Book Reviews

Dictionary of Physics

The Encyclopaedic Dictionary of Physics. vols. 4–7. J. Thewlis, Ed. Pergamon, London; Macmillan, New York, 1961–62. $298. [For set of nine volumes, announced for publication. Volumes 1–3 were reviewed by Villars in *Science* **136**, 867 (1962). The index (vol. 8) and the multilingual glossary (vol. 9) are still not available.]

Now that all seven text volumes of the *Encyclopaedic Dictionary of Physics* are available and can be considered as a unit, one may well begin a review of them with this question: Is such a dictionary useful? The price of this massive work will encourage only a few individuals to purchase it, so we think of seeing it mainly on the shelves of libraries—of colleges, universities, research institutions, and perhaps public libraries.

A potential user is likely to be one who seeks information that lies within one of the following categories: (i) material that will refresh his memory on a special subject in an area with which he is generally familiar; (ii) information in a field he does not know (for example, the definition of a technical term, concept, or method); (iii) references which will introduce him to a new specialty, together with a suitably short description of the important concepts, methods, facts, and problems of that particular field, and references for more detailed study.

Easy access to exactly the kind of information that one wants is unquestionably a prime requirement that such a dictionary should satisfy. The index volume (volume 8, which is still not available) will be the key to this dictionary. Indeed, the index will have to carry the burden of guiding readers; cross references in the text are very sporadic and totally inadequate by themselves.

Clearly it is easiest for a dictionary to satisfy the reader's requests for information in the first category—material that will refresh his memory on a known topic; all this reader wants is a reasonably self-contained presentation of a very limited subject. An excellent example of such a presentation is the two-page article entitled "Viral theorem," which clearly describes the subject and its application in classical and quantum physics and also supplies references to further details. Not every subject fares as well; the information given in some instances is both irrelevant (or inaccurate) and misleading—for example, see the entries "Rotational levels of nuclei" and "Rigid rotator."

The purely mathematical articles appear to be much more uniformly well written than the others; luckily the areas of mathematics relevant to physics are relatively well defined. By contrast, one is impressed by the extent to which the allotment of space, and the level of presentation of the various parts of "physics" and all its allied fields, is a matter of painful choice. I find the hard core of fundamental physics, on which our basic understanding of phenomena rests, badly underrepresented in this dictionary, especially in the area of modern physics; this gives the work a somewhat old-fashioned appearance. One appreciates the two-page treatment, "Perturbation theory in classical mechanics," but why does quantum mechanical perturbation theory receive less space? To separate the irrelevant from the important must be a difficult task indeed. But, in physics, there should be no question that the important things are the facts of nature, on the one side, and the conceptual structures that have been built to reduce and "explain" these facts, on the other. There is no need in this work for the article "T.N.T. preparation." To devote 56 pages to nuclear reactors is fine, but the same number of pages on the subject photography is excessive.

Let us now consider a reader's request for information in either of the other categories—information in less-known territory. The basic difference is that this reader may not know exactly what he is seeking; thus, the presentation of the material, in the index and the text entries, should channel him to his goal.

There is one peculiar feature of this work which may disturb the reader, even when he has the index available: a looseness in the organization of the dictionary allows the same material to be presented two or three times under different headings, without any apparent correlation—for example, the electric properties of matter are discussed in the section "Dielectric constant," then again under "Permittivity and dielectric loss," and again under "Polarization of matter." Undoubtedly a single, more complete article would be the better way to treat the material. And one finds Euler's equations under "Euler's equations" and again under "Rotating bodies." There are many other examples of redundant presentation, even where it easily could have been avoided. Is the hapless reader then forced to read all of these presentations and to take his choice? Also, these users will find that the basic "survey type" articles are generally too short, too inadequate (not up-to-date), or missing altogether. The entry entitled "Optics" correctly attempts to give a survey of the subject but is too short. The entry entitled "Thermodynamics" is similarly inadequate, and Planck (1927) is the most modern reference cited. There is no entry for solid-state physics; perhaps it is assumed that everybody knows what this is.

These remarks are not intended to veil the fact that there is a staggering amount of information available in this work. A short sample of a sequence of entries may give an idea of what is offered: "Karman vortex sheet"; "Katabatic wind"; "Kata-thermometer"; "Katharometer"; "K beta factor"; "Kelvin contraction theory of the stars"; "Kelvin theorem"; "Kepler's laws"; "Kernel functions in nuclear reactor calculations"; "Kerr effect"; "Keto enol tautomerism"; "Ketone"; "K gamma factor"; "Kick sorter"; "Kikuchi lines"; and "Killer, in luminescense."

There is great wealth, but it is too loosely organized; a stricter coordination of the material, the use of cross references in the text, and a rigorous

insistence on up-to-date references to the available literature would have enhanced the value of this work. And much will also depend on the organization of its key—the not-yet-available index.

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History of Biology

The Science of Life. A picture history of biology. Gordon Rattray Taylor. McGraw-Hill, New York, 1963. 368 pp. Illus. $9.95.

The Science of Life is basically a picture book. The illustrations are varied and numerous and average about one to a page. No other history of biology has been so copiously illustrated. Sixteen of the pictures are full-page color plates; the others, in black and white, range in size from whole pages to small figures stuck in the margins. The pictures are clearly reproduced and, on the whole, well chosen. They include, of course, many of the familiar figures, well known to all historians of biology, but they also include many that are refreshingly novel. Unlike our standard histories of biology, *The Science of Life* does not end at some arbitrary date, but the coverage is extended almost to the present—to within a year or two of the time the book went to press. A number of the illustrations are very recent, and photographs of some of our better looking contemporaries are included.

The pictures are accompanied by a text that is replete with odd facts. The mere quantity of information assembled here is extraordinary. Much of the material, however, is trivial and could have been omitted from serious intellectual history, but to condemn the author for including the trivial is to miss the point. The work is not aimed at the academic historian or the professional biologist. It is intended rather for the well-read amateur or even for the beginning student of biology; thus, it meets a real need. A beginning student, introduced for the first time to a history of his science, is often confronted with a mass of unfamiliar names, each of which he must connect with some small event or advance in his subject. Whether the student retains the connection often will depend on a mere memory of words. Oddities and unusual incidents related to historical figures are excellent mnemonic devices, and they can be very helpful, if one has examinations to pass.

The author's own interests seem to be concentrated on the personalities of the biologists but, in a work of this kind, this is an asset rather than a liability. No matter how greatly the author may have emphasized the personal idiosyncrasies of his subject, or how gay and carefree he may have depicted them as being as they went about their work, he does describe the work itself, and he does fit the discoveries into the growing mass of biological information.

The book contains any number of minor and unimportant inaccuracies, which any biologist can recognize, but these can be corrected easily in future editions. However, a more serious consideration arises, for *The Science of Life* is intentionally very elementary. The question is: how shallow must an elementary text be? Here, the very clarity of the writing makes the shallowness stand out vividly. Many interpretations and explanations of biological principles are definitely below the undergraduate level. Incidentally, the dust jacket tells us that the author "is a writer who illuminates contemporary society by interpreting it in terms of new findings in science."

It should be emphasized that the three illustrative, light-weight passages which are cited below, and others like them, set the tone of the whole. The first passage deals with the transition from a belief in special creation to the acceptance of evolution: "And it was the fear of such a change which lent bitterness to the rejection of evolutionary ideas, and which made the work of Lyell and the geologists alarming to the propertied classes. Equally it was this which made them so attractive to the poorer classes" (p. 142).

Here we have a stance—one not entirely divorced from political overtone —that was much more popular 20 years ago than today. It now seems rather dated, at least in the United States, although it may have lingered longer in Britain.

Our second example is from the description of Morgan's discovery of linked genes that are also sex-linked. Taylor writes: "At first Morgan's results were greeted with a customary incredulity. It all seemed too neat" (p. 323).

On the contrary, Morgan's results were greeted with enthusiasm and even with some excitement. In fact, linkage had been reported some years earlier. Morgan simply found experimental proof for an hypothesis originally proposed by T. Boveri, and in so doing converted himself to the chromosome theory of heredity. Taylor, however, has routinely followed the stereotype that depicts new discoveries as being resented and rejected by the bad, conservative majority of biologists, who did not want to be disturbed by the new advances. In this book, it is very easy to separate the "goodies from the baddies." No one need be puzzled.

One final example. Fleeming Jenkins stated that the variations, which Darwin had relied on as raw material for nature to select, would be diluted whenever the variant bred back into the general stock and that this dilution would slow up evolution indefinitely. Here Taylor writes: "In this dilemma, Darwin lost his nerve, and began to insert little Lamarckian loopholes into the new editions of his works" (p. 165).

As this evaluation of Darwin's reaction has become a rather popular cliché, it deserves a little of our attention. From the beginning, Darwin had accepted the inheritance of acquired characters and had relied on it as an ancillary factor to his hypothesis of natural selection. A generation would pass before the inheritance of acquired characters would have to be abandoned and before Mendelism, which would answer Jenkins' objection, would be discovered. Darwin's action was reasonable, in view of what was known at the time, and it indicated not that he had lost his nerve but that he had retained his intellectual honesty. For Darwin to limit himself to explaining evolution by natural selection, at a time when natural selection would not explain it adequately, would have required more dogmatism than intelligence.

The fact that a reviewer could have a field day with *The Science of Life* should not blind us to its many virtues. The author has done many things exceptionally well. For example, he very effectively uses half a page to dispose of Luther Burbank, a job that has needed doing for sometime.

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