



Yoram Rudy

The Fred Saigh Distinguished Professor.
Director, Cardiac Bioelectricity and Arrhythmia Center (CBAC)
Professor of Biomedical Engineering,
Cell Biology & Physiology, Medicine, Radiology,
and Pediatrics.

Websites: <http://rudylab.wustl.edu/> ; <http://cbac.wustl.edu/>

Expertise

Mathematical modeling of cardiac ion channels, cells and tissue to study cardiac excitation and arrhythmias across scales. Noninvasive electrocardiographic imaging (ECGI) for the study, diagnosis and treatment of clinical cardiac arrhythmias in patients

Research

Rhythm disorders of the heart lead to over 400,000 cases of sudden death annually in the U.S. alone. Yoram Rudy's research aims at understanding the mechanisms that underlie normal and abnormal rhythms of the heart at various levels, from the molecular and cellular to the whole heart. Through development of detailed mathematical models of ion channels biophysics and electrophysiology, and of cardiac cells and tissue, the Rudy Lab is investigating arrhythmia mechanisms. The cell models have been used worldwide for research, teaching and training. Professor Rudy has also developed a novel noninvasive imaging modality (Electrocardiographic Imaging, ECGI) for diagnosis and guided therapy of cardiac arrhythmias. ECGI is used to study mechanisms of clinical arrhythmias (e.g. atrial fibrillation, ventricular tachycardia, heart failure) in patients. The premise in the Rudy Lab is that an integrated approach to the study of mechanisms at all levels of the cardiac system, from cell to bedside, and the development of novel diagnostic and therapeutic tools will lead to successful strategies for prevention and treatment of cardiac arrhythmias and sudden death.

Professor Rudy is the director of the interdisciplinary **Cardiac Bioelectricity and Arrhythmia Center (CBAC)**, which includes 39 faculty members.

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PhD, Case Western Reserve University,
Biomedical Engineering, 1978

MSc, Technion-Israel Institute of Technology,
Physics, 1973

BSc, Technion-Israel Institute of Technology,
Physics, 1971

Member of the National Academy of Engineering of the United States of America (since 2003). Citation: "For leadership in the engineering sciences of cardiac excitation at the genetic and molecular levels and for introducing new methods in clinical diagnosis and therapy"

Fellow of the National Academy of Inventors of the United States of America, since 2018. Citation: "Have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and the welfare of society"

Biography

Professor Rudy came to Washington University in St. Louis in 2004 from Case Western Reserve University, where he had been a member of the faculty in Biomedical Engineering and Director of the Cardiac Bioelectricity Research and Training Center since 1980.

He has also served as a visiting professor in various universities worldwide, including Oxford, University College London, Columbia, Cornell, Johns Hopkins, Bern, Nagoya, Maastricht, Stanford, Milan, Parma, Florence, Taiwan (Tainan) and Technion, and delivered many keynote addresses at international scientific meetings.

Professor Rudy published over 300 scientific articles and delivered over 300 invited lectures. He graduated 40 doctoral students, who continue to pursue careers in academic research and medicine and in the biomedical industry.

Professor Rudy is Member of the National Academy of Engineering and Fellow of the National Academy of Inventors. He is the recipient of numerous awards, among which are: the NIH Merit Award, the Biomedical Engineering Society Distinguished Lectureship Award, the Astor Visiting Professorship and Royal Academy of Engineering Distinguished Fellowship at Oxford, the Heart Rhythm Society Distinguished Scientist Award, Case Western Reserve University Distinguished Alumni Award, Washington University Chancellor's Award for Innovation and Entrepreneurship, the Technion Israel Pollak Award and the Hein Wellens Distinguished Professor in Cardiology at Maastricht University. He also served as President of the Cardiac Electrophysiology Society from 2006-2008.

Selected Publications

Mathematical Modeling

C. E. Clancy, **Y. Rudy**, "Linking a genetic defect to its cellular phenotype in a cardiac arrhythmia" *Nature* 1999;400:566-569.

R.M. Shaw and **Y. Rudy**, "Ionic Mechanisms of Propagation in Cardiac Tissue: Roles of the Sodium and L-Type Calcium Currents During Reduced Excitability and Decreased Gap-Junction Coupling" *Circ Res* 1997; 81:727-741.

J. R. Silva, H. Pan, D. Wu, A. Nekouzadeh, K. Decker, J. Cui, N. A. Baker, D. Sept, **Y. Rudy**, "A Multiscale Model Linking Ion-Channel Molecular Dynamics and Electrostatics to the Cardiac Action Potential" *Proc Natl Acad Sci USA (PNAS)* 2009;106:11102-11106.

T.J. O'Hara, L. Virág, A. Varró, **Y. Rudy**, "Simulation of the undiseased human cardiac ventricular action potential: Model formulation and experimental validation" *PLoS Computational Biology* 2011; 7(5): e1002061.doi:10.1371/journal.pcbi.1002061

S Ramasubramanian, **Y Rudy**, "The Structural Basis of IKs Ion-Channel Activation: Mechanistic Insights from Molecular Simulations" *Biophys. J.* 2018 Jun 5;114 (11):2584–2594.

Electrocardiographic Imaging (ECGI)

C. Ramanathan, R.N. Ghanem, P. Jia, K. Ryu, **Y. Rudy**, "Electrocardiographic Imaging (ECGI): A Noninvasive Imaging Modality for Cardiac Electrophysiology and Arrhythmia" *Nature Medicine* 2004;10:422-428.

C. Ramanathan, P. Jia, R.N. Ghanem, K. Ryu, **Y. Rudy**, "Activation and repolarization of the normal human heart under complete physiological conditions" *Proc Natl Acad Sci USA (PNAS)* 2006; 103: 6309-14.

Y. Rudy, "Noninvasive Electrocardiographic Imaging of Arrhythmogenic Substrates in Humans" *Circulation Research*, 2013;112:863-874.

Y. Wang, P.S. Cuculich, J. Zhang, K. A. Desouza, R. Vijayakumar, J. Chen, M. N. Faddis, B. D. Lindsay, T. W. Smith, **Y. Rudy**, "Noninvasive Electroanatomic Mapping of Human Ventricular Arrhythmias Using ECG Imaging (ECGI)" *Science Translational Medicine* 2011 (31 August); Volume 3 (issue 98):191-200 (98ra84)

P Cuculich, MR Schill, R Kashani, S Mutic, A Lang, D Cooper, M Faddis, M Gleva, A Noheria, TW.Smith, D Hallahan, **Y Rudy**, C G Robinson "Noninvasive Cardiac Radiation for Ablation of Ventricular Tachycardia" *N Engl J Med* 2017;377:2325-36.