# SYSTEMS BIOLOGY AND SYNTHETIC BIOLOGY

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To my wife Juan Huang and sons, Eugene and Edgar

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# FOREWORD

The popular use of the term ''systems biology'' arose following the appearance of the first full genome sequences. These genome sequences suggested that we would have a full delineation of the molecular components of an organism. Expression profiling and proteomic data then could tell us when these components were actually used in a context-specific manner.

The need to track the interrelationship of all such components created the need to develop networks of the interactions of such components. Protein–protein interaction maps are one manifestation of this need, stoichiometric models are another; they are, however, amenable to rigorous mathematical analysis and prospective uses. Network reconstruction took center stage in systems biology, as networks describe the interactions between the gene products and the chemical compounds they make, provide context for high-throughput data mapping, and give the basis for mechanistic models that can compute phenotypic functions.

Having molecular manipulation tools and mathematical models in turn provides tools that allow the synthesis of biological components and biological functions. We thus witnessed the emergence of ''synthetic biology.'' It is practiced on multiple scales, from component design, that is akin to classical molecular biology, to design of whole cell functions, such as metabolic engineering.

Thus, in retrospect we can state that genomics gave rise to systems, and systems biology in turn gave rise to synthetic biology. This of course is a simplified view, but provides a first-order approximation to the historical origin and appearance of these popularly used terms. This volume contains a series of chapters that highlight the development and status of the various aspects of systems and synthetic biology.

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