Preface

Cardiovascular disease is the leading cause of death in developed countries, but is quickly becoming an epidemic in such well-populated countries as China, India, and other developing nations. Cardiovascular research is the key to the prevention, diagnosis, and management of cardiovascular disease. Vigorous and cross-disciplinary approaches are required for successful cardiovascular research. As the boundries between different scientific disciplines, particularly in the life sciences, are weakening and disappearing, a successful investigator needs to be competent in many different areas, including genetics, cell biology, biochemistry, physiology, and structural biology. The newly developed field of molecular medicine is a cross-disciplinary science that seeks to comprehend disease causes and mechanisms at the molecular level, and to apply this basic research to the prevention, diagnosis, and treatment of diseases and disorders. This volume in the *Methods in Molecular Medicine* series*, Cardiovascular Disease,* provides comprehensive coverage of both basic and the most advanced approaches to the study and characterization of cardiovascular disease. These methods will advance knowledge of the mechanisms, diagnoses, and treatments of cardiovascular disease.

Cardiovascular Disease is a timely volume in which the theory and principles of each method are described in the Introduction section, followed by a detailed description of the materials and equipment needed, and step-by-step protocols for successful execution of the method. A notes section provides advice for potential problems, any modifications, and alternative methods.

We have gathered a group of highly experienced cardiovascular researchers to describe in detail the most important techniques in molecular medicine that are employed in genetic, molecular, cellular, structural, and physiological studies of cardiovascular disease. The thirty-seven chapters in the two volumes cover varied methods that include the following:

- Cytogenetic analyses (karyotyping, FISH, array CGH, somatic hybrid analysis).
- Linkage programs for mapping chromosomal locations of disease genes.
- Bioinformatics.
- Human genetics for identifying genes for both monogenic and common complex diseases (positional cloning and genome-wide association study).
- Mouse genetics for identifying genes for complex disease traits (chromosome substitution strains).
- Mutation screening, genetic testing, and high throughput genotyping of single-nucleotide polymorphisms (SNPs).
- Microarray (Genechips) analysis.

- Proteomics.
- Generation of knockout, knock-in, and conditional mutant mice and transgenic overexpression mice for cardiovascular genes.
- Animal models for coronary artery disease, heart failure, hypertension, cardiac arrhythmias, and thrombosis.
- Cardiac physiology (recording techniques for action potentials, sodium and other ionic currents, and optical mapping).
- Cell biology (isolation of adult cardiomyocytes, endothelial cells, smooth muscle cells, angiogenesis, cell proliferation, adhesion, migration, and apoptosis assays).
- Gene transfer and gene therapy (adenovirus vectors, HIV-based retroviral vectors, nucleofection®).
- Structural biology (X-ray crystallography, NMR spectroscopy, and electron cryomicroscopy).
- Stem cells.

Cardiovascular Disease should be particularly useful for inspiring undergraduate students, graduate students, postdoctoral fellows, cardiology fellows, clinicians, basic scientists, and other researchers who are entering a new area of cardiovascular research to experience the new challenges. It will serve as a valuable resource book for active researchers when they design new experiments. Although many techniques are described for studying cardiovascular disease, they should be equally valuable for researchers studying other human diseases.

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