GENOMIC REGULATORY SYSTEMS: DEVELOPMENT AND EVOLUTION.

By Eric H Davidson. San Diego (California): Academic Press. $49.95. xii + 261 p; ill.; index. ISBN: 0–12–205351–6. 2001.

One of the enduring challenges of biology and evolution is to understand the genetic events that direct a single fertilized egg to give rise to millions of cells of hundreds of functionally distinct cell types in diverse organisms. It has long been accepted that the blueprint for developmental events is embedded in the genome, and that the specification of any single cell type is the product of one or more regulatory cascades that direct tissue-specific gene transcription in a temporal and spatial manner. The past 20 years of research in developmental biology and genetics has led to the identification of genes and gene arrays that participate in these cascades. These studies have revealed extensive similarities of components and pathways that give rise to very different looking adult insects, mammals, and other intermediate species. In *Genomic Regulatory Systems,* Davidson synthesizes these findings in developmental and evolutionary contexts in a cohesive, insightful, and accessible volume.

The primary emphasis of the *Genomic Regulatory Systems* is on the role of *cis*-elements, located within the noncoding DNA, in providing specificity for the transcriptional regulation of individual genes. These *cis*-elements are organized as discrete modules with a role to process environmental cues for directing temporal and spatial patterns of gene expression during development. This scholarly account is extremely timely, as the genome projects are generating the raw material for systematic computational and laboratory approaches to identify and delineate the function of *cis*-elements and uncover the true complexity of developmental pathways. It will help shape this emerging field as it outlines, articulates, and elaborates concepts in the organization of these *cis*-elements.

In the first two chapters of the book, the fundamental concepts of *cis*-regulatory modules are introduced along with the operating principles by which they are able to regulate specification and pattern formation during embryonic development. Well-characterized *cis*-regulatory systems from *Strongylocentrotus purpuratus* (sea urchin) and *Drosophila melanogaster* (fruit fly) are effectively used to demonstrate how the composition of repressor and enhancer elements within a module affects its function. A third order of complexity is then introduced by examining the relationship of multiple *cis*-regulatory modules in determining the transcription of genes that are expressed more than once or in diverse tissues during development. This is followed in Chapters 3 and 4 with an examination of the role of *cis*-regulatory modules in directing cell type specification.

The author separates his discussion into simple systems where specification occurs early during embryogenesis and more complex organisms where the formation of distinct adult body parts precedes specification. As with the introduction, the majority of the examples are drawn from *D. melanogaster* and *S. purpuratus,* where the link between *cis*-elements and the developmental pattern of gene transcription is better understood (classic vertebrate models of heart, limb, and hindbrain development are also included for a more complete discussion). The developmental aspects are written with an integrated evolutionary genomic approach (especially Chapter 5), which is an important and advanced feature of the scholarly text. The wealth of knowledge in this first edition will be most accessible to senior graduate students and experts in developmental biology, evolution of development, and genetics. Inclusion of a more detailed introduction in a future edition is likely to make it accessible to readers outside developmental biology.

This book accomplishes its goal of presenting a clear illustration of the contribution of *cis*-regulatory elements to the regulatory cascades that shape embryo development. Most of the figures are a composite of primary data from research papers, models, and circuitry diagrams, which effectively guide readers through complex regulatory systems. It will leave a lasting impression about the importance of taking an integrative evolutionary genomic approach to understanding blueprints of developmental networks. *Genomic Regulatory Systems* will be essential for anyone interested in delving into how adult animals form and how their body plans evolve over time.

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