

Book Reviews

The Study of Man. Michael Polanyi.
University of Chicago Press, Chicago,
Ill., 1959. 102 pp. \$1.75.

In these three Lindsay memorial lectures, Michael Polanyi summarizes some of his conclusions from the larger book *Personal Knowledge* in order to take some steps forward. In brief, his analysis is intended to show that all knowledge from mathematics and physics through biology to historiography and the humanities has involved in its structure two components, a tacit one and an explicit one, and that all acts of knowing involve both that which is focally seen and that which is subsidiarily understood. Not *everything* within a science or a single proposition can be rendered explicit or seen in the focus of thought. Hence all knowledge involves a "personal commitment," namely, a responsible acknowledgment of one's commitment to those tacit and subsidiary factors which render our explicit and focal knowledge possible. To comprehend or make sense of experience is to organize its detail, seen focally or explicitly, into certain understood, comprehensive entities which make *sense* of the detail. Thus, the "ultimate particulars of nature" are understood by comprehending the *patterns* they form in space and time, and the "passionate intimations of this harmonious order are the guides of discovery in physics, and the beauty of a physical theory is the mark of its scientific value" (page 74). Machines, tools, and living things on the vegetable level are understood through their *purposes* or functions. Animals, the next order, are understood in terms of their *actions*, which are guided by the animals' knowledge, a knowledge which may be correct or incorrect. And man—"whose capacity to think is his most outstanding attribute" (page 11), human thought being "the highest level of reality in our experience" (page 71)—how are we to understand *him*?

This, as the title indicates, is essentially the concern of this book. Ac-

cordingly, the first lecture reflects on the question how we think, and thought is taken more or less theoretically. The second lecture finds that the "calling" of man, or the purpose in terms of which he is to be understood as a species, is to engage in "works of the mind." The third lecture, "Understanding history", tries to comprehend man in his historical uniqueness—that is, the decisive world historical personalities who, although there are nobler human types, nevertheless present the most striking instances of human beings whose decisions affected history. But here our logical situation as historiographers is the reverse of that which obtains on the lower levels. In the first instance, we "look down" upon the ultimate particularities of nature—machines, plants, animals. But confronted with the hero of dramatic history, we "look up" to our object (page 97). Our attitude is no longer that of being adequate to an object of lower or equal height; in history we can confront persons whom we admire as higher individuals and, instead of judging them, we judge ourselves by them; they, in their individuality, become as it were the principles by which we understand ourselves and others. Polanyi observes, and it is essential to his argument, that the self-education involved in the "reverent submission to greatness" may "amount to a corruption." But that is part of an intrinsic hazard: "This choice must indeed ultimately fall back on us, since no authority can teach us how to choose between itself and its rivals. We must enter here on an ultimate commitment which coincides essentially with the act of deciding to what extent we should accept as given the social and mental milieu within which we shall deploy our own thoughts and feelings. By recognizing our heroes and masters we accept our particular calling" (page 98).

As I see it, the freshness of Polanyi's thought in the Anglo-American scene is due to the continental influences in it. As Polanyi says, this is an effort to apply Gestalt psychology to questions

of epistemology. In addition, there are phenomenological influences, and others deriving from Hegel, Windelband, and Dilthey. Polanyi's personal synthesis of these influences represents a sharp break with positivism and any form of radical empiricism. Polanyi's effort is to show the ingredience of the responsible *person* in his own acts; and one of the significant acts of the person is that of *knowing*. The knower's tacit commitment to certain values is ingredient in what he knows. Knowledge, then, is hardly understood if it is thought to be the registration of *sensa* and their subsequent mechanical codification into something thought to be "laws." Such a radical positivism is inadequate for even our simplest knowledge. I, for one, find many of Polanyi's analyses important, valid, and most welcome in recalling to our wits, after the positivistic debauch, what knowledge *is*. But Polanyi's work is not merely a lucid and well-written version, in English, of ideas which have had long currency on the continent. Polanyi has shaped it all anew, and shaped it largely in the light of his own concrete, scientific knowledge. Again, a welcome relief from discussions in epistemology which expire in a vacuum of abstraction.

But this is not to say that Polanyi has wholly succeeded. In my review of *Personal Knowledge* [*Science* 129, 831 (1959)], I advanced the thesis that while Polanyi desires to retain the validity of truth, his theory in its more radical statements, in fact, leaves us with nothing but a desire for validity. We must responsibly *aim* at truth; and this responsible aiming at something valid, at some contact with reality, is itself the only criterion that we *have* it. "A passionate search for the correct solution of a task leaves no arbitrary choice open to the seeker. He will have to guess right, but he must make the utmost effort to guess right. The sense of a pre-existent task makes the shaping of knowledge a responsible act, free from subjective predilections. And it endows, by the same token, the results of such acts with a claim to universal validity. For when you believe that your discovery reveals a hidden reality you will expect it to be recognized equally by others. To accept personal knowledge as valid is to accept such claims as justified, even though admitting the limitations imposed by the particular opportunity which enables the human mind to exercise its personal powers. This opportunity is then regarded as the

person's calling—the calling which determines his responsibilities” (page 36).

What has gone wrong here? By transposing epistemological questions concerning the validity of theoretical claims into psychological questions concerning “claims” and the acceptance of claims,” Polanyi has, I suggest, deprived himself of any means whatsoever for defining the *meaning* of a claim to truth. The same thing occurs in his briefly sketched theory of values; when he has finished we are in no position even to define what an authentic value might be; we are left in the hazards of an admiring submission to a greatness which might also be a corruption. Now this, indeed, may be an essential part of our existential situation. But even this cannot be the whole story, since if it were, all talk about real greatness and real corruption would be senseless in principle. If the very *criterion* by which we are to estimate ourselves is one or more historical heroes, what *sense* indeed does it make to talk then of “corruption”? Corruption in *terms* of what? And what sense does it make to talk of validity in knowledge if that notion is dissolved into “acceptances,” “claims,” and “commitments”? Has not Polanyi so radically psychologized the whole affair that he has deprived himself of the very means by which he might give meaning to the validity he aims at, accepts, and claims? The value of Polanyi's analyses is great; but I find that in its ultimate formulations all dialectical tension between the subjective and objective is lost, an almost inevitable result of confusing the phenomenology of validity with psychology.

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Chemical Engineering Practice. vol. 6, *Fluid Systems, II*. Herbert W. Cremer and Trefor Davies, Eds. Academic Press, New York; Butterworths, London, 1958. xxvii + 600 pp. \$19.50.

This latest volume in a series of reference books on chemical engineering practice presents the conventional unit operations of gas absorption, evaporation, fluidization, adsorption, leaching, crystallization, filtration, and centrifugation. In addition, liquefaction and fractionation of gases, as well as refrigeration practice, sublimation, and vacuum freeze-drying are covered. The general topic of colloids is also included.

As in the previous volumes of this work, the author of each chapter has attempted to present highlights and emphasize the practical aspects of a particular field. However, for certain operations two chapters have been included, one on theory and one on practice. This procedure, for example, has been followed in the case of gas absorption and crystallization. Although thorough coverage of each topic included would require a volume the size of the total compilation, the authors have, in most cases, presented useful details, which may be amplified by reference to the extensive bibliography. This is a valuable addition to the chemical engineer's bookshelf, particularly because of its emphasis on technological details.

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Oceanography and Marine Biology. A book of techniques. H. Barnes. Macmillan, New York, 1959. 218 pp. Illus. \$7.

Oceanographers have developed a large number of special techniques and devices with which they attempt to investigate the depths of the sea from their research vessels. A review of these methods and instruments, such as this book purports to present, could serve a useful purpose for the general public as well as for the student and professional oceanographer.

The author has deliberately omitted the many kinds of fishing gear, and he does not consider the Aqualung or such devices as the bathysphere and bathyscaphe. Even within these limits, the range of techniques is very great, and it would be too much to expect comprehensive coverage in so small a book. Biologists, to whom the book seems to be primarily addressed, will doubtless find the section dealing with methods of sampling living organisms too cursory and uneven. A number of instruments are very briefly described and illustrated, and a very few are given detailed, at times minute, description. Only in the case of the Hardy plankton recorder is there sufficient discussion of the limitations and advantages of an instrument. Biologists may find more satisfactory for their purposes the chapter on measuring such properties of water as currents, temperature, and salinity. Some common, and a few uncommon and outmoded, instruments

used by physical oceanographers are briefly described and illustrated. There is, however, no mention of methods for measuring transparency and radiation in the sea, factors that may be of paramount importance to biologists.

The most useful portions of the book are the chapter that deals with the use of sound waves in the sea, in which the use of the echo sounder and underwater sound in marine biology is discussed, and the chapter that deals with photography and underwater television. In the latter chapter is reviewed the recent work in underwater television, in which Barnes himself has been one of the most active participants. These two chapters present some material that it is difficult to find elsewhere in text form.

The text is marred by some digressions, and some of the verbal descriptions of the mechanisms are difficult to follow. A good portion of the figures seem to serve little purpose in such an abbreviated text. There is a bibliography of about 140 titles, none of which is cited in the text.

This book may be adequate as an introduction for the layman to some of the methods of oceanography, but it is too incomplete and too hurriedly written to serve as a handbook of techniques in marine biology and oceanography for the professional oceanographer, and the student is given too little insight into the applications and limitations of the techniques described to be able to use the techniques intelligently.

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Comprehensive Analytical Chemistry. vol. 1A, *Classical Analysis*. Cecil L. Wilson and David W. Wilson, Eds. Elsevier, Amsterdam, 1959 (order from Van Nostrand, Princeton, N.J.). xix + 557 pp. \$17.50.

This book is the first part of the first volume of a treatise which will eventually comprise five volumes and about 6000 pages. In the general introduction the editors say, “The aim has been to provide a work which will act as a standard reference, self-sufficient in as many cases as possible, and where this cannot be achieved, a work which will be a natural starting point for any analytical investigation.”

A chapter entitled “Analytical processes” occupies nearly half the book. It discusses materials, sampling, sta-