system, whereas we know that he was profoundly influenced by Archimedes and the axiomatic-deductive method followed in his work on floating bodies.

The second chapter on "Celestial clockwork in Greece and China" is admirable. The enthusiasm and immediacy of the writing here is altogether infectious and I owe to it my first realisation of the fascination and dignity of the history of technology as an academic subject. One is prompted to ask here: given that the object found in the sunken treasure ship was a piece of clockwork, and that Greek *technology* was therefore far more developed than we have hitherto been led to believe, is it possible that Roman *science* may have contained some hitherto unsuspected treasures of the intellect?

In the third chapter on "Renaissance roots of Yankee ingenuity" considerable emphasis is placed on the importance of the little men in science, especially the technicians, for an understanding, and even explanation, of scientists of genius such as Galileo and Newton. No doubt the rôle of genius in science has been overemphasised in the past, and the modern fashion of resurrecting forgotten figures is a valuable corrective to such over-emphasis; but I think that the little men are often more important less for their own contributions than for the contrast they provide to the greatness of the great. So that even so very considerable a figure as Hooke is on occasion most interesting when one compares his limitations with the apparently unlimited capacity of his compatriot Newton. In any case I am not convinced that any *ultimate* explanation of genius is possible in terms of environment or contemporaries. It could be argued, for example, that the successive appearance of Kepler, Galileo, Descartes and Newton was more in the nature of a vast coincidence which might just as well not have happened. In which case what reasons have we for assuming that science today would be much further forward than at the time of Bacon?

But my disagreements with Professor Price in these and other questions were for me the best measure of the immense stimulation I received from reading his book which is, in my estimation, required reading for all those seriously interested in the history of science and technology.

J. W. HERIVEL

The Queen's University,
Belfast.

William Herschel. MICHAEL HOSKIN (1959). Pp. 48. 2s. 6d.

The Development of Physical Theory in the Middle Ages. JAMES A. WEISHEIPL (1959). Pp. 92. 4s.

Pioneers of Prehistory in England. L. K. CLARK (1961). Pp. 112. 5s.

The Image of Newton and Locke in the Age of Reason. GERD BUCHDAHL (1961). Pp. 116. 5s.

Social Anthropology. D. F. POCOCK (1961). Pp. 118. 5s.

The Structure of Chemistry. E. F. CALDIN (1961). Pp. 49. 3s. 6d.

Theories and Things. R. HARRÉ (1961). Pp. 114. 5s.
(Newman History and Philosophy of Science Series, Sheed & Ward, London.)

The publishers are to be congratulated on this (still continuing) series of monographs in history and philosophy of science. Pocket-sized, and priced easily on the pocket, they form excellent introductions to various special topics in the field, topics which are otherwise liable to be lost to the general reader in learned journals or highly-priced volumes.

The seven most recent of the series include three mainly historical essays, two in the history of the philosophy of science, and two mainly philosophical. But if proof is still needed that the whole subject of history and philosophy of science has an essential unity, it is amply provided here. At the historical end of the spectrum interest is constantly focused on that interaction of observation and theory about which philosophers dispute, and at the philosophical end, there is constant reference to actual cases, contemporary and historical.

Michael Hoskin's *William Herschel* is a partly biographical and partly scientific account of the work of the man who "opened the path to all the principal branches of modern stellar astronomy". Herschel combined in unusual degree persistence in patient observational drudgery, expertness in the design of instruments, and boldness in theoretical interpretations, and we see him creating a structured universe out of the confusing and conflicting telescopic evidences. Herschel's was one of the earlier investigations which directed attention to the *evolution* of systems of the universe and to the time-scales involved in this, and this significant revolution in scientific thinking is also the main theme of L. K. Clark's *Pioneers of prehistory in England*, for although we are here concerned with the shorter time-scale of the appearance of man on the earth, the emphasis on irreversible change in time indicates the same departure from the static mechanism of the Newtonian universe. Father Clark's is a delightful case-history of the little-known work of the Reverend John MacEnery of Torquay and the subsequent events leading up to the ultimate conclusion during the 1860's that the earliest human remains are contemporary with those of extinct mammals, and hence considerably antedate the 'Druidical' remains previously associated with the earliest appearance of man. Here, as in the case of Herschel, we are convincingly shown the impossibility of interpreting confused data 'objectively', and the reasons for resistance on scientific as well as religious grounds to accepting what *now* looks to us like clear evidence. Both these essays are the best kind of history of science, perceptive and concentrated on detailed problems.

James A. Weisheipl's *The development of physical theory in the middle ages* has a wider canvas. He traces the conceptual oscillations between Platonic mathematical abstraction and Aristotelian science of nature, through the Alexandrians, Albertus Magnus and Aquinas, the Paris impetus theorists, and the mathematical school of Merton College, to Galileo. He shows how the anticipations of Galileo are to be found in Bradwardine's "calculations of motion" rather than in Buridan's impetus theory, for the latter was a natural development of Aristotelian science with its rejection of mathematical abstraction, whereas Galileo's originality lies in the insistence that the book of nature is written *only* in mathematics. Newton is seen in this context as the restorer of natural science, since he allowed room for physical explanations of gravitation to supplement the mathematical structure of the *Principia*, and hence with him, rather paradoxically, the pendulum begins to swing back to Aristotle. Even Galileo is said to have made the *Posterior analytics* the *logical* basis of his theory of nature, but here one feels that too much is allowed to the Aristotelian tradition, for surely the practice of science comes before the statement of its logic, and it is a mistake to claim that "until the *Posterior analytics* was understood, no systematic science of nature . . . could be constructed" (p. 23).

The tension between mathematical system and the multiplicity of nature also provides the theme of Gerd Buchdahl's *The image of Newton and Locke in the age of reason*. This is a pioneering essay in the history of ideas, bringing together texts from Pope, Laplace, d'Alembert, Voltaire, Goethe, Diderot, Burke, Rousseau, Carlyle, together with the eighteenth-century philosophers and experimental scientists, and illustrating the 'image' of Newtonian science in general literature.

The various strands of Newton's own thought are shown, diverging into positivism in the experimentalists and empiricist philosophers; into deterministic mechanism in Laplace; into teleology (a dying theme) in Voltaire and Maupertuis; and into the romantic revolt on behalf of a non-mechanical multiplicity of nature in Diderot, and on behalf of the freedom of man in Goethe. The story is intrinsically a tangled one, and would repay more extended treatment than Mr Buchdahl can give it here. What is perhaps most striking is that this was the period, perhaps never to recur, when science was not only a formative influence on all educated men, but was understandable by them, and therefore consciously assessed. The eighteenth century had not yet fully arrived at the 'dissociation of sensibility', for part at least of its romantic revolt was still on behalf of a true understanding *within science itself*, and not, as later, an exasperated rejection of the whole conception of a scientific study of nature.

Social anthropology, by D. F. Pocock, carries the history of the interaction of science and ideas forward in time, in reference to a particular social science. Mr Pocock describes the debates between conflicting conceptions of society and their reflections in different images of what a social science should be. Is society a 'natural' phenomenon, and hence to be studied by a natural science, continuous in all methodological respects with the physical sciences, or has it special characteristics which must be reflected in a discipline differing from that of physics? If it is a natural science is it 'reducible' to physics, biology, or psychology, or is it autonomous? What are the 'facts' of sociology, and what is the place of theory and speculation in it? What is the meaning of 'objectivity' in a study where the investigator is himself part of a system of the kind he is studying, whether this is the same system or a different one? Discussion of all these questions is traced from the eighteenth century through Comte, Mill, and Spencer, to Durkheim and the twentieth-century field anthropologists—Malinowski, Radcliffe-Brown, and Evans-Pritchard. The earlier parts of this history are unfamiliar to most historians of science, and at least one uninformed reader found the treatment somewhat too condensed, but the description of modern anthropology and the schools into which it is divided is detailed and full of interest.

The two essays which are primarily philosophical will have to be dealt with briefly. In *The structure of chemistry*, E. F. Caldin gives a clear and careful account of the kinds of concept, law, and theory which are characteristic of chemistry, relates the practice of chemistry to various theories of scientific method, and pleads for greater attention to be paid by philosophers to this science, which is not adequately described by assimilating it to physics. R. Harré's *Theories and things* is a discussion of theoretical concepts and models, mainly in relation to physics, and of what is involved in claiming 'existence' for them. Mr Harré uses examples of scientific procedures to undermine the positivist thesis that only what is observed can be said to exist. A stimulating attack on a neglected problem.

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The Making of Modern Science. Ed. by A. R. HALL (Leicester University Press, 1960). Pp. 56. 6s.

These six essays by well-known historians of science were first given as B.B.C. broadcast talks in 1959 and subsequently published in *The Listener*. They have now been reprinted in this booklet edited by A. R. Hall, who also contributes a Foreword on the use of the history and philosophy of science as an educational discipline providing "a meeting ground and a community of understanding pretty