northwestern corner of Syria and the Mediterranean Sea.

The bibliography contains 4500 references dating from "*ca.* 1250" through any, zoology, and archeology are in- 1963. Peripheral subjects such as botcluded. Original titles in European languages are retained; non-European titles are translated into English. The chronological index shows that publications increased progressively from the rate of five papers a year during the years from 1849 to 1865 to more than 120 a year during the time 1949 to 1963. The National Union Catalogue shows that 11 of the 19 references published prior to 1800 are available in the United States.

Avnimelech processed a wide group of publications, and retrieved references that are not readily available. In order to assess the coverage, I compared the 1962 references in the analytical subject index, listed under the Levant country headings, except Hatay and Israel, with those in the *Bibliography and Index of Geology Exclusive of North America* (Geological Society of America, 1964). The Levant bibliography includes 13 titles not listed in the G.S.A. bibliography, and omits two titles recorded in the latter.

This book is a valuable research tool for those interested in geological and peripheral disciplines of the Levant countries. Typographical errors are few.

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Developmental Psychology

Henry Maier's intentions in writing **Three Theories of Child Development** (Harper and Row, New York, 1965. 332 pp., $6.75) are to explicate and compare major orientations in the realm of child development. He does so with the hope that the presentation of these theories, together with their implications for current practice in the helping of children in their development, will generate new ideas, guide professional practices, and lead to new explorations in this area. The orientations of Erik H. Erikson, Jean Piaget, and Robert Sears are chosen from among others. A primary criterion leading to this decision was that these three approaches dealt with "personality development as a continuous and sequential process, starting with a child's status as an infant and dealing with each subsequent stage of psychological growth: early childhood, childhood, and adolescence. Moreover, theories to be selected had to supplement one another to provide a composite explanation or description of human personality development" (p. 6). These theories were contrasted with most, which were characterized as concerned with man as a virtually completed product. The perspectives are seen to supplement one another in that Erikson is viewed as focusing primarily on emotional development, Piaget on cognitive development, and Sears on behavioral development.

Separate chapters are devoted to the somewhat informal explication of the primary substance of each of the orientations. After these presentations, the author, who has a primary concern with child guidance, outlines what he sees to be the fundamentals in the helping process. The "helping process" is defined as "A process of socially engineered intervention in which the practitioner deliberately introduces into the experience of an individual specifically structured means of preventing or treating deviant development" (p. 207). The helping process is subdivided into (i) study processes, (ii) appraisal processes, and (iii) treatment processes. The three theoretical orientations are then compared, with the result that they are found to be primarily congruent. A primary congruence is argued for their treatment of similar developmental phases. The loose complementarity established in this chapter is then interpreted in terms of its implications for the helping relationship.

Developmental psychology, like its superordinate subject matter, psychology, needs theoretical integration. Although this volume perhaps does not attain the rigor of Hall and Lindzey's *Theories of Personality*, let alone that of a volume like *Modern Learning Theory*, by William Estes and others, it is informative and has value as a step in the right direction.

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On the Perceptual Worlds of Philosophers and Scientists

It is the intention of the author, Rom Harré, in this essay, **Matter and Method** (Macmillan, London, 1964; St. Martin's Press, New York, 1965. 135 pp., $3.25), to show the importance of the "general conceptual scheme" in the development of natural science, and to illustrate this by the discussions of the nature of matter and its relation to the perceptual world by 17th-century philosophers and scientists.

Harré begins by distinguishing two sorts of scientific theories. Reticular theories, the first type, consist of "a set of relationships between refined observational concepts, mediated by one or more theoretical concepts which are to be understood wholly in terms of a complex of the refined observational concepts of the theory" (p. 13). In contrast to this, there are explanatory theories in which a set of generalizations stated in terms of essentially observable features of the physical world are explained by the assumption that there are some theoretical entities and some relations among them which are, in turn, so related to the observables that changes assumed to occur among the theoretical entities can be said to explain the regular changes among the observables.

Harré emphasizes that in explanatory theories there are two quite different connections or links between the theoretical and the observables. One is the *causal* link (when a theoretical concept refers to an event that causes an observable event); the other is the *modal* link (where a theoretical concept and an observable concept express two aspects of the same "phenomenon"). In the case of *causal* links, Harré states that cause here must mean more than regular sequence—that is, it must mean generation or production. His argument is as follows: "We cannot observe a concomitance between the phenomena posited by the theory and the phenomenon observed, since, at least in the initial period of a thing's history, the former cannot be observed." This argument does not convince me for the following reason: we must distinguish between (i) the *meaning* of causal connection in the regular sequence theory, and (ii) the *evidence* for causal connection in the regular sequence theory. If this is done (even though the earlier adherents of the sequence theory of causal connection may have made something of a mess of this), the regular sequence theorist is surely at as much liberty to posit sequences that are unobserv-

able as are those who point to "production" or "generatings" that are unobservable. And thus far the two theories of causal connnection will be on a basis of equality. We cannot now use the argument that unobservable sequences should not be countenanced, for one of Harré's main points in this book is that theoretical constructions of general conceptual schemes are to be judged and understood in terms of the success of the scientific enterprise which is undertaken in their terms.

The essay now proceeds to discuss the hierarchy of mechanisms of explanation. It is often the case that one theory which explains the observable regularities in nature is, in turn, explained by another theory. Whether this "imbedding" (as it might be called) of one explanatory theory in another is feasible will depend on what the general conceptual scheme allows.

In the Newtonian general conceptual scheme, a certain process, the motion of a free body in a straight line, is invariant, and certain properties (energy, momentum, and mass) are conserved. These conservations and invariants are not obtained as the direct result of experiment, but are parts of the G.C.S. But, as the author urges, some invariants of these sorts are necessary for prediction. There are, in the G.C.S. with which Harré is concerned, certain general principles that he calls regulative principles, such as those of sufficient reason and universal causality. In the Newtonian conceptual system, in particular, there are assumptions about the regularities of coexistence and succession. And in this system there are basic individuals, the minimal atomic constituents of matter, basic properties of such individuals, mass, extension, figure, and basic relation of time, space, and motion. Finally, there are two kinds of interaction: namely, impact and gravity.

In the second part of his essay, Harré discusses in succession Gassendi, Bacon, Boyle, Galileo, Locke, and Newton to illustrate the variety of methods and arguments used in the 17th century to recommend the G.C.S. of the corpuscularian philosophy. The distinction between the qualitative and quantitative features of perceptual experience was the basis for the most important ingredients of the G.C.S. of most of the 17th-century philosophers of science. The distinction was construed as a distinction between the real features of the physical world, and those qualitative features that were ascribed to the effects of interaction between the percipient and the bodies affecting his senses—that is, the distinction between primary and secondary qualities. Harré distinguishes three different methods by which their distinction was argued: the general method of Boyle, the empirical method of Bacon, and the analytical method of Galileo and Locke. These methods of argument were soundly criticized by Berkeley who showed that they were all philosophically deficient. Harré's main point about this criticism amounts to the following: Berkeley's arguments are not fatal to the corpuscularian philosophy. Berkeley did succeed in proving that this philosophy will not do as a theory of knowledge. But the justification of the corpuscularian philosophy "does not consist in the impossible task of demonstrating that perceptual experience forces the primary properties of matter upon us, but in the power to unify and underwrite the laws of the superficial relations of phenomena."

Harré has done a very valuable service in reminding us that this G.C.S. was an important part of the great 19th-century enterprise which launched physical science in the form that assured its permanent success. Without some such metaphysics to justify the procedures it might never have gotten under way, and, certainly, would have taken a different form. The philosophical deficiencies of this metaphysics which Berkeley revealed did not deter the scientists of the time, and it is fair to say that the unacknowledged metaphysics of science to this day bears marks of its 17th-century origin. Harré's book may be read by contemporary scientists with profit in this connection.

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Dynamics of Chromatography

A welcome addition to the literature on chromatography is this first part of a three-volume treatise, *Dynamics of Chromatography*. In part 1, **Principles and Theory** (Dekker, New York, 1965. 335 pp., $11.50), the author, J. Calvin Giddings, attempts to unify all forms of chromatography with one common theory and language. The "rate theory" is presented to the virtual exclusion of other theories (the plate theory is discussed briefly); discussion of the thermodynamics of the separation process is intentionally omitted. (A companion volume on the equilibrium aspects of chromatography by Keller is promised.) Zone spreading is treated from the dynamic, nonequilibrium point of view based on the model of a random walk. The author has had a significant role in the development of this theory, and his book strongly reflects his viewpoints. Because the theory is still in the process of development, there are undoubtedly those who will disagree with parts of the presentation [see, for example, a recent exchange of letters in *Anal. Chem.* **38**, 489 (1966)].

Unfortunately some of the conventional symbols have had to be changed to achieve a common language. However, confusion has been kept to a minimum by repeated definitions and useful appendices of symbols and significant equations.

Each chapter contains references to primary sources, totaling about 300. Of these approximately 45 cite the author's own work. Most of the references are from the period 1954 to 1964. Adequate author and subject indices are included.

This book will appeal to many because it is not "primarily a theoretical work designed to cast ideas into mathematics; it is more an interpretive work whose object is to make physical sense of theoretical developments in chromatography." Although this goal has been achieved, the book is not devoid of mathematical equations and derivations.

The treatment is thorough and comprehensive and ranges all the way from "difficult" theoretical parts ("may be omitted without loss of continuity") to practical applications of theory (often in the form of "rules-of-thumb"). In order to comprehend the material at either level, some background in chromatography is required. Parts of the book, most notably chapter 4, are so theoretical that they will be of little interest to the practicing chromatographer.

The nonmathematical parts are clearly written. All chapters are extensively subdivided for easy reading. The author often concludes and summarizes individual sections, using short definitive statements.

While the practical chromatographer may not be willing to take the time