
Mechanisms of Molecular Carcinogenesis – Volume 2

Johannes Haybaeck
Editor

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 Springer

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Preface

This book entitled *Mechanisms of Molecular Carcinogenesis* addresses the latest developments in the assessment of molecular carcinogenesis. Mechanistic insights gained by various model systems in vitro and in vivo need to be validated in patients in order to find their way into clinics. Although the clinical relevance of model systems sometimes is not obvious, drug development is increasingly based on their mechanisms of action, and targeted drugs are a first step toward individualized medicine.

Patient-derived model systems that faithfully recapitulate human cancer are critical for the identification and validation of innovative drug targets and particular drugs and, thus, the basic understanding of cancer. Traditional approaches most often fail late in drug development (i.e., clinical phase II/III) due to substantial limitations of currently available preclinical models which inappropriately predict tumor plasticity and heterogeneity in the human patient. Scientists seek to overcome these limitations in cancer research by utilizing a panel of clinically well-characterized tumor tissues for the generation of different patient-derived 3D cell culture models (PD3D) containing either tumor cells alone or in combination with cancer-associated fibroblasts, as well as xenograft mouse models (PDX). The in-depth comparison of various models with regard to the stability of gene expression and their response toward chemotherapy poses a critical challenge in applied cancer research. Therefore, well-described mutations and translocations of particular tumor entities are nowadays characterized in the original patient tissue by next-generation sequencing, whereas their transcriptome is often analyzed using RNAseq.

Patient-derived tissues, as well as models, are often implemented into high-content-analysis and screening platforms for high-throughput drug discovery taking into account the influence of the tumor stroma on drug treatment efficacy. Model systems like transgenic or knockout animals, PD3D models, or cell lines are assumed to allow for compound profiling with high precision on both mRNA expression patterns and protein levels of novel targets, as well as the dissection and discovery of signaling pathways.

Novel tools allowing for the construction of computer-based models and simulation of biological processes are based on the emerging field of computational pathology, which is of high clinical relevance.

In-depth knowledge about the relevant molecular mechanisms of carcinogenesis is increasingly important for targeted molecular therapy in the framework of

personalized medicine and patient care. Thus, the purpose of this book is to provide the reader with up-to-date insights into molecular and cellular mechanisms of cancer onset and progression, spread of cancer cells, and metastasis. It intends to fill the gap between basic cancer research and daily clinical practice where the prescription and advancement of routinely applied treatment strategies and targeted drugs can only be accomplished by individuals with a deeper understanding of the mode of action of the respective medications. Notably, the more advanced the tools for fighting cancer, the greater the need for a mechanistic understanding of medical approaches becomes. Therefore, this book deals with molecular diagnostics and their usability, as well as with targeted and genetic therapies. It draws a parallel to modern technology platforms and gives an overview of future developments.

This book aims at bridging the gap between basic and applied cancer research and the clinics, thereby trying to transfer knowledge from bench to bedside. A mechanistic understanding of carcinogenic events might be fundamental to the future of cancer research and treatment. Prognostic and predictive tumor biomarkers are extremely important and, thus, are highlighted in various chapters of this work.

Few medical areas have undergone such dramatic changes as did molecular pathology over the last few years. Thus, it is reasonable to have a look at this fascinating and very fast growing scientific field from different angles. Although excellent books on molecular technologies, diagnostic approaches, and therapeutic algorithms, are already available, a book addressing all these areas and simultaneously shedding light on the molecular mechanisms related to tumorigenesis is lacking.

This book not only provides a summary of basic knowledge but also, more importantly, gives an overview of the of recent advances in basic cancer research. We hope that it will serve as a comprehensive and concise source of knowledge, providing the reader with new developments and insights into carcinogenesis.

We hope that this book stimulates our readers, and that they will be fascinated by this exciting and scientifically, as well as clinically relevant, emerging topic.

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