geology of North America. The emphasis is on the development of the structure of the outer shell of North America, rather than on its stratigraphy, its paleontology, or the origin of its land forms.

The book deals, in the main, with southern Canada and the United States (exclusive of Alaska), because that portion of North America is geologically best known. Moreover, regions that are thought to illustrate principles of continental evolution or stages in that evolution have been selected. The author, therefore, warns the reader that he is likely to discover that some favorite area of his is not discussed.

The book comprises nine chapters. Each chapter closes with a short list of references, mainly of the more recent literature. These lists are not exhaustive but "represent reading in which the author himself found pleasure, instruction, or stimulus."

The idea that the North American continent has undergone a steady evolution dates back to James D. Dana. "The scheme of progress even to minor details dates from the beginning. . . . Tracing out the development of the American continent from these Archean beginnings, is one of the main purposes of geological history." In short, Dana's hypothesis was that the continents, beginning from old nuclei, grew by successive additions, on their borders, of folded geosynclinal belts more and more recent in age. This idea is still widely held. King's view, which is similar, is given briefly in chapter 1 (pages 7–8); it is that the continental plate was built outward from a nucleus over the original underlying layers of basic rock ("sima"). However, the idea of an evolutionary growth of North America is not developed *in extenso* or presented in chronologic sequence.

In contrast, Kuenen in 1950 bluntly stated that the widely held idea on continental growth "does not meet the facts." The folding of a geosynclinal tract, according to Kuenen, instead of enlarging a continent, actually thickens and narrows a belt that already belongs to the continent. Such opposing hypotheses manifestly require further examination.

In a remarkably frank statement in the preface of the book King declares that the work is not "a textbook in the usual sense. . . . It is avowedly 'slanted' in directions of his [King's] current thinking, and contains willful prejudices and outrageous hypotheses, some of which may not stand the test of time. These prejudices and hypotheses would certainly corrupt the tender minds of undergraduate students and uninitiated laymen as no textbook should do." To ameliorate this harsh judgment, which implies a complete negation of the scientific method, it is but fair to point out that *outrageous hypotheses* is used in the William Morris Davis sense of meaning hypotheses that were considered completely unreasonable but eventually became orthodox doctrine [*Science* **63**, 463 (1926)].

In conclusion, geologists will find this volume, within the limitations indicated, to be a remarkably interesting and valuable synthesis of the regional geology of North America.

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The House of Intellect. Jacques Barzun. Harper, New York, 1959. viii + 276 pp. $5.

It is fashionable to feel uneasy about education and to have a sense of disquiet about the status of educators, scholars, and intellectuals. College presidents are coming out of their mendicant stoop and looking their constituency in the eye. Scientists speak up, are heard, and get money. *The House of Intellect*, by Jacques Barzun, is good medicine for the uneasy minds and for the self-confident ones.

His "Intellectual"—aggressively capitalized—is not simply the educator or the scholar. He is broadly defined through comparison with the artist and the scientist. More specifically he is the critical, discriminating, and clarifying mind, not imprisoned within a narrow speciality but with access to the broad fields of human knowledge. For different reasons the artist, the scientist, and the professional specialist are enemies of, or obstacles to, "the Intellect." The artist is the enemy of the Intellect because of such things as art's revulsion from words, from coherence, and from a normal and clear portrayal of the real world. Thus, art provides imprecision in language and distortion in thought and lets good taste and discrimination founder in inconsistent, arbitrary, and eccentric forms of expression. Science is the enemy of the Intellect because it has broken up the unity of knowledge and has favored a high-walled disciplinary separateness. Finally, the pervasive American spirit of philanthropy—which is the parent of mass education, of the right of equal entry for other forms of knowledge into education—is the enemy of the Intellect because it corrupts judgment, makes it difficult to insist on quality and success as established by rigorous standards of measurement.

Each reader will find his own favorite chapters in this aggressively written book. Two chapters, "Education without instruction" and "Instruction without authority," are required reading for all who seek some of the explanations of why American education may be failing to meet the challenge by which it is faced. The underpayment of the teacher and the underemployment of the pupil are only the first of these.

Each reader will also find cause for irritation and disagreement. Barzun is clearly unfair to the scientist in failing to recognize that some of the characteristics of new scientific fields, especially the submicroscopic ones in biology and physics, do not lend themselves to easy communication. In these, essential understanding is available only to small, specially trained corps of experts. Sometimes Barzun descends from helpful criticism to mere faculty-club chitchat without seeming to notice the difference. There are statements on the letting of scientific research contracts that are simply not true.

This is a book of nuggets; the reader must do a lot of his own panning to get them out, but it is worth while.

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Progress in Biophysics and Biophysical Chemistry. vol. 8. J. A. V. Butler and B. Katz, Eds. Pergamon, New York, 1957. viii + 409 pp. Illus. $17.50.

Volume 8 in this series will be as useful as the previous volumes to specialists and advanced research workers in physiology. One must agree with the editors of this informative collection that here is something for all tastes. Among the best chapters are one by R. H. Smith on the biosynthesis of connective tissue components, which emphasizes the important role of ascorbic acid in the formation of collagen, and one by F. O. Schmitt and N. Geschwind on axon surfaces and the problem of neuronal junctions. Likewise, I. C. Whitfield has contributed a superb summary of the physiology of hearing. But other sections do not meet the same standard of organization.

It is, of course, understandable that

physicists are attracted to chapters with titles like "Color vision," "Electrical charges on bacterial surfaces," "Radiation effects on DNA synthesis," "Nerve transmission," and "Sound wave reception." On the other hand, chemists tend to favor subjects such as "Biosynthesis of protein" and "The physical chemistry of DNA." Physiologists should approve highly I. M. Glynn's critique "Ionic permeability of the red cell membrane."

The editors, J. A. V. Butler and B. Katz, state in their preface, "There is no need to apologize for the diversity of this biophysical menu." They hope their collection will "help provide a meeting ground for all those scientists, who in spite of their very different methods of approach, are concerned with the applications of physical principles to biology." In my opinion, biophysics as a branch of science is still not very secure. In fact this volume could, with seemingly equal justification, be issued under several other titles, such as "Recent Progress in Physiology," or "Recent Progress in Biochemistry," or simply "Progress in Biology." It is noticeable that many references are to work done before 1940. The illustrations are good but scanty.

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Ozeane Salzlagerstätten. Grundzüge der Entstehung und Metamorphose ozeaner Salzlagerstätten sowie des Gebirgsverhaltens von Salzgesteinsmassen. Hermann Borchert. Borntraeger, Berlin, 1959. 237 pp. Illus. DM. 48.

The Permian salt beds of central Germany have long been famous, not only as a source of potash but as a beautifully clear example of the usefulness of physical chemistry in the solution of geological problems. The painstaking work of van't Hoff and his colleagues, at the beginning of this century, on equilibria in saturated salt solutions made it seem probable that the history of the salt beds could be reconstructed in a fairly simple fashion, by the evaporation of enormous quantities of sea water under geologically reasonable conditions. Further investigation showed that this simple picture was inadequate, and during the past 50 years both chemists and geologists have tried to work out the necessary modifications. During this period, also, other extensive deposits of potash salts have been discovered—in England, Russia, the United States, and Canada—with characteristics even less consistent with van't Hoff's simple hypothesis. Inevitably, the subject has grown exceedingly complex and has been cloaked with a special nomenclature and a number of conflicting hypotheses that pose a formidable barrier to understanding by nonspecialists.

By far the best recent attempt to summarize current thinking on salt deposition is contained in a book published 2 years ago—*Steinsalz und Kalisalze,* by Franz Lotze. This volume is a comprehensive account of all kinds of salt deposits, and the space devoted to the German potash beds is necessarily limited. The author of the book under review explains in his introduction that he is setting out to amplify Lotze's treatment of marine deposits and to place in what he considers a fairer perspective certain theoretical ideas that Lotze passes over lightly. For the nonspecialist, therefore, the book is difficult reading because it assumes a knowledge of Lotze's previous work—as well as an intimate knowledge of German geography and geology. The book also taxes its readers' ability to maintain an unbiased viewpoint, because in it Borchert is frankly emphasizing the theoretical ideas which he considers important—ideas to which he himself has made fundamental contributions in a series of papers extending over many years.

In reconstructing the probable environment of original deposition of the German salt beds, Borchert envisions a time of hot-arid climate, when northern Germany was closer to the equator than it now is. The salts were laid down in a deep basin of partly stagnant water, much like the present Black Sea, separated from the open ocean by a series of bars and shallow lagoons; excessive evaporation in the basin caused inflow of sea water, the rate of inflow having changed from time to time in response to fluctuations of climate and to minor ups and downs of the bars. This reconstruction differs only in detail from the usual textbook picture. Some such mechanism for the addition of fresh sea water over an extended period of time has long been recognized as necessary to account for the extraordinary thickness of the salt beds.

The sequence of salts that would be expected as primary precipitates in this kind of situation can be worked out, as Borchert explains in detail, from experimental results on simple salt systems. The correspondence between prediction and mineral associations actually observed is sufficiently close so that the German salt beds were long taken as a classic example of primary precipitates only slightly modified after deposition. In detail, however, the sequence of salts departs in many respects from predictions based on experiment, and the discrepancies persist despite many attempts to modify the postulated conditions of precipitation. Probably most salt geologists would now agree with Borchert's conclusion that the Stassfurt beds look like a simple depositional sequence only by accident, and that other processes besides deposition from an evaporating brine must be invoked to explain their origin.

Borchert ascribes the lack of agreement between experiment and observation to three principal factors. First is the probability that strong temperature gradients existed within the basin of deposition, or between the basin and the marginal lagoons; such gradients, as Borchert himself has demonstrated experimentally, would lead to preferred deposition of different salts in the hot and cold areas and to broadening of the fields of stability for some salts. Second, burial of the primary salts beneath later sediments would lead to a rise in temperature and hence to progressive metamorphic changes in the salt minerals; Borchert differs from most other salt geologists in emphasizing the stepwise character of the metamorphism and in ascribing the metamorphism chiefly to fluids derived from the salts themselves—especially to water set free in the conversion of thick beds of gypsum to anhydrite. The third kind of change that affects the primary salt precipitates is "reverse" metamorphism brought about by dilute solutions from outside the salt beds, either surface water percolating downward or volcanic water coming from below. The variations in mineral association made possible by deposition in a temperature gradient and by the two kinds of metamorphism are so numerous that, in Borchert's opinion, a complete reconstruction of salt-bed history on the basis of physical chemistry and mineral association alone is impossible. Additional information can be obtained, however, from textures and from horizontal and vertical changes in mineral association, and by use of such data the history of any well-explored salt accumulation can be worked out.

Much of the book is devoted to examples of the application of these ideas to specific areas. The examples are taken