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System Engineering Approach to Planning Anticancer Therapies

- Provides an overview about mathematical modeling in cancer
- Focuses on the analysis of cancer dynamics
- Brings together various aspects of modeling anticancer therapies

This book focuses on the analysis of cancer dynamics and the mathematically based synthesis of anticancer therapy. It summarizes the current state-of-the-art in this field and clarifies common misconceptions about mathematical modeling in cancer. Additionally, it encourages closer cooperation between engineers, physicians and mathematicians by showing the clear benefits of this without stating unrealistic goals. Development of therapy protocols is realized from an engineering point of view, such as the search for a solution to a specific control-optimization problem. Since in the case of cancer patients, consecutive measurements providing information about the current state of the disease are not available, the control laws are derived for an open loop structure. Different forms of therapy are incorporated into the models, from chemotherapy and antiangiogenic therapy to immunotherapy and gene therapy, but the class of models introduced is broad enough to incorporate other forms of therapy as well. The book begins with an analysis of cell cycle control, moving on to control effects on cell population and structured models and finally the signaling pathways involved in carcinogenesis and their influence on therapy outcome. It also discusses the incorporation of intracellular processes using signaling pathway models, since the successful treatment of cancer based on analysis of intracellular processes, might soon be a reality. It brings together various aspects of modeling anticancer therapies, which until now have been distributed over a wide range of literature.

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