cusing primarily on lethal mutations that define the maternal contribution to embryonic development, are concisely described for *Caenorhabditis* by Kemphues and for *Drosophila* by Perrimon and Mahowald.

Four chapters convey the state of the art of genetic analysis in assorted vertebrates: fish, chickens, amphibians, and mice. The reader is presented not only with the problems inherent in carrying out the genetic analysis in these organisms but also with compelling reasons why one should try. In a delightfully clear chapter, McCormick and Alton discuss in simple and critical terms the significance of the mouse T/t complex. They conclude that this complex probably does not comprise a set of genes with related functions such as the *Antennapedia* and *Bithorax* complexes in *Drosophila* (described from anterior to posterior in the chapter by Mahaffey and Kaufman) but that it nonetheless offers excellent opportunities to study developmentally important genes in a mammal.

A third theme is how new molecular methods extend the power of genetics in any organism, as described in the four chapters on transgenesis in fruitflies, nematodes, plants, and mice. In addition, ways in which gene function can be studied without involving the isolation of mutants are also described. Jäckle *et al.* review studies in which antisense RNA is used to inactivate gene activity and hence to mimic mutant phenotypes. Flytzanis *et al.* discuss gene transfer experiments with sea urchin eggs that facilitate studies of the regulation of gene expression during development of this hitherto genetically unstudied organism.

Four chapters cover the theme of DNA rearrangements and transposable elements well, but the reasons for their inclusion are often left unclear. For example, Federoff provides a lucid account of transposable elements in maize, but it may not be obvious to the uninitiated that this chapter is included because mobile elements have played an important role in the development of molecular genetics and somatic mosaicism caused by transposition is an important method of establishing cell lineage relationships.

Overall, this volume leaves the reader with an appreciation for the wealth of developmental phenomena still to be understood, a feel for the current excitement in developmental genetics, and an optimistic view of the future based on new technologies. In addition, one glimpses the thought processes of some of the researchers in the field. The candid questions posed by the editor to the contributors provoke dialogue such as one hears spoken among developmental geneticists during reflective moments. Although this volume makes interesting reading for the professional, it is neither comprehensive nor balanced and thus will not be useful as an introductory textbook. However, because it contains many excellent articles that provide lucid reviews of a variety of topics, it would serve well as a companion book for upper-division and graduate-level courses.

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Neural Differentiation

From Message to Mind. Directions in Developmental Neurobiology. STEPHEN S. EASTER, JR., KATE F. BARALD, and BRUCE M. CARLSON, Eds. Sinauer, Sunderland, MA, 1987. x, 368 pp., illus. $55; paper, $35. Based on a symposium, Ann Arbor, MI, June 1986.

To furnish even an outline of how molecular messages control the cellular differentiation that results in the thinking brain may be too much to ask from any single book. This one offers instead a series of careful reviews by people engaged in investigating various aspects of this general question. Each contributor is a specialist in a system that is adding useful information about neural development at a particular level. There are six chapters at the molecular and molecular genetic level, ten that deal with cellular differentiation and cellular interactions, and four at the level of emerging mental properties. Together, they constitute a fragmentary tale made up of isolated pieces of one of the most challenging puzzles facing scientists today. Of the several collections of papers in developmental neurobiology published during the last ten or so years, this one—because of the broad focus and the generally high quality of the reviews—may be the best.

Most of the reviews have general appeal, but some seem too focused on the contributors' own work to be of interest to nonspecialists. The introductions at the beginning of each section of the book help to put these reviews into broader context. In his chapter on the sexual differentiation of the brain, Roger Gorski describes how steroid hormones, notably estrogen, influence the development of a sexually dimorphic nucleus (SDN) in the hypothalamus. Estrogen, as a metabolite of testosterone, masculinizes the SDN. Gorski points out that the whole mammalian brain is "inherently female." He takes us through experiments that show how estrogen enlarges the SDN in males, possibly by promoting the survival of its developing neurons. Could it then be that the inherently female SDN is sculpted out of a set of neurons ready, given the signal, to become the male nucleus? A single injection of testosterone given shortly after birth can permanently modify the brain structure of a genetic female and her adult sexual behavior. Gorski makes it clear that for other dimorphic nuclei the hormones involved and their modes of action may be quite different.

Lynn Landmesser, in her excellent chapter on the formation of motor connections in the chick embryo, does not ask how the different pools of motor neurons acquire their individuality, but she shows that presumable differences in their membrane proteins lead the growing axons of these neurons to react selectively to the extracellular terrain through which they navigate the route to their target muscles. The review by Harrelson *et al.* offers a glimpse of a class of membrane-associated glycoproteins which in insects appear to be involved in pathfinding and in vertebrates may be central to target finding by axons, though it is not yet known if homologous proteins even exist in vertebrates.

To become individualized and express the membrane proteins that will ultimately regulate connections, a neuron must turn on a specific set of genes. Two chapters, one by McKinnon *et al.* and one by Chikaraishi, expertly discuss approaches to neural differentiation by studying populations of brain-specific messenger RNAs. At this level of analysis, the results are extremely sketchy and mechanistically disappointing but nevertheless intriguing. Are there special "identifier sequences" that tag genes to be turned on in neural tissues? Are there RNA messengers without polyadenylate in the brain, and if so what are their roles? Time will judge the ultimate significance of these unexpected molecular findings.

I have worked backward from sexual behavior to RNA molecules. The book goes forward and points to future research into the link between message and mind.

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Books Received

Anaerobic Bacteria. K. T. Holland, J. S. Knapp, and J. G. Shoesmith. Blackie, Glasgow, and Chapman and Hall (Methuen), New York, 1987. x, 206 pp., illus. $49.95; paper, $24. Tertiary Level Biology.

Body Posture. Experimental-Physiological Investigations of the Reflexes Involved in Body Posture, Their Cooperation and Disturbances. R. Magnus. National Institutes of Health, Bethesda, MD, 1987 (available from National Technical Information Service, Springfield, VA). xxiv, 801 pp., illus. $40. Translated from the German edition (Berlin, 1924).

The Butterflies of Indiana. Ernest M. Shull. Indiana Academy of Science, Indianapolis, 1987 (distributor, Indiana University Press, Bloomington). viii, 262 pp.,