A recent surge in the exploring noncoding RNAs in stem cell research has ignited a field of discovery into many diseases including heart diseases. Heart diseases continue to be among the leading causes of death in Western countries. The most common heart diseases such as Myocardial infarction, atherosclerosis and hypertension which are mainly affect the heart, lungs and the blood vessels. Several independent risk factors have been identified and shown to be responsible for cardiovascular diseases. Although important progress has been made in the treatment of heart failure during the last decade, most interventions relieve symptoms or prevent disease progression. Thus, an improved knowledge and treatment or curative regimen is desperately needed. Recently, scientists have demonstrated that RNA functions not only as an intermediate molecule between DNA and protein, but also plays a critical role in regulating gene expression. Some of the RNAs are functional in cells but do not encode proteins. Hence, these RNAs are called noncoding RNAs (ncRNAs). Approximately 10% of the host genome consist of ncRNAs and are occupied at intergenic or intragenic regions. These ncRNAs play an important role in regulating genes that are involved in controlling the transcriptional or translational pathways. Importantly, ncRNAs are having diverse biological functions like development, differentiation, growth, and metabolism. Among ncRNAs, the short interfering RNAs and microRNAs (miRNAs) have been extensively studied, but their specific functions yet to be identified. In recent years, miRNAs are efficiently studied as one of the important candidates for involvement in most biological processes and have been implicated in many human diseases. Thus, the identification and the respective targets of miRNAs may provide novel molecular insight and new therapeutic strategies to treat diseases.

Number of recent studies has shown that miRNAs are essential for the normal development and physiology of various organs, including the heart. Studies have also started to characterize the link between miRNAs and different aspects of cardiac pathogenesis as well as proliferation, differentiation, function and maintenance of cardiac cells. Moreover, congenital heart anomalies can be associated with the dysregulation of specific miRNAs. The recently developed high-throughput approaches revealed the miRNA size, and their target, and the connectivity of the miRNA-dependent regulatory network. One step further, the expression levels of miRNAs and their decay rates have been identified in individual cell types. These works together help us to understand miRNA-dependent gene regulation to study the response of the entire network. During the past decade, numerous research articles have shown a wide knowledge about the basic mechanisms of miRNAs, biogenesis and its functions in the circulatory system. Although miRNAs are richly expressed in the heart, relatively little is explored about the multi-functional effect of these molecules in the heart.

Circulating miRNAs in patients with MI have been examined very recently. It was reported that miRNAs served as a critical modulating regulator, which participates in almost all aspects of cardiovascular diseases and vascular biology. Studies demonstrated that miRNAs also existed in blood, in the form of circulating miRNAs and are resistant to endogenous ribonuclease activity and can be present in a remarkably stable form during pathological conditions. More importantly, circulating miRNAs are currently explored as biomarkers in a wide range of cardiovascular conditions, including atherosclerotic disease. Based on genome-wide studies, thousands of miRNAs exist, however as of now only a limited number of functional miRNAs have been sequenced, identified and characterized. It takes part actively in regulating splicing, localization, stability, and translation of the target mRNAs. MicroRNAs that are capable of interfering with either complete or partial complementary to the cellular mRNAs, would be a useful treatment strategy for various diseases. I hope that the literature and examples provided here will illustrate the diversity of mechanisms regulating miRNAs while protecting the young and old heart. Certainly, many more needs to be discovered and the full potential of miRNA as therapeutic agents to be revealed. Thus, miRNAs have a promising and an exciting future in the field of research.

In this book, studies have highlighted the mechanisms by which miRNAs regulate various biological functions in model systems and could be a potential molecular therapeutic target for various heart diseases. Moreover, the authors discussed the functional roles of miRNAs and its potential use of diagnostic biomarker for cardiovascular diseases, as well as the limitations and challenges in miRNA-based therapy.

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