Book Reviews

Thomas Bradwardine His Tractatus de Proportionibus. Its significance for the development of mathematical physics. H. Lamar Crosby, Jr., Ed. and Trans. Univ. of Wisconsin Press, Madison, 1955. xi + 203 pp. $3.50.

The study of the history of science slowly is coming to be a recognized discipline in university instruction. There are at least three American institutions, Cornell, Harvard, and Wisconsin, that grant the doctorate in this field; and at the last named there has been an emphasis on research in the history of medieval science. The present work is another welcome product of the active group that has been working at the University of Wisconsin under the able leadership of Marshall Clagett.

Traditionally the origins of modern dynamics have been found in the work of Galileo, although it now is half a century since Pierre Duhem argued persuasively that the source should be pushed back two and a half centuries to the Buridan school at Paris. H. L. Crosby here proposes a backward shift of a few more years to the activities of Merton College at Oxford, and more especially to 1328, the date of Bradwardine's *De proportionibus*.

The reputation of Bradwardine, "Doctor Profundus," never has needed apologists. He was elected Archbishop of Canterbury about a month before he died of the Black Death in 1349; and Chaucer's Nun's Priest mentions him in the same breath with Boethius and St. Augustine. Histories of mathematics cite with respect Bradwardine's contributions to the study of star-polygons, continua, and proportions. Only quite recently, however, has the significance of *De proportionibus* for the history of physics been appreciated, for the language of the original Latin has been difficult and obscure to readers brought up on modern tongues and mathematical symbolism. Now the treatise is available in a handy form with Latin and English on alternate pages, together with notes and index and an excellent introduction of more than 50 pages. The book is photographically reproduced from typescript, but it is done with exceptional neatness and clarity.

The *De proportionibus* is perhaps the earliest treatise to propose a general law of physics the expression of which called for transcendental functions rather than simple direct or inverse variation. Aristotle had assumed that velocity of motion V is determined by a proportionality between motive force F and resistance R; but the older use of the word *proportion* (or *analogia*) was so general as to make it practically equivalent to the modern function concept. Natural philosophers consequently had argued for centuries whether Aristotle's proportion should be "arithmetic" (of the form $kV = F - R$) or "geometric" (that is, given by $kV = F/R$). Bradwardine refuted both of these forms as well as the hybrid $kV = (F - R)/R$, showing that they are inconsistent with other Aristotelian axioms of motion. (Aristotle had assumed that halving both the motive force and the resistance would leave the velocity unchanged; and he had denied that there can be motion if there is equilibrium between the motive forces and the forces of resistance.) Then, having "put to flight" these "fogs of ignorance, these winds of demonstration," Bradwardine stated his own law that "the proportion of the speeds of motions varies in accordance with the proportion of the power of the mover to the power of the thing moved" (p. 111). His exposition shows, in words rather than symbols, that he had in mind the exponential relationship $n^V = F/R$, where n is constant. Later Mertonians applied this type of function, not only to uniformly accelerated motion, but also to problems of variation in psychology, ethics, and even theology.

Crosby's "Introduction" is a perspicuous interpretation of the place of *De proportionibus* in the growth of science. Among other provocative theses, it is argued that the origins of modern science are to be found less in the vaunted *Platonic* movement than in Bradwardine's mathematical treatment of the *Aristotelian* principles of motion (p. 17). And again, Crosby holds that Bradwardine's association of force with instantaneous, rather than average, velocity led directly to the work of his successors on uniformly accelerated motion, and that in this respect the Mertonian kinematics "seems closer to the modern point of view" than the impetus theory of the Paris school (p. 52). Such bold suggestions may undergo subsequent modification, but they afford a far more challenging picture of the history of science than does the stultifying and discredited idea that dynamics was created single-handedly by Galileo.

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Morbidity in the Municipal Hospitals of the City of New York. Report of an exploratory study in hospital morbidity reporting. Marta Fraenkel and Carl L. Erhardt. Russell Sage Foundation, New York, 1955. 229 pp. $4.50.

This work contains (i) a description of the procedures by which data on age, sex, race, marital status, religious affiliation, length of stay, diagnoses, surgical intervention, and condition on discharge were obtained for 121,952 patients discharged during May–October 1952 from 31 hospitals operated by the city of New York; (ii) 55 tables that mainly summarize data on the frequency of diagnosis in relation to one or more of the other aforementioned characteristics; and (3) general comments on the findings. In view of the kinds of hospitals studied, it is impossible to generalize the findings to all hospitalized patients in New York, let alone in other cities. The authors have wisely refrained from making any such generalizations.

The purpose of this "exploratory study" was "to test a plan for morbidity reporting." The test has apparently been considered successful, because the city of New York was able to obtain, process, and tabulate data from some of the hospitals it controls. It is surprising that a doubt existed about achieving this, especially when the authors state in the preface: "A morbidity reporting system of this kind has long been recognized as practicable for New York City but budgetary restrictions have prevented its establishment."

As reported here the study contributes little to the solution of the problems of measuring the incidence and prevalence of diseases in a community. Data on the characteristics of hospitalized patients are needed for this purpose, but until these data can be related to a well-defined population base and to nonhospitalized morbidity they are not very in-