yet not so numerous as to be able to thrive without interacting with local native-born Americans. When Hughes comes to characterize the influence of the émigrés on social theory in the United States, he is strangely elliptical and indecisive. Since Hughes is the author of the major book on the migration of the social theorists, his inability to speak with clarity and conviction about his subject is another indicator of how resistant to historical analysis is the problem of the intellectual migration.

If our historians seem slow to get the intellectual migration into satisfactory focus, our moralists, however, may be ready to assure us that we are now too sophisticated to learn much from the émigrés. This is the remarkable upshot of Alfred Kazin's essay on Thomas Mann and Hannah Arendt. "How much we owe them," Kazin concludes, but what he most appreciates about Arendt, and to a lesser extent Mann, is their *negative* moral and intellectual example. "No Jewish writer coming out of the terrible years" of Nazism could describe the Hebrew God as mischievously as Mann did in *Joseph and His Brothers*; and to treat the Jewish people as abstractly as Arendt often did "is positively unthinkable among American intellectuals today." Some readers may be interested in assessing the truth or falsity of these claims, but others will wish that Kazin had done something more than to report on his own current opinions and to imply that these opinions are shared by the *cognoscenti*.

Kazin's obiter dicta contrast with the fact-gathering, the anecdote-telling, and the particularized analysis of individuals and small groups that continue to dominate the study of the intellectual migration to America, but his adamantly ahistorical contribution is yet another reminder of how elusive as a historical subject this migration remains. Some of the contributors correctly identify "deprovincialization" as a central theme in experience of the émigrés and in their impact on American life, but studies of what actually replaced the varieties of "provincialism" are slow to accumulate and to find a convincing relationship to one another. What may be needed is more attention to the system of values, however loosely constituted and variously formulated, that seems to have been shared by the diverse émigrés and those American intellectuals who responded to them. Strauss, in the essay that is now the best brief introduction to the entire problem of the intellectual migration, refers to this value system as a "new internationalism . . . as yet inadequately conceptualized and explored." It is perhaps to this cosmopolitanism of the intelligentsia of the 1930's, 1940's, and 1950's that we must turn if we are to consolidate and deepen scholarship on "the intellectual migration."

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Anoxic Strata

Nature and Origin of Cretaceous Carbon-Rich Facies. S. O. SCHLANGER and M. B. CITA, Eds. Academic Press, New York, 1982. x, 230 pp., illus., $39.

One of the most intriguing discoveries over the past few years in the study of earth history has been the recognition that sedimentary rocks of Cretaceous age (135 to 65 million years old) are characterized by an unusual abundance of strata deposited under anoxic marine conditions. Because anoxic conditions limit organic reworking of sediment during deposition, the rock that forms from this sediment is generally carbon-rich. Development of anoxic sedimentary environments is usually attributed to variations in local environmental parameters. An exciting possibility that has been raised for Cretaceous "anoxic" strata is that they are related to a general tendency of Cretaceous oceans to develop widespread anoxia in certain portions of the water column, the so-called Cretaceous "oceanic anoxic events." Because strata deposited in anoxic environments are thought to be important source beds for petroleum, the study of these rocks has unusual economic importance; the Mesozoic, in particular the Cretaceous, contains the bulk of known petroleum source beds.

Nature and Origin of Cretaceous Carbon-Rich Facies provides a wide-ranging sample of studies and viewpoints on Cretaceous as well as other strata deposited under conditions of reduced oxygen content. The first three papers combine sedimentological, geochemical, and paleontological data in studies of primarily Cretaceous marine strata. Arthur and Premoli Silva relate carbon-rich strata now exposed in Alpine Mountain belts to periodic upwelling. Dean and Gardner interpret cyclic interbeds of carbon-rich strata off the continental margin of northwest Africa as primarily due to cyclic variations in sediment redox conditions. Such cyclicity may have been caused by variable amounts of organic detritus transported to these deep-water environments from shallow water by turbidity currents. Thiede, Dean, and Claypool interpret "anoxic" strata from the central Pacific Ocean as originating in anoxic environments caused by local coincidence of oceanographic and tectonic factors.

The following four papers examine specific sedimentological, geochemical, or paleontological data in detail from particular Cretaceous carbon-rich strata. In an examination of clay mineralogy of black shales from the Atlantic Basins, Chamley and Robert interpret these sediments as having originated in badly drained terrestrial source areas of tectonic stability and low relief. Habib has studied organic matter from black shales in the North Atlantic and concludes that anoxia was controlled by high sedimentary supply of organic matter and that such high supply rates could have led to deposition of "anoxic" strata regardless of the oxygen content of overlying waters. De Boer's isotopic studies of cyclic carbon-rich facies in the Apennines lead to the conclusion that such cyclicity was caused by shifts of the caloric equator and hence the tropical upwelling zone. Simoneit and Stuermer use organic geochemical indicators to show that Cretaceous "anoxic" strata from around the world vary in terrestrial and marine input of organic material.

The final three papers, although not specifically on Cretaceous carbon-rich strata, provide useful comparative information on "anoxic" strata of other ages. Cita and Grignani's study of Late Neogene Mediterranean cyclically deposited sapropels shows that organic material from these beds has a marine origin and that deposition may have been controlled by a number of processes leading to euxinic conditions. McKenzie's investigation of the carbon-13 content of "anoxic" sediments from a Recent lake in Switzerland is used as a model for examination of some cyclic Cretaceous carbon-rich facies and leads to the postulate that cycles in circulation and productivity were a major reason for the development of these Cretaceous strata. Wilde and Berry, in a comparison of Paleozoic and Mesozoic oceanic ventilation, present a physical oceanographic model to account for the development of oceanic anoxia in the Cretaceous.

The study of "anoxic" strata has reached a vigorous development only in the past ten years. The discovery and study of widespread Cretaceous carbon-rich facies on continents and in the ocean basins have considerably spurred this research. As is demonstrated in this volume, there clearly are a wide variety of

scenarios that may account for the deposition of carbon-rich facies in the Cretaceous. Continued advances in studies of Recent anoxic environments, in development of sedimentological, geochemical, and paleontological information available from the stratigraphic record, and in conceptualization of geochemical and physical oceanographic models are necessary before the true nature of many of the "anoxic" strata of Cretaceous and other ages can be understood. This well-conceived volume not only summarizes the present nature of such research but will serve as a stimulus to outline the direction of future research.

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Embryonic Development

The Neural Crest. NICOLE LE DOUARIN. Cambridge University Press, New York, 1983. xii, 260 pp., illus. $65. Developmental and Cell Biology Series, 12.

The neural crest of the vertebrate embryo appears early in development as the embryo's central nervous tissue is formed. Crest cells separate from the epithelial folds that produce the embryonic neural tube, disperse extensively, and eventually produce diverse cellular phenotypes in precise embryonic locations. These derivatives include the neurons and supportive cells of the peripheral (autonomic, sensory, and enteric) nervous systems, pigment cells, endocrine derivatives, and skeletal and connective tissues of the head and face. Because the vertebrate neural crest is a precisely identified embryonic cell population whose developmental history, morphogenetic behavior, and differentiative fates are known, it may be useful in answering two central questions posed by cell and developmental biologists—namely, how developmental restrictions are established within cell lineages and how cellular morphogenetic movements are controlled. At least ten review articles on aspects of neural crest development have appeared in the last three years, indicating the high level of interest in and research on this attractive system and suggesting that its usefulness is being recognized and exploited.

Le Douarin's monograph is the latest and most complete of the recent reviews of research on the neural crest. It is a beguiling and highly personalized work, focusing primarily on the very substantial contributions Le Douarin and her colleagues have made exploiting a marking technique that she introduced about a decade ago. This technique, in which cells of quail embryos can be permanently distinguished from those of chicken embryos by the characteristic staining of heterochromatin, involves reciprocal grafting between embryos of the two genera. Using such quail-chick chimeras, Le Douarin and her colleagues have been able to establish in exquisite detail the normal developmental fates of avian neural crest cells and the origin in the early avian embryo of the crest cells that produce particular tissue derivatives. The existence of such detailed information has been essential in enabling her and others to test the developmental potential of the neural crest in vivo and in vitro and to examine the role of environmental cues in regulating morphogenetic and differentiative processes in normal development.

The monograph begins with a useful summary of methods of analysis of crest development and a consideration of the migratory ability of crest cells and its control. The remaining chapters on the crest derivatives each begin by characterizing the crest-derived structures and presenting a concise, well-balanced, and useful historical perspective of early work on the system. They continue with evenhanded and critical presentation of recent experimental results.

The author presents a perceptive description of the stages of crest dispersal, emphasizing the multiplicity of steps in the process. Her treatment of the role of the environment in controlling directional migration and localization includes a brief summary of the extracellular matrix components encountered by migrating crest cells and their interactions to form fibrillar elements in the interstitial spaces. Although not definitive, Le Douarin's summary has at least identified many of the important questions that remain about the structure of the environment and its role in affecting crest cell morphogenetic behavior.

The author's presentation of pigment cell differentiation and pigment pattern formation will introduce the reader to the extensive and complex literature on the genetics of pigment patterns. Her summary is necessarily too brief, however, to permit her to identify useful generalizations.

The most extensive and thorough treatments are reserved for the contributions of crest to the peripheral nervous system and to skeletal and connective tissue of the head and face. Since these are the subjects on which Le Douarin's laboratory has made the most detailed contributions, the presentations are both authoritative and heuristic. Le Douarin's discussion of the limited crest contributions to the so-called APUD (amine precursor uptake and decarboxylation) series is definitive and should set straight prevailing misconceptions. The extremely thorough discussion of the development of ectomesenchymal derivatives will be an important resource for workers concerned with this subject. Likewise, Le Douarin's treatment of the development of autonomic neuronal derivatives in vivo and in vitro, including careful and insightful interpretations of her own data, will undoubtedly provide a valuable point of departure for further work on the subject. I was disappointed, however, that she largely ignores the crest-derived supportive cells of the peripheral nervous system and fails to mention the extensive literature on the responsiveness of peripheral nervous system neurons to nerve growth factor and other trophic factors. I would also have welcomed color plates with "textbook examples" of enzyme- or immuno-cytochemical stained crest derivatives instead of diagrams that have been adequately presented as line drawings in previous publications.

In summary, Le Douarin has described significant portions of the extensive crest literature, including the many important contributions of her laboratory, thoroughly and critically. In many, but not all, instances, she was probably wise to resist the temptation to examine other subjects of research on specific neural crest derivatives. Her monograph is, on balance, a worthy culmination of the many reviews that have recently been published on neural crest development. It will become the standard reference for cell and developmental biologists working on neural crest and related subjects. The book appears not when the facts about early neural crest development are settling comfortably into place, but rather when new experiments are providing exciting approaches to questions about possible heterogeneity in the migrating crest cell population, about alternative modes of crest cell dispersal, about the role of crest cells in pattern formation of the head and face, and about the possible role of neural crest derivatives in vertebrate evolution. It should therefore fulfill the author's declared goal of enticing new recruits into the field.

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