### POLARIZATION OF GLOBIGERINA

On examining a group of ancient microscopic slides of modern foraminifers it was found that they polarize very beautifully, showing with plane polarized light several concentric circular spectra and a very clear black cross with broad bands and a broadened central area. This appeared most perfectly with globigerina, the young forms with but a single globe showing most perfectly. In the larger forms each half enveloping globe shows the same phenomena very clearly. The spectral rings are crowded toward the edge of the sphere and the explanation is clearly that the hollow sphere is in effect a circular wedge with its thinnest part at the center and becoming thicker radially, at first gradually and at last much more rapidly.

It was found also that minute valves of a bivalve, in shape like a quahog, would do exactly the same things only the rings were pear-shaped with a projection at the beak of the shell and broader and brighter. It was clear that the very sharp black cross was due to the fact that the outer layer of the shell is fibrous and we may deduce that the similar black cross in the globigerina is due to a minute fibrous structure in the shell of the latter.

Thin plates of the inner mother of pearl layer of *Margaritifera* and *Pinna* polarize brilliantly and give the lemniscate of a negative biaxial mineral with the axis at right angles to the layers, and so the mineral in all these cases is doubtless aragonite.

The smaller species of deep sea *Globigerina* show all this most beautifully and are a convenient object to demonstrate the stationary black cross and the higher order spectra in concentric rings. The silicious forms, Diatoms, Polycistina and sponge spicules do not polarize. This is true of the marine sponges like *Aspergillum* and *Euplectella,* but the freshwater sponge *Grantia* from the ponds around Amherst polarizes very strongly.

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### THE TEACHING OF THE HISTORY OF SCIENCE

To the Editor of Science: In his interesting and valuable paper on "The Teaching of the History of Science" published in Science, November 26, 1915, Mr. Brasch calls attention to early courses in this subject which were given at the Massachusetts Institute of Technology, referring particularly as one of these to a reading course on the history of the physical sciences laid out as a requisite for graduation in the course in physics. The date which he mentions for its institution is 1887.

In fact, however, its beginning was much earlier. The writer from the outset of his work as a teacher had recognized the surprising lack of perspective existing among college students, but chiefly on account of the great pressure upon the teaching staff which existed here as everywhere, it was not possible at the time to institute a course of oral lectures upon the subject and the best that could be done was to lay out a suitable course of required reading, which was necessarily limited to physical science. This reading course was established at a considerably earlier date than that mentioned by Mr. Brasch, and is found set forth in the Catalogue of the Institute for 1880–81 in the scheme of studies leading to a degree in physics. A required reading course upon the logic of scientific investigation is also referred to in the same scheme.

A similar course on the history of the natural sciences is referred to in the same catalogue of the Institute in the scheme of the course in natural history.

C. R. Cross

## SCIENTIFIC BOOKS

*British Ants, Their Life-History and Classification.* By H. St. J. K. Donisthorpe. Plymouth: Wm. Brendon & Son, Ltd., 1915. Pp. xv + 373, 18 pls. and 92 text-figs.

In this attractive volume we are given for the first time an exhaustive monograph of the ant-fauna of Great Britain, the result of many years of patient labor by one who served his biological apprenticeship as an ardent student of myrmecophiles. The volume serves also as a useful manual for the study of ants in general since it contains concise chapters on the anatomy, development and behavior of ants and the methods of keeping and studying

them in artificial nests. Naturally the greater portion of the work is devoted to a detailed account of each species known to be indigenous to Britain, under several heads, beginning with the original description, the synonymy, a good modern description and the geographical range, and ending with full ethological notes and a list of the myrmecophiles that have been taken in the nests of each form. The synonymy has been compiled with great care and from many old and obscure sources, often inaccessible to the American student. The work concludes with a list of species introduced into Britain, compiled in great part from scattered records of specimens taken in the hothouses of Kew Gardens and in dwellings, lumber yards, etc., in other parts of the islands. Among these introduced ants are a few dangerous pests, notably the Argentine ant (*Iridomyrmex humilis*), which was found "in vast numbers in a house in Windsor Park, Belfast, in 1900, where it had been observed for eighteen months," and in the Botanic Gardens of Edinburgh in 1912, and *Pheidole megacephala,* which in many tropical regions completely destroys all insects in its environment, except the Coccids, and disseminates and attends these to the great injury of many kinds of cultivated plants.

One is surprised to find the indigenous ant-fauna of Great Britain so meager compared with that of continental Europe. Only 40 forms are recorded by Donisthorpe, comprising 28 species, 14 subspecies (often ranked as species) and 8 varieties, representing only about one third of the central European fauna. Switzerland, a much smaller area than Great Britain and one which has been very carefully explored by Forel, has 116 indigenous Formicidæ, comprising 63 species, 17 subspecies and 36 varieties. The British fauna not only lacks any species peculiar to itself, but is also deficient in a whole series of genera and subgenera known to occur in Central Europe (*Strongylognathus, Harpagoxenus, Temnothorax, Neomyrma, Crematogaster, Pheidole, Messor, Aphænogaster, Dolichoderus, Bothriomyrmex, Plagiolepis, Polyergus, Camponotus* and *Colobopsis*). Most surprising is the absence of any species of the great cosmopolitan genus *Camponotus* in Great Britain. The carpenter ant (*C. herculeanus*), which is common throughout the northern portions of North American and Eurasia, could hardly be expected to be absent, but Donisthorpe shows that all records of its indigenous occurrence in Great Britain are very dubious. Some of the continental genera such as *Strongylognathus, Harpagoxenus, Bothriomyrmex* and *Polyergus* are rare and parasitic and it is very doubtful whether they will ever be found in the British Isles. Nevertheless, the singular parasitic *Anergates atratulus* was not discovered there till 1912, when it was taken by Crawley and Donisthorpe in New Forest, Hants.

Donisthorpe does not consider the interesting questions suggested by the relations of the British to the continental ant faunas, especially the reasons for the depauperate condition of the former, for not only are there few species in Britain, but these are represented by comparatively few colonies and therefore individuals. Insular ant-faunas in nearly all parts of the world are small, either because many islands are of too recent geological origin to have received many species by immigration (*e. g.,* Cuba and other West Indian Islands), or because their original Mesozoic or early Tertiary faunas have been greatly depleted or entirely obliterated by glaciation. Thus Iceland is entirely destitute of ants, and the ant-faunas of Great Britain and New Zealand are undoubtedly the meager survivors of glaciation. But when we consider that both of these regions have mild, temperate climates and an abundant vegetation, we find it more difficult to understand why the small number of surviving species is not represented by a great number of individuals, especially when we remember that Australia, North Africa and North America, which are, at least in part, much more arid and may have more severe, continental winters, nevertheless, have abundant ant-faunas. A consideration of such facts seems to indicate that moist, cloudy, cool temperate climates are very unfavorable to ants and that this may account for the meager

development of individuals in Great Britain and New Zealand. Even on continents we may notice the same dearth of ants in cool, humid regions, as, *e. g.*, in the Selkirk Mountains of British Columbia as compared with the Rockies of Alberta. The former mountains, which are very humid and covered with a rich vegetation, have a much poorer ant fauna than the latter, which are drier and have a more meager flora, though sufficiently moist and warm to afford optimum conditions for ants during the summer months.

In addition to a great amount of taxonomic and purely descriptive material Donisthorpe's book contains many original observations on the behavior of ants, especially in the sections devoted to the species of *Lasius* (notably *L. fuliginosus* and *umbratus*) and the blood-red slavemaker (*Formica sanguinea*). The illustrations are excellent and abundant and, with few exceptions, have been specially prepared for the volume. Most interesting are the figures of the gynandromorphs and ergatandromorphs of *Formica rufibarbis, F. sanguinea* and *Myrmica scabrinodis* (Pl. IV. and Figs. 45 and 46) and of the mrymithogyne of *Lasius flavus* (Fig. 47).

The only matter open to criticism in the volume is, perhaps, Donisthorpe's too hasty adoption of the generic name *Donisthorpea* for *Lasius*. The genus *Lasius* was based by Fabricius in 1804 on *Formica nigra* L., the common garden ant, one of the most abundant insects of the northern hemisphere, and since that date universally known, both in technical and popular literature, as *Lasius niger*. In 1914 Morice and Durrant exhumed a paper by Jurine published in 1801, in which the name *Lasius* was assigned to a genus of bees. The authors therefore renamed the ant-genus *Donisthorpea*. It seems, however, that there is serious doubt concerning the status of Jurine's paper, so that we need not be in a hurry to make this deplorable change in our nomenclature. At any rate, it will probably be difficult to persuade the majority of living myrmecologists, including Forel, Emery and the reviewer, to substitute *Donisthorpea nigra* for *Lasius niger*, a name which for more than a century has been almost as much of a household term as *Musca domestica, Equus caballus* and *Canis familiaris*. W. M. Wheeler

## SPECIAL ARTICLES

### THE IMPORTANCE OF BACTERIUM BULGARICUS GROUP IN ENSILAGE

This department has been investigating the microbial flora of different kinds of ensilage at various stages of fermentation throughout the past year. The presence of *Bacterium Bulgaricus* group was first observed from the preliminary examinations of miscellaneous samples of ensilage. Since that time several hundred bacteriological analyses have been made from different kinds of ensilage, and at all stages of fermentation. The results obtained offer sufficient evidence to indicate the importance of this *Bulgarian* group in the ripening of normal ensilage. In a review of the literature relating to microorganisms of ensilage, only one reference[1] could be found which mentions the presence of *Bacterium Bulgaricus* group. The reference in question cites ensilage, along with many other substances, only as a source from which *Bacterium Bulgaricus* has been isolated.

Plate cultures, made upon acidulated glucose agar, were used for the cultivation of this group. The acid (1 cc. of a 1 per cent. sterile acetic acid solution) was added directly to the plates and mixed with the glucose agar when the latter was poured into the plates. The cultures were incubated at 35°C. for four days. The media permitted the growth of practically only two groups of microorganisms; the "*acid group*" and *yeasts*. The colonies of the latter were always few in number, if present at all, and with a little practise could be easily differentiated from the *Bulgarian* group.

The *Bulgarian* colonies showed varying degrees of size and form. In size, the colonies appear as very minute forms scarcely visible to the naked eye, to a type as large as the average lactic acid colony, and often larger.

In form, the characteristic "woolly edge" colony was frequent, but the predominating type was very similar to the common *Bac-*

[1] "A Study of *B. Bulgaricus*," P. G. Heinemann and M. Hifferan, *Jour. Inf. Diseases*, Vol. 6, No. 3, June 12, 1909.