Philosophies and biologies

A.J. Cain

T.H. Huxley's Place in Natural Science. By Mario A. di Gregorio. *Yale University Press: 1985. Pp. 247. $25, £21.*

THE title of this book is somewhat misleading. Dr di Gregorio has indeed read Huxley's scientific papers, but, almost without exception, with no insight into their scientific content, the materials Huxley had to work with or the actual methods of a practising scientist. There are many doubtful statements on scientific matters (as well as a number of bad misspellings of scientific names) — *Macrauchenia* is not a camelid, a phylogeny of the Podophthalmia is not of the Crustacea (a far larger group), the "ordo Placoids" is a solecism and Haeckel was well aware of exceptions to recapitulation, to name only a few. It is incredible that (p. 97) "the evolution of groups above the level of species" can be described without qualification as "a kind of evolution which is still somewhat controversial", and even more so that this latter statement can be supported by a reference to William Paley's *Natural Theology* (1802).

What Dr di Gregorio is mainly concerned with is to extract from Huxley's scientific writings an analysis of his philosophy of science, and the psychological peculiarities that gave him his immense drive and success. Unfortunately part at least of Dr di Gregorio's conclusions depend on misreadings of nineteenth-century English prose, both scientific and informal. He believes that Huxley "over-read" Darwin's analogy of artificial and natural selection into a belief that they were "essentially identical" in action. A look at the use of analogy in the nineteenth century (and previously) would correct this impression. Even the eccentric William Swainson understood the difference between a superficial (or poetical) analogy and a real scientific one (see, for example, Chapter 6 of his *Preliminary Discourse on Natural History* of 1834).

Similarly a letter from Darwin to Huxley is exaggerated into a quarrel between them, and (with others) into a fundamental difference in their philosophies of science, Huxley requiring theory to be verified absolutely by direct experiment, Darwin looking only to its powers of explanation. The real issue here is that Darwin (a good experimentalist) believed like most people that evolution was so slow that an experiment to produce a new species would take far too long; Huxley, presumably influenced by the advances in livestock breeding of the previous half-century, thought it must be successfully carried out before evolution could be more than the best hypothesis so far. Dr di Gregorio quotes (p. 62) from a letter to Hooker, Darwin's statement that "the change of species cannot be directly proved" but exalts it into a major difference in philosophy instead of a practical difficulty.

Not realizing the practical value of Huxley's use of the type concept, Dr di Gregorio accuses him of employing a metaphysical term without a proper system of philosophy, and again mystifies the situation because he has no experience of its employment empirically both in grasping the diversity within a group and in teaching it. Viewing Huxley primarily as a careerist driven by a sense of insecurity, he sometimes praises him for his fairness and grasp of the subject. More often he seems to regard him as a fool, a crafty opportunist and a mere power-seeker. The best thing that this book can do is to stimulate people to read Huxley and judge for themselves. □

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New in paperback

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Key to symmetry

J.P. Elliott

Group Theory in Physics, Vols 1 and 2. By J.F. Cornwell. *Academic: 1984. Vol. 1 pp. 371, $75, £49.50. Vol. 2 pp.562, $100, £70.*

IF mathematics is the tool-chest of the theoretical physicist, then group theory is the instrument which opens up an understanding of symmetries. Of course, group theory is only algebra, but it would be foolish today to argue that one should carry out the algebraic steps without recognizing the group-theoretical structure of those processes.

Although group theory plays a role in classical physics, it is in the realm of quantum physics that it dominates. In some concrete applications, vibrations for example, group theory can be seen as a neat way of understanding results that would emerge, in any case, from numerical calculations. However, in more abstract fields such as elementary particle physics, where the new concepts of strangeness, charm and colour, and even the particles (quarks) themselves are quite beyond human experience, symmetry often provides the foundation of the theory. Group theory can also be seen as a unifying element enabling us to recognize, as consequences of the same symmetry arguments, certain features such as degeneracies and selection rules which occur in diverse physical systems.

It is appropriate therefore that the seventh title in the *Techniques of Physics* series should be *Group Theory in Physics.* Many books have been written on this topic since the 1920s but, even in 900 pages, an author faces some difficult decisions. First, should he concentrate on just one branch of physics, to allow space to describe both the physics and the group theory, or should he stress the wide range of application of group theory by describing many fields with only a brief account of the relevant physics? Secondly, what balance should be struck between readability and mathematical rigour? And finally, for whom is the book to be intended?

On the first question, J.F. Cornwell chooses to cover several fields and the 900 pages in two volumes are allocated roughly as follows: molecular and solid-state physics (100), elementary particle physics (90), Schrödinger equation (30), Lorentz groups (50), general group theory (100), Lie groups and algebras (300) and appendices (200). Atomic and nuclear structure problems get little or no mention. On the second question, the books emphasize mathematical rigour more than most of their competitors making it rather difficult for a reader meeting these topics for the first time. For example, molecular vibrations are discussed through a succession of eight theorems with proofs, and generally the style is that of a mathematics rather than a physics textbook. The third question is not answered in the preface, but the principal target must be postgraduate students getting to grips with theory in solid-state or elementary particle physics.

The strength of these books lies in the extensive account of Lie groups and their relation to Lie algebras, here done more simply than in a genuine mathematics text. This makes them a useful reference work for people who are already familiar with the basic ideas. On more detailed points I was surprised to find the symmetric group of permutations discussed, not in its own right, but as part of the study of the unitary groups. Also, having seen a mention of super-algebras in the preface, I was disappointed to find no further discussion of this comparatively new development except for an "aside" on one other page.

Technically, the two volumes are nicely produced and even the most elaborate equation is easy to read, though cross-reference by chapter and section is difficult because only the page number is carried at the top of each page. So one has to refer to the contents every time. Special praise, however, for the proof-reading. There must be misprints in a work of this length, but I didn't find any! □

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