

PROGRESS IN COSMOLOGY

Cosmology

By H. Bondi. (Cambridge Monographs on Physics.) Pp. ix+179. (Cambridge: At the University Press, 1952.) 22s. 6d. net.

IN his presidential address to Section A (Mathematics and Physics) of the British Association in 1888, G. F. FitzGerald suggested that "a successor in this chair might well devote himself to a review of the cosmical theories propounded within the last few years". He added, "The opportunities for piquant criticism would be splendid". Since there seems never to be lacking a supply of these theories produced "within the last few years", there is naturally not lacking a number of men of science still sharing FitzGerald's attitude towards them.

Criticism there must, of course, be. But the important thing is that general progress is being made in the study of the large-scale problems of the physical universe. Observational evidence is accumulating; this in itself is almost inevitable, but there is also progress in appreciating its relevance and significance from a general physical point of view apart from highly specific theories. On the side of the theories themselves, much has been learned that could be discovered only by the actual working out of the results of their attempted application to the cosmological problem; each serious new theory seeks to overcome the difficulties encountered by its predecessors. In the course of the work, much has been learned, too, about various general physical theories as such, apart from this particular application. Some theorists would claim that fundamental insight has been gained into the origin of laws of Nature. Above all, the main problems to be solved in cosmology are becoming more and more clearly formulated; and, though the theories differ greatly in their ways of getting results, when due regard is paid to the features common to the results themselves, definite progress towards the solution of some of these problems can undoubtedly be claimed.

As a masterly account of this whole state of affairs, it is hard to imagine anything that could be better than Mr. H. Bondi's book. By the exercise of the greatest skill in marshalling his material and of the utmost clarity of expression, he succeeds in making his account effectively complete without any sense of undue compression. Also, he does not shirk the exposition of what is essential in the technicality of the work, while always giving primary attention to the concepts involved.

Though scrupulously fair to other theories, Mr. Bondi naturally states his preference for the "steady-state" theory of cosmology, with its concomitant hypothesis of the continual creation of matter. This theory was originated by him and T. Gold in 1948. They did not claim that it *must* be correct, but Mr. Bondi points out the extreme epistemological difficulty in the way of any fundamental progress if it is found to be false. Actually, it does seem to give a better account of the large-scale behaviour of the universe than does any previous theory. However, it encounters the obvious trouble that the universe does not conform strictly to the "perfect cosmological principle", from which the theory is derived, though there is no evidence that it does not conform statistically. F. Hoyle's alternative approach, originally published about the same time, is more satisfactory from this point of view, but Hoyle was

not so concerned to deal with the epistemological situation. All this is clearly explained in the book.

It seems to me that the relationship between the procedures of Bondi and Gold and of Hoyle indicates the way in which further progress may be expected. They illustrate the "deductive" and "extrapolating" procedures so well distinguished by Mr. Bondi (p. 5). Whereas in the past this distinction has been ill-recognized and has resulted in fruitless controversy, we now have an instance of the procedures tending to consistency. A fundamental examination of the conditions for consistency of the two types of procedure is required and may yield the next advance.

W. H. MCCREA

AMPHIBIANS OF WESTERN NORTH AMERICA

Amphibians of Western North America

By Robert C. Stebbins. Pp. xvii+539 (64 plates) (Berkeley and Los Angeles: University of California Press; London: Cambridge University Press, 1951.) 56s. 6d. net.

IT is refreshing to find an author who makes no pretensions to writing for the benefit of some section of his fellow men, but says with simplicity, "I have put into the volume what I have wanted to know . . .". The result reveals Mr. R. C. Stebbins as a naturalist, and for anyone who, like him, wants to know not only what amphibians occur in western North America but also, and above all, how and under what conditions they live, the book provides a great many answers; it also provides a wealth of comparative information for others of similar bent but concerned more directly with other geographical regions.

As a member of the staff of the Museum of Vertebrate Zoology of the University of California, the author is an experienced taxonomist, and the framework of the book is the taxonomic arrangement of the animals. There are keys, accompanied by explanatory diagrams, for the identification of the animals both as adults and larvæ. Species and subspecies are described and figured, and their general and local distribution indicated and mapped. Then, for each form, there are extensive notes on its behaviour, habitat, food, reproduction and so forth. These notes are based on the author's personal observations or are taken from impeccable sources, many of them hitherto unpublished. Twelve plates show typical habitats, and there is a glossary of technical terms as well as an index.

No book of this kind can satisfy everybody. Those whose interests are mainly ecological will doubtless regret the absence of physical data relating to the different types of habitat, information regarding predators, parasites and so on. Others, more taxonomically inclined, will wish that more had been said about the very interesting phenomenon shown by the salamander *Ensatina eschscholtzi*, where the end-terms of two subspecies chains, deriving from a common stem, meet and behave as distinct species; that more, too, had been said about the discontinuous distribution of *Ambystoma tigrinum* and its causes; and that genera and subgenera had been less capriciously treated. But apart from such matters of scope and emphasis, there are few serious defects for criticism. The segregation of the illustrations of the larvæ and of the distributional maps away from the

main accounts of the species has the advantage of facilitating direct comparisons but little else to recommend it. Some may also find it a nuisance that habitats are sometimes described in terms of life-zone concepts (for example, Sonoran, Hudsonian, Arctic Alpine) that are not defined in the book, rather than in terms of the natural vegetation the distribution of which is mapped (Plate 47).

There can be no doubt of the quality of this book with its reliable information and excellent illustrations, and equally there can be no doubt that its publication will stimulate studies that must result in an increased knowledge of a group of animals still relatively little known.

H. W. PARKER

SCIENTIFIC PRINCIPLES OF FURNACE TECHNOLOGY

The Science of Flames and Furnaces

By M. W. Thring. Pp. xiv + 416. (London: Chapman and Hall, Ltd., 1952.) 42s. net.

THIS book is a useful contribution to the scientific study of flames and furnaces, a subject in which a fairly extensive background of applied science already exists, but is not readily accessible to the average reader of the subject. Furnace design is a somewhat specialized subject, and furnace practice is almost every industrialist's concern. Nevertheless, the systematic treatment of the subject in text-books has been curiously enough neglected. It would be unfair, however, to claim that furnace technology is therefore backward, though frequently such criticism of modern furnace development has been heard. In point of fact it is commonly the rule in the technology concerned with the development of valuable industrial plant that practice is in front of the text-book exposition of the subject. In the present case, however, as the title of the volume indicates, the author is concerned with the science rather than with the technology of the subject.

The introductory chapters are devoted to the heat liberation from the flame and the subject of heat transmission. Novel features deal with the interpretation of the second law of thermodynamics in terms of what has been called the 'virtue' of a system's energy, and a more than usually complete treatment of the subject of flame radiation. One doubts whether the introduction is necessary of such special terms to define the obvious value of the heat potential of the fluid above the levels of temperature in the furnace. Indeed, such may even lead to confusion of ideas. Useful summaries of recent experimental work in furnace investigations, in heat transmission and in the determination of thermal constants are given. These constitute perhaps the most valuable features of the work. Again, under the somewhat pedantic title of "Aerodynamics of Hot Systems" are included those sections of the work which describe the science of draughting of furnaces and of jets of hot gas. This chapter comprises a good collection of references, but resembles so much a series of notes and mathematical formulæ, signs of a worthy effort to collect as much information as practicable into a limited number of pages, that the reader is left with the feeling that for an effective understanding of the subject he must still consult the original papers. The chapter purporting to cover the science of furnace construction

is mainly devoted to refractory and insulating materials. It is so condensed that it serves only to give guidance to a very limited series of references.

The final chapter on scientific method is a valuable and suggestive one.

The paragraphs are numbered in the manner of the Cambridge mathematical texts. It is doubtful if the average reader takes much notice of the numbering, but he will profit from the useful summaries at the ends of the chapters. This may in some degree compensate for a somewhat meagre index. The book is well produced, the printing clear, and the illustrations legible.

ORNITHOLOGY OF THE CHANNEL ISLES

The Birds of the Channel Islands

By Roderick Dobson. Pp. xvi + 263 + 25 plates. (London and New York: Staples Press, Ltd., 1952.) 30s. net.

IN the middle of the last century a great change began to take place in the use of the land in the Channel Islands, owing to the development of early fruit and vegetable growing for the London market. This necessitated the cutting down of orchards to make room for glass-houses, the draining of wet ground, and clearing of rough areas for early potatoes. Unfortunately there is little information as to the status of the resident species, or summer visitors, previous to 1866 when Cecil Smith published his "List of Birds . . . Summer Visit to the Channel Islands, exclusive of Jersey", which was amplified in his "Birds of Guernsey" (1879). Some species have ceased to breed owing to the increased utilization of the land, and others from some unknown cause. The choughs, for example, were common in Guernsey in 1878, in Alderney they ceased to breed in 1876, in Jersey in 1880, and in 1929 a pair were seen in Guernsey—the last record for the Channel Islands. In the British Isles the increase of jackdaws is sometimes blamed for the decrease of the chough; but in the Channel Islands jackdaws were never very abundant and have now decreased, and only a few nest in the western half of Jersey.

It is interesting to note that during the German occupation carrion crows, which in the breeding season were formerly confined to the cliffs, began to nest in woods and trees inland. This was owing to all the farmers' guns having been confiscated. During the same period the Germans felled many of the tall trees in the sheltered valleys, with the result that in a year or two the undergrowth increased and black-caps and garden-warblers began to nest again, which they had not done for many years. On the cliffs and rocky islands around Guernsey and the other main islands, many kinds of sea-birds breed and, during the Second World War, an additional species—the gannet—established colonies on the rock of Ortac and Les Etaes, off Alderney.

The information about each species is arranged in this book under the four largest islands, and in some cases the available information is rather meagre; nevertheless this is a valuable contribution to the ornithology of the Channel Islands, and no doubt in a future edition there will be many additions to the list of species, especially among the migrants. There are a number of photographs of various birds, nests and well-known breeding places.