalogue refers to reliefs of strain throughout the whole world, and not simply to earthquakes which have occurred on land surfaces, it seems possible that it may be used as a basis for new investigations.

A note at the end of the report shows that although records obtained on smoked surfaces are extremely good for large disturbances, they fail to record very small movements, which possibly may represent disturbances which were large at their origins.

A communication from Prof. H. H. Turner was a note on the periodogram of earthquake frequency. The conclusion arrived at was that no period of from seven to twenty years existed, or was shown in the materials which he had examined. These materials, however, only referred to large earthquakes which had originated on or near to land surfaces.

Mr. Maxwell Hall communicated a paper on the solar cycle: the Jamaica rainfall and earthquake cycles. The earthquakes observed in Jamaica closely followed the periods of sun-spot activity.

A paper by Mr. Napier Denison, of Victoria, B.C., has been referred to separately (NATURE, November 2).

JOHN MILNE.

SOME RECENT WORK ON SEX.

AT the Portsmouth meeting of the British Association there were several communications to Section D (Zoology) relating to recent work on sex, an account of which is subjoined.

Mr. Geoffrey Smith referred to the theory he put forward at last year's meeting to account for the effect of the parasite *Sacculina* upon the sexual characters of its host, the crab *Inachus*, according to which the development of adult female characters in infected crabs of both sexes was held to be due to the production in excess of a yolk or fatty material in the blood similar to that which is stored in the ovary of a normal adult female. Mr. Robson's work (see below) shows clearly that the presence of *Sacculina* profoundly influences the fat metabolism of its host. Mr. Smith has made observations on the fluctuations in growth of the comb of fowls, which demonstrate the close connection between fat metabolism and the development of the female characters. Measurements show that the combs of hens are continually fluctuating in size, the changes being rapid and between wide limits; a comb may increase 200 per cent. in area in three weeks. It was found that such rapid increase of the comb invariably took place just before a period of egg-laying began. The hen's comb is composed of two walls of fibrous and vascular tissue, between which is a loose core of connective tissue, which at the period of egg-laying becomes infiltrated with fat, and to this cause is due the sudden increase in the mass of the comb. This increase takes place when the ovary is storing up large quantities of yolk, i.e. when large amounts of fatty material are being conveyed in the blood to the ovary. Here, then, is another

instance of a simultaneous effect upon the ovary and secondary sexual character brought about by the presence of an excess of fatty material in the blood. Mr. Smith suggested that this case is analogous to that of *Inachus* infected with *Sacculina*.

Mr. G. C. Robson described observations, made recently by him in Naples, to test Mr. Smith's theory that *Sacculina* stimulates the production in the host crab of a yolk-forming substance similar to that developed in the normal female and stored in the ovary at the time of sexual maturity. He examined the blood of the crab *Inachus*, and especially the lipochromes, which, by reason of their solubility in fat, may be regarded as evidence of the presence of fat. He found a large quantity of fat in the blood of sexually mature females with ripe ovaries, and also that the amount of fat in the blood of infected *Inachus* was considerably greater than that in the blood of non-infected males and immature females. The blood of moulting individuals of both sexes was also found to have a high fat content, but not so high as in infected examples and breeding females. An increased fat content was also registered in the liver of infected crabs, and there was strong presumption that this was also the case in the breeding female. Mr. Robson also dealt briefly with the changes in colour in the blood lipochromes, and suggested that in all probability the fate of infected crabs is death from starvation, owing to their inability to obtain enough foodstuff of fatty nature for their own immediate needs.

Dr. Cresswell Shearer gave an account of his recent investigations on the archannelid *Dinophilus gyrociiliatus*, collected at Plymouth. This species produces two kinds of eggs, some small, destined to give rise to the small and rudimentary males, others almost six times as large, and also more numerous, which give rise to the large females. The two kinds of eggs are laid together. In a few days the males hatch full-grown and sexually mature, while the females leave the egg in a small and immature condition; just previous to leaving the egg-capsule they are fertilised by the small males. Sections of females at this stage show the sperms collected on the ventral side of the gut at the junction of stomach and intestine, i.e. where the future ovary will appear, but as yet no trace of the latter is visible. The ova appear much later, when the female has grown very considerably in size. Shortly after the female germ cells appear, each is seen to be joined by a spermatozoon, the head of which becomes imbedded in, or attached to, the nuclear wall. Ultimately the nucleus of each primitive ovum is composed of two portions, one derived from the spermatozoon, the other from the female cell. These two elements do not fuse, but retain their individuality throughout the various oogonial divisions (about forty to fifty in all). In the majority of these divisions the male and female portions of the nucleus divide equally, so that a similar amount of nuclear material, both male and female, goes into each daughter cell. Now and again, however, the female half of the nucleus seems to divide before the male portion, so that the latter is, as it were, left behind, and is shut off entirely from one of the daughter cells. Of the two resulting daughter cells one has, therefore, the whole of the male part of the original nucleus and its share of the female part, while the other has its share of the female part only. This appears to be the sex-determining factor, for of the two daughter cells the former, which has its share of the female and the whole of the male element, becomes the female egg, while the latter, which has a portion of the female nucleus only, becomes a male egg. Both kinds of eggs, once the sex-determining division has taken place, grow rapidly, absorbing and building up into themselves other immature egg cells with which they come into contact, and in which the divisions of the two portions of the male and female nuclear substance have been equal. The outcome of this process is that the female egg is fertilised, but the male egg is not fertilised in the ordinary sense of the term; but it is impossible to speak of it as really unfertilised, as it has been directly under the influence of the spermatozoon in all the oogonial divisions previous to the sex-determining one. It is only in the late stages, shortly before the female egg is laid, that the two parts of the nucleus fuse beyond recognition.

Prof. C. J. Patten discussed the vernal-plumage changes