

# BOOK REVIEWS

## Logical Development

*Development of Mathematical Logic.* By R. L. Goodstein. Pp. vii+150. (Logos: London, September 1971.) £3.50.

WHEN Boole applied algebraic techniques to logic in 1847, he was thinking of logic in the traditional manner, as the theory of correct inference; and both Frege and Russell also confined their attention to such subject matter when they sought to exhibit logic as the ultimate foundation of pure mathematics. But as mathematical logic entered its classical phase, during the 1930s, other studies were seen to be very much bound up with it, as for example recursive arithmetic. Today we find mathematical logic firmly established as one of the central mathematical disciplines, ramifying in many different directions, for example into mathematics proper, foundations of mathematics, and the theory of computation. Many good books on mathematical logic are now available, written at all levels of difficulty, and varying between complete informality and austere formal rigour of presentation; but it is not altogether easy to get from any one of them an overall view of the entire field. This is precisely what Professor Goodstein's remarkable book provides.

The book begins with four chapters on propositional and predicate logic, treated both by model theory and by proof theory (that is, both semantically and syntactically). But these chapters are not as in most other books, since very many special topics are touched upon, such as Post's theorem on Sheffer functions, intuitionist calculi, natural inference and tableaux, sequent logic and Kripke semantics. There then come four more chapters, devoted respectively to recursive functions, formalized arithmetic, free-variable arithmetics, and axiomatic set theory, with an even greater wealth of special topics—and all this in 150 pages, which include a well chosen bibliography!

It seems to me that beginners would tend to find much of the book hard, and perhaps rather bewildering, since so many big topics are reported on in summary fashion, accurately indeed, but without much explanation. To the

reader who already has some initial knowledge of the whole field, however, the book could prove invaluable, both as a means of orientation and as a guide to further topics that it is important to learn something about. Anyone who worked through the book systematically, reading up each topic in turn with the aid of the notes and bibliography, would find himself committed to an extended course of study; but by the end of it he would really understand what modern mathematical logic, taken in an all-embracing sense, is about. He might not have studied automata theory, say, and perhaps a few other things, but his reading would have been thorough and productive.

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## US Science

*Science in American Society: a Social History.* By George H. Daniels. Pp. xii+390+x. (Alfred A. Knopf: New York, May 1971.) \$10.

THIS well written and amply documented book is largely about the period before 1900. Only the last and part of the penultimate chapters cover the present century, making this another case of *Hamlet* without the Prince. The time focus is all the more regrettable because of the promise of the subtitle and the author's politely polemical preface, a promise largely unrealized even in the treatment of the earlier period. Promise and performance do not match; why they do not match endows this book with some historiographic interest.

Daniels bluntly characterizes much of the writings in the history of science as "celebratory", presumably of great men and great achievements or as being an idealized, if arid, analysis of scientific ideas. Science as a human activity, Daniels insists, occurs within a national ideological framework, and is best viewed as a part of a national culture. The part influences the whole, while the whole influences the part. While Daniels stops short of asserting that science as practised in one nation is inevitably different from the practices in another nation, the book is definitely in the old tradition stressing America's historical uniqueness.

Among historians of science at present is a rather lively stirring about the shape of the subject. Voices are heard asserting the importance of factors outside the internal flow of scientific data and concepts. Coming to mind immediately is the recent spate of articles on the origins of the Royal Society. In this rather academic discussion the United States is unique, for only there, to my knowledge, do we find a substantial body of historians investigating the sciences as part of the national experience, rather than particular disciplines. These historians—at least twenty-four come to mind—are, for the most part, not close to their colleagues in the history of science proper, being concerned with governmental policies, scientific organizations and informal groupings; the applications of science to medicine, agriculture, and technology; the relations of scientists with other groups in the United States; and (recently) the socio-economic origins of the scientific community. They are best described as general American historians trying to integrate the sciences into the national history.

Daniels seems to belong to this school; parts of the text are explicitly derived from such writings, including his own contributions. But the volume is far from social history. It is, rather, from a different genre, that of American intellectual history. The method is closer to Perry Miller, Henry Steele Commager or Ralph Gabriel than to Marc Bloch. What we have here are idealized abstractions—Newtonianism, Darwinism, the Progressive Era, the Jacksonian Spirit—around which Daniels arrays what scientists and non-scientists said about science. Although the genre is worthwhile, it hardly constitutes a social history. Only his nationalistic focus prevents Daniels from realizing that his practice is closely related to many writings of conventional historians of science. A real social history of science is sorely needed. Large stretches of the literature are either too close to a pedantic antiquarianism or too idealized. Whatever the relationships between the content of science and the ambient milieu, we sorely need a full picture, not a