

Contents

Part I Normal Cardiac Rhythm and Pacemaker Activity

1 Cardiac Ion Channels and Heart Rate and Rhythm	3
Onkar Nath Tripathi	
2 Ionic Basis of the Pacemaker Activity of SA Node Revealed by the Lead Potential Analysis	33
Yukiko Himeno, Chae Young Cha, and Akinori Noma	
3 The “Funny” Pacemaker Current	59
Andrea Barbuti, Annalisa Bucci, Raffaella Milanesi, Georgia Bottelli, Alessia Crespi, and Dario DiFrancesco	
4 Novel Perspectives on Cardiac Pacemaker Regulation: Role of the Coupled Function of Sarcolemmal and Intracellular Proteins	83
Victor A. Maltsev, Tatiana M. Vinogradova, and Edward G. Lakatta	
5 Pacemaker Activity of the SA Node: Insights from Dynamic-Clamp Experiments	101
Ronald Wilders, Antoni C.G. van Ginneken, and Arie O. Verkerk	
6 Heart Rate Variability: Molecular Mechanisms and Clinical Implications	119
Kishore K. Deepak	
7 Mechano-Electric Feedback in the Heart: Effects on Heart Rate and Rhythm	133
T. Alexander Quinn, Rebecca A. Bayliss, and Peter Kohl	

Part II Modeling

**8 A Historical Perspective on the Development of Models
 of Rhythm in the Heart 155**
 Penelope J. Noble and Denis Noble

9 Simulation of Cardiac Action Potentials 175
 Jonathan D. Moreno and Colleen E. Clancy

Part III Cardiac Development and Anatomy

**10 Development of Pacemaker Activity in Embryonic
 and Embryonic Stem Cell-Derived Cardiomyocytes 197**
 Huamin Liang, Michael Reppel, Ming Tang, and Jürgen Hescheler

**11 Molecular Basis of the Electrical Activity of the Atrioventricular
 Junction and Purkinje Fibres 211**
 Halina Dobrzynski, Oliver Monfredi, Ian D. Greener, Andrew Atkinson,
 Shin Inada, Mary-Anne Taube, Joseph Yanni, Olga Fedorenko, Peter
 Molenaar, Robert H. Anderson, Igor R. Efimov, and Mark R. Boyett

**12 Molecular Basis and Genetic Aspects of the Development
 of the Cardiac Chambers and Conduction System:
 Relevance to Heart Rhythm 231**
 Martijn L. Bakker, Vincent M. Christoffels, and Antoon F.M. Moorman

**13 Role of the T-Tubules in the Response of Cardiac Ventricular
 Myocytes to Inotropic Interventions 255**
 C.H. Orchard, F. Brette, A. Chase, and M.R. Fowler

Part IV Mechanisms of Acquired Arrhythmia

**14 An Overview of Spiral- and Scroll-Wave Dynamics
 in Mathematical Models for Cardiac Tissue 269**
 Rupamanjari Majumder, Alok Ranjan Nayak, and Rahul Pandit

**15 Post-infarction Remodeling and Arrhythmogenesis: Molecular,
 Ionic, and Electrophysiological Substrates 283**
 Nabil El-Sherif

16	The Role of Intracellular Ca^{2+} in Arrhythmias in the Postmyocardial Infarction Heart	305
	Wen Dun, Henk ter Keurs, and Penelope A. Boyden	
17	Molecular and Biochemical Characteristics of the Intracellular Ca^{2+} Handling Proteins in the Heart	323
	Yasser Abdellatif, Vijayan Elimban, Delfin Rodriguez-Leyva, and Naranjan S. Dhalla	
18	Pharmacological Modulation and Clinical Implications of Sarcolemmal Ca^{2+}-Handling Proteins in Heart Function	337
	Yasser Abdellatif, Adriana Adameova, and Naranjan S. Dhalla	
19	Calmodulin Kinase II Regulation of Heart Rhythm and Disease ...	351
	Thomas J. Hund	
20	MicroRNA and Pluripotent Stem Cell-Based Heart Therapies: The Electrophysiological Perspective	365
	Ellen Poon, Deborah K. Lieu, and Ronald A. Li	

Part V Mechanisms of Inherited Arrhythmia

21	Intracellular Calcium Handling and Inherited Arrhythmogenic Diseases	387
	Nicola Monteforte, Carlo Napolitano, Raffaella Bloise, and Silvia G. Priori	
22	Molecular Mechanisms of Voltage-Gated Na^+ Channel Dysfunction in LQT3 Syndrome	409
	Thomas Zimmer and Klaus Benndorf	
23	The Short QT Syndrome	431
	Jules C. Hancox, Mark J. McPate, Aziza El Harchi, Rona S. Duncan, Chris E. Dempsey, Harry J. Witchel, Ismail Adeniran, and Henggui Zhang	
24	Adrenergic Regulation and Heritable Arrhythmias: Key Roles of the Slowly Activating Heart I_{Ks} Potassium Channel	451
	David Y. Chung, Kevin J. Sampson, and Robert S. Kass	

25	Defects in Ankyrin-Based Protein Targeting Pathways in Human Arrhythmia	461
	Hjalti Gudmundsson, Francis Jareczek, and Peter J. Mohler	
26	Genetically Modified Mice: Useful Models to Study Cause and Effect of Cardiac Arrhythmias?	473
	Gregor Sachse, Martin Kruse, and Olaf Pongs	
27	Genetics of Atrial Fibrillation	485
	Saagar Mahida, Michiel Rienstra, Moritz F. Sinner, Steven A. Lubitz, Patrick T. Ellinor, and Stefan Käb	
Part VI Role of Specific Channels and Transporters in Arrhythmia		
28	The Role of Gap Junctions in Impulse Propagation in the Heart: New Aspects of Arrhythmogenesis and New Antiarrhythmic Agents Targeting Gap Junctions	503
	Stefan Dhein, Joanna Jozwiak, Anja Hagen, Thomas Seidel, Anna Dietze, Aida Salameh, Martin Kostelka, and Friedrich Wilhelm Mohr	
29	Possible Mechanisms of the Acute Ischemia-Induced Ventricular Arrhythmias: The Involvement of Gap Junctions	525
	Ágnes Végh and Rita Papp	
30	Role of NCX1 and NHE1 in Ventricular Arrhythmia	543
	András Tóth and András Varró	
31	TRP Channels in Cardiac Arrhythmia: Their Role During Purinergic Activation Induced by Ischemia	563
	Guy Vassort and Julio Alvarez	
32	Cardiac Aquaporins: Significance in Health and Disease	581
	Tanya L. Butler and David S. Winlaw	
Part VII Drugs and Cardiac Arrhythmia		
33	Ion Channels as New Drug Targets in Atrial Fibrillation	599
	Ursula Ravens	
34	hERG1 Channel Blockers and Cardiac Arrhythmia	611
	Michael C. Sanguinetti and Matthew Perry	

35 Preclinical Drug Safety and Cardiac Ion Channel Screening 627
Zhi Su and Gary Gintant

**36 QT Prolongation Is a Poor Predictor of Proarrhythmia Liability:
Beyond QT Prolongation! 639**
Luc M. Hondeghem

37 K Channel Openers as New Anti-arrhythmic Agents 655
Nathalie Strutz-Seeböhm and Guiscard Seeböhm

Index 669