
Preface

The fact that ischemic heart disease is the leading cause of morbidity and mortality in the industrial world highlights the importance of the coronary vasculature. Although a wealth of literature regarding coronary vessels and myocardial perfusion exists, by virtue of necessity, most laboratories are highly specialized performing work that is highly focused. As a consequence, cross talk between various areas of this broad field is limited. This publication is intended for an audience of cardiovascular scientists and physicians, and the goal is to provide a single comprehensive publication that reviews, discusses, and integrates findings in the various areas of research pertaining to the coronary vasculature. The chapters were written with some redundancy and include references to other chapters, to present the topics in an integrated manner and in recognition that chapters are often read in isolation. The focus of each of the 12 chapters included in this book is described below.

Chapter 1 is aimed at providing the reader with a basic understanding of the principles of vessel formation and the molecules that regulate this process. This chapter considers the cascade of events that comprise vascular formation and the major signaling pathways that regulate these events. Chapter 2 provides an account of the cells that migrate to the heart to form its outer layer (epicardium) and the mechanisms that promote the related cell transformations and the development of the coronary vasculature. The third chapter is an extension of Chap. 2 and reviews development of the coronary vasculature during postnatal growth. The early postnatal period involves a rapid period of growth that challenges the coronary vasculature to adapt to meet greater metabolic demands.

Chapter 4 dissects the structure of the coronary vasculature in relation to its regulation of coronary flow and myocardial perfusion. This chapter considers the regulation of flow by various components of the coronary hierarchy and examines the structure–function relationships for the various types of vessels. Chapter 5 considers a topic rarely addressed: a historical perspective of the coronary system. One can appreciate some of the most important discoveries in the context of many centuries and come to appreciate that new findings require considerable time to become accepted. Errors of coronary vessel development, i.e., anomalies, and their effects on the coronary circulation are the topics of Chap. 6. Most importantly, this chapter addresses possible mechanisms underlying coronary anomalies and the effect of these anomalies on myocardial ischemia and sudden death. Chapter 7 covers aging of the coronary vasculature and provides contrasts between biological aging and age-related changes; the latter are alterations that are linked to life style and disease (senility) rather than to normal biological aging (senescence).

Chapters 8–11 address adaptations of the coronary vasculature. Exercise training (Chap. 8) represents one of the most important avenues to reducing the risks of cardiovascular disease. Differences in protocols and animal models are discussed with regard to discordant findings. Chapter 9 reviews hypoxic signaling mechanisms, and the role of hypoxia in coronary vessel formation and growth, adaptations to high altitude and cardiac hypertrophy, and the protective effects of hypoxic preconditioning. This chapter is closely related to Chap. 10 on myocardial

ischemia and infarction, because hypoxia is a component of ischemia. Chapter 10 addresses both the acute and chronic effects of ischemia on the coronary circulation, vascular growth and remodeling, and pre- and postconditioning. Chapter 11 considers the coronary vasculature with regard to the type of stimulus that evokes the hypertrophy, e.g., pressure overload, volume overload, increased thyroid hormone levels, and cardiomyopathy. The importance of vascular growth during cardiac hypertrophy is that it normalizes myocardial perfusion and oxygen delivery in the context of increased workloads. Chapter 12 (Therapy for the Coronary Circulation) explores the various strategies employed to induce coronary vascular growth and function. Major topics include therapies utilizing (1) genes and proteins, (2) endothelial stem and progenitor cells, and (3) pharmacological agents. Responses of various components of the coronary hierarchy, especially the collateral circulation, are reviewed. The development of the various chapters was aided by consultants with expertise on the topics included in this publication.

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Development, Structure-Function, and Adaptations

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