

gallery of geology has been opened, and the famous series of Lias and Inferior Oolite ammonites in the Tatcher Collection classified and labelled. Popular study of botany has been encouraged by the wild plant table throughout three of the seasons, while even winter had its offering of displays of twigs. British birds and their nests have been prepared for exhibition, while for students accessions include skins of mammals and birds from the region and the Marle collection of shells, many from the district.

The work of the department of archæology ranges from salvaging small Romano-British relics to erecting "an unclimbable fence" around the Roman villa at Kings Weston, and one wonders if there is any connexion between this and the reference to the unruly behaviour of certain young visitors on Sunday afternoons—a time-honoured complaint that belies "The better the day, the better . . .". Bristol played its part during the year by organizing an administration course for students for the Museums Association diploma, and in its turn sending members of its own staff to technical courses elsewhere. Twenty major temporary exhibitions were staged in the Museum, 3,420 cases of specimens were circulated to schools, etc., and 8,118 children attended for lessons—an entirely creditable performance.

The little handbook to Stratford Mill, costing sixpence, gives on art paper some five pages of text on the history and mechanism of corn-mills in general, and this one in particular, together with a photograph of the mill on its new site and an attractive drawing of its working parts. May we have others on the thatched dairy and the gypsy caravan?

BLUE HILL OBSERVATORY OF HARVARD UNIVERSITY

THE report of the visiting committee to the Blue Hill Meteorological Observatory, Harvard University, Milton, Mass. (Reprint No. 7, 1953), includes the activities of the Observatory over the previous five years. During this period the facilities of the Observatory have had many users, among which may be noticed not only students working on research problems but also a number of Harvard departments, the United States Weather Bureau, the United States Air Force, the Massachusetts Institute of Technology, Clark University, Illinois State Water Survey, American Meteorological Society, Woods Hole Oceanographic Institution, Mt. Wilson Observatory, the Lowell Institute's Cooperative Broadcasting Council Station *WGBH*, and various business corporations and local towns.

The work of the Observatory staff is concerned with the following topics: evaluation of the Blue Hill and other climatic records, especially as indicators of climatic change; development of statistical aids to the forecasting of snow-storms for Greater Boston; designing and comparing station equipment and exposures; researches concerning clouds and the physics of precipitation; training of graduate students; and improvement of the library and its service. A very complete and mostly automatic record of the weather has been kept since the winter of 1884-85, when it was started by Abbott Lawrence Rotch. A record kept of the temperature in Milton by the Rev. A. Breck from 1849 has supplied further

data on temperature conditions, and it appears that during the past hundred years there has been a remarkable amelioration of the climate. In recognition of the value of the Observatory's current work on climatology, the United States Weather Bureau is supplying it with standard instruments, broadcasting its monthly data and publishing its records. Under instrumentation is included an account of the work of Dr. Wallace E. Howell and Mr. John H. Conover in designing and testing new instruments for Blue Hill and other institutions. In research on clouds and precipitation, work was carried out at Blue Hill before Schaefer's experiment in November 1946 of dropping solid carbon dioxide on a cloud of supercooled droplets to make snow, and a month after this Dr. W. E. Howell successfully repeated the experiment on Mt. Washington.

Finally, mention must be made of the Observatory's Library, which is widely used by professional meteorologists all over the country, but particularly in the large group in Boston; so great has been the demand for the Observatory's research publications that Blue Hill has always received on an exchange basis the publications of weather services, universities, research stations or institutes and individuals from all over the world.

THE COLLECTION OF DATA FROM FIRMS

THE research workers who need to collect data from firms cover a wide range of studies and use the data for many different purposes. As, nevertheless, they have many difficulties and problems in common, the Acton Society Trust held a conference on April 28 on "The Pitfalls in the Collection of Data from Firms", at which twenty-three research workers attended, drawn from universities, national research organizations, government departments, co-operative research associations and private industry. They included economists, psychologists, sociologists, statisticians and some whose particular speciality it would be hard to define.

After the formal opening of the conference by Mrs. Honor Croome, Dr. T. E. Easterfield (Department of Scientific and Industrial Research) opened the first session with a discussion of some of the main sources of error in data obtained from firms. The firm's own records may not be kept correctly, or may be kept in a form suitable for its own needs but misleading to the research worker. Information supplied in reply to questionnaires is particularly unreliable, as even the simplest question may not fit every case and may be misunderstood in many different ways.

The second morning session was opened by Mr. Stafford Beer (Samuel Fox and Co.), who spoke of the pitfalls found in data by workers doing research inside industry. Many seemingly excellent data are derived from notebooks and scraps of paper filled up by the semi-literate. Measurements may be given a misleading appearance of accuracy by being recorded to too many significant figures. Nomenclature may also be misleading, the same words being used in different senses in different places. But the worst source of error is the pure blunder: Mr. Beer himself recently reached some quite wrong conclusions by analysing a column giving furnace numbers under the impression that it gave the number of ingots in

the furnace. The best way of avoiding these errors, he said, is to record the data oneself, or to control the recording. This makes it especially necessary for the research worker to have technical knowledge of the industry he is studying. Mr. Beer thought the use of automatic recording devices to be necessary if human error is to be eliminated.

In the afternoon, Mr. W. F. Luttrell (National Institute of Economic and Social Research) described his methods of collecting economic data. He said that the sending of questionnaires is useful only for collecting figures already kept in an agreed form, and even then visits to firms are often necessary. In all other cases data must be gathered personally. Mr. Luttrell starts to work in a firm by making a list of all the records which can possibly bear on the matter being investigated. Where the records do not show what is wanted, it is often possible to get it from the notebooks in which the data were first recorded; but these may have been destroyed. The notebooks are also useful for test checks—to show how the records derived from them are compiled. The cost records of firms are seldom suitable for research as they stand; it is quite common, for example, for overhead costs to be allocated in an arbitrary and distorting way, perhaps by a fixed percentage addition to labour costs. A further source of bias is the greater readiness of firms to give information about successes than about failures. The last session was opened by Mr. J. D. Handyside (National Institute of Industrial Psychology), who stressed the large amount of work involved in the various methods of avoiding errors suggested by other speakers.

The conference as a whole showed that a methodology of research on industry has grown up which cuts across the normal boundaries of a number of disciplines. It also showed that the data produced by industry to-day are not sufficiently accurate to be worthy of the elaborate methods developed by theoretical statisticians.

SIPHONOPHORA OF THE INDIAN OCEAN

STRUCTURE and taxonomy of the Coelenterata continue to interest zoologists even in this period when the concern of the majority is experimental. Since the War three major monographs have been published in Great Britain alone. The life-work of the late Cyril Crossland culminated in his report (edited by A. K. Totton) on the Madreporaria, Hydrocorallinae, Heliopora and Tubipora of the Great Barrier Reef Expedition. Following in the footsteps of Ellis, Forbes, Allman, Hincks and Browne, E. S. Russell has produced his admirable "Medusae of the British Isles". Now A. K. Totton renders no less service by the work here reviewed*.

Opportunity has been taken not only to study and report on collections made by the *Discovery II* in 1935, 1950 and 1951, but also those made by the *John Murray* and other expeditions since 1933, eight collections in all. We gain some idea of the labour involved, and so of the stimulating enthusiasm

* *Discovery Reports*. Vol. 27: Siphonophora of the Indian Ocean, together with Systematic and Biological Notes on Related Specimens from other Oceans. By A. K. Totton. Pp. 1-162 + plates 1-12. (Cambridge: At the University Press, 1954.) 60s. net.

inspired initially by study of H. B. Bigelow's 'Albatros' Report on the Siphonophora. "For many years now", the author informs us, "I have been occupied with the laborious task of picking out hundreds of thousands of fragmentary specimens from plankton samples and of trying to form some idea of how many species are represented, and then attempting to apply old specific names and, where none are available, giving new ones". And again, "One may search for a very long time before being lucky enough to find a really well-preserved specimen, or a larval or other much desired stage, of some particular species. . . . There is also the inherent difficulty of dealing with fragmentary specimens. Again, many of the species occur in two phases. . . .". Meanwhile in the *Discovery* collections alone there are thousands of still unexamined plankton hauls.

The suspected wide distribution of Siphonophores is confirmed; no species would appear confined to the Indian Ocean or, apart from purely antarctic species, excluded from it. There is great restriction of species within the Red Sea, as there is in the Mediterranean in comparison with the Atlantic, and probably for similar reasons, namely, outflow of deep water over the sill and high minimum temperatures in deep water.

Attempts to interpret the extraordinary complexity of structure in the Siphonophores, on the success of which must depend final conclusions about classification, raise what are among the most perplexing, if not *the* most perplexing, problems in zoology. The fantastic development of polymorphism probably involves, apart from precocious budding, both neoteny and early manifestation in ontogeny of structures or individuals which appeared late in phylogeny. Totton pays tribute to the morphological acumen of Garstang, who made fundamental contributions by revealing that the 'medusome' theory of Haeckel is untenable and that the pelagic habit of the Siphonophores probably represents prolongation of an actinula-like larval phase.

Unfortunately Garstang failed to realize the extent of the dissimilarity between the Chondrophora (= Disconanthae) comprising *Velella*, *Porpita* and *Porpema* and the Siphonophora (= Siphonanthae). As Totton clearly shows, these represent distinct orders, not suborders. The former are really floating Tubulariid hydroid-phases of inconspicuous Codonid medusae. The ancestral Siphonophora, on the other hand, had probably a larval polypoid stage and an adult medusoid stage, both, in various structural manifestations, eventually making simultaneous appearance in the same colony.

This is a beautifully produced report, admirably illustrated by text-figures and plates, a credit alike to author and to publisher. C. M. YONGE

THE CYTOCHROME *b* COMPONENT OF CHLOROPLASTS

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DAVENPORT¹ isolated etiolated chloroplasts from barley seedlings grown in the dark and observed in them the spectrum of cytochrome *f*. As the chloroplasts in this case are developed to a size