Igor R. Efimov, PhD, FNAI, FAHA, FHRS, FAIMBE

- Professor of Biomedical Engineering and Professor of Medicine (Cardiology), Northwestern University, Chicago, IL
- Director of the Cardiovascular Engineering Laboratory at Northwestern University in Chicago, an NIH-funded cardiovascular research and engineering laboratory focusing on cardiovascular disease's physiological mechanisms and developing novel therapies for heart diseases, emphasizing heart rhythm disorders.
- Director of Graduate Studies in Biomedical Engineering
- Founder of startups Cardialen (exited 2022) and NuSera Biosystems, which developed device therapy for heart diseases.
- Fellow of the National Academy of Inventors, American Heart Association, Heart Rhythm Society, and other professional societies.
- Member, the American Academy of Sciences and Letters, 2025.
- Co-founder and first president (2009-2011) of the Russian American Science Association.
- Editor-in-Chief of the Cardiovascular Engineering & Technology journal, published by the Biomedical Engineering Society. (2021-2025)

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Chicago, IL 60611, USA

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Home address:

180 E Pearson St., Apt. 6206
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Email: irefimov@gmail.com
Mobile: (202) 294-8182

Training:

1986	B.Sc./M.Sc. in experimental nuclear physics from Moscow Institute of Physics and Technology, USSR. The experimental research was completed jointly at the Institute of Nuclear Physics, USSR Academy of Sciences, Moscow, and at the Institute of High Energy Physics, Protvino, Moscow Region, USSR.
4/3/1992	Ph.D. in Biophysics (Biophysics/Biomedical Engineering) from Moscow Institute of Physics and Technology, Moscow, Russia and Institute of Biological Physics, Russian Academy of Sciences, Puschino, Moscow region, Russia. Ph.D. adviser Prof. Valentin Krinsky.

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1992-1994 Postdoctoral training. Fast fluorescent imaging and cardiac bioelectricity. University of Pittsburgh, Pittsburgh, PA. Scientific adviser Prof. Guy Salama.
1993-1994 Parallel and distributed computational methods and techniques. Pittsburgh Supercomputing Center.

Academic Positions held:

2022-present Professor of Biomedical Engineering, McCormick School of Engineering, Northwestern University, Chicago IL.
2022-present Professor of Medicine, Division of Cardiology, Feinberg School of Medicine, Northwestern University, Chicago IL.
2022-present Affiliate Member, Querrey Simpson Institute for Bioelectronics, Northwestern University, Chicago IL.
2021-2025 Editor-in-Chief, Cardiovascular Engineering & Technology, Biomedical Engineering Society, Springer Nature.
2021-2022 Visiting Scholar, Querrey Simpson Institute for Bioelectronics, Northwestern University, Chicago IL.
2015-2022 The Alisann & Terry Collins Professor, Department of Biomedical Engineering, George Washington University, Washington, DC.
2015-2019 Founding Chairman, Department of Biomedical Engineering, George Washington University, Washington, DC.
2014-2022 Visiting Professor, Moscow Institute of Physics and Technology, Moscow, Russia
2013-2022 Visiting Professor, University of Bordeaux Segalen, and L'Institut de rythmologie et modélisation cardiaque (LIRYC), Bordeaux, France.
2008-2015 The Lucy and Stanley Lopata Distinguished Professor of Biomedical Engineering, Washington University, St. Louis, MO
2010-2015 Professor of Medicine (Cardiology), Washington University School of Medicine
2008-2015 Professor of Radiology, Washington University School of Medicine
Professor of Cell Biology and Physiology, Washington University School of Medicine (secondary appointments)
2004-2008 Associate Professor of Biomedical Engineering on the Stanley and Lucy Lopata Endowment, Washington University, St. Louis, MO
Associate Professor of Radiology, Associate Professor of Cell Biology and Physiology, Washington University Medical School, St. Louis, MO
2004-2014 Adjunct Associate Professor of Biomedical Engineering, Case Western Reserve University, Cleveland OH (secondary appointment)
2002-2004 Associate Professor of Physiology and Biophysics, Case Western Reserve University, Cleveland OH (secondary appointment)
2000-2004 Elmer L. Lindseth Associate Professor of Biomedical Engineering, Case Western Reserve University, Cleveland OH
1998-2000 Assistant Staff, Department of Cardiology, Cleveland Clinic Foundation, Cleveland OH
1998-2000 Assistant Staff (secondary appointment), Department of Molecular Cardiology, Cleveland Clinic Foundation, Cleveland OH
1999-2000 Adjunct Assistant Professor of Biomedical Engineering, Case Western Reserve University, Cleveland OH

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1994-1998 Research Associate, Department of Cardiology, The Cleveland Clinic Foundation, Cleveland OH
1992-1994 Research Associate, Department of Cell Biology and Physiology, School of Medicine, University of Pittsburgh
1987-1992 Junior researcher and graduate program, Institute of Biological Physics, USSR Academy of Sciences, Puschino, Moscow Region, Russia
1986-1987 Junior researcher in the Scientific Council for Cybernetics, USSR Academy of Sciences, Moscow, Russia

Honors and awards:

- 2025, Member, the American Academy of Sciences and Letters.
- The 2025 Ralph Lazzara Lectureship Award. The Heart Rhythm Society.
- The 2023 Fred S. Grodins Keynote Lecture in the Alfred E. Mann Department of Biomedical Engineering, University of Southern California, Los Angeles, CA
- The 2023 Hermann Rahn Memorial Lecture and Seminar, Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, State University of New York, Buffalo, NY
- The 2022 Naranjan Dhalla Honorary Lecture Award and Medal, International Academy of Cardiovascular Sciences.
- HRS 2021 Distinguished Scientist Award.
- Fellow, National Academy of Inventors, 2019.
- The 7th Burton E. Sobel Lecture on Cardiovascular Research Day at Washington University in St. Louis, MO, 2018.
- The Rita Kicher Lectureship in Cardiology, Harrington Heart and Vascular Institute, Case Western Reserve University, Cleveland Ohio, 2018.
- The Dr. E. R. Smith Lecture in Cardiovascular Research, 2018 Research Day at the Libin Cardiovascular Institute of Alberta, University of Calgary, Canada.
- 2018 Keynote lecture at the Heart Research Symposium, Auckland Bioengineering Institute, University of Auckland, New Zealand.
- 2018 George Washington University School of Engineering and Applied Science Distinguished Researcher Award.
- Chair, History Committee, Heart Rhythm Society. 2016-2020.
- 2015, RASA George Gamow Award and Medal.
- 2015, Fellow, American Institute for Medical and Biological Engineering
- Distinguished Lecture in 2015-2016 Distinguished Seminar Series, Department of Biomedical Engineering, University of California, Davis.
- 2014 Washington University SEAS Dean's Faculty Award for Innovation in Research
- Fellow, American Heart Association, 2001
- Fellow, Heart Rhythm Society, 2006
- Inaugural Fellow, Council on Basic Cardiovascular Sciences, American Heart Association, 2001
- Honorary Member, Russian Society for Clinical Electrophysiology, Arrhythmology and Cardiac Pacing
- Chair, Gordon Research Conference on Cardiac Arrhythmia Mechanisms
- Chartered Member, Electrical Signaling, Transporters and Arrhythmia study section, NIH
- Member, Case School of Engineering Executive Committee

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- Astor Visiting Fellow, University of Oxford, UK
- Washington University Chancellor's Hartwell Prize for Innovative Research
- The Doris J.W. Escher, MD Lecture in Medicine. Montefiore Medical Center, The University Hospital for the Albert Einstein College of Medicine, New York, NY
- The Walter Lillehei Lecture, University of Minnesota, Minneapolis MN
- The Richard B. and Lynne V. Cheney Lecture, The George Washington University, Washington, DC
- Visiting Professor, University of Bordeaux Segalen, Bordeaux, France
- Visiting Professor, University of Nizhny Novgorod, Russia
- President, Russian American Medical Association
- President, Russian American Scientists Association
- Member, Council of Canadian Academies, The Expert Panel on the Medical and Physiological Impacts of Conducted Energy Weapons
- Member, RosNano Prize Committee, Moscow, Russia

Industry Positions held:

2020-present	NuSera Biosystems, Inc. Co-founder and member of the board.
2008-2022	Cardialen, Inc., Founder, Chairman of the Scientific Advisory Board
2016-2020	CardioForm, Inc., Founder, Chairman of the Scientific Advisory Board
2012-2015	Pharus Cardio, Co-founder, Member of the Board of Directors
2008-2011	Humgenex, Inc., Co-Founder, Member of the Board of Directors
2005-present	Bioelectric, LLC, President and CEO, Founder

Grant Support:

Active:

2025-2029	NIH R01HL180676 "Wireless implantable cardiac systems for continuous multiparametric investigation of cardiac arrhythmias in vivo", Role Co-I, PI: Lu.
2025-2029	NIH R01 HL183355 "Optoelectronics integrated multimodal heart tissue platform for online probing of cardiac physiology and therapeutic screening" Role Co-I, PI: Lu.
2025-2029	NIH R01HL178535 "Epicardial high-definition electrotherapy of AFib", Role MPI with Philipp Gutruf.
2024-2028	Leducq Foundation Transatlantic Network of Excellence "Bioelectronics for Neurocardiology. Role: MPI with Shivkumar, Paterson, Rogers, Trayanova, Bernus.
2023-2028	NIH R01 HL166746 "Soft wireless multimodal cardiac implantable devices for long-term investigating heart failure pathogenesis," Role Co-I, PI: Lu.
2023-2028	NIH R01 HL165002 "Reagentless Sensor Technologies For Continuous Monitoring of Heart Failure Biomarkers," Role: MPI with Shana Kelley.

Completed:

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2023-2025	NIH R33 HL168758 "Optimization of electromechanical monitoring of engineered heart tissues." Role: MPI, with Elizabeth McNally and John Rogers.
2019-2025	American Heart Association, 2019 CENTER Arrhythmias SCD Strategically Focused Research Network, 'Targeting intracellular calcium leak for ventricular arrhythmia prevention in structural heart disease', Role: Multiple-PI (with B. Knollmann and W. Stevenson)
2020-2025	NIH K99HL148523, 'Role of epicardial adiposity as a local mediator of VT/VF dynamics in donor human hearts'. Role: Mentor. PI: Kedar Aras.
2019-2024	NIH R01 HL141470 'High-Definition Conformal Electronics for VT/VF', Role: PI
2021-2024	NIH R44 HL107055 "Unpinning Termination Therapy for Ventricular Tachyarrhythmias", Role: Consultant, PI: Bourn.
2020-2023	NSF grant 2011093 'Wireless implantable optoelectronic arrays for untethered high-performance cardiac monitoring and modulation', Role: Co-PI; PI: Luyao Lu.
2019-2023	NIH 3OT2OD023848, 'Comprehensive Structural and Functional Mapping of the Mammalian Cardiac Nervous System', Role: Co-I, PI: K. Shivkumar, UCLA.
2020-2023	NIH R21 HL152324, 'Graphene optoelectronic biointerfaces for enabling optical cardiac pacemaking', Role: M-PI with Luyao Lu, Alex Savtchenko, Elena Molokanova.
2019-2020	Cardialen, Inc. "Validation of MPT in ex vivo Human Heart", Role: PI
2016-2021	Leducq Foundation Transatlantic Network of Excellence 'RHYTHM: Repolarization HeterogeneitY imaging for personalised Therapy of Heart ArrhythMia'. Role: North-American Coordinator. (Michel Haissaguerre: European Coordinator).
2018-2021	NIH U01 HL141074 'Simulation Guidance of Ablation Therapy for Persistent Atrial Fibrillation', Role: Co-I (PI: Trayanova)
2018-2021	NIH R44 HL139248 'HLS-Cardiac Safety AI Trained Human Heart and Micro Heart Model', 2018-2021. Role: Co-I (PI: Wakatsuki).
2019-2020	American Heart Association pre-doctoral fellowship 19PRE34380781, 'Selective optical defibrillation of the excitable gap to terminate ventricular arrhythmias in mice'. Role: Mentor. PI: Rose Yin.
2019-2020	American Heart Association post-doctoral fellowship, 'Differential roles of p38 MAPK isoforms in Doxorubicin-induced cardiotoxicity'. Role: Mentor. PI: Sharon George.
2016-2020	NIH R01 HL126802 'Exploration of arrhythmogenic triggers and substrates in heart failure'. Role: Multiple-PI with N. Trayanova and J. Gorelik.
2017-2019	NIH R44 HL107055 'Unpinning Termination Therapy for Ventricular Tachyarrhythmias', Role: Multiple-PI (with D.W. Bourn and D.H.Cooper).
2016-2019	NIH R21 EB023106 "Near-infrared optogenetic control of the human heart", Role: Multiple-PI (with Emilia Entcheva).
2016-2018	NIH R01 HL130212 "Wnt Signaling In Cardiac Conduction And Arrhythmogenesis". Role: Co-investigator. PI: S. Rentschler, Washington University in St. Louis, MO.
2012-2018	NIH R01 HL114395, "Arrhythmogenic remodeling in human heart failure". Role: Principal investigator.

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2013-2018	NIH R01 HL115415, “Low Energy Defibrillation”. Role: Principal Investigator.
2016-2017	GW BME and Cancer Center Collaborative Research Initiative “The role of p38 isoforms in cardiac toxicity of anti-cancer doxorubicin therapy in mice”, Role: M-PI. (With T. Efimova)
2016-2017	GW Cross Disciplinary Research Fund “The role of p38 isoforms in cardiac toxicity of anti-cancer doxorubicin therapy in human”, Role: M-PI. (With T. Efimova)
2012-2015	NIH R43 HL114329, “Low energy ventricular defibrillator”. Principal investigator.
2012-2014	NIH R21 HL112278, “Opto-Electric Mapping Of Action Potentials”. Principal investigator.
2008-2013	NIH R01 HL095010 “SUR1 (ABCC8) and Atrial KATP Channels”, Co-investigator, PI: Colin Nichols, Washington University in Saint Louis, MO.
2008-2013	NIH R01 EB008999 “Advanced ultrasound ablation therapy for atrial fibrillation”, Co-investigator, PI: Cheri Deng, University of Michigan, Ann Arbor, MI
2008-2013	NIH R01 HL085369, “Structure/function of the pacemaking and conduction system of the heart”, Principal investigator.
2011-2013	NIH R21 HL108617 “Implantable mouse pacemaker”. Principal investigator.
2007-2012	NIH, R01 HL67322 "Virtual Electrode Hypothesis of Defibrillation", Principal investigator.
2007-2012	NIH, R01 HL082729, “Defibrillation Mechanisms in Infarcted Hearts”, Co-PI, PI: Natalia Trayanova, Johns Hopkins University.
2006-2010	NIH, R01 HL083393, “Computational and Experimental Study of Early Cardiac Morphogenesis”. Co-investigator, PI: Larry Taber, Washington University in Saint Louis, MO
2006-2011	NIH, R01 GM075200, “Computational Modeling of Developmental Processes”. Co-investigator, PI: Larry Taber, Washington University in Saint Louis, MO
2004-2009	NIH, R01 HL074283, “The role of electroporation in defibrillation”, Principal investigator.
2007-2009	AHA, Grant-in-Aid. “Structure of the human AV junction”. Principal Investigator,
2006-2008	Coulter Foundation, “Low-energy implantable atrial defibrillator”, Principal Investigator.
2005-2007	Medtronic, “Electrical Stimulation of AV Node/Bundle of His (ESAB)”, Principal Investigator.
2005-2007	Hartwell Foundation, “Low voltage defibrillation in a large animal model”, Principal Investigator.
2001-2006	NIH, R01 HL67322 "Virtual Electrode Hypothesis of Defibrillation", Principal investigator.
1999-2005	NIH, R01 HL58808, “Structure-function relationship of the AV node”, Principal investigator.
2003-2004	Medtronic, “Understanding Defibrillation Mechanisms Using Optical Mapping”, Principal investigator,
2001-2004	Whitaker Foundation Research Grant "Mechanisms of pacing of the Heart: Implications for the optimal waveform and lead design", Principal investigator.

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1998-2001	NIH, R01 HL56464, “Mechanisms of defibrillation by implantable electrodes”, Principal investigator.
1999-2000	NIH, R43, "Burst pacing improves efficacy of defibrillation shocks", Co-investigator.
1998-2000	Beginning Grant-in-Aid, American Heart Association, Northeast Ohio Affiliate. “Effects of ischemia on cardiac defibrillation”, Principal Investigator.
1997-1998	Proctor & Gamble Pharmaceuticals, Research Grant in Pharmacology, Principal Investigator,
1997-2000	NIH, RO1, "Human atrial fibrillation-changes in channel expression" Co-Investigator. PI: David Van Wagoner.
1996-1998	Beginning Grant-in-Aid, Northeast Ohio Affiliate American Heart Association. Principal Investigator
1993-1994	NSF grant for Supercomputing Resources in the Pittsburgh Supercomputing center. Principal Investigator
1993-1994	National Research Council, CAST (Cooperation in Applied Science and Technology) Program. Co-Investigator.

Editorial Board Service

- Editor-in-Chief, Cardiovascular Engineering & Technology, 2021-2025.
- Editorial Board Member: Journal of Molecular and Cellular Cardiology, 2020-2021.
- Editorial Board Member: Frontiers in Medical Technology, 2019-2024.
- Editorial Board Member: Scientific Reports, 2019-2020.
- Editorial Board Member, Heart Rhythm Journal, 2005-2010, 2015-2020.
- Associate Editor, American Journal of Physiology: Heart and Circ. Physiology, 2011-2016.
- Associate Editor, IEEE Transactions on Biomedical Engineering, 2012-2015.
- Editorial Board Member, International Journal of Arrhythmia, 2018-present.
- Editorial Board Member, Circulation Research, 2000-2013.
- Editorial Board Member, Biomedical Engineering, 2011-2013.
- Editorial Board Member, Intellect & Technology, 2011-2013.
- Editorial Board Member, Journal of Cardiovascular Electrophysiology, 1998-2012.
- Editorial Board Member, Journal of Molecular and Cellular Cardiology, 2002-2007.
- Editorial Board Member, Experimental Physiology, 2004-2008.
- Guest editor, Journal of Cardiovascular Electrophysiology, 2006.
- Guest editor, Journal of Biomechanical Engineering, 2008.

Ad-hoc peer review service:

American Journal of Physiology, Analytical Chemistry, Anatomical Records, Annals of Biomedical Engineering, Biophysical Journal, BMC Physiology, Cardiovascular Engineering & Technology, Cardiovascular Research, Cell Calcium, Chaos, Circulation, Circulation Research, Comparative Biochemistry and Physiology, Computational and Mathematical Methods in Medicine, Developmental Dynamics, Experimental Biology and Medicine, Experimental Physiology, EuroPACE, FASEB Journal, Heart Rhythm, IEEE Transactions on Biomedical Engineering, IEEE Transactions on Medical Imaging, International Journal for Molecular

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Science, Journal of American College of Cardiology, Journal of Applied Physiology, Journal of Biological Systems, Journal of Biomedical Optics, Journal of Biological Rhythms, Journal of Cardiovascular Electrophysiology, Journal of Interventional Cardiovascular Electrophysiology, Journal of Microscopy Research and Techniques, Journal of Molecular and Cellular Cardiology, Medical and Biological Engineering and Computing, Molecular and Cellular Biochemistry, Nature, Nature Biomedical Engineering, Nature Cardiovascular Research, Nature Communications, Nature Electronics, Nature Nanotechnology, Nature Clinical Practice Cardiovascular Medicine, Nature Sensors, Pacing and Clinical Electrophysiology (PACE), Pflügers Archiv – European Journal of Physiology, Physics in Medicine and Biology, Proceedings of the National Academy of Sciences, Proceedings of Royal Society (London), Progress in Biophysics and Molecular Biology, Recent Patents in Engineering, Review of Scientific Instruments, Science, Science Advances, Scientific Reports, Tissue Engineering, Ultrasound in Medicine and Biology.

Professional Service:

- Editor-in-Chief, Cardiovascular Engineering & Technology (2021-2025).
- Chairman, History Committee, Heart Rhythm Society (2017-2020).
- Member, BMES International Committee (2021-2023).
- Member, Communications Committee, Heart Rhythm Society (2017-2020).
- President, Russian American Medical Association, (2012-2014).
- President, Russian American Science Association (2009-2011).
- Member, Research Committee, Heart Rhythm Society (2014-2016).
- Leader, Basic Science group, Program Committee, Heart Rhythm Society (2010-2014).
- Member, Council of Canadian Academies, The Expert Panel on the Medical and Physiological Impacts of Conducted Energy Weapons (2012-2013); Canada.
- Chartered Member, NHLBI Systems Biology Collaborations special emphasis panel, NIH (term 2009-2013).
- Chartered Member, Electrical Signaling, Transporters and Arrhythmia study section, NIH (term 2009-2013).
- Member, Committee for the Thesis Prize of IdEx (Initiative of Excellence Bordeaux), University of Bordeaux, France.
- Member, Young Investigator Award Subcommittee, Heart Rhythm Society, (2009-2011).
- Member, External Review Committee, Duke University Department of Biomedical Engineering, Durham, NC. 2010.
- Consultant, World Bank.
- Chair, Gordon Research Conference on Cardiac Arrhythmia Mechanisms, March 18-23, 2007. Ventura, CA

Grant Reviewer

National Science Foundation, National Institutes of Health, Department of Defense, British Heart Foundation, Welcome Trust UK, Medical Research Council UK, Israel Science Foundation, Israel Binational Science Foundation, Swiss National Science Foundation, Marsden Fund New Zealand, The Netherlands Organization for Health Research and Development

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Professional Societies Abstract Reviewer

American Heart Association, Heart Rhythm Society, European Heart Rhythm Association,

Selected Patents

1. Sharon George, Igor R. Efimov, Systems and methods for triple-parametric optical mapping. US20230085578A1. Published 2023/03/16.
2. Gina C. Adam, Igor R. Efimov, Distributed neuromorphic computing for high-definition bioelectric diagnostics and therapy. US20200245870A1. Published 2020/08/06.
3. Han Mengdi, Roozbeh Ghaffari, Igor Efimov, John A. Rogers, Multimodal soft electronics in advanced balloon catheter devices. Filed 2020/08/18.
4. Brennan Jaclyn, Efimov, Igor R. Fast Label-Free Method for Mapping Cardiac Physiology, PCT/US 16/661,733, Filed 2019/10/23.
5. Efimov, Igor R.; Aras, Kedar; Rogers, John A.; Gremi, Erdit; Pospisil, David; High Resolution Multi-Function And Conformal Electronics Device For Diagnosis And Treatment Of Cardiac Arrhythmias. PCT/US18/16499 Filed 2018/02/01.
6. Efimov, Igor R.; Yun Qiao; Kang, Chaoyi; Li, Zhenyu; Dong, Quan; Li, Baichen; Apparatus And Methods For In Vitro Preclinical Human Trials, PCT/US18/15052 Filed 2018/01/25.
7. Stacey Rentschler, Igor R. Efimov, David Curiel, Induction Of Pacemaker-Like Cells From Cardiomyocytes, U.S. National Phase Patent Application Serial No. 15/554,371. 2017/08/29.
8. Efimov, Igor R.; Kedar Aras; Erdit Gremi; High Resolution Multi-Function And Conformal Electronics Device For Diagnosis And Treatment Of Cardiac Arrhythmias. Serial No. 62/453,184; Priority date February 1, 2017.
9. Efimov, Igor R.; Qiao, Yun; Kang, Chaoyi; Li, Zhenyu; Dong, Quan; Li, Baichen; Apparatus And Methods For In Vitro Preclinical Human Trials. Provisional Application No. 62/450,412. January 25, 2017.
10. Efimov, Igor; Li, Wenwen; Janardhan, Ajit. Methods And Devices For Three-Stage Ventricular Therapy. US 8,874,208 B2. Oct 28, 2014.
11. Efimov, Igor R.; Krinski, Valentin I.; Nikolski, Vladimir P.; Method For Low-Voltage Termination Of Cardiac Arrhythmias By Effectively Unpinning Anatomical Reentries. US 8,639,325 B2. Jan 28, 2014.
12. Efimov, Igor R.; Hucker, William; Cardiac Pacing Using The Inferior Nodal Extension. US 8,391,995 B2. Mar 5, 2013.
13. Wessles, Richard; Sha, Qun; Efimov, Igor R.; Low-Energy Atrial Cardioversion Therapy With Controllable Pulse-Shaped Waveforms. US 8,473,051 B1. June 25, 2013.
14. Efimov, Igor R.; Ripplinger, Crystal M.; Fedorov, Vadim V.; Foyil, Kelley V.; Ambrosi, Christina. Method And Device For Low-Energy Termination Of Atrial Tachyarrhythmias. US 8,509,889 B2. Aug 13, 2013.
15. Efimov, Igor; Li, Wenwen; Janardhan, Ajit. Method And Device For Three-Stage Atrial Cardioversion Therapy. US 8,560,066 B2. Oct 15, 2013.

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16. Efimov, Igor R.; Krinski, Valentin I.; Nikolski, Vladimir P.; Method For Low-Voltage Termination Of Cardiac Arrhythmias By Effectively Unpinning Anatomical Reentries. US 8,175,702 B2. May 8, 2012.
17. Efimov, Igor; Li, Wenwen; Janardhan, Ajit. Method And Device For Three-Stage Atrial Cardioversion Therapy. US 8,706,216 B2. Apr 22, 2014. Priority date Dec 11, 2007.

Invited presentations and lectures:

1. "Millimeter-scale Bioresorbable Stimulator (milli-pacemaker)", European Section Meeting of the International Academy of Cardiovascular Sciences. Prague, Czechia, 2025/11/04.
2. "Millimeter-scale Bioresorbable Stimulator", 1st RASA Europe conference, Berlin, Germany, 2025/11/1.
3. "Cardiovascular Conformal Bioresorbable Devices", Abbott, 2025/10/21.
4. "Heart-AI interface: Soft Bioresorbable Devices", Cardiology Grand Rounds, University of Rochester Medical Center, Rochester, NY, 2025/09/10.
5. "Heart-AI interface: novel bioelectronic therapy for heart rhythm disorders", Department of Internal Medicine Grand Rounds at the University of Iowa Carver College of Medicine, Iowa City, IA, 2025/09/04.
6. "Bioelectronics for Neurocardiology: Leducq Foundation Update", Lyric, University of Bordeaux, France, 2025/08/27.
7. "Bioresorbable transient electronics", Abbott, 2025/06/16.
8. "Bioresorbable transient electronics", Heart Rhythm Society, San Diego, CA, 2025/04/27.
9. "Bioresorbable milli-pacemaker: transient arrhythmia therapy", Ralph Lazarra Lecture Award, Heart Rhythm Society, San Diego, CA, 2025/04/24.
10. "Selective p38γ silencing by rationally designed siRNA for mitigating anthracycline cardiotoxicity", Lurie Cancer Center, Feinberg School of Medicine, Northwestern University, Chicago, IL, 2025/04/22.
11. "Transient bioelectronics for cardiovascular tissue engineering and medicine", Department of Biomedical Engineering, University of Alabama at Birmingham, AL, 2025/04/18.
12. "Cardiac bioelectronics for heart rhythm disorders", Leiden University Medical Center, Leiden, Netherlands, 2025/01/21.
13. "Implantable devices: from theory to device and experience in start-up creation," University of Bordeaux, France, 2024/11/26.
14. "Cardiac bioelectronics for heart rhythm disorders," Department of Biomedical Engineering, The University of Massachusetts at Amherst, MA, 2024/10/30.
15. "Heart-AI interface: Cardiac implantable and wearable bioelectronics," Cardiology Grand Rounds, University of Chicago, 2024/10/25.
16. "Heart-AI interface: flexible and transient bioelectronics," Cardiac Physiome 2024, Freiburg, Germany, 2024/09/13.
17. "Human organotypic cardiac slice: a platform for preclinical pharmacological cardiotoxicity and efficacy trials," Cardiovascular Medicine Seminar, Novartis, 2024/08/15.
18. "Data Visualization and Modelling to Support Cardiovascular Control Studies," International Society for Autonomic Neuroscience, Oxford and Birmingham, UK. 2024/07/26.

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19. "Heart-AI interface: Bioelectronics for Arrhythmia Management," Imperial College London, UK, 2024/07/23.
20. "Soft transient bioelectronics: a novel technology for pacing and defibrillation," The 49th International Congress on Electrocardiology, Lund, Sweden, 2024/06/14.
21. "The Energy From Light To Stimulate The Heart," Keynote lecture, Advances and controversies in cardiovascular diseases," Pompei, Italy, 2024/06/13.
22. "New Device Technology for Arrhythmia Management," American Heart Association Strategically Focused Research Networks Meeting, Cleveland Clinic Foundation, Cleveland, OH, 2024/04/29.
23. "Approaching the AV node from the latest physiological insights," The 88th Annual Scientific Meeting of the Japanese Circulation Society, Kobe, Japan, 2024/03/08.
24. "Sex Dimorphism of Promoters and Enhancers in Cardiac Health, Failure, and Aging," The Feinberg Cardiovascular & Renal Research Institute, Northwestern University Feinberg School of Medicine, Chicago IL, 2023/06/30.
25. "High-resolution bioresorbable optoelectronic cardiac interfaces." The 2023 Fred S. Grodins Keynote Lecture in the Alfred E. Mann Department of Biomedical Engineering, University of Southern California, Los Angeles, CA, 2023/04/31.
26. "Organ Conformal Bioresorbable Electronics: A New Platform for Implantable and Interventional Devices." The 2023 Hermann Rahn Memorial Seminar, Department of Physiology and Biophysics, University at Buffalo, State University of New York, Buffalo, NY, 2023/03/16.
27. "Sex Dimorphism of Promoters and Enhancers in Cardiac Health, Failure, and Aging," The 2023 Hermann Rahn Memorial Lecture & Seminar, Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, State University of New York, Buffalo, NY, 2023/03/16.
28. "Experimental Arrhythmia Research: in vivo Bioelectronics," Gordon Research Conference on Cardiac Arrhythmia Mechanisms. Galveston, TX, 2023/02/26.
29. "Sex dimorphism of the human genome regulatory network in heart failure and aging", Department of Biomedical Engineering, Ohio State University, Columbus, OH, 2023/02/03.
30. "Organ conformal cardiac biointerfaces", Department of Biomedical Engineering, Illinois Institute of Technology, Chicago, IL, 2023/01/23.
31. "Optoelectronic cardiac biointerfaces." Oasis 8: International Conference and Exhibition on Optics and Electro-Optics. David Intercontinental Hotel, Tel Aviv, Israel. 2022/12/12.
32. "Bioelectronics implantable devices: from theory to device and experience in start-up creation," CARDIAC EP Electromechanical Heart Diseases, University of Bordeaux, France. 2022/12/02.
33. "Defibrillation implantable devices: from theory to device and experience in start-up creation," CARDIAC EP Electromechanical Heart Diseases, University of Bordeaux, France. 2022/12/02.
34. "Pacing implantable devices: from theory to device and experience in start-up creation," CARDIAC EP Electromechanical Heart Diseases, University of Bordeaux, France. 2022/12/02.
35. "Bioresorbable bioelectronics platform," Department of Cardiology, University of California, Los Angeles, CA, 2022/11/21.
36. "Sex Dimorphism in the Work of Heart," Russian-American Science Association, University of LaVerne, CA, 2022/11/19.

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37. "Sex Dimorphism in Gene Regulatory Elements During Heart Failure and Aging", Science and the City: Trends in Drug Discovery and Delivery, Northwestern University, Chicago, IL, 2022/11/07.
38. "Wearable and implantable network for temporary cardiac pacing", Venice Arrhythmias 2022, Venice, Italy. 2022/10/14.
39. "Transient implantable devices to treat arrhythmia: bioresorbable bioelectronics platform", Grand Rounds, Harrington Heart & Vascular Institute, University Hospitals, Cleveland Medical Center and Case Western Reserve University, 2022/10/06.
40. "Regulatory Genome Networks in Normal and Failing Human Heart", Naranjan Dhalla Honorary Lecture, European Section of the International Academy of Cardiovascular Sciences, University of Szeged, Hungary. 2022/09/28.
41. "An atlas of transcribed human cardiac promoters and enhancers reveals an important role of regulatory elements in heart failure", Leducq final network RHYTHM meeting, Barcelona, Spain, 2022/08/29.
42. "Low-Voltage Multi-Pulse Therapy for AF", Catheter Ablation and Surgical Therapy for Atrial Fibrillation, Annual Conference, Chicago, IL. 2022/08/27.
43. "Implantable, interventional, and wearable bioelectronics for heart disease", Washington University in St. Louis, MO, 2022/06/22.
44. "Mechanisms of Focal and Reentrant Arrhythmias in the Human Ventricles." American Heart Association, Strategically Focused Research Networks: Arrhythmia and Sudden Cardiac Death. University of Washington, Seattle, WA. 2022/07/09.
45. "Genome Regulatory Networks in Failing Human Heart", Lurie Cancer Center's Cancer and Physical Sciences (CAPS) Program, Fienberg School of Medicine, Northwestern University, Chicago, IL, 2022/05/04.
46. "Implantable, interventional, and wearable bioelectronics for heart disease", Leducq network RHYTHM meeting, San Francisco, CA, 2022/04/28.
47. "Implantable, interventional, and wearable bioelectronics for heart disease", Advisory Board meeting, Department of Biomedical Engineering, Northwestern University, Evanston, IL, 2022/04/19.
48. "Transient bioelectronics for temporary pacemakers". 3rd Iasi Arrhythmia Forum 2022. Iasi, Romania, 2022/4/9.
49. "First in Human Trial on low energy defibrillation of paroxysmal AF". 3rd Iasi Arrhythmia Forum 2022. Iasi, Romania, 2022/4/7.
50. "Heart Failure and Arrhythmias – a never ending loop: an anatomo-clinical point of view". 3rd Iasi Arrhythmia Forum 2022. Iasi, Romania, 2022/4/7.
51. "New Generation of Cardiac Bioelectronics for Treatment of Cardiac Arrhythmias." Cardiology Grand Rounds. University of Pittsburgh School of Medicine, Pittsburgh, PA, 2022/03/16.
52. "Regulatory Genome Networks in Failing vs. Non-failing Human Heart", Chicago Regional Cardiovascular Research Symposium. Loyola University Chicago Stritch School of Medicine, 2022/3/11.
53. "Molecular and Functional Remodeling of the Inferior and Superior Sino-Atrial Nodes in Rat Model of Hypertrophic Cardiomyopathy". The 86th Annual Scientific Meeting of the Japanese Circulation Society JCS2022, Kobe Japan, 2022/3/11.
54. "Bioresorbable organ conformal bioelectronics: new platform for treating cardiac arrhythmias", University of Göttingen, Germany. 2022/02/17.

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55. "Soft, bioresorbable, and neuromorphic cardiac implantable electronics", Amirkabir University of Technology Winter School, Iran. 2022/02/08.
56. "High definition soft soluble cardiac biointerfaces for diagnostics and therapy of arrhythmia", Cardiovascular Medicine Grand Rounds, University of Michigan, 2022/01/27.
57. "Wireless networks of transient, implantable, and wearable cardiac bioelectronics", 5th Sechenov International Biomedical Summit, SIBS-2021. Sechenov Medical University, Moscow, Russia, 2021/11/10.
58. "Transcriptomic Basis of Remodeling in Heart Failure", University of Oxford, UK 2021/11/09.
59. "Bioresorbable Pacemakers - The Future of Arrhythmology", Arrhythmology and Minimally Invasive Cardiac Surgery: AMICS 2021, Moscow Russia, 2021/10/28.
60. "Development of bioresorbable and flexible electronics platform for implantable and percutaneous device therapies", U.S. Food and Drug Administration, Washington DC, 2021/10/26.
61. "Genomic and transcriptomic basis of heart failure", 7th Meeting of European Section and 8th Meeting of North American Section of the International Academy of Cardiovascular Sciences, Banja Luka, the Republic of Srpska, Bosnia and Herzegovina, 2021/9/21.
62. "High definition soluble cardiac biointerfaces for diagnostics and therapy of arrhythmia", Computers in Cardiology 2021, Brno, 2021/09/15.
63. "Soft and dissolvable electronics for treatment of heart disease", Siberian Federal University, Krasnoyarsk, Russia 2021/04/16.
64. "Fully bioresorbable, leadless, battery-free cardiac pacemaker", Bioinformatics Seminar, Higher School of Economics, Moscow Russia, 2021/04/09.
65. "Superior and Inferior Sino-atrial nodes in the human heart", 4th A.F. Samoilov International Congress on Fundamental and Clinical Electrophysiology. Kazan, Russia. 2021/04/08.
66. "Heart Failure and Arrhythmias - a never ending loop: an anatomo-clinical point of view". IASI Arrhythmia Forum 2021, Iasi, Romania. 2021/03/30
67. "Mechanisms of clinical degeneration of ventricular arrhythmias originating in the right ventricular outflow tract in structurally normal heart: how to prevent syncope." Arrhythmia Workshop of the Eurasian Arrhythmology Association EURA, Moscow, Russia. 2021/03/26
68. "Cardiac conformal and bioresorbable electronics for treatment of arrhythmia", UCLA Cardiovascular Theme, Distinguished Seminar Series, Department of Medicine, UCLA School of Medicine. Los Angeles, CA, 2021/02/22.
69. "Cardiac bioelectronics: Flexible and bioresorbable cardiac stimulators". Eurasian Arrhythmology Association EURA, Moscow, Russia. 2021/01/29
70. "Bioinformatics of heart disease", Moscow Region State University, Russia, 2020/10/28.
71. "Organ conformal and transient cardiac bioelectronics", Frontiers of Cardiovascular Bioengineering Series, University of Alabama at Birmingham, AL, 2020/10/09.
72. "Evidence of two pacemakers in the rat and human heart: Superior and Inferior SA Nodes", Department of Medical Physiology, University Medical Center Utrecht, WebEx Seminar, 2020/08/20.
73. "New mechanisms of AF pathogenesis: superior SA node", Moscow State University, Moscow Russia, Zoom lecture, 2020/07/17.
74. "Genetics and Bioinformatics of the Heart", Moscow Institute of Physics and Technology, Moscow, Russia, Zoom lecture, 2020/07/15

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75. "Pacemakers of the mammalian heart: evidence of superior and inferior SA nodes', International Society for Heart Research Cardiovascular Webinar Series, 2020/06/19.
76. "Organ-conformal neuromorphic bioelectronics for heart therapy", Department of Biomedical Engineering, Pratt School of Engineering, Duke University, Chapel Hill, NC. 2020/02/07.
77. "Mechanisms of remodeling in human heart failure", Faculty of Computer Science, Higher School of Economics, Moscow Russia, 2020/01/28.
78. "Hi-C technology method and human heart transcriptomics", 1st International congress "Genetics and the Heart", Moscow Russia, 2020/01/25.
79. "Patient-specific computer models of action potential derived from functional and molecular data", 10th TRM Forum on Computer Simulation and Experimental Assessment of Cardiac Function. University of Lugano, Switzerland. 2019/12/10.
80. "Mechanisms of remodeling in human heart failure", Feinberg School of Medicine, Northwestern University, Chicago IL. 2019/11/22.
81. "Future of cardiac implantable devices", McCormick School of Engineering, Northwestern University, Evanston IL. 2019/11/21.
82. "Electroporation: Hype or hope for arrhythmia ablation?", Arrhythmia Research Summit: Ventricular Arrhythmias and Sudden Cardiac Death: Bench to Bedside, American Heart Association Annual Sessions, Philadelphia, PA, 2019/11/16.
83. "New Generation of Bioelectronics", 10th Annual Conference of Russian-American Scientists Association, University of North Carolina at Chapel Hill, NC. 2019/11/10.
84. "Future implantable device therapy", Cardiology Grand Round, George Washington University School of Medicine and Health Sciences, Washington DC. 2019/10/23.
85. "Computational approaches to transcription-function relationship in the human heart", Leducq Foundation RHYTHM network 2019 meeting, Johns Hopkins University, Baltimore MD. 2019/10/09.
86. "First in man trial of low energy multistage electrotherapy of AF", Venice Arrhythmia 2019, Venice, Italy. 2019/10/05.
87. "Arrhythmogenic Remodeling of Human Heart", Imperial College London, UK. 2019/10/02.
88. "Bioinformatics of Heart Disease", Russian National Congress of Cardiology, Ekaterinburg, Russia, 2019/09/26.
89. "Digital Cardiology", Russian National Congress of Cardiology, Ekaterinburg, Russia, 2019/09/26.
90. "Arrhythmogenic remodeling of human heart", The Icahn School of Medicine at Mount Sinai, New York City, NY. 2019/08/14.
91. "Critical mass of fibrillation", Max-Planck-Institute on Dynamics and Self-Organization, Goettingen, Germany, 2019/07/02.
92. "Mechanisms of sudden cardiac death due to ventricular fibrillation", University of California System 20th Bioengineering symposium, Plenary lecture. University of California Merced, CA, 2019/06/25.
93. "Wireless, battery-free fully implantable multimodal and multisite pacemakers for applications in small animal models", Gordon Research Conference Bioelectronics, Andover NH, 2019/06/17.
94. "Genetic basis of atrial and ventricular arrhythmias", VIII All-Russian Congress of Arrhythmologists. Tomsk, Russia. 2019/06/07.

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95. "New Insights into mechanisms of ventricular fibrillation", VIII All-Russian Congress of Arrhythmologists. Tomsk, Russia. 2019/06/06.
96. "Optical mapping of the human heart in health and disease", Symposium Honoring the 80th Birthday of Lawrence B Cohen. Yale University, New Haven CT, 2015/05/15.
97. "Electrical Propagation in the Cardiomyopathic Heart", Heart Rhythm Society 2019 scientific sessions. San Francisco, CA. 2019/05/09.
98. "Critical 3D Wavelength: Mechanisms of VF in the human heart", Leducq research network RHYTHM annual meeting, San Francisco, CA. 2019/05/07.
99. "Using Human Hearts to Study Arrhythmogenesis", US National Academies of Science, Engineering and Medicine: Public Workshop on the Uses of Dogs in Biomedical Research. Washington, DC. 2019/03/27.
100. "Low voltage electrotherapy for atrial arrhythmias - First-in-human", European Heart Rhythm Association, 2019/03/18.
101. "Digital Cardiology 3: OMICS technologies and heart disease", Moscow Institute of Physics and Technology, Moscow Russia, 2019/03/06.
102. "Digital Cardiology 2: Digital Experimental and Computational Cardiology", Moscow Institute of Physics and Technology, Moscow Russia, 2019/03/05.
103. "Digital Cardiology 1: Prevention and Therapy of Sudden Cardiac Death Syndrome", Moscow Institute of Physics and Technology, Moscow Russia, 2019/03/04.
104. "Digital Experimental and Computational Cardiology: Heart AI Interface", Sechenov First Moscow State Medical University, Moscow, Russia, 2019/03/04.
105. "Mechanisms of sudden cardiac death: ventricular tachycardia and fibrillation", International Congress on "Sudden Cardiac Death: Strategies for Prevention and Resuscitation", Russian Society of Cardiology, Moscow Russia, 2019/02/16.
106. "Mechanisms of Arrhythmogenesis in the Human Heart", Vanderbilt University Cardiovascular Institute, Nashville TN, 2018/12/19.
107. "Mathematical methods of signal and image processing in cardiac electrophysiology", Ekaterinburg State University, Ekaterinburg, Russia. 2019/12/13.
108. "Bioinformatics and OMICS of human heart diseases", Ekaterinburg State University, Ekaterinburg, Russia. 2019/12/12.
109. "Mechanisms of Arrhythmogenesis in the Human Heart", The 7th Burton E. Sobel Lecture on Cardiovascular Research Day at Washington University in St. Louis, MO, 2018/11/29.
110. "New Approaches to Treatment of Atrial Fibrillation: Organ Conformal Electronics", Rita Kicher endowed lectureship, Harrington Heart and Vascular Institute Conferences. University Hospitals, Case Western Reserve University, Cleveland OH, 2018/11/08.
111. "High Resolution Panoramic Optical Imaging of VF in the Human Heart", Asia Pacific Heart Rhythm Society, Taipei, Taiwan, 2018/10/20.
112. "High-Resolution Conformal Electronics Devices", Asia Pacific Heart Rhythm Society, Taipei, Taiwan, 2018/10/17.
113. "Conformal bioelectronics for new generation of implantable cardiac devices", University of La Verne Los Angeles, CA 2018/09/19.
114. "Critical Volume of Human Myocardium Necessary to Maintain Ventricular Fibrillation", Cardiology Grand Rounds, University of California at Los Angeles. Los Angeles CA, 2018/09/20.
115. "Conformal bioelectronics for new generation of implantable cardiac devices", University of Maryland, College Park MD, 2018/08/31.

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116. "Mechanisms of Arrhythmogenesis in Human Heart", Siberian Federal University, Krasnoyarsk, Russia, 2018/06/15.
117. "New generation of bioelectronics for implantable devices and cardiac research", Siberian Federal University, Krasnoyarsk, Russia, 2018/06/14.
118. "First-in-human trial of low energy atrial multi-stage electrotherapy", 2nd St. Petersburg Arrhythmology Forum, St. Petersburg, Russia, 2018/06/07.
119. "3D wavelength volume predicts ventriocular fibrillation in human heart", 2nd St. Petersburg Arrhythmology Forum, St. Petersburg, Russia, 2018/06/07.
120. "Studying pathophysiological mechano-electrical interactions in human", International Society for Heart Research, Halifax, Canada, 2018/05/31.
121. "From Phenotype to Omics Studies of Human Heart" Life of Genomes Symposium, Kazan State University, Kazan, Russia, 2018/05/22.
122. "The How To and Why of Arranging International Research Fellowships", 2018 Heart Rhythm Society annual sessions, Boston, MA. 2018/05/10.
123. "Low Energy Multi-Stage Therapy of AF", 2018 Stanford Biodesign New Arrhythmia Technologies Retreat, Boston, MA. 2018/05/08.
124. "New Technology for Human Heart Physiology", The Dr. E. R. Smith Lecture in Cardiovascular Research, Keynote lecture at the annual Libin Cardiovascular Institute Research Day, University of Calgary, Canada, 2018/04/16.
125. "Ventricular fibrillation is predicted by human cardiac 3D wavelength volume", keynote lecture at the Heart Research Symposium, Auckland Bioengineering Institute, University of Auckland, New Zealand, 2018/03/16.
126. "Heart Rhythm: New Methods, New Insights", School of Engineering and Auckland Bioengineering Institute public lecture, University of Auckland, New Zealand, 2018/03/13.
127. "Mechanisms of ventricular fibrillation in the human heart", 9th Theo-Rossi-di-Montelera Foundation Forum on Computer Simulations of Cardiac Function, Lugano, Switzerland, 2017/12/05.
128. "Human Cardiac Tissue Slices: A Novel Platform to test Cardiotoxicity of Cancer Drugs", First International Scientific Research Summit GW – Spanish Consortium, Hospital Universitario de Hierro, Madrid, Spain, 2017/12/02.
129. "Mechanisms and treatments of AV nodal reentry", Arrhythmia Research Summit, American Heart Association 2017 sessions, Los Angeles, CA, 2017/11/13.
130. "Phase mapping of atrial fibrillation", 2nd Grodno Arrhythmology Conference, Grodno State Medical University, Grodno Belarus. 2017/10/23.
131. "New Generation of Implantable Devices", 2nd Grodno Arrhythmology Conference, Grodno State Medical University, Grodno Belarus. 2017/10/23.
132. "Wavelength restitution and ventricular fibrillation", Leducq Foundation RHYTHM network annual meeting 2017. Bordeaux, France. 2017/10/02.
133. "Soft electronics: future of bionics", Center for Strategic Initiatives, Moscow, Russia. 2017/09/22.
134. "High-definition bioelectronics and human biology", Biomed 2017 Symposium, Moscow Institute of Physics and Technology, Moscow, Russia. 2017/09/21.
135. "Pacemaker Activity and Conduction in the AV Node", Asia-Pacific Heart Rhythm Society 2017 Scientific Session. Yokohama, Japan. 2017/09/17.
136. "Pathophysiological Mechanisms of Cardiac Fibrillation", Asia-Pacific Heart Rhythm Society 2017 Scientific Session. Yokohama, Japan. 2017/09/16.

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137. “Activation and Repolarization Restitution Properties: What Are the Vulnerable Parameters?”, The Second Annual Signals Summit: The Forgotten Art of Electrophysiology”, Boston MA, 2017/09/08.
138. “Novel cardiac technology: flexible bioelectronics, microfluidics, and organotypic culture”, International Symposium Physics Meets Medicine: The Heart of Active Matter, University of Göttingen, Germany. 2017/09/06.
139. “Cardiac Human Physiology”, Washington Regional Transplant Community, Fairfax, VA. 2017/08/16.
140. “Optocardiography: Optical Imaging of Cardiac Physiology”, BitesizeBio webinar: http://bitesizebio.com/webinar/optocardiography-optical-imaging-cardiac-physiology/, 2017/08/20.
141. “Organ conformal bioelectronics”, American Heart Association: Basic Cardiovascular Science Scientific Sessions, Portland OR, 2017/07/11.
142. “First-in-Man Low-Energy Multistage Therapy of Atrial Fibrillation”, Stanford Biodesign, Chicago IL, 2017/05/09.
143. “Improved Panoramic Imaging System for Assessment of Arrhythmia in a Rabbit Model”, NIST Imaging Precision Medicine Workshop, Gaithersburg MD, 2017/05/04.
144. “Human Organotypic Slices as a Platform for Preclinical Drug Studies”, Cardiac Arrhythmia Mechanisms Gordon Research Conference, Ventura CA. 2017/02/05.
145. “Conformal Electronics: Future of Implantable Devices”, Purdue University, West Lafayette IN, 2016/12/05.
146. “High-definition Organ Conformal Electronics”, Open Innovations Forum, SkolTech. Moscow, Russia. 2016/10/27
147. “High Resolution Mapping of Rotors: Optical vs. Electrical Mapping”, 9th Asia Pacific Heart Rhythm Society Scientific Session, Seoul, Korea. 2016/10/12.
148. “High-definition Organ Conformal Electronics”, 9th Asia Pacific Heart Rhythm Society Scientific Session, Seoul, Korea. 2016/10/14.
149. “Low Energy Cardioversion of Atrial Fibrillation”, 9th Asia Pacific Heart Rhythm Society Scientific Session, Seoul, Korea. 2016/10/14.
150. “From Animal Models to Human Heart Disease: Lost in Translation”, Cardiac Research Day at Dalhousie University in Halifax, Nova Scotia, Canada. 2016/10/03.
151. “Heart-computer interface: novel platform for cardiac devices”, Scientific Workshop, L’Institut De Rythmologie et Modelisation Cardiaque (LIRYC), University of Bordeaux, France, 2016/09/30.
152. “Organ Conformal Electronics: Novel Platform for CV Research and Therapy”. Cardiovascular Science at the Cutting Edge Symposium, Omaha NE, 2016/09/08.
153. “From Animal Models to Human Heart Electrophysiology: Gaps in Translation”, 3rd annual NIH course "Summer Course on Image-Based Biomedical Modeling" Park City, UT, 2016/07/20.
154. “Human Heart Physiology and Conformal Electronics: an Update”, L’Institut De Rythmologie et Modelisation Cardiaque. University of Bordeaux, France. 2016/07/06.
155. “Future of Implantable Devices: Heart-Computer Interface”, Technical University of Munich, Germany. 2016/06/14.
156. “Heart-Computer Interface: Future of implantable devices”, Max Lab Symposium, Emperial College London, UK. 2016/05/26.

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157. "Future of implantable cardiac devices", Kazan Federal University, Kazan, Tatarstan, Russia, 2016/05/24.
158. "Future of implantable and wearable electronics", Workshop: "Tatarstan: Innovative Region in Medical HighTech", Kazan, Tatarstan, Russia. 2016/05/22.
159. "Providing CLARITY to the Heart", Heart Rhythm Society 2016 Annual Sessions, San Francisco, CA. 2016/05/04.
160. "3D MIMs Platform for Implantable Devices", Stanford Biodesign New Arrhythmia Technologies Retreat, Stanford University, CA. 2016/05/03.
161. "From Animal Models to Human Physiology", UK-Russian workshop on Mathematical Modeling in Physiology: Biomedical Applications. Moscow Institute of Physics and Technology, Moscow, Russia. 2016/03/21.
162. "Remodeling of Failing Human Heart", Children's National Health System, Division of Cardiology, Washington, DC. 2016/03/03.
163. "Human failing heart: mechanisms of remodeling", Virginia Tech Carilion Research Institute, Roanoke, VA. 2016/02/26.
164. "Human failing heart: mechanisms of remodeling", Washington Regional Transplant Community, Annandale VA. 2016/02/24.
165. "Functional anatomy of the sinus and AV nodes: from mouse to man". National Institute of Aging. Baltimore, MD. 2016/02/18.
166. "Future of Implantable Devices: Conformal High-Definition Electronics", Distinguished Lecture in 2015-2016 Distinguished Seminar Series, Department of Biomedical Engineering, University of California, Davis, 2015/12/03.
167. "Experimental mapping of ventricular fibrillation", 8th Asia Pacific Heart Rhythm Society Scientific Sessions, Melbourne, Australia. 2015/11/22.
168. "Transmural Rotor Mapping: Insights from Optical Studies", 8th Asia Pacific Heart Rhythm Society Scientific Sessions, Melbourne, Australia. 2015/11/20.
169. "Adrenergic and Metabolic Remodeling of the Failing Heart", 8th Asia Pacific Heart Rhythm Society Scientific Sessions, Melbourne, Australia. 2015/11/20.
170. "Remodeling of Failing Human Heart", Department of Bioengineering, University of Utah, Salt Lake City, 2015/11/13.
171. "Pathophysiology of Failing Human Heart", The 1st International Multidisciplinary From Bench to Bed Conference. Ahmet Yassawi International Kazakh-Turkish University, Shymkent Kazakhstan, 2015/11/08.
172. "Future of implantable cardiac devices", 6th annual conference of Russian American Science Association, George Washington University, Washington DC, 2015/11/07
173. "Innovation in Biomedical Engineering Industry: A Vision for the Future and how to be a part of it", 4th CIMES: Innovation in Healthcare Devices Summit: New Technologies in healthcare and dentistry" ("4º CIMES: Congresso De Inovacao Em Meteriais E Equipamentos Para Saude"), Sao Paulo, Brazil. 2015/10/05.
174. "Future of Implantable Devices: From Implantable Pacemakers to High-Definition Conformal Electronics", Department of Biomedical Engineering, University of Virginia, Charlottesville, VA. 2015/09/25
175. "Arrhythmogenic Remodeling of Failing Human Heart", Cardiovascular Research Center, University of Virginia, Charlottesville, VA. 2015/09/24

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176. “Future of Implantable Devices: From Implantable Pacemakers to Conformal Electronics”, The George Mason University, Department of Biomedical Engineering Seminar. Fairfax, VA. 2015/09/16.
177. “Low Energy Defibrillation”, The 33rd Congress of the European Section of the International Society for Heart Research, Bordeaux, France, 2015/07/02.
178. “High-definition Conformal Devices”, Federal Drug Administration, Silver Spring, MD, 2015/06/23.
179. “The future technologies for treatment of cardiac arrhythmias”, 6th Symposium of Arrhythmologists, Novosibirsk, Russia, 2015/06/11.
180. “3D MIM (multifunctional integumentary membranes) platform for implantable devices”, 2015 Stanford Biodesign New Arrhythmia Technologies Retreat, Boston, MA, 2015/05/12.
181. “Engineering Biological Pacemaker”, Moscow Institute of Physics and Technology, Dolgoprudny, Russia. 2015/04/29.
182. “High-definition Conformal Devices”, Design of Medical Devices Conference, University of Minnesota, Minneapolis, MN, 2015/04/15.
183. “Arrhythmogenic Remodeling of Failing Human Heart”, The 2nd UCLA Autonomic Nervous System Control of the Heart in Health and Disease Symposium. UCLA, Los Angeles, CA. 2015/03/12.
184. “Autonomic Regulation of Cardiac Excitability: Technology Response”, SPARC Program Workshop, National Institutes of Health, Bethesda MD. 2015/02/25.
185. “Remodeling of failing human heart”, Cardiology Grand Rounds, George Washington University, Washington, DC. 2015/01/14.
186. “Arrhythmogenic and metabolic remodeling of failing human heart”, Baylor College of Medicine, Dan L. Duncan Institute for Clinical and Translational Research, Cardiovascular Research Institute, Houston TX, 2014/12/09.
187. “Arrhythmogenic and metabolic remodeling of failing human heart”, The Davies Heart and Lung Institute, Ohio State University, Columbus, OH, 2014/12/03.
188. “Novel Approaches to Defibrillation”, Arrhythmia Research Summit, American Heart Association Scientific Sessions 2014, Chicago IL, 2014/11/19.
189. “Future Cardiac Implantable Devices: 3D Printed to Size”, The Women’s Society of Washington University, Washington University in Saint Louis, MO, 2014/11/18.
190. “Pathological remodeling of the failing human heart”, The Gordon K. Moe Lecture, 24th Annual Upstate New York Cardiac Electrophysiology Society Meeting, University at Buffalo, The State University of New York, Buffalo NY, 2014/11/03.
191. “Next Generation of Implantable Devices”, Moscow Institute of Physics & Technology, Dolgoprudny, Russia, 2014/10/10.
192. “The Mechanisms of Fibrillation”, Moscow Institute of Physics & Technology, Dolgoprudny, Russia, 2014/10/10.
193. “International Experience of Partnership between Universities and Business in Medicine”, Moscow Office of the World Bank, Moscow, Russia, 2014/10/09.
194. “Arrhythmogenic Remodeling of Failing Human Heart”, Cardiology Grand Rounds, University of Rochester, NY, 2014/09/10.
195. “What is Fibrillation?” The California Heart Rhythm Symposium 2014. The Beverly Hilton, Beverly Hills, CA. 2014/09/06.
196. “Is Low Energy Defibrillation Possible”, Cardiostim 2014, Nice, France, 2014/06/21

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197. “Functional Anatomy of the Sinus and AV Node: From Mouse to Man”, University of Milan, Milan, Italy, 2014/06/17.
198. “Metabolic Remodeling of Failing Human Heart”, British Heart Foundation Symposium, Imperial College London, London, UK, 2014/06/05.
199. “Research of the human heart is needed to develop new drugs”, IV International conference PhysTech Bio, Moscow Institute of Physics and Technology, Dolgoprudny, Russia. 2014/05/30.
200. “Novel therapies for the failing human heart”. International Conference “Instabilities and Control of Excitable Networks. Focus on: Cardiac Biophysics and General Aspects of Excitable Media Self-organization”. Moscow Institute of Physics and Technology, Dolgoprudny, Russia. 2014/05/28.
201. “Cardiac Remodeling in the Human Ventricles”, Copenhagen Meeting on Cardiac Arrhythmia, Copenhagen, Denmark, 2014/05/20.
202. “3D MIM (multifunctional integumentary membranes) platform for implantable devices”, Stanford Biodesign New Arrhythmia Technologies Retreat, Stanford, CA, 2014/05/06.
203. “The Mechanism Underlying Remodeling of Transmural Repolarization”, Washington University in Saint Louis, MO, 2014/04/30.
204. “Engineering Healthy Heart”, George Washington University, Washington, DC, 2014/04/22.
205. “Computational mapping inside the black box”, 13th Atrial Fibrillation Symposium, Prague, Czech Republic, 2014/03/15.
206. “Pro-fibrillatory remodeling of failing human heart: excitation-contraction coupling, metabolism, signaling”, Seventh TRM Forum on Computer Simulation and Experimental Assessment of Cardiac Function. Lugano, Switzerland, 2013/12/03.
207. “Pathogenesis: Basic Mechanisms of Atrial Flutter and Fibrillation”, Contemporary Approach to Diagnose and to Treat Atrial Flutter in CAD Patients, International congress and teaching program, Moscow, Russia, 2013/11/22.
208. “Optocardiography of Failing Human Heart”, Saint Petersburg State University, Russia, 2013/11/18.
209. “Two centuries of electrotherapy: from VF to AF”, L’Institut de Rythmologie et Modélisation Cardiaque (LIRYC) Workshop, Château Pape Clément, Bordeaux, 2013/10/24.
210. “Human heart physiology in health and disease”, Cardiac Physiome Society, 2013 Annual Meeting. Bar Harbor, ME, 2013/10/17.
211. “Arrhythmogenic and autonomic remodeling of failing human heart”, University of Wisconsin at Madison, School of Medicine and Public Health, Madison, WI. 2013/09/17.
212. “Optical Imaging of the Human Heart”, University of Pennsylvania, Philadelphia. 2013/0905.
213. “Low Energy Atrial and Ventricular Defibrillation”, Sorin Group, Paris, France, 2013/07/24.
214. “Arrhythmogenic and autonomic remodeling of failing human heart”, University of Bonn, Germany, 2013/07/22.
215. “Arrhythmogenic cardiac remodeling in cardiomyopathies”, Inherited Channelopathies 2013, Moscow, Russia. 2013/06/22.
216. “Electrophysiological remodeling and arrhythmogenesis by β1, β2 stimulation in human heart failure”, Imperial College London, UK, 2013/06/14.

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217. “Optical mapping of the human heart”, British Heart Foundation Centre of Research Excellence Symposium: Bridging Cardiovascular Science And Bioengineering, London, UK. 2013/06/13.
218. “Low Energy Atrial Defibrillation”, Heart Rhythm Society annual sessions, Denver, CO. 2013/05/11.
219. “Electrical Remodeling in the Human Heart”, Heart Rhythm Society annual sessions, Denver, CO. 2013/05/10.
220. “The Mechanisms: From Multiple Wavelets to Leading Circle and Rotors”, Heart Rhythm Society annual sessions, Denver, CO. 2013/05/09.
221. “Low Energy Atrial and Ventricular Defibrillation”, Stanford BioDesign, Denver, CO, 2013/05/07.
222. "Physiology of failing human heart", Calhoun Cardiology Center, University of Connecticut Medical Center, Farmington, CT, 2013/03/12.
223. "Electrophysiological Properties of the Human Normal and Failing Heart", Gordon Research Conference on Cardiac Arrhythmia Mechanisms, Ventura CA, 2013/02/20.
224. “Inventing in Academia”, Technology Transfer Workshop, Washington University, St. Louis, MO, 2013/02/08.
225. “Human Sinus and AV Nodes: Mechanisms of Nodal Arrhythmia”, University of Toronto, Toronto, Canada, 2013/01/31.
226. “Optical Mapping of the Human Sinus and Atrioventricular Nodes”, Developmental aspects of arrhythmias, Academic Medical Center, University of Amsterdam, Amsterdam, Netherlands, 2012/12/18.
227. “Russian American Medical and Science Associations: Decade of Experience”, Russian Higher Education – CRDF Global: Developing Global Leaders in Science through Russian-US University Collaboration, CRDF Global, Arlington, VA, 2012/12/11.
228. “Cardiac Arrhythmia Therapy: Devices vs. Pharmacology”, Case Western Reserve University, Cleveland, OH, 2012/11/19.
229. “Novel Approached to Defibrillation”, University of Minnesota, Minneapolis, MN, 2012/10/15.
230. “Pacemakers of the Heart: from Mouse to Man”, University of Stony Brook, Stony Brook, NY, 2012/10/10.
231. “Arrhythmogenic Remodeling of Failing Human Heart”, Cardiac & Respiratory Physiology Themed Meeting, Physiological Society, University of Manchester, Manchester, UK, 2012/09/05.
232. “Arrhythmogenic Remodeling of Failing Human Heart”, Symposium “Autonomic Nervous System Control of the Heart in Health & Disease”. UCLA, Los Angeles, CA, 2012/07/19.
233. “Physiology of the failing human heart”, Academic Medical Center, University of Amsterdam, the Netherlands. 2012/07/02.
234. “Update on the human heart project”, University of Bordeaux, Bordeaux, France. 2012/06/20.
235. “Arrhythmogenic Remodeling of Failing Human Heart”, Gordon Research Conference on Cardiac Regulatory Mechanisms, Colby-Sawyer College, New London, NH, 2012/06/14.
236. “Update on Repolarization: Dispersion of Repolarization in the Human Heart”, Heart Rhythm Society annual sessions, Boston MA, 2012/05/12.
237. “Novel Mechanisms for Defibrillation: Low-Voltage Multiple Shocks for Atrial Fibrillation and Flutter”, Heart Rhythm Society annual sessions, Boston MA, 2012/05/11.

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238. "My perspective on how to develop ideas into products and therapies", Heart Rhythm Society annual sessions, Boston MA, 2012/05/10.
239. "Low energy atrial and ventricular defibrillation", Stanford Biodesign New Arrhythmia Technologies Retreat, Boston MA, 2012/05/08.
240. "Using high definition ECG in implantable cardiac devices", International Society of Computerized Electrocardiography, Birmingham, AL, 2012/04/23.
241. "Fluorescent Imaging of the human heart", Multi-Modality Cardiovascular Molecular Imaging Symposium at NIH, Bethesda, MD, 2012/04/19.
242. "Arrhythmogenic Remodeling of Failing Human Heart: The Role of $[Ca^{2+}]_i$", UC Davis Cardiovascular Symposium "Systems Approach to Understanding Cardiac Excitation-Contraction Coupling & Arrhythmias", University of California at Davis, CA, 2012/03/03.
243. "Towards a pain-free atrial defibrillator", EP Conference. University of Alabama at Birmingham, AL, 2012/02/23.
244. "Arrhythmogenic Remodeling of Failing Human Heart", Cardiology Grand Rounds. University of Alabama at Birmingham, AL, 2012/02/22.
245. "Mechanisms of ventricular fibrillation and novel approaches to cardioversion and defibrillation", Cardiostim, St. Petersburg, Russia, 2012/02/17.
246. "Low Energy Cardioversion of Atrial Fibrillation", Plenary Lecture, Cardiostim, St. Petersburg, Russia, 2012/02/16.
247. "Electrophysiological remodeling of failing human heart", Virginia Commonwealth University, Richmond, VA, 2012/01/26.
248. "The structure and function of the human sinus node", Australian Physiological Society, Perth, Australia, 2011/12/05.
249. "Biophotonic imaging of the human heart bioelectricity", Old Dominion University, Norfolk, VA, 2011/11/28.
250. "The Sinus and AV Nodes of the Heart: from Mouse to Man", State University of Nizhny Novgorod, Russia. 2011/11/25.
251. "EP remodeling of human atria and ventricles during heart failure: implications for AF", Symposium: Catheter Ablation Of Atrial Fibrillation In Heart Failure Patients, Moscow, Russia, 2011/11/22.
252. "Optical mapping of the conduction system", American Heart Association, Orlando, FL, 2011/11/15.
253. "Physics of the heart", 300th anniversary of Mikhail Lomonosov, Russia Science and Culture Center, Washington, DC. 2011/11/11.
254. "Arrhythmogenic Remodeling in the Human Heart Failure". Montreal Heart Institute, University of Montreal, Canada, 2011/11/04.
255. "Low voltage therapy of atrial fibrillation", Academician E.N. Meshalkin Novosibirsk State Research Institute of Circulation Pathology, Novosibirsk, Russia, 2011/10/07.
256. "Arrhythmogenic remodeling of atria and ventricles in patients with heart failure", Academician E.N. Meshalkin Novosibirsk State Research Institute of Circulation Pathology, Novosibirsk, Russia, 2011/10/07.
257. "Human heart physiology research program – an update", The EXCITE Seminar, Center for the Investigation of Membrane Excitability Diseases, Washington University in St. Louis, MO, 2011/10/03.
258. "Optical mapping of the sinoatrial and atrioventricular node", Riley Heart Center Symposium On Cardiac Development, Indianapolis, IN, 2011/09/12.

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259. “Electrical activation of the human heart: molecular and functional mapping”, 4th Cardiac Physiome Workshop, Merton College, Oxford, UK, 2011/07/10.
260. “Molecular and functional remodeling of the failing human heart”, British Heart Foundation Centre ElectroCardioMaths Multidisciplinary Programme Symposium: The Electromechanics Of Heart Muscle: Conduction And Arrhythmogenesis. Imperial College, London, 2011/07/07.
261. “Functional Remodeling in Heart Failure”, Heart Rhythm Society, San Francisco, CA, 2011/05/06.
262. “Biophotonic Imaging of the Human Heart”, Heart Rhythm Society, San Francisco, CA, 2011/05/04.
263. “Dual Pathways and Connexin 43 in the Human AV Node”, Andrew L. Wit Symposium, Columbia University, New York City, NY, 2011/05/02.
264. “Structural and functional evidence for discrete exit pathways”, International Society for Computerized Electrocardiography, San Jose, CA, 2011/04/14.
265. “Towards a Pain-free Implantable Atrial Cardioverter”, Visiting Professor, Cleveland Clinic Foundation, 2011/04/11.
266. “Painless defibrillation”, Old Dominion University, Norfolk, VA, 2011/03/18.
267. “Electrophysiology of Failing Human Heart”, Gordon Research Conference on Cardiac Arrhythmia Mechanisms, Galveston, TX. 2011/02/15.
268. “Low voltage atrial defibrillation”, Boston Scientific, Minneapolis, MN, 2011/02/04.
269. “The Sinus and AV Nodes of the Heart: from Mouse to Man”, New York University, New York, NY, 2010/12/17.
270. “Low Voltage Atrial Defibrillation”, Medtronic, Minneapolis, MN, 2010/11/09.
271. “History of Progress Towards Painless Defibrillation”, Department of Biomedical Engineering, University of Michigan at Ann Arbor, MI, 2010/11/04.
272. “Electrophysiological Remodeling of Failing Human Heart”, Department of Molecular and Integrative Physiology, University of Michigan at Ann Arbor, MI, 2010/11/03.
273. “Biophysics and Bioengineering of the Heart”, State University of Nizhny Novgorod, Russia, 2010/10/15.
274. “Low voltage defibrillation”, Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod, Russia, 2010/10/12.
275. “History of Progress Towards Painless Defibrillation”, Department of Cardiology, Rhode Island Hospital, Cardiology Grand Rounds, 2010/10/01.
276. “Imaging Electrophysiological Remodeling in Failing Human Heart”, Cardiovascular Research Center, Rhode Island Hospital and Brown Medical School, 2010/09/30.
277. “Electrophysiological Remodeling in Human Cardiomyopathy”, Grand Rounds, Department of Anesthesiology, Washington University School of Medicine, 2010/09/08
278. “Cardiac electrotherapy”, Nizhny Novgorod State University, Nizhny Novgorod, Russia, 2010/06/29
279. “Quantitative cardiac physiology”, Nizhny Novgorod State University, Nizhny Novgorod, Russia, 2010/06/28
280. “Molecular basis of human heart physiology”, Ioffe Physico-technical Institute, Sankt Peterburg, Russia, 2010/06/23
281. “Sinoatrial excitation”, Cardiostim, Nice, France, 2010/06/17
282. “Quantitative Cardiac Human Physiology”, Department of Biomedical Engineering, Cornell University, Ithaca, NY, 2010/03/17.

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283. “Biophotonic imaging of the whole heart excitation”, UC Davis Cardiovascular Symposium: Systems Approach to Understanding Cardiac Excitation-Contraction Coupling, University of California, Davis, CA. 2010/02/25.
284. “Quantitative Human Cardiac Physiology”, Biomedical Engineering Seminar Series, Johns Hopkins School of Medicine and the Whiting School of Engineering, Baltimore, MD. 2010/02/22
285. “History and Development of Therapy for Sudden Cardiac Death”, Electrical & Systems Engineering Department Seminar, Washington University in St. Louis, MO. 2010/02/05.
286. “Entrepreneurship in Biomedical Industry and Academia—Challenges, Opportunities, and Ethics”, AHMB BME Honors Society, Washington University, St. Louis, MO. 2010/02/04
287. “History of Progress Towards Painless Defibrillation”, Research Lyceum Series, St Jude Medical, Sunnyvale, CA 2010/01/22
288. “History of Progress Towards Painless Defibrillation”, Research Lyceum Series, St Jude Medical, Sylmar, CA 2010/01/21
289. “Mechanisms of Induction of Ventricular Tachycardia”, Scientific Sessions, American Heart Association, Orlando, FL, 2009/11/18.
290. “Anatomy and Physiology of the Mammalian Sinus Node”, Scientific Sessions, American Heart Association, Orlando, FL, 2009/11/17.
291. “Cardiac Pacing and Defibrillation: History and Mechanisms of Antiarrhythmia therapy” Department of Pharmacology, The George Washington University, Washington, DC, 2009/11/11.
292. “Optical Mapping of the Human Heart. Do Animal Models Predict Clinical Physiology?” Cardiology Grand Rounds, The Richard B. and Lynne V. Cheney Cardiovascular Institute, The George Washington University, Washington, DC, 2009/11/11.
293. “Low voltage defibrillation”, Cornell University, Ithaca, NY, 2009/11/4.
294. “Electrical re-engineering of the heart: New treatments of Arrhythmias”, Iowa State University, Ames, IA, 2009/10/27
295. “Quantitative molecular physiology of the human heart”, Nano-Technology Revolution 2009, Bastia, France, 2009/09/28.
296. “Functional Anatomy of the Human Sinus and AV Nodes: Nature's Engineering of the Biological Pacemaker”. California Heart Rhythm Symposium, San Francisco, CA, 2009/09/25
297. “Physiology of the human heart: Do we really know it?” Workshop: “The Cardiac Physiome: Multi-scale and Multi-physics Mathematical Modeling Applied to the Heart”. Isaac Newton Institute for Mathematical Sciences, University of Cambridge, UK. 2009/07/22
298. “Structure/Function of the Sinus and Atrio-Ventricular Nodes”, “Cardiology Update” lecture series, Washington University Medical School, 2009/06/27
299. “Pandemics of Cardiovascular Diseases: The emerging role of Nanosciences and Tissue Engineering”, Nano-forum in Science and Education, Hanty-Mansiysk, Russia, 2009/05/22
300. “New Modalities for Low Voltage Termination of Cardiac Arrhythmias”, Heart Rhythm Society Annual Meeting, Boston, MA, 2009/05/14
301. “Transgenic Rabbit Model of Hypertrophic Cardiomyopathy: Implications for Human Arrhythmias”, Heart Rhythm Society Annual Meeting, Boston, MA, 2009/05/15
302. “Optically Mapping the Human Heart”, Heart Rhythm Society Annual Meeting, Boston, MA, 2009/05/16

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303. “Fluorescence Electrophysiology Imaging of the Human Heart”, 2009 Symposium on Multimodality Cardiovascular Molecular Imaging, Society for Nuclear Medicine, National Institutes of Health, Bethesda, MD, 2009/04/30
304. “Advancing the Understanding of Arrhythmogenesis: From Animal to Human Heart”, UCLA Symposium on Systems Approaches to Cardiac Biology & Medicine, Los Angeles, CA, 2009/02/06
305. “Human pacemaking and conduction system: from reductionism to integration”, Nora Eccles Treadwell Distinguished Lecture Series, Nora Eccles Harrison Cardiovascular Research and Training Institute, University of Utah, Salt Lake City, Utah, 2008/12/04
306. “Cardiac protection in hibernating ground squirrels: The role of Connexins and Cadherens”, University of Missouri, Springfield, MO, 2008/11/21
307. “Functional anatomy of the AV Node: from Rabbit to Human”, Cardiac Electrophysiology Society, New Orleans, LA, 2008/11/08
308. “Pathogenesis of Ventricular Arrhythmias in Dilated Cardiomyopathy: Insights from Optical Mapping Studies”, 3rd Annual International Symposium on Ventricular Arrhythmias: Pathophysiology and Therapy, Miami, FL, 2008/10/24
309. “Basic Aspects of Nodal Arrhythmias”, Bakulev Scientific Centre for Cardiovascular Surgery, Russian Academy of Medical Sciences, Moscow Russia, via videoconference, 2008/10/06
310. “3D structure of the AVJ. Permanent ventricular pacing within the AVJ – possible new perspective treatment of bradysystolic AF”. Aritmija – Lietuva 2008, 9th biannual International symposium. Klaipeda, Lithuania. 2008/09/19
311. “Design of a biological pacemaker: animal models vs. human SAN and AVN”, National Heart, Lung and Blood Institutes, NIH, Bethesda, MD, 2008/08/19.
312. “Cardiac protection in hibernating ground squirrels: The role of Connexins and Cadherens”, 13th International Hibernation Symposium, Swakopmund, Namibia, 07/07/2008
313. “Optical Imaging or Rhythms and Arrhythmias”, Gordon Research Conference on Cardiac Regulatory Mechanisms, New London, NH, 2008/07/23.
314. “Voltage and calcium imaging in the human failing ventricles”, CARDIOSTIM 2008, Nice, France. 2008/06/18.
315. “Molecular and structural basis of arrhythmia in the human AV junction: Insights from biophotonic imaging”, Cardiology Grand Rounds, University of Cincinnati College of Medicine, 2008/04/22.
316. “Functional anatomy of the AV junction”, Cardiac Bioelectricity and Arrhythmia Center, Washington University, Saint Louis, MO, 2008/03/31
317. “Basic electrophysiological mechanisms of initiation of supraventricular tachyarrhythmia”, VIII Pan Slavic International Congress on Cardiac Pacing and Electrophysiology "CARDIOSTIM", Saint Petersburg, Russia, 2008/02/14.
318. “New approaches for the low energy cardioversion and defibrillation”, VIII Pan Slavic International Congress on Cardiac Pacing and Electrophysiology "CARDIOSTIM", Saint Petersburg, Russia, 2008/02/15.
319. “Mechanisms of ventricular fibrillation and a new approach to cardioversion-defibrillation”, VIII Pan Slavic International Congress on Cardiac Pacing and Electrophysiology "CARDIOSTIM", Saint Petersburg, Russia, 2008/02/15.
320. “Electroporation in the intact heart: implications for defibrillation, arrhythmia and stunning”, Medtronic, Inc., Minneapolis, MN. 2008/01/28.

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321. “Biophotonic Imaging of Atrial Pacemaker Complex”, Cardiovascular Research Seminar, Washington University School of Medicine, St. Louis, MO, 2008/01/24.
322. “Heterogeneous protein expression in the cardiac pacemaker and conduction system”, Department of Biochemistry and Molecular Biology, Saint Louis University, St. Louis, MO, 2007/12/12.
323. “Implantable Defibrillation Therapy: A Century of Breakthrough”, St. Louis Chapter of IEEE Engineering in Medicine and Biology Society, St. Louis, MO, 2007/10/10.
324. “Fundamental mechanisms of AV conduction: ionic channels and gap junctions”, Bakulev Scientific Centre for Cardiovascular Surgery, Russian Academy of Medical Sciences, Moscow Russia, 2007/10/08.
325. «Basic aspects of AV-nodal tachycardia: Ion Channels, Currents and Gap Junctions», III Russian Symposium on Interventional Arrhythmology and Educational Course of European Cardiac Arrhythmia Society (ECAS). Pathogenesis, Diagnosis And Treatment of Supraventricular Tachyarrhythmias, Moscow, Russia, 2007/09/14
326. «How to fix a broken heart: Modern Bioengineering Approaches to Cardiovascular Diseases, from Molecules to Patients», Club Bilingua, Moscow, Russia, 2007/09/12
327. «Brain drain and integration of world academic community», Moscow Institute for Transmission of Information, Russian Academy of Sciences, Moscow, Russia, 2007/09/11
328. «Multimodal Biophotonic Imaging of Supraventricular Pacemaker and Conduction System», Focused Meeting of The Physiological Society, Cardiac Electrophysiology - with a special celebration of the centenary of the discovery of the sinoatrial and atrioventricular nodes, University of Manchester, Manchester, UK, 2007/09/05
329. “Atrial Pacemaker Complex: Orchestrating cardiac rhythm”, University of Iowa, Cardiology Grand Rounds speaker, 2007/08/22.
330. "New approaches to defibrillation and resynchronization therapies learned from optical mapping", Division of Cardiology Grand Rounds at Weill Cornell Medical College, New York NY, 2007/05/14.
331. “Biophotonic Imaging of Embryonic Heart”, Weinstein Cardiovascular Development Conference, Indianapolis IN, 2007/05/11.
332. “New approaches to device therapy of cardiac arrhythmias: insights from optical imaging”, Lillehei Institute Grand Round, University of Minnesota, Minneapolis MN. 03/06/2007
333. “Sinoatrial and Atrioventricular Nodal Structure and Function”, Saudi Heart Association XVIII annual meetings, Jeddah, Saudi Arabia, 02/07/2007
334. “New Advances Towards Painless Defibrillation”, Saudi Heart Rhythm Society Satellite Symposium, Saudi Heart Association XVIII annual meetings, Jeddah, Saudi Arabia, 02/07/2007
335. “Optical Imaging of Arrhythmias”, University of Missouri, St. Louis, 01/12/2007
336. “New approaches to device therapy of cardiac arrhythmias: insights from optical imaging”, Duke University, Department of Biomedical Engineering, Speaker for Bioengineering Leaders Seminar Series, 01/08/2007
337. “The structure/function relationship in the AV node”. Fifth International Workshop on Computer Simulations and Experimental Assessment of Electrical Excitation, Beau-Rivage Palace, Lausanne, Switzerland. 12/11/2006
338. “New strategies for resynchronization and defibrillation therapies: insights from the rabbit heart”, Brigham and Women’s Hospital, Harvard University Medical School, Boston, MA. 12/07/2006

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339. “Optical imaging of cardiac arrhythmias: The Bermuda triangle of the AV junction”. Division of Engineering and Applied Sciences, Harvard University, Cambridge MA. 12/06/2006
340. “Optical mapping of cardiac electrical activity”, Mathematical Biosciences Institute, Ohio State University, Columbus, OH. 10/06/2006
341. “Reentrant arrhythmias”, Mathematical Biosciences Institute, Ohio State University, Columbus, OH. 09/28/2006
342. “Hibernating ground squirrel”, Kavli Institute for Theoretical Physics. University of California at Santa Barbara. Cardiac Dynamics workshop. 08/03/2006
343. “Pacemaking and conduction system of the heart”, Saint Jude Medical, Los Angeles, CA. 07/31/2006
344. “Towards painless defibrillation”, Saint Jude Medical, Los Angeles, CA. 07/31/2006
345. “Low voltage defibrillation”, Kavli Institute for Theoretical Physics. University of California at Santa Barbara. Cardiac Dynamics workshop. 07/27/2006
346. "Structure/function of the supraventricular pacemaking and conduction system of the rabbit heart". American Association of Anatomists, FASEB annual meeting. San Francisco, CA. 04/04/2006
347. “Imaging arrhythmias in 3D: the final frontier”, Oxford University, Oxford, UK. 03/17/2006
348. “Towards painless defibrillation: virtual electrode theory of electrical stimulation of the heart”, Oxford University, Oxford, UK. 03/15/2006
349. “Structure/function relationship of the pacemaking and conduction system of the heart”, Oxford University, Oxford, UK. 03/13/2006
350. “Imaging Cardiac Arrhythmias”, Department of Biomedical Engineering, Saint Louis University, St. Louis, MO. 02/18/2006
351. “History and mechanisms of defibrillation: toward painless defibrillation”, Cardiology Grand Round Lecturer, Albert Einstein College of Medicine and Montefiore Medical Center, New York, NY. 02/14/2006
352. “Imaging arrhythmias: toward painless defibrillation”, Cardiac Bioelectricity and Arrhythmia Center, Washington University, St. Louis, MO. 10/17/2005
353. “Optical mapping of the conduction system of the heart”, Mammalian Myocardium 2005, Bristol, UK. 07/20/2005
354. “Mechanisms of defibrillation”, 1st Russian Arrhythmology Congress, Moscow, Russia. 06/18/2005
355. “Optical Mapping of Cardiac Conduction: the Role of Connexins”, University of Medicine and Dentistry of New Jersey, Newark. 05/17/2005
356. “Optical mapping of the AV junction”, 30th annual meeting of the International Society of Computerized Electrocardiography, Kauai, Hawaii. 04/15/2005
357. “Optical mapping of cardiac arrhythmias”, Imaging Science Seminar. Washington University in St. Louis, MO. 03/25/2005
358. “Mechanisms of Cardiac Conduction and Vulnerability to Arrhythmias: Protection in Hibernation?” University of Alaska, Fairbanks, Alaska. 03/04/2005
359. “The mechanisms of stimulation and defibrillation: virtual electrodes and electroporation”, Indo-US Frontiers of Science Symposium, U.S. National Academy of Sciences and Indian Institute of Science, Bangalore, India. 01/09/2005
360. “Molecular determinants of cardiac conduction: the role of connexins”, University of Minnesota, Duluth, MN. 12/13/2004

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361. “On history and mechanisms of defibrillation”, Medtronic, Minneapolis, MN. 10/11/2004
362. “Structure-function relationship in the AV junction”, National Institute of Aging, National Institutes of Health, Baltimore, MD. 10/07/2004
363. “Structure-function relationship in the AV junction”, Conference “Cardiac Cellular Electrophysiology: From funny currents to the current Physiome”, September 2-5, 2004, Montpelier, France. 09/03/2004
364. “Cardiac conduction and resistance to ventricular fibrillation in Siberian hibernator Cittelus undulatus: Does the switch from Cx43 to Cx45 improve safety of slow conduction?”, International symposium “Life in the cold 2004”, July 25 – 31, 2004, Vancouver, BC – Seward, Alaska. 07/31/2004
365. “The role of cellular uncoupling and electroporation in defibrillation”, Fourth International Workshop on Computer Simulation and Experimental Assessment of Electrical Cardiac Function and Second Salon Scientifique de Cap d’Ail From Gene to Life, June 14-15, 2004, Cap d’Ail, France. 05/15/2004
366. “Molecular Basis of Triggers and Substrates in Atrial Fibrillation: Role of the AV junction”, Heart Rhythm Association annual meeting, San Francisco, CA. 05/21/2004
367. “Are Virtual Electrode-Induced Graded Responses Important in the Mechanisms of Ventricular Vulnerability and Defibrillation?” Heart Rhythm Association annual meeting, San Francisco, CA. 05/20/2004
368. “Structure-function relationship of the AV junction”, American Association of Anatomists, Washington, D.C. 04/19/2004
369. “The role of intercellular communications in the AV junction”, University of Pittsburgh, PA. 02/24/2004
370. “The role of connexin diversity and remodeling in cardiac conduction and arrhythmogenesis”, Cardiac Rhythm Management Laboratory, University of Alabama at Birmingham, AL 01/26/2004
371. “Molecular mechanisms of AV conduction”, Burdenko Hospital, Moscow, Russia. 12/25/2003
372. “The role of heterogeneity of connexins in the AV junction and infarction border zone: substrate for focal and reentrant activity”, Medtronic Technical Forum, Minneapolis, MN. 12/17/2003
373. “Molecular and structural basis of conduction in the AV junction”, Cardiology Journal Club, University Hospitals of Cleveland. 11/21/2003
374. “Mechanisms of fibrillation and defibrillation”, Bakulev Scientific Centre for Cardiovascular Surgery, Russian Academy of Medical Sciences, Moscow Russia. 10/27/2003
375. “Molecular mechanisms of propagation and arrhythmias”, Bakulev Scientific Centre for Cardiovascular Surgery, Russian Academy of Medical Sciences, Moscow Russia. 10/23/2003
376. “What do we know about mechanisms of vulnerability and defibrillation?”, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, CA. 10/08/2003
377. “Century of Defibrillation”, Burdenko Hospital, Moscow, Russia. 06/20/2003
378. “Virtual electrodes in defibrillation”, Heart Rhythm Society (NASPE) annual meeting, Washington, D.C. 05/15/2003

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379. “Mechanisms of cardiac pacing and defibrillation”, Marquette University, Milwaukee, WI. 03/21/2003
380. “Mechanisms of cardiac defibrillation”, Cornell University, Ithaca, NY. 03/11/2003
381. “Century of Defibrillation”, XIIth World Congress on Cardiac Pacing and Electrophysiology, Hong Kong, China. 02/20/2003
382. “Models of cardiac excitation”, Xth International Workshop “Mathematical Models of Leaving Systems”. Puschino, Russia. 01/25/2003
383. “On ways of interaction between Russian and Western Science Communities”, International Conference “Intellectual bridge Russia-West: Problems and Perspectives”. Dubna, Russia. 12/25/2002
384. “Active bidomain modeling and fluorescent imaging of virtual electrode induced scroll waves”, 3rd International Workshop on Computer simulation and Experimental Assessment of Electrical Cardiac Function. Lausanne, Switzerland. 12/05/2002
385. “The mechanisms of stimulation and defibrillation: virtual electrodes, electroporation and electrode-tissue interface”, Biomedical Engineering Department Seminar, Washington University, St. Louis, MO. 10/17/2002
386. “Mechanisms of Stimulation and Defibrillation: Virtual Electrodes, Electroporation and Electrode Tissue Interface”, Technical Forum (EP chapter), Medtronic, Minneapolis, MN. 9/27/2002
387. “Stimulation with a Single Electrode”, 13th International Congress Cardiostim-2002, Nice, France. 6/20/2002
388. “Shocking experience: electrically induced virtual electrodes and scroll waves in the heart”, Massachusetts Institute of Technology, Boston, MA. 5/30/2002
389. “Action potential duration restitution slope of greater than one is not always a key determinant of ventricular fibrillation”, Annual meeting of North American Society of Pacing and Electrophysiology, San Diego, CA. 5/11/2002
390. “The core of reentry”, Annual meeting of North American Society of Pacing and Electrophysiology, San Diego, CA. 5/09/2002
391. “Shocking experience: Electrical Stimulation of the Heart”, Biomedical Engineering Department Seminar, CWRU, Cleveland, OH. 4/25/2002
392. “Mechanisms of cardiac stimulation and defibrillation”, Heart Failure and Electrophysiology Seminar Series, Cleveland Clinic Foundation, Cleveland, OH. 4/09/2002
393. “Mechanisms of cardiac stimulation and defibrillation”, Department of Physiology and Biophysics, Case Western Reserve University, Cleveland, OH. 3/21/2002
394. “Mechanisms of defibrillation”, Department of Cardiology, University Hospitals, Cleveland, OH. 3/1/2002
395. “Mechanisms of fibrillation”, Department of Cardiology, University Hospitals, Cleveland, OH. 2/25/2002
396. "Virtual electrode hypothesis of defibrillation ", Queenstown, New Zealand. 8/19/2001
397. "Virtual electrode hypothesis of defibrillation: three-dimensional aspects", University of Leeds, UK. 7/13/2001
398. "Mechanisms of vulnerability and defibrillation", University of Oxford, UK. 7/8/2001
399. "Virtual electrode polarization induced phase singularity or cross-field induced critical points", Copenhagen, Denmark. 6/21/2001
400. "Mechanisms of cardiac stimulation and defibrillation: new insights from fluorescent imaging", McGill University, Montreal, Canada. 6/6/2001

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401. "Fluorescent Imaging of the Heart", University of Montreal, Montreal, Canada. 6/4/2001
402. “Mechanisms of defibrillation”, Department of Cardiology, University Hospitals, Cleveland, OH. 3/2/2001
403. “Mechanisms of fibrillation”, Department of Cardiology, University Hospitals, Cleveland, OH. 2/26/2001
404. "Virtual Electrode Theory of Defibrillation", Second International Workshop on Computer simulation and Experimental Assessment of Electrical Cardiac Function. Lausanne, Switzerland. 5/12/2000
405. “A century of fibrillation. Ventricular Fibrillation: Initiation, Maintenance and Termination”, Cardiostim 2000, Nice, France. 6/25/2000
406. "Electric Stimulation of the Heart: New Mechanistic Insights from Fluorescent Imaging In Vitro", Medtronic, Inc., Minneapolis, MN. 2/7/2000
407. "Fluorescent Imaging Of The Vortex Core In The Rabbit Heart ", BMES-EMBS meeting, Atlanta, GA. 10/12/1999
408. "Role of Critical Points in Defibrillation", XI World Symposium on Cardiac Pacing and Electrophysiology, Berlin, Germany. 6/28/1999
409. “Mechanisms of Fibrillation and Defibrillation”, Department of Molecular Cardiology, Cleveland Clinic Foundation, Cleveland, OH. 5/1/1999
410. "Mechanisms of defibrillation", Tulane University, New Orleans, LA. 4/19/1999
411. “Mechanisms of defibrillation”, Metro Hospital Research Center, Cleveland OH. 2/2/1999
412. “ICD therapy for sudden cardiac death”, Department of Anesthesiology, Cleveland Clinic Foundation, Cleveland OH. 1/19/1999
413. “Optical mapping of supraventricular conduction”, Medical University of South Carolina, Charleston SC. 10/30/1998
414. “Mechanisms of defibrillation: role of heart structure”, Medical University of South Carolina, Charleston SC. 10/28/1998
415. “Virtual electrode-induced wavefronts and phase singularities: mechanisms of defibrillation failure”, Biomedical Engineering Society meeting, Cleveland, OH. 10/13/1998
416. “Genesis and dynamics of shock-induced spiral waves”, Biomedical Engineering Society meeting, Cleveland, OH. 10/13/1998
417. “Mechanisms of defibrillation”, Department of biomedical Engineering, Case Western Reserve University, Cleveland, OH. 9/29/1998
418. “Mechanisms of internal defibrillation”, Department of Physics, Ohio University, Athens, OH. 9/14/1998
419. “Genesis of phase singularity by virtual electrode effect during defibrillation”, Optical Mapping Symposium, Phoenix, AZ. 4/25/1998
420. “Virtual electrodes induced phase singularity: a basic mechanisms of defibrillation failure”, Guidant Corp., Minneapolis, MN. 3/13/1998
421. “Virtual electrodes-induced phase singularity: a basic mechanisms of defibrillation failure”, St. Jude Medical CRMD, Sunnyvale, CA. 3/1/1998
422. “Effects of biphasic shocks on transmembrane polarization: virtual electrodes and critical points”, University of Alabama, Birmingham, AL. 1/16/1998
423. “Virtual electrodes induced phase singularity: a basic mechanisms of defibrillation failure”, Case Western Reserve University, Cleveland, OH. 1/7/1998
424. “Optical mapping of electrical activity during defibrillation”, Krannert Institute of Cardiology, Indiana University, Indianapolis, IN. 3/21/1997

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Teaching:

2024:	BME 304: Cardiovascular, Respiratory, And Immune Systems Physiology
2023:	BME 512: BME Seminar, Course master
	BME 304: Cardiovascular, Respiratory, And Immune Systems Physiology
2022:	BME 512: BME Seminar, Course master
	BME 302: Cardiovascular, Respiratory, And Immune Systems Physiology
2021:	BME 6045: Cardiovascular Engineering, Course master
2020: Fall:	BME 2810: Biomedical Engineering Seminar, Course master
	BME 6045: Cardiovascular Engineering, Course master
2019: Fall:	BME 2810: Biomedical Engineering Seminar, Course master
2018: Fall:	BME 2810: Biomedical Engineering Seminar, Course master
	BME 6045: Cardiovascular Engineering, Course master
2018: Spring:	BME 6995: Regulatory BME Practicum II, Instructor
2017: Fall:	BME 2810: Biomedical Engineering Seminar, Course master
	BME 6994: Regulatory BME Practicum I, Instructor
2017, Spring:	BME 3907: Bioelectricity, Course Instructor
2016, Fall:	BME 3820: Principles and Practice of Biomedical Engineering, Course Instructor
	BME 4920W, Biomedical Engineering Capstone Project Lab II, Mentoring 4-student team
	BME-1020, Introduction to Biomedical Engineering II, 1 lecture.
2015, Spring:	BME 301B: Quantitative Physiology II, Course master
	BME 1010: Introduction to BME, Course master
2014, Spring:	BME 301B: Quantitative Physiology II, Course master
	BME 573: Applied Bioelectricity, Course master
	BME 5901: Integrative Cardiac Electrophysiology, 25%
2013, Spring:	BME 301B: Quantitative Physiology II, Course master
	BME 5909: Physiology of the Heart, Course master
2012, Spring	BME 301B: Quantitative Physiology II, Course master
	BME 573: Applied Bioelectricity, Course master
	BME 5909: Physiology of the Heart, Course master
2011, Fall	Biol 5146, Principles and Applications of Biological Imaging
	BME 140, Introduction to Biomedical Engineering
2011, Spring	BME 301B, Quantitative Physiology II, Course master
2010, Fall	Biol 5146, Principles and Applications of Biological Imaging
	BME 140, Introduction to Biomedical Engineering
2010, Spring	BME301B, Quantitative Physiology II, Course master
	BME 573: Applied Bioelectricity, Course master
	BME594 Integrative Cardiac Electrophysiology, Instructor (1/3 lectures)
2009, Spring	BME 301B, Quantitative Physiology II, Course master
2008, Fall	Biol 5146, Principles and Applications of Biological Imaging
	BME 140, Introduction to Biomedical Engineering
2008, Spring	BME 301B, Quantitative Physiology II, Course master
	BME 573, Applied Bioelectricity, Course master
2007, Fall	Biol 5146, Principles and Applications of Biological Imaging
	BME 140, Introduction to Biomedical Engineering

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2007, Sprint	BME 301B, Quantitative Physiology II, Course master.
2006, Spring	BME 301B, Quantitative Physiology II, Course master.
	BME 573, Applied Bioelectricity, Course master.
2005, Fall	BME 301B, Quantitative Physiology II.
	BME 140, Introduction to Biomedical Engineering.
2005, Spring	BME 471, Bioelectric Phenomena, Instructor.
	BME 301B, Quantitative Physiology II.
2004, Fall	BME 140, Introduction to Biomedical Engineering.
2004, Spring	EBME 452, Tissue and Organ Systems Physiology. Organizer.
2003, Fall	EBME 105, Introduction to Biomedical Engineering. Organizer.
	EBME 313. Biomedical Engineering Laboratory.
	EBME 417. Structure and Function of Excitable Cells.
2003, Spring	EBME 452, Physiological Processes II. Organizer.
	ENGR 210, Introduction to Circuits and Instrumentation.
2002, Fall	EBME 105, Introduction to Biomedical Engineering. Organizer.
	EBME 313, Biomedical Laboratory.
2002, Spring	EBME452, Physiological Processes II.
	ENGR 210, Introduction to Circuits and Instrumentation.
	PHOL 518, Integrative Approaches to Cardiovascular Research.
	EBME 417, Structure and Function of Excitable Cells.
2001, Fall	EBME 105, Introduction into Biomedical Engineering.
	EBME 313, Biomedical Engineering Laboratory.
2001, Spring	EBME 452, Physiological Processes II.
	ENGR 210, Introduction to Circuits and Instrumentation.
	EBME 314, Biomedical Engineering Laboratory.
	PHOL 518, Integrative Approaches to Cardiovascular Research.
	EBME 417, Structure and Function of Excitable Cells.
2000, Fall	EMBE 403, Biomedical Transducers and Instrumentation.
	EBME 314, Biomedical Engineering Laboratory.
1999	EBME 314, Biomedical Engineering Laboratory.
1995	Advanced graduate course in Cardiac Electrophysiology and Electropharmacology, Ohio State University.
1993-1994	Undergraduate students project adviser, University of Pittsburgh.
1981-1983	Evening School of Physics and Technology of Moscow Institute of Physics and Technology, Moscow, Russia. Taught calculus, physics, and differential equations for advanced high school students.
1980-1985	Krasnoyarsk State University, Natural Sciences Summer School, Krasnoyarsk, Russia. Taught physics, classical mechanics, calculus, and differential equations to advanced high school students.

University service

2023-present	Director of Graduate Studies, Northwestern University.
2015-2019	Chairman, Biomedical Engineering Department, George Washington University
2012-present	Member, BME Graduate Program Committee, Washington University

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2012-present Member, Study section, Institute of Clinical and Translational Sciences, Washington University School of Medicine, St. Louis MO.
2012-present Member, Search committee, Associate Vice Chancellor for Innovation, Washington University in Saint Louis.
2011-present Member, RAC Subcommittee for Entrepreneurship, Washington University School of Medicine.
2008-2012 Member, Information Technology Advisory Committee, School of Engineering and Applied Sciences, Washington University in Saint Louis
2004-2012 Member, Imaging Training Program Committee, Washington University
2004-2012 Member, BME Undergraduate Program Committee, Washington University
2000-2004 Member, Graduate Education Committee, Biomedical Engineering Department, Case Western Reserve University.
2001-2004 Freshman student adviser, Case School of Engineering, Case Western Reserve University.
2001-2004 Member, Imaging faculty search committee, Biomedical Engineering Department, Case Western Reserve University.
2001-2003 Member, Case School of Engineering Executive Committee.

Laboratory members research awards and prizes

1. Anna Gams, 2023 JACC CEP Best publication award.
2. Jaclyn Brennan, 2021 JACC CEP Best publication award.
3. Anna Gams, 2020-2021 Chateaubriand Fellowship, France.
4. Katherine Holzem, 1st Prize in Poster competition at the Cardiac Arrhythmia Mechanisms Gordon Research Conference, Il Chiocco, Italy, 2015.
5. Fu Siong Ng, MD, PhD, European Cardiac Arrhythmia Society, 1st Prize for best presentation, 2014.
6. Ajit Janardhan, MD, PhD, Heart Rhythm Society, Young Investigator Competition Finalist, May 2013.
7. Joseph Marmerstien, SURF fellowship, Washington University in Saint Louis, April 2013.
8. Saraha Gutbrod, Whitaker Foundation, Whitaker International Program Summer grant. 2013.
9. Katherine Holzem, Research grant, American Medical Association, 2013.
10. Jacob Laughner, 1st Prize at the Washington University School of Medicine 1st Annual Cardiovascular research Day Poster Presentation. 2012/12/07.
11. Katherine Holzem, National Institutes of Health, National Research Service Award, 2012-2015. Score 10, Percentile 1%.
12. Ajit Janardhan, MD, PhD, Dr. Manohar Sai Gowda Memorial Young Investigator Cardiovascular Research Award for “Low-Energy Multi-Stage Electrotherapy Cardioverts AF With Lower Energy Than a Single Biphasic Shock: In Vivo Results and Mechanism Revealed by Optical Mapping In Vitro”, Kansas City Heart Rhythm Symposium.
13. Matt Sulkin, Amercian Heart Association Predoctoral Fellowship, 7/1/2012-6/30/2014.
14. Katherine Holzem, Amercian Heart Association Predoctoral Fellowship, 7/1/2012-6/30/2014.
15. Vadim V. Fedorov, Ph.D., Best Science Award for his abstract presentation at the American Heart Association Scientific Sessions in November 2009.
16. William Hucker, MD, PhD, Spencer T. and Ann W. Olin Fellowship in Medical Sciences, Washington University, 2009.

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17. Roger Chang, Summer Undergraduate Research Fellowship, 2008.
18. Geran Kostecki, Summer Undergraduate Research Fellowship, 2008.
19. Hyuliya Aferol, Summer Undergraduate Research Fellowship, 2008.
20. Vadim V. Fedorov, Ph.D., American Heart Association Beginning Grant-In-Aid, 01/2008-12/2009, 0860047Z, "The role of substrates in atrial fibrillation mechanisms: implications for painless defibrillation therapy".
21. Crystal Ripplinger, 2nd place – Gordon Research Conference on Cardiac Arrhythmia Mechanisms Poster Competition, Organ/Tissue-level Category 2007.
22. Geran Kostecki, Summer Undergraduate Research Fellowship, 2007.
23. Vadim V. Fedorov, Ph.D, 1st Runner-up, American Association of Anatomists, Presley-Zeiss Postdoctoral Fellowship Award Presentation - "Functional and structural optical imagining of the rabbit sinoatrial node" 2006 Experimental Biology Conference, San Francisco, CA.
24. William Hucker, 1st runner-up, American Association of Anatomists Langman Award for Best Graduate Presentation – "A multi-imaging approach to study the structure and function of the atrioventricular junction". 2006 Experimental Biology Conference, San Francisco, CA.
25. William Hucker, Whitaker Graduate Fellowship from the Whitaker Foundation, 2004–2006.
26. Crystal Ripplinger, 2nd place – Gordon Research Conference on Cardiac Arrhythmia Mechanisms Poster Competition, Organ/Tissue-level Category, "Low-Voltage Termination of Ventricular Reentrant Arrhythmias" 2005.
27. Crystal Ripplinger, 1st place – Design of Medical Devices Conference Poster Competition, Cardiovascular Category (Midwest Biomedical Engineering Society Meeting): "Novel approach for low-voltage termination of anatomically defined reentry" 2005.
28. Crystal Ripplinger, 1st place – Washington University Graduate Research Symposium Post Competition: "Novel approach for low-voltage termination of anatomically defined reentry" 2005
29. Crystal Ripplinger, AHA Predoctoral Fellowship, "Unpinning and low-voltage termination of reentrant arrhythmias in the right ventricular endocardium", 07/01/2005-06/30/2007. 1% percentile.
30. Christina Ambrosi, Imaging Sciences Pathway Fellowship, NIH, 10/1/2006-7/31/2008.
31. Sangita Sudharshan, Hoopes Summer Research Fellowship, 2006.
32. Jennifer Hadley, Howard Hughes Medical Institute Summer Research Fellowship, 2006.
33. Kristy Ratkowski, Howard Hughes Medical Institute Summer Research Fellowship, 2005.

Ph.D. students (name degree start date, completion date)

1. Charles Stark, 2025-present.
2. Pavan Bhat, 2023-present
3. Katy Trampel, 2022-present.
4. Binjie Li, 2022-present.
5. Micah Madrid, 2019-2024.
6. Zexu Lin, 2018-2023.
7. Anna Gams, 2017-2022.
8. Alexander Timofeev, 2020-2021.
9. Rose Yin, 2017-2021. Current position: research scientist, Stryker Corp. Seattle WA.
10. Jaclyn Brennan, 2015-2020. Current position: postdoctoral fellow, the George Washington University, Washington DC.

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11. John Qiao, Ph.D. 2013-2018. Current position: senior scientist, St. Jude Medical/Abbot, Los Angeles CA.
12. Christopher Gloschat, Ph.D., 2012-2017. Current position: Senior scientist, St. Jude Medical/Abbot, Los Angeles, CA.
13. Chaoyi Kang, Ph.D. 2012-2016. Current position: senior scientist, St. Jude Medical/Abbot, Los Angeles CA.
14. Sarah Gutbrod, Ph.D., 2010-2015. Current position: Senior Scientist, Boston Scientific, Minneapolis, MN.
15. Matthew Sulkin, Ph.D., 2010-2015, Current position: Boston Scientific, Minneapolis, MN.
16. Katherine Holzem, M.D., Ph.D., 2009-2015. Current position: vascular surgery fellowship, Washington University School of Medicine, St. Louis, MO.
17. Di Lang, Ph.D., 2008-2013, Current position: postdoctoral research scientist, University of Wisconsin, Madison, WI.
18. Jacob Laughner, Ph.D., 2009-2013, Current position: Senior scientist, Boston Scientific, Minneapolis, MN.
19. Christina Ambrosi, Ph.D., 2006 – 2011, Current position: postdoctoral research associate, Stony Brook University, NY.
20. Wenwen Li, Ph.D., 2007 – 2011. Current position: Senior Scientist, Abbot/St. Jude Medical.
21. Qing Lou, Ph.D., 2007 – 2011. Current Position: postdoctoral research associate, Ohio State University, Columbus, OH.
22. William Hucker, M.D., Ph.D., 2004 - 2007. Current position: Assistant Professor of Medicine (Cardiology), Harvard Medical School.
23. Crystal M. Ripplinger, Ph.D., 2004 - 2008. Current position: Associate Professor of Pharmacology, University of California, Davis, CA.
24. Fujian Qu, D.Sc., 2001 - 2006. Current position: Principle Scientist, St. Jude Medical/Abbot, Sa Jose, CA.
25. Li Li, Ph.D., 2000 - 2005. Current position: Instructor, University of Utah, Salt Lake City, UT.
26. Alexandre T. Sambelashvili, Ph.D., 2000 – 2004. Current position: Director, Medtronic, Minneapolis, MN.

M.Sc students (name degree start date, completion date)

1. Lichao Tang, 2022-2023.
2. Erdit Gremi, 2016-2017.
3. Kelley Foyil, M.Sc. 2006-2008.

Graduate student rotations (name degree start date, completion date)

1. Wandi Zhu, Spring 2014.
2. Tedan Hu, Fall 2013.
3. Austin Cocciolone, Fall 2013.
4. Yun (John) Qiao, 2012.
5. Erina Ghosh, rotation, Fall 2008.
6. Casey Donahoe, rotation, Spring 2008.
7. Mohit Sharma, rotation, Spring 2008.

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8. Benjamin Filas, rotation, 2006-2007.
9. Metasebya Solomon, rotation, Fall 2006.
10. Cionne Wolfe, rotation, Fall 2006.
11. Brain White, MD/PhD, rotation, Summer 2005.

Undergraduate student research supervision

1. Grace Bakalag, 2016-2017.
2. Brianna Cathey, 2016-2019.
3. Devon Guerrelli, 2015-2018.
4. Sofian Obaid, 2016-2018.
5. Rayhaan Rasheed, 2015-2017.
6. Trisha Talaptra, 2016-2017.
7. Brittany Brumback, 2015-2016.
8. Christian Miccile, 2016.
9. Joseph Marmerstein, 2012-2015.
10. Eli Madden, 2011-2014.
11. Connie Shao, 2011-2013.
12. Birce Onal, 2011-2012.
13. Sophia Cui, 2010-2012.
14. Colleen Rhoades, 2010-2012.
15. Alice Ndikumana, 2010.
16. Paul Kalish, 2009-2010.
17. Vinod Ravikumar, 2009-2012.
18. Stefanie Tanenhaus, 2008-2009.
19. Gregory Holton, 2008.
20. Hyuliya Aferol, 2008-2009.
21. Anubodh (Sunny) Varshney, 2007-2008.
22. Geran Kostecki, 2007-2009.
23. Roger Chang, 2006-2009.
24. Sangita Sudharshan, 2005-2007.
25. Jacob Laughner, 2005-2007.
26. Matt Hemphill, 2005-2008.
27. Jennifer Hadley, 2005-2008.
28. Kateline Gruber, 2005.
29. Karl Zelik, 2005-2007.
30. Kristy Ratkowski, 2005.
31. Megan McCain, 2004-2006.
32. Andreas Fritz, 2002-2003.
33. Camellia Banerjee, 2003-2004.
34. Daniel Johnson, 2001-2002.
35. Douglas Goldstein, 2001-2002.

Postdoctoral trainees and advisees

1. Eric Rytkin, MD, PhD, 2021-present, Research Associate, Current.

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2. Sharon George, PhD, 2017-2024. Research Assistant Professor, Current position: Assistant Professor of Pharmacology, University of Pittsburgh, Pittsburgh, PA.
3. Jaclyn Brennan, PhD, 2020-2021, Postdoctoral Fellow, Current position: AAAS Science and Technology Policy Fellow, Washington, DC.
4. Kedar Aras PhD, 2016-2022. Research Associate, Current position: Assistant Professor of Physiology, University at Buffalo, Buffalo, NY.
5. Rokhaya Faye, PhD, 2017-2020, Research Scientist. Current Position: Senior Scientist, University of Bordeaux.
6. Timothy Holleran, 2020-2021. Surgery fellow.
7. Michael Napolitano, 2019-2021. Surgery fellow.
8. Ethan Rosenfeld, 2019-2020. Surgery fellow.
9. Sheena Chen, MD. 2018-2020. Surgery fellow.
10. Jeffrey Panting, MD. 2018-2019. Surgery fellow.
11. Alexandro Murillo, MD. 2017-2018. Surgery fellow.
12. Ben Lee, MD. 2017-2019. Surgery fellow.
13. Matt Skancke, MD. 2016-17. Surgery fellow.
14. Kendal Endicott, MD. 2015-16. Surgery fellow.
15. Bastian Boukens, Research Associate. Current Position: Assistant Professor, AMC, University of Amsterdam, the Netherlands.
16. Fu Siong NH, MD, Research Associate. Current position: Senior Lecturer in Cardiology (Associate Professor), Imperial College London, UK.
17. HeyJin Hwang, MD, Visiting Professor.
18. Deborah Janks, PhD, Research Associate. Current Position: Research Associate, Washington University in Saint Louis, MO.
19. Ajit Janadrhan, MD, PhD, Cardiology Fellow. Current: Clinical cardiac electrophysiologist, Fort Walton Beach Medical Center and Cape Canaveral Hospital, Fort Walton Beach FL
20. Alexey Glukhov, PhD., Research Associate. Current Position: Associate Professor, University of Wisconsin, Madison WI.
21. Vadim Fedorov, PhD, Research Assistant Professor. Current Position: Professor of Physiology, Ohio State University, Columbus, OH.
22. Vladimir Nikolski, Ph.D., Research Assistant Professor. Current Position: Principle Scientist, Medtronic.
23. Alena Nikolskaya, PhD, Research Associate. Current Position: Senior Scientist, Medtronic.
24. Noriko Niwa, MD, Research Associate. Current Position: Research Associate, Washington University School of Medicine.
25. Yuanna Cheng, M.D., Ph.D., Research Associate. Current Position: Scientific Review Administrator, NIH.
26. Gil Bub, Ph.D., Research Associate. Current Position: Assistant Professor, McGill University, Montreal Canada.
27. Florence Rothenberg, M.D., Research Associate. Current Position: Professor of Medicine (Cardiology), University of Cincinnati, OH.
28. Ayman S. Al-Khadra, M.D. Clinical Fellow. Current Position: President, Saudi Heart Rhythm Society. Staff Cardiologist, King Fahd Armed Forces Hospital, Jeddah, Kingdom of Saudi Arabia
29. Stephane Garrigue, MD, Clinical Fellow. Current Position, Clinical Cardiac Electrophysiologist, Associate Professor University of Bordeaux, France.

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Thesis committees:

1. Andrew Chen,
2. Kara Garrot,
3. Smiruthi Ramasubramanian,
4. Jiajing Xu,
5. Erik Zellmer,
6. Arie Krumholz
7. Amanda Smith,
8. Ya-Jian Cheng,
9. Piyush Karande,
10. Junjie Zhang,
11. Ramya Vijayakumar,
12. Li Li,
13. Junjie Zhang,
14. Urvi Lee,
15. Yang Li,
16. Yu Wang,
17. Christine Fleming,
18. Manojit Pramanik,
19. Kwang Hyun Song,
20. Chulhong Kim,
21. Song Hu,
22. Neelesh Soman,
23. Hua Pan,
24. Thomas O'Hara,
25. Namit Gaur,
26. Ben Filas,
27. Lina El-Esber,
28. Keith Decker,
29. Raj Kothapalli.

Books:

1. **Efimov I.R.**, Ng F.S., Laughner J.I., Eds., Cardiac Bioelectric Therapy: Mechanisms and Practical Implications, Springer, 2nd Edition. 2021. ISBN 978-3-030-63354-7.
2. The Health Effects of Conducted Energy Weapons. The Expert Panel of the Medical and Physiological Impacts of Conducted Energy Weapons. Council of Canadian Academies, 2013. ISBN 978-1-926558-63-9.
3. **Efimov I.R.**, Kroll, M.W., Tchou, P.J., Eds., Cardiac Bioelectric Therapy: Mechanisms and Practical Implications, Springer, 2008. ISBN 978-0-387-79402-0.

List of peer-reviewed research publications (Web of Science h-index: 59; Google Scholar h-index 80):

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1. Fast, V.G., **Efimov, I.R.** & Krinsky, V.I., "Transition from circular to linear rotation of a vortex in an excitable cellular medium", *Phys. Let.* **151A** (3-4), 1990, 157-161.
2. Fast, V.G. & **Efimov, I.R.** "Stability of vortex rotation in an excitable cellular medium", *Physica* **49D**, 1991, 75-81.
3. Krinsky, V.I., Biktashev, V.N. & **Efimov, I.R.**, "Autowave principles for parallel image processing", *Physica* **49D**, 1991, 247-253.
4. Burashnikov, A.Y., **Efimov, I.R.**, Fast, V.G., Karasaeva, A.H. & Pertsov, A.M, "Isolated coronary perfused right rat ventricle as a model of ischemic and reperfusion arrhythmias", *Kardiologiia* **31**(7), 1991, 58-61 (in Russian).
5. Krinsky, V.I., **Efimov, I.R.** & Jalife, J. "Vortices with linear cores in excitable media", *Proc. R. Soc. Lond.*, **438A**, 1992, 645-655.
6. Krinsky, V.I. & **Efimov, I.R.**, "Vortices with linear cores in mathematical models of excitable media", *Physica* **188A**, 1992, 55-60.
7. Salama, G, Kanai, A. & **Efimov I.R.**, "Subthreshold stimulation of Purkinje fibers interrupts ventricular tachycardia in intact hearts. Experimental study with voltage-sensitive dyes and imaging techniques," *Circ. Res.*, 1994, **74**: 604-619.
8. **Efimov I.R.**, Huang D.T., Rendt J.M. & Salama G., "Optical mapping of repolarization and refractoriness from intact heart", *Circulation*, 1994, **90**: 1469-1480.
9. **Efimov, I.R.**, Krinsky, V.I. & Jalife, J., "Dynamics of Rotating vortices in the Beeler-Reuter model of cardiac tissue", *Chaos, Solitons and Fractals*, 1995, **5**: 513-526.
10. **Efimov, I.R.,** Ermentraut, B., Rendt, G.M., Salama, G., "Activation and Repolarization are Governed by Different Structural Characteristics of Ventricular Myocardium: experimental study with Voltage-Sensitive Dyes and Numerical Simulations". 1995, *J. Cardiovasc. Electrophysiol, 1996,* **7**:512-530.
11. **Efimov, I.R.,** Fahy, G.J., Cheng, Y., Van Wagoner, D.R., Tchou, P.J., Mazgalev, T.N., "High Resolution Fluorescent Imaging of Rabbit Heart Does Not Reveal a Distinct Atrioventricular Nodal Anterior Input Channel (Fast Pathway) During Sinus Rhythm", *J. Cardiovasc. Electrophysiol., 1997*, **8**: 295-306.
12. Fahy, G., **Efimov, I.**, Cheng, Y.N., Kidwell, G.A., Tchou, P., Mazgalev, T., "Mechanism of atrioventricular nodal facilitation in the rabbit heart: Role of the distal AV node", *Am J Phisiol*, 1997, **272**: H2815-H2825.
13. Cheng, Y., Mowrey, K., **Efimov, I.R.**, Van Wagoner, D.R., Tchou, P.J., Mazgalev, T., "Effects of 2,3-Butanedione Monoxime on the Atrial-Atrioventricular Nodal Conduction in Isolated Rabbit Heart", *J. Cardiovasc. Electrophysiol.*, 1997, **8**:790-802.
14. Tchou, P.J., Cheng, Y.N., Mowrey, K., **Efimov, I.**, Van Wagoner, D.R., Mazgalev, T.N., "Relation of the Atrial Input Sites to the Dual Atrioventricular Nodal Pathways: Crossing of Conduction Curves Generated with Posterior and Anterior Pacing", *J Cardiovasc. Electrophysiol.* 1997, **8**:1133-1144.
15. **Efimov, I.R.**, Cheng, Y., Van Wagoner, D.R., , Mazgalev, T., Tchou, P.J., "Transmembrane Voltage Change Produced by Real and Virtual Electrodes During Monophasic Defibrillation Shock Delivered by an Implantable Electrode", *J. Cardiovasc. Electrophysiol.*, 1997, **8**:1031-1045.
16. Mazgalev, T., Mowrey, K., **Efimov, I.**, Fahy, G., Van Wagoner, D.R., Cheng, Y.N., Tchou, P., "Mechanism of atrioventricular nodal facilitation in the rabbit heart: Role of the proximal AV node", *Am. J. Physiol.* 1997, **273**:H1658-H1668.

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17. Salama, G., Kanai, A.J., Huang, D., **Efimov, I.R.,** Girouard, S.D., Rosenbaum, D.S., "Hypoxia and Hypothermia Enhance Spatial Heterogeneities of Repolarization in Guinea Pig Hearts: Analysis of Spatial Correlation of Optically recorded Action Potential Durations", *J. Cardiovasc. Electrophysiol.* 1998, **9**:164-183.
18. **Efimov, I.R.**, Cheng, Y., Van Wagoner, D.R., Mazgalev, T.N., Tchou, P.J., Virtual electrode-induced phase singularity: a basic mechanism of defibrillation failure. *Circulation Research*, 1998, **82**: 918-925.
19. **Efimov,I.R.,** Mazgalev, T.N., "High-resolution three-dimensional fluorescent imaging reveals multilayer conduction pattern in the atrioventricular node". *Circulation*, 1998, **98**: 54-57.
20. **Efimov IR**, What is the role of the atrio-ventricular node if the AV delay occurs before it? *Am. J. Physiol.* 1998, **44**(5): H1905-H1906. Letter to editor.
21. Entcheva, E., Eason, J., **Efimov, I.R.,** Cheng, Y., Malkin, R., Claydon, F., "Virtual electrode effects in transvenous defibrillation - modulation by structure and interface: Evidence from bidomain simulations and optical mapping", 1998, *J. Cardiovasc. Electrophysiol.*, 1998, **9**: 949-961.
22. Cheng, Y., Van Wagoner, D.R., Mazgalev, T.N., Tchou, P.J., **Efimov, I.R.**, "Voltage-Sensitive Dye RH421 Increases Contractility of Cardiac Muscle", *Can. J. Physiol. Pharmacol.*, 1998 **76**(12): 1146-50.
23. Yamanouchi, Y., **Efimov, I.R.,** Mowrey, K.A., Mazgalev, T.N., Wilkoff, B.L., Tchou, P.J., "Biventricular shocking leads improves defibrillation efficacy", 1999, *J. Cardiovasc. Electrophysiol.*, **10**: 561-565.
24. **Efimov, I.R.,** Sidorov, V.Y., Cheng, Y., Wollenzier, B., Evidence of 3D Scroll Waves with Ribbon-Shaped Filament as a Mechanism of Ventricular Tachycardia in the Isolated Rabbit Heart, *J. Cardiovasc. Electrophysiol.*, 1999, **10**: 1052-1062.
25. Anderson RH, Mazgalev TN, **Efimov IR**, Three-dimensional imaging of atrioventricular node. *Circulation*, 1999 **99**: 2219-22. Letter to editor.
26. Cheng, Y., Mowrey, K.A., Van Wagoner, D.R., Tchou, P.J., **Efimov, I.R.**, Virtual Electrode Induced Re-excitation: a Mechanism of Defibrillation, *Circ. Res.*, 1999, **85**: 1056-1066
27. Nikolski, V. **Efimov, I.R.**, Virtual Electrode Polarization of Ventricular Epicardium During Bipolar Stimulation, J. Cardiovasc. Electrophysiol., 2000, **11**(5): 605
28. **Efimov, I.R.,** Cheng, Y., Yamanouchi, Y., Tchou, P.J., Direct Evidence of the Role of Virtual Electrode Induced Phase Singularity in Success and Failure of Defibrillation, 2000, *J. Cardiovasc. Electrophysiol.*, **11**: 861-868.
29. **Efimov, I.R.**, Aguel, F., Cheng, Y., Wollenzier, B., Trayanova, N., Virtual Electrode Polarization in the Far Field: Implications for External Defibrillation, *Am. J. Physiol.*, 2000, **279**: H1055-H1070.
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