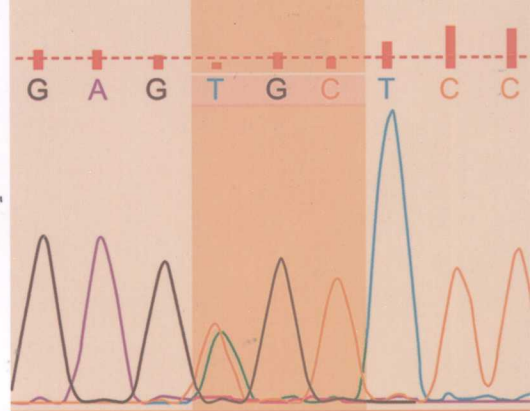
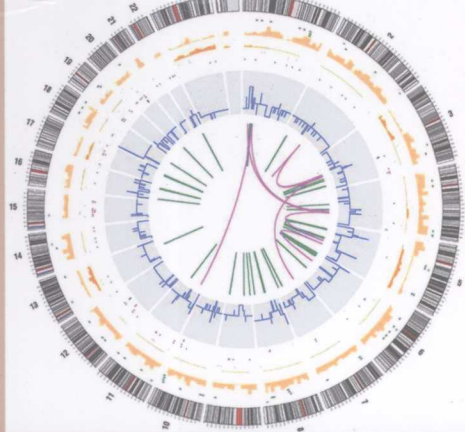


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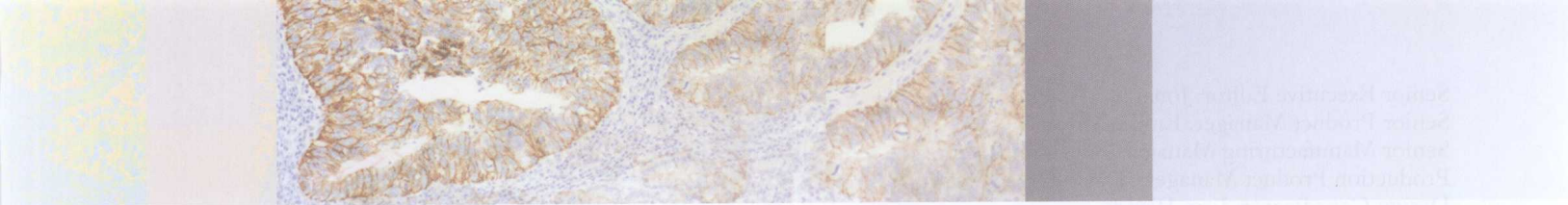
PRINCIPLES OF Molecular Diagnostics AND Personalized Cancer Medicine

Dongfeng Tan • Henry T. Lynch



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Principles of Molecular Diagnostics and Personalized Cancer Medicine

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Principles of Molecular Diagnostics and Personalized Cancer Medicine



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*This book is dedicated to my wife **Hong (Helen) Zou**, my daughters **Connie**
and **Christina**, my mother **Shubao Tang**, and my late father **Jiaqi Tan***

Dongfeng Tan, MD, FCAP

*I dedicate this book to my late wife, **Jane**, who worked with me on all of my research.
Despite this ongoing commitment, she remained a devoted mother to our three children
and a loving and beloved wife throughout our more than sixty years of marriage.*

Henry T. Lynch, MD



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PREFACE

Personalized medicine, in concert with targeted oncologic therapy, has become one of the most active, rapidly advancing, and clinically challenging pursuits in cancer treatment. A major concern for molecular geneticists and clinicians must be to focus upon prioritizing those issues that are most important for research and targeted management in these most prolific days of cancer medicine. In no area of medicine is this more apparent than in cancer medicine, where arrays of specific genetic alterations have been used to manage various types of malignancies. The discoveries that form our understanding of cancer have substantially accelerated over the past decade. These emerging findings have significantly affected the traditional practice of oncology and have resulted in a subspecialized multidisciplinary approach to patient care that incorporates personalized therapies such as targeted molecular therapy, prognosis, risk assessment, and prevention, all of which are primarily based on molecular diagnostics and imaging.

This book, written by a cadre of renowned experts in cancer research, pathology, clinical trials, molecular diagnostics, personalized therapy, bioinformatics, and federal regulations, provides broad, comprehensive perspectives on the current trends in molecular diagnosis of cancer and personalized cancer medicine. It updates readers on recently acquired knowledge and emphasizes new uses for that knowledge in the changing landscape of specialized multidisciplinary care and personalized medicine.

The book consists of 7 sections and 70 chapters. Although the chapters follow a sequence from pathogenesis to therapy, each chapter stands alone in its treatment of the subject matter. Section I updates readers on general cancer biology and genetics and provides a basis for the more specialized sections that follow. Cancer cell proliferation, signal transduction pathways, cancer stem cells, and the interaction between genetics and environmental factors in carcinogenesis are emphasized. Section II is devoted to molecular technologies, including the popular polymerase chain reaction technique, single nucleotide polymorphisms, whole-genome assessments, and next-generation sequencing. Section III provides rich information on molecular imaging and screening, genetic counseling, minimal residual disease detection, circulating

tumor cell tests, molecular cancer prognosis assessment, regulatory perspectives on genetic tests, quality assurance and standardization of molecular diagnostics, and the use of biostatistics and bioinformatics in molecular tests and personalized cancer medicine.

Section IV focuses on molecular diagnostics of common malignancies. Detailed information is provided on the use of molecular methods in clinical cancer assessment. Section V reviews and updates information on the molecular basis of cancer therapy and emphasizes critical molecules as special treatment targets, particularly genes/DNA, RNA, proteins/antibodies, and nanoparticles. Section VI covers personalized targeted therapy for the most common human malignancies. The goal of such therapy is to deliver the right drug to the right patient at the right time at the right dose. This effort requires the integration of information from the DNA, RNA, and protein levels with predictors of treatment response to particular therapies. Novel therapeutic agents against specific genetic, molecular, and antigenic targets are discussed, as is the process for deciding whether to use these agents (for example, the need to determine whether specific *KRAS*, and *BRAF* mutations are present in colorectal cancer before treating it with EGFR antagonists). The book concludes with Section VII, which covers the future of molecular pathology and personalized medicine in cancer management. Clearly, over the next 10 years, we will have the opportunity to clinically evaluate a number of novel biological and chemical agents that target specific molecular irregularities in malignant cells.

This textbook assists pathologists, oncologists, other clinicians, and basic scientists and provides a basis for interactions among all professionals involved in multidisciplinary cancer care. It also provides timely information that is necessary for continued medical education. As such, this book is invaluable to practicing physicians at all levels of experience who need to keep up with advances to provide molecular diagnoses and to deliver personalized treatment. Moreover, the information presented in this book should supply a basis upon which research investigators can evaluate new approaches to molecular diagnostics and targeted therapy, allowing them to understand and

critically assess the many new products of the biotechnology revolution.

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