Gene regulatory networks and network models in development and evolution

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The passion, energy, and intellectual rigor that the late Eric Davidson brought to science transformed fields and the lives of many scientists working in them. Key among his many contributions was developing a testable framework and global approach to understanding the mechanics of gene regulation and development. For several decades, Davidson and his colleagues developed the tools, concepts, and approaches that led to a conceptual revolution in our understanding of the role of circuits of interacting genes, regulatory elements, and transcription factors in the differentiation of cells, tissues, and organs in both development and evolution. Indeed, one of the things Davidson was working on before his untimely passing in September 2015, was organizing a Sackler Colloquium highlighting progress in the field of gene regulatory networks and the potential directions for future research.

The conference that emerged, led by Douglas Erwin, Ellen Rothenberg, and myself, brought together a broad array of leaders and their students to identify key results, critical challenges, and exciting opportunities in the rapidly changing field, captured by the title of the conference: Gene Regulatory Networks and Network Models in Development and Evolution. One thing that is clear from the papers that follow is that the impact of thinking on gene networks in bioscience is truly broad and deep. The topics span a wide range, from the differentiation of germ cells (1), immunology (2, 3), and the molecular basis of cell-type differentiation (4–11), to paleontology (12, 13) and behavior (14). The central role of network thinking is revealed in the way it allows for both the design of testable experimental frameworks to probe complex biological processes and the conceptual framework for understanding biological mechanisms. By revealing the broad impact of gene regulatory networks, and the explanatory power that a rigorous approach to them contains, the work of the authors of these papers, as well as those who participated in the meeting, supplies a fitting tribute to the person whose energy initiated the conference and catalyzed discovery in the field at large.

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