



# Ingenious Genes: How Gene Regulation Networks Evolve to Control Development (Life and Mind: Philosophical Issues in Biology and Psychology)

*Roger Sansom*

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Each of us is a collection of more than ten trillion cells, busy performing tasks crucial to our continued existence. Gene regulation networks, consisting of a subset of genes called transcription factors, control cellular activity, producing the right gene activities for the many situations that the multiplicity of cells in our bodies face. Genes working together make up a truly ingenious system. In this book, Roger Sansom investigates how gene regulation works and how such a refined but simple system evolved. Sansom describes in detail two frameworks for understanding gene regulation. The first, developed by the theoretical biologist Stuart Kauffman, holds that gene regulation networks are fundamentally systems that repeat patterns of gene expression. Sansom finds Kauffman's framework an inadequate explanation for how cells overcome the difficulty of development. Sansom proposes an alternative: the connectionist framework. Drawing on work from artificial intelligence and philosophy of mind, he argues that the key lies in how multiple transcription factors combine to regulate a single gene, acting in a way that is qualitatively consistent. This allows the expression of genes to be finely tuned to the variable microenvironments of cells. Because of the nature of both development and its evolution, we can gain insight into the developmental process when we identify gene regulation networks as the controllers of development. The ingenuity of genes is explained by how gene regulation networks evolve to control development.

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