

The biological sciences have become more quantitative and information-driven since emerging computational and mathematical tools facilitate collection and analysis of vast amounts of biological data. Complexity analysis of biological systems provides biological knowledge for the organization, management, and mining of biological data by using advanced computational tools. The biological data are inherently complex, nonuniform, and collected at multiple temporal and spatial scales. The investigations of complex biological systems and processes require an extensive collaboration among biologists, mathematicians, computer scientists, and engineers to improve our understanding of complex biological process from gene to system. Lectures in the summer school expose attendees to the latest developments in these emerging computational technologies and facilitate rapid diffusion of these mathematical and computational tools in the biological sciences. These computational tools have become powerful tools for the study of complex biological systems and signals and can be used for characterizing variability and uncertainty of biological signals across scales of space and time since the biological signals are direct indicators of the biological state of the corresponding cells or organs in the body.

The integration and application of mathematics, engineering, physics and computer science have been recently used to better understand the complex biological systems by examining the structure and dynamics of cell and organ functions. This emerging field called "Genomics and Proteomics Engineering" has gained tremendous interest among molecular and cellular researchers since it provides a continuous spectrum of knowledge. However, this emerging technology has not been adequately presented to biological and bioengineering researchers. For this reason, an increasing demand can be found for interdisciplinary interactions among biologists, engineers, mathematicians, computer scientists and medical researchers in these emerging technologies to provide the impetus to understand and develop reliable quantitative answers to the major integrative biological and biomedical challenges.

The main objective of this edited book is to provide information for biological science and biomedical engineering students and researchers in genomics and proteomics sciences and systems biology. Although an understanding of genes and proteins are important, the focus is on understanding a system's structure and dynamics of several gene regulatory networks and their biochemical interactions.

System-level understanding of biology is derived using mathematical and engineering methods to understand complex biological processes. It exposes readers with biology background to the latest developments in proteomics and genomics engineering. It also addresses the needs of both students and postdoctoral fellows in computer science and mathematics who are interested in doing research in biology and bioengineering since the book provides exceptional insights into the fundamental challenges in biology.

I am grateful to Jeanne Audino of the IEEE Press and Lisa Van Horn of Wiley for their help during the editing of this book. Working in concert with them and the contributors really helped me with content development and to manage the peer-review process.

Finally, many thanks to my wife, Dr. Yasemin M. Akay, and our son, Altug R. Akay, for their support, encouragement, and patience. They have been my driving source. I also thank Jeremy Romain for his help in rearranging the chapters and getting the permission forms from the contributors.

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Tempe, Arizona
September 2006