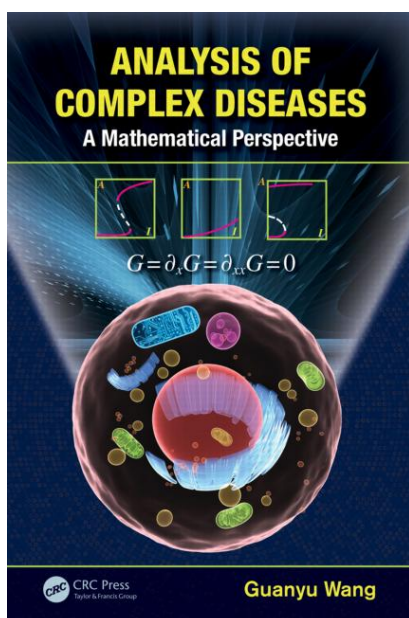


## GUANYU WANG

# ANALYSIS OF COMPLEX DISEASES: A MATHEMATICAL PERSPECTIVE



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A complex disease is intrinsically linked with many etiological and risk factors operating at multiple levels. The incidence of such diseases as cancer, obesity, and diabetes are increasing in occurrence. This suggests that a fundamental rethink of the problem and the use of a broader perspective to identify their connection, possibly leading to new effective treatments, are required. The understanding of biological data derived from studying diseases can be enhanced by theories and mathematical models, which clarify the big picture and help in revealing insights about the overarching mechanisms in the regulation of the complex biological phenomena.

Focusing on diseases related to cellular energy metabolism, such as cancer and diabetes, *Analysis of Complex Diseases: A Mathematical Perspective* presents a holistic approach for illuminating the molecular mechanisms of these diseases and the evolutionary underpinning of their simultaneous epidemics.

Using mathematics to identify patterns of deviation from normality, or the healthy state – spanning multiple levels from molecules to the organism – the author identifies a range of dynamical behaviors that correspond to either cellular physiology or pathology. The author uses the information from multiple levels in order to develop a unified theory, which includes the discovery that certain diseases may stem from well-evolved, useful mechanisms activated in the wrong context.

The book is divided into three parts describing what happens at the different levels and then examines the complex diseases in this context. The first part is dedicated to the organismal level and describes the normal physiology and how the body as a whole meets its functional requirements. The second part addresses the subcellular, molecular level to elucidate the organizing principles of cellular biomolecules needed to meet the demands of the organism. The third part is devoted to complex diseases, offering a paradigm that can be possibly extended to the study of other categories of diseases.

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