This book is a unique overview of cardiovascular development from the cellular to the organ level across a broad range of species. Leading experts in the fields of anatomy, embryology, experimental and molecular biology, comparative physiology, pediatric cardiology, and fetal heart surgery have contributed to this integrated text. The book is divided into three parts. The first focuses on the molecular, cellular, and integrative mechanisms that determine cardiovascular development. It discusses the molecular biology, intracellular and extracellular environment, functional maturation, vasculogenesis, and regulation of developing cardiovascular systems. The second part summarizes cardiovascular development in invertebrate and vertebrate systems. The third provides an overview of environmental factors and the effects of disease on cardiovascular development with discussions of the effects of environmental and morphogenetic influences on non-mammalian and mammalian development. It offers strategies for the management of congenital cardiovascular malformations in utero and postnatally.

The book will interest those who work in the fields of developmental biology, physiology, and molecular and pediatric cardiology.

DEVELOPMENT OF CARDIOVASCULAR SYSTEMS

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MOLECULES TO ORGANISMS

Edited by

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Foreword

CONSTANCE WEINSTEIN

Several features distinguish this book from others on development of the cardiovascular system and therefore establish it as an important contribution to literature on the subject. Among these features is the careful description of the anatomy and physiology of various animal models of development commonly used in genetic and molecular biological studies of the heart and vascular system. Understanding the differences among species is crucial to proper interpretation of findings, particularly when those findings form the basis for inferences on their significance for human malformations and diseases.

A laudable emphasis on the physiology of the developing cardiovascular system appears throughout the book. This draws attention to the fact that, although form and function are closely related, function may be perturbed without visible perturbations of form, and because the physiology of the embryo and fetus differs from that of the postnatal organism, malformations may have deleterious physiological effects only after birth. The text sets out clearly that among species there are important functional differences that are reflected in the expression of proteins characteristic of the individual species and that change with maturation of the cardiovascular system. All these factors must be taken into account when considering the significance of experimental results.

To my knowledge, this is the first book to cover comparative embryology of the cardiovascular system in invertebrates and vertebrates in a text that is intended to attract readers engaged in biomedical research, closing as it does with chapters on human disease and treatment strategies. Comparative embryology is an important branch of science, and its inclusion in this book may inspire investigators to explore less commonly used models for answers to difficult questions about more complex physiological systems. For example, scientists have long been puzzled by the fact that mature cardiomyocytes appear to be terminally differentiated; that is, they are unable to reenter the cell cycle and replace dead cells after injury to the heart. If the controls that govern the cardiomyocyte cell cycle were understood, it might be possible to treat myocardial infarction by stimulating cellular proliferation to replace dead muscle tissue. Despite the eagerness of investigators to overcome the obstacle of terminal differentiation, few have paid attention to the observation made by the Oberprillers more than 20 years ago (Oberpriller & Oberpriller, 1974) that cells of adult newt and frog hearts are able to reenter the cell cycle and undergo complete mitosis with cytokinesis in response to injury. Over the years they have identified a number of molecules that enhance or inhibit replication of cardiac myocytes in amphibians (Oberpriller et al., 1995). Such information provides a strong background for cell-cycle experts to initiate new studies of mammalian cardiac cells.

This book provides interesting reading but, more important, it will be a source of ideas for new approaches to the problems of perturbed cardiovascular development and treatment of acquired disease.