Book Reviews

Newton's Beginnings as a Mathematician

The Mathematical Papers of Isaac Newton. Vol. 1, 1664–1666. D. T. WHITESIDE, Ed. Cambridge University Press, New York, 1967. 638 pp., illus. $40.

The name of Isaac Newton has been as familiar on the tongues of men of science as that of relative or friend. Yet to date little of Newton's work has actually reached their hands. And much of that printed material has been in great need of proper editing. It becomes ever more evident, too, that the man to whom this work brought great fame and fortune during his lifetime is scarcely known to us in proper perspective or detail. The first biographical effort (1728) by Monsieur Fontenelle, Perpetual Secretary of the Royal Academy of Sciences at Paris, of which Newton was an *associé étranger*, was reproduced by I. B. Cohen and R. E. Schofield (1958) as "Elogium of Sir Isaac Newton" in *Isaac Newton's Papers and Letters on Natural Philosophy*. Cohen remarked in an article in *Isis* (1960) that biographical materials from the hand of Conduitt, Newton's surviving nephew-in-law, have never been published *in extenso* and that this project has yet to be undertaken, along with extensive commentary.

Much of Newton's optical work is unknown, and even his work in that field so richly fertilized by his genius, mathematics, has been but spottily assessed and inadequately presented in a few pieces such as A. De Morgan's *Essays on the Life and Work of Newton* (1914) and the late H. W. Turnbull's *Mathematical Discoveries of Newton* (1945).

Current Newtonian scholarship is attempting to fill this almost inexplicable void, and at last the fruits of recent studies are ready for the picking. A joint effort by I. B. Cohen and the late A. Koyré will soon bring us a three-volume variorum edition of the *Principia* with complete commentary, index, biographical register of all persons mentioned therein, and other scholarly apparatus. We already have on hand three of the continuing volumes of the *Correspondence of Isaac Newton*, skillfully edited by Turnbull. We have also had recently *The Mathematical Works of Isaac Newton* (Johnson Reprint Corp., 1964–1967), featuring facsimiles of English versions of six of the most significant *printed* Newtonian mathematical tracts found in Samuel Horsley's *Isaaci Newtoni Opera Omnia* of two centuries ago. This material was edited and given an illuminating introduction by D. T. Whiteside. And now the first of eight volumes of the complete corpus of Newton's mathematical output has reached us. Whiteside is responsible for the fine editing, informative commentary, and scholarly annotation.

Whiteside's special competence as a mathematically sensitive and perceptive coordinator and commentator was revealed in his treatment of the abundant and entangled materials of his Ph.D. thesis, "Patterns of Mathematical Thought in the Later Seventeenth Century," which was published as volume 1, No. 3, of the *Archives for History of Exact Sciences*. Whiteside has been working for many years now in the source materials of Newton's century located principally in the University Library, Cambridge. He was encouraged and aided by Turnbull, had access to Turnbull's vast store of material, and was Turnbull's choice for this particular study.

The Newtonian mathematics in the volume under review is of particular interest, since it was developed during a crucial period of Newton's intellectual life. Whiteside speaks of Newton as having been practically innocent of mathematical learning up to the summer of 1664. A book on astrology purchased at the midsummer fair on Stourbridge Common made him turn to Euclid and Schooten's heavily documented Latin edition of Descartes's *Géometrie*. It took but two short years thereafter (summer 1664–October 1666) for Newton the mathematician to be born. The materials in this volume amply justify Whiteside's conclusion that "in a sense the rest of his creative life was largely the working out, in calculus as in his mathematical thought in general, of the mass of burgeoning ideas which sprouted in his mind on the threshold of intellectual maturity." Newton began with Descartes's construction of the subnormal to an algebraic curve, turned to Hudde's rule for maximum and minimum, and then reached his own construction of the subtangent and the circle of curvature at a general point of an algebraic curve. At first he generalized a differentiation procedure founded on an infinitely small element o. The differential algorithm came quickly and was followed by the radius of curvature of two-valued functions. The inverse problem of tangents in the quadrature problem was perceived by him as such and, finally, he changed over from the small, discrete increment o to the fluxion and instantaneous speed. Using these new patterns Newton recast his earlier work in the "October 1666 tract," which is given a most attractive setting in this volume. One finds a special pleasure also in coming upon the binomial theorem invented in Wallisian style in a pocket-book in the University Library. According to De Moivre, Newton discovered this formula "on the occasion of a certain interpolation for the quadrature of the circle" in Wallis's *Arithmetica Infinitorum*, and one finds it so exhibited in this text.

The superb editorial craftsmanship and mathematical competence of Whiteside can well be appreciated by comparison of the "October 1666 tract" with the same tract as it appears in its first printing in *Unpublished Scientific Papers of Isaac Newton* (1962), edited by A. R. and M. B. Hall. In a severely critical review of the Hall effort Whiteside had complained of the editors' apparent lack of acquaintance with Newton's Waste Book (Add. 4004) in the University Library. As Whiteside presents these materials, the Waste Book proves to be, as he claimed, "the most important and extensive of his early mathematical compendia now extant." A side-by-side inspection of the two versions of the October 1666 tract brings the realization that the Whiteside volume will stand as the definitive

presentation for many generations to come.

If all eight volumes of this mathematical collection maintain the high level achieved in volume 1, Whiteside will have found his hope fulfilled that the present edition might be "a small step toward that long-overdue monument to a man who in so many areas of human thought himself took a giant's leap."

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On Science and Scientists

The Art of the Soluble. P. B. MEDAWAR. Methuen, London; Barnes and Noble, New York, 1967. 160 pp. $4.50.

The most descriptive single word for this book is one more often found in crossword puzzles than in book reviews: it is an olio, or hodgepodge. As the author notes, this miscellany is recurrently concerned with the nature of science and of scientists, but there is little unity beyond the fact that the diverse bits are all products of the same mind—a brilliant one, whose least products can never be called trivia. An even more recurrent theme is that of Medawar's dislikes, so outspokenly attacked as to be diverting even for those who do not share them.

Adverse opinions that this reviewer does share are that Teilhard's *The Phenomenon of Man* and Koestler's *The Act of Creation* are two of the very worst books ever hailed as masterpieces. To be sure, Medawar in his introduction does somewhat modify his reprinted review of Teilhard's book, now feeling that it is only "a dotty, euphoristic kind of nonsense" with "no real harm in it." We can hope, but hardly believe, that this second thought is justified.

The two character sketches reprinted in the book are acts of hero worship, but do not wholly ignore feet of clay. Herbert Spencer is considered worthy of rescue from current obscurity, and yet he exemplifies the silly confusion that results from calling all directional processes "evolution" and from assigning a single direction to organic evolution. He thus anticipated one of the many weaknesses of Teilhard and some other more recent evolutionists who are definitely not heroes to Medawar. D'Arcy Thompson was a gentleman and a scholar, fascinating in both roles, but his highly readable masterpiece, *On Growth and Form*, admittedly has had almost no direct effect on modern biology. Reading between Medawar's lines, one must conclude that this is just as well and that Thompson's indirect influence has been overestimated.

A brief essay on Darwin's chronic illness is a vehicle for Medawar's distrust of psychoanalysis, further expanded in his introduction. A Biological Retrospect, originally a presidential address before an unnamed group, is notable especially as completely belying the astounding and indefensible statement, twice made elsewhere in this book, that "the physical sciences and mathematics offer us the only pathway that leads to an understanding of animate nature."

The Two Conceptions of Science (title of another essay), reduced to the simplest terms, are those of pure and applied science or, as others might prefer to say, just science and technology. There can be little quarrel with the view that neither concept of science is justified or operable alone and in its extreme form. It is an interesting thesis that the concept of pure science and its overvaluation are by-products of Anglo-Saxon snobbery.

Finally, the essay Hypothesis and Imagination is an attack on induction as scientific method (another of Medawar's pet dislikes) and a history, as far as concerns the United Kingdom, of the preferred "hypothetico-deductive system." This system is assigned "unquestionably" to Karl Popper, another hero, but the historical notes fascinatingly demonstrate that what is undoubtedly valid in the system was already a commonplace before Popper was born. There is also here an echo of Medawar's famous broadcast "Is the Scientific Paper a Fraud?" (not here reprinted as such), and again one must disagree with his conclusion that it is somehow fraudulent in the art of writing a report on research not to follow exactly the noninductive steps involved in that research. It is diverting to think what would become of other arts, such as poetry, painting, or music, if the final product had to incorporate the steps by which it was achieved.

The other meaning of *olio*, from the Spanish *olla*, is that of a tasty, spicy, varied dish. Medawar's book is an olio in that sense, too. By the way, Medawar's somewhat cryptic title comes from his review of Koestler, in which he refers to scientific research, a practical-minded affair, as the art of the soluble. It is insistence on practicality that underlies Medawar's whole attitude toward science and scientists and that sparks most of his dislikes. That after all does lend unity to the olio and is a contribution to common sense.

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The Therapist and the Researcher

Clinical Judgment. ALVAN R. FEINSTEIN. Williams and Wilkins, Baltimore, 1967. 422 pp., illus. $9.50.

This is an important book, and one prays that its messages will be read and heeded. Feinstein is a clinician, and proud of it. He finds the universe of diseased patients exciting and challenging. The complexity and infinite variety are reasons for rejoicing, not despair. But since Feinstein is also a research scientist, he is unwilling to be frustrated by the ambiguities and imprecision that too often characterize clinical research. In addition, he is a philosopher, a fact which gives the book a distinctive flavor.

The writing is neither aseptic nor telegraphic. Rather, it is leisurely and personal. If a point needs to be driven home with three or four examples instead of one, so be it. If repetition seems to reinforce the message, the author rephrases the idea in several different ways. (This is not to imply that the book is larded with literary fat; one of the problems with the book is that much of it is tightly written, so that the reader has to work and cannot browse or skip.) The volume is written not simply to explain, but to convince.

Since "the care of a patient is the ultimate, specific act that characterizes a clinician," Feinstein laments the common relegation of problems of therapy to inferior status in the hierarchy of values in academia. *Clinical Judgment* was written to revise the belief that therapy is almost automatically "subscientific," and to reorient clinical de-