Mathematical Models in Cell Biology and Cancer Chemotherapy (Lecture Notes in Biomathematics)

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The purpose of this book is to show how mathematics can be applied to improve cancer chemotherapy. Unfortunately, most drugs used in treating cancer kill both normal and abnormal cells. However, more cancer cells than normal cells can be destroyed by the drug because tumor cells usually exhibit different growth kinetics than normal cells. To capitalize on this last fact, cell kinetics must be studied by formulating mathematical models of normal and abnormal cell growth. These models allow the therapeutic and harmful effects of cancer drugs to be simulated quantitatively. The combined cell and drug models can be used to study the effects of different methods of administering drugs. The least harmful method of drug administration, according to a given criterion, can be found by applying optimal control theory. The prerequisites for reading this book are an elementary knowledge of ordinary differential equations, probability, statistics, and linear algebra. In order to make this book self-contained, a chapter on cell biology and a chapter on control theory have been included. Those readers who have had some exposure to biology may prefer to omit Chapter I (Cell Biology) and only use it as a reference when required. However, few biologists have been exposed to control theory. Chapter 7 provides a short, coherent and comprehensible presentation of this subject. The concepts of control theory are necessary for a full understanding of Chapters 8 and 9.

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