rect conclusion) can be deduced from the assumption that the velocity of fall is directly proportional to the distance of fall (an incorrect assumption). I also find the discussion of Galileo's treatment of inertia quite inadequate. The only passage discussed at length is the famous passage at the beginning of the "Fourth Day" of the *Discorsi,* wherein Galileo describes projectile motion as taking a parabolic path compounded of uniform inertial motion on a horizontal plane and vertical uniform acceleration. The interesting question is this: How do his views in this passage relate to his often expressed doctrine of circular inertial motion? As I have recently pointed out in my *Science of Mechanics in the Middle Ages,* the two apparently different views of inertia are parts of a single concept of inertia, the horizontal plane being used only where the trajectory of motion is very small in relation to the radius of the earth. Or to put it briefly, the nature of the physical problem of projectile motion allows Galileo to take one further step in abstraction that simplifies the treatment of the problem.

The only major disadvantage of this volume is one that stems from the nature of the genre. As a survey, which includes the work of many contributors in limited space, it does not offer sufficient scope for the thorough treatment of any one line of development. But if survey volumes are desirable and play a role in the spread of knowledge, we can agree that this is an excellent example of the type.

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A Philosopher Looks at Science. John G. Kemeny. Van Nostrand, Princeton, N.J., 1959. viii + 273 pp. $4.95.

The philosophy of science is a broad and highly technical field. Kemeny's book is an attempt to survey this field for the "interested layman"—in 263 rather thinly printed pages of text. How much may one expect? It will be enough —more than enough—if the author conveys clearly to the reasonably literate reader some of the basic ideas of the area. The uninitiated reader will indeed get from this book some notion of the difference between factual and formal truth; of the nature of scientific laws and their use in explanation and prediction; of the issues in the mechanism-vitalism controversy; and of several other problems in the philosophy of science.

Unfortunately, Kemeny does not escape paying the price of saying too little about too much. The price is not merely thinness but a certain muddying of the waters. For example, Kemeny explicates the distinction between formal or mathematical truth and factual truth by using as a paradigm formalized, uninterpreted "geometry." In such a system, only the connections between the axioms and theorems are mathematically true, while, since they are uninterpreted, the axioms themselves are neither true nor false. Upon interpretation, by Euclidean or non-Euclidean concepts, the axioms become contingent factual statements. But the symbols of the same system may also be interpreted into arithmetic concepts, like pairs of numbers and equations, and this results, of course, in analytical geometry. In this case, which is not mentioned by the author, the axioms themselves are also necessary, mathematical truths. Should this case occur to the reader (as well it might), he will be puzzled (as well he may be) by Kemeny's flat statement that *all* interpretations of formalized systems are factually true or false. Geometry is a fine illustration for explaining the structure of scientific theories, but it is a confusing one, unless considerable care is used, for explaining the difference between formal and factual truth.

Also, hobby-horse technicalities are sometimes introduced which, for clarity's sake, might better have been suppressed. An otherwise useful discussion of how theories are verified suffers badly from overemphasis on an unexplicated notion of "simplicity" as a criterion for choosing among alternative theories. Though this permits Kemeny to emphasize, rightly, how complex a matter it may sometimes be to confirm any isolated statement, it also leads him to assert on one page that we can always cling to any theory and, on another, that theories may be definitely falsified. This confusion is abetted by an unnecessarily equivocal use of the word *theory.* (Nor is the cause of clarity served by calling the referents of all defined terms "fictions"!) Similarly, the mathematically rather trivial point that a function can always be found to fit any set of data is not relevant to all the grief about determinism. Although Kemeny realizes this, he confusingly clutters up an otherwise elementary exposition by unduly elaborating this point.

Having caviled this much, let me add that Kemeny's book is refreshingly free of nonsense—of either naive overestimation or obscurantist depreciation of the achievements and limits of science. The "interested layman" will certainly profit from this book, and the confusions created are at least of the kind that stimulate rather than inhibit further study.

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The Canal Builders. The story of canal engineers through the ages. Robert Payne. Macmillan, New York, 1959. ix + 278 pp. Illus. $5.

The publishers of this book have provided an attractive format and careful proofreading. The author, who has written biographies of Mao Tse-tung, Albert Schweitzer, General Marshall, Charlie Chaplin, and Heinrich Schliemann, has produced a disappointing book.

Payne treats successively but discursively the canals of ancient Mesopotamia and Egypt, of classical Greece and Italy, of medieval Italy and France, and of 18th- and 19th-century England and the United States. There are chapters on the Panama Canal and the Suez Canal, in that order, and there is a final chapter on Russian canals and the St. Lawrence Seaway.

If any subject extending "through the ages" is to be successfully presented in a single book, the author must pursue his subject unswervingly, making every sentence do its full share in carrying the argument forward. In this book, Payne repeatedly deserts his subject to include all sorts of peripheral and frequently unrelated items that he has noted in his reading.

The canal engineers are often neglected in favor of more colorful or better known people. For example, in the chapter on canals in the United States, DeWitt Clinton and the Erie canal occupy six pages, but no engineer connected with the project is named. In all, eight American canals are described, but only three canal engineers are identified; of these, the one most fully discussed is allotted but two paragraphs.

The editor should share responsibility for the careless, and in places ungrammatical, writing; there are many pages of exasperating trivia that could have been removed by a careful editor. The book suffers from numerous absurdities, overstatements, and sweeping generalizations.

In a preface, canals are credited with

a causative role in, among other things, the birth of civilization and the rise of armies, "bureaucracy," and law courts. Mathematics, we are told, grew out of the need to measure water; metallurgy, out of the need for "sharp digging instruments."

The history of technology is a promising and exciting field, in which serious interest is just beginning to develop. A book of this sort does not whet the appetite for more.

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The Western Economy and Its Future as Seen by Soviet Economists. Richard G. Stolt, Ed. International Film and Publications Company, Montreal, Canada, 1958. 102 pp.

It never hurts to know what our self-chosen rivals think about us, and this digest of recent views is useful for that purpose. The editor has collected together, in magazine format on double-columned pages, a miscellany of translated articles, speeches, and interviews by Soviet economists and political leaders, all of the original articles having been published within the last 2 or 3 years. About two-thirds of the space is given over to the economists, who prophesy the ultimate doom of capitalism with a unanimity strange to Western ears. The remaining space contains statements by Mikoyan, Gomulka, and Khrushchev and includes a large segment of the latter's landmark speech to the 20th Party Congress of the Soviet Union.

Through Soviet eyes we see the West as a group of imperialist nations in the last throes of survival, struggling with each other for foreign markets as dumping grounds for the products of overproduction, forcing labor ever deeper into wage slavery and permanent unemployment, moving from one economic crisis to another, and postponing the inevitable collapse only by intensifying militarism and the cold war. Meanwhile communism flourishes, raising production and living standards at an unprecedented pace, embracing an ever-widening circle of mankind, liberating workers from exploitation, and promoting the cause of peace.

Most of the articles were written during the 1957–58 recession, which promised at that time to be the most severe business setback since the Great Depression. The Soviet economists seized this opportunity to reaffirm the established communist doctrine of progressive worsening of crises, a doctrine that had gone without supporting evidence during the postwar years. The reader may now wonder whether the Soviet economists were not overanxious.

One finds many examples of the tenacity of dogma in the face of contradictory evidence. An interesting case is the following statement by A. Katz of Moscow University (page 7): "It was the war in Korea that halted the development of the 1948–1949 crisis. The fact that the war began in mid-1950 (i.e., after there was a certain upturn in industrial production) does not contradict this conclusion; the big monopolies knew beforehand of the gamble that was being prepared in Korea and already in the first half of 1950 began to extend production, anticipating an increase stimulated by demand of a military nature."

This collection, while useful, would have been more illuminating had a few selections from an earlier period been included. It would also have benefited from further editing. The editor and publisher are poorly identified, and there is no statement explaining the purposes of the volume or the criteria of selection. The translators are anonymous, and the original sources are not documented. The volume is therefore suitable only for casual reading. For more careful study, one should consult the standard scholarly translations, such as those published in the *Current Digest of the Soviet Press.*

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The Hydromedusae of the Atlantic Ocean and Adjacent Waters. P. L. Kramp. Carlsberg Foundation, Copenhagen, Denmark, 1959. 283 pp. Illus. + plates. Paper, Kr. 60.

This work—the most recent report in the "Dana"-Expeditions series—reflects the considerable experience of its author, a scientist long devoted to the systematics of the Hydrozoa.

The scope of the report is actually somewhat broader than the title implies. The text is divided into three sections. Section A, "Systematic account of the collected species" (74 pages), is for the most part an annotated list of the species collected (56 genera, 77 species) but also includes descriptions of three new species and one new subspecies. Section B, "A survey of the Hydromedusae occurring in the Atlantic Ocean and adjacent water" (129 pages), contains keys to and diagnoses of all families, genera, and species occurring in the area. Most of the more than 300 figures illustrating this section are redrawn from other works and have a tendency to be diagrammatic, but they are, on the whole, adequate. There is some repetition of the material covered in section A. Section C, "Zoogeography" (70 pages), covers ecology as well as zoogeography; the primary breakdown is ecological, while the neritic species are further treated zoogeographically.

As implied in the text, the work is by no means definitive in any one of its several aspects. Nevertheless, it exceeds anything previously published on the subject and is certain to be of considerable value to systematists, ecologists, zoogeographers, and oceanographers alike.

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Studies in Invertebrate Morphology. Smithsonian Institution, Washington, D.C., 1959. v + 416 pp. Illus. + plates.

This volume was published in honor of Robert Evans Snodgrass on the occasion of his 84th birthday and is a very fitting tribute to one of the foremost insect morphologists living today. The first chapter is a delightful account of his life and an evaluation of his work, written by Ernestine B. Thurman. It is illustrated by a number of cartoons and nonentomological drawings by Snodgrass and closes with a very characteristic personal note by the artist. Thurman has also compiled a list of 79 papers published by Snodgrass between 1896 and 1958.

The rest of the volume contains 17 papers on various aspects of invertebrate morphology. This is a truly international tribute, since nine of the 29 authors write from eight countries in Europe and Asia, and it is interesting to note that all 29 are associated with educational institutions.

Space does not permit discussion of each paper, but most of them are very fundamental studies of a number of aspects of morphology, defined by Snodgrass as "what you *think* you see with your mind." The papers range from studies of the external anatomy of a