PATRICK M BOYLE, PHD, PENG, FHRS

Curriculum Vitae

Department of Bioengineering
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EDUCATIONAL HISTORY

University of Calgary, Calgary, Alberta, Canada
PhD, Biomedical Engineering
Conferred November 10, 2011
Roles of the Purkinje System During Electric Shocks and Arrhythmia

University of Calgary, Calgary, Alberta
BSc with Distinction in Computer Engineering, Internship Program
Conferred June 10, 2005

EMPLOYMENT HISTORY

University of Washington
Seattle, WA, USA
- Assistant Professor, Department of Bioengineering — 2018 – present

Johns Hopkins University
Baltimore, MD, USA
- Assistant Research Professor, Department of Biomedical Engineering — 2015 – 2018
- Assistant Research Professor, Institute for Computational Medicine — 2015 – 2018
- Assistant Research Scientist, Institute for Computational Medicine — 2014 – 2015
- NSERC Postdoctoral Fellow, Institute for Computational Medicine — 2011 – 2014

Sanyo Electric Company
Osaka, Japan
- Intern, Broadcast Multimedia Department — 2003 – 2004

Westhoff Engineering Resources
Calgary, AB, Canada
- Part-time research, special projects, and software development intern — 2002 – 2005

AWARDS AND HONORS

- Johns Hopkins Department of Medicine Research Retreat Basic Research Faculty Award (Finalist), 2018, Johns Hopkins University Whiting School of Engineering

- Official Selection for "EP Concepts Ignited: Innovative Techniques and Technologies," 2017, Heart Rhythm Society Annual Scientific Sessions
- Outstanding Scientific Poster Presentation, 2012, Cardiac Physiome Workshop
- Rosanna Degani Young Investigator Award (Finalist), 2012 Computing in Cardiology Conf.
- Lifetime Achievement Award, 2011, University of Calgary Graduate Students' Association
- Leaders of Tomorrow Honouree, 2011, AStech Foundation
- APEGA Education Foundation Graduate Scholarship, 2010 (Alberta)
- Queen Elizabeth II Scholarship, Government of Alberta
- Graduate Citizenship Award, 2010, Government of Alberta
- Best Overall Poster, 2009, Alberta Biomedical Engineering Conference
- Best Oral Presentation, 2009, Alberta ECE Graduate Research Symposium
- Alberta Ingenuity Student Scholarship, 2008-10, Government of Alberta
- NSERC Post-Graduate Scholarship D, 2008-10 (Canada)
- Teaching Assistant Excellence Award, 2007-08, University of Calgary
- Best Oral Presentation, 2007, Alberta Biomedical Engineering Conference
- Teaching Excellence Award (Shortlist), 2007, University of Calgary
- Engineering Internship Merit Award (nominee), 2004, University of Calgary
- iCORE Graduate Scholarship, 2005-07, Government of Alberta
- NSERC Post-Graduate Scholarship M, 2005-07 (Canada)
- Louise McKinney Scholarship, 2001, Government of Alberta
- Alexander Rutherford Scholarship, 2000, Government of Alberta
- Canadian National Advanced Placement Scholar Award, 2000, College Board

AFFILIATIONS AND OTHER APPOINTMENTS

Member, Center for Cardiovascular Biology (University of Washington)
Member, Institute for Stem Cell & Regenerative Medicine (University of Washington)

PUBLICATIONS

Total Scholarly Metrics (via Google Scholar): 2030 citations • h-index: 28 • i10-index: 48

Refereed archival journal publications

*equal first author contributions; †equal last author contributions
Supervision: [1]undergraduate students; [2]graduate students; [3]postdoctoral fellows and/or clinical fellows

Papers accepted or in press

1. Yu JK, Liang JA, Franceschi WH[1], Huang Q, Pashakhanloo F, Sung E, **Boyle PM**, Trayanova NA. Assessment of arrhythmia mechanism and burden of the infarcted ventricles following remuscularization with pluripotent stem cell-derived cardiomyocyte patches using patient-derived models. Cardivasc Res. Available online Apr 21, 2021. doi: 10.1093/cvr/cvab140.

Papers published in peer-reviewed journals

2. Bifulco SF[2], Scott GD[1], Sarairah S, Birjandian Z, Roney CH, Niederer SA, Mahnkopf C, Kuhnlein P, Mitlacher M, Tirschwell D, Longstreth Jr. WT, Akoum N, **Boyle PM**. Computational Modeling Identifies Embolic Stroke of Undetermined Source Patients with Potential Arrhythmic Substrate. eLife. 2021; 10:e64213.

3. **Boyle PM**[*], Yu J[*], Klimas A, Williams JC, Trayanova NA, Entcheva E. OptoGap is an optogenetics-enabled assay for quantification of cell-cell coupling in multicellular cardiac tissue. Nat Sci Rep. 2021; 11:9310.

4. **Boyle PM**, Ochs AR[2], Ali RL[3], Paliwal N, Trayanova NA. Characterizing the arrhythmogenic substrate in personalized models of atrial fibrillation: sensitivity to mesh resolution and pacing protocol. Europace. 2021; 23 Suppl 1:i3-i11.

5. **Boyle PM**, del Álamo JC, Akoum N. Fibrosis, Atrial Fibrillation, and Stroke: Clinical Updates and Emerging Mechanistic Models. Heart. 2021; 107:99-105.

6. Bifulco SF[2], Akoum N, **Boyle PM**. Translational Applications of Computational Modelling for Patients with Cardiac Arrhythmias. Heart. 2021; 107:456-461.

7. Methachittiphan N, Akoum N, Ngo C, Gopinathnnair R, **Boyle PM**, Sridhar A. Dynamic voltage threshold adjusted substrate modification technique for complex atypical atrial flutters with varying circuits. Pacing Clin Electrophysiol. 2020; 43:1273-80.

8. **Boyle PM**, Trayanova NA. Leave the light on: chronic optogenetic tachypacing of human engineered cardiac tissue constructs. Cardiovasc Res. 2020; 116(8):1405-06. *(Invited editorial)*

9. Shade JK, Cartoski MJ, Nikolov PP, Prakosa A, Doshi A, Binka A, Olivieri L, **Boyle PM**, Spevak PJ, Trayanova NA. Ventricular Arrhythmia Risk Prediction in Repaired Tetralogy of Fallot using Personalized Computational Cardiac Models. Heart Rhythm. 2020;17(3):408-414.

10. **Boyle PM**[*], Zghaib T[*], Zahid S, Ali RL[3], Deng D[3], Franceschi WH[1], Hakim JB[1], Murphy MJ[1], Prakosa A, Zimmerman SL, Ashikaga H, Marine JE, Kolandaivelu A, Nazarian S, Spragg DD, Calkins H, Trayanova NA. Targeted Ablation of Persistent Atrial Fibrillation Using Personalized Computational Modeling. Nat Biomed Eng. 2019;3:870-879. *With editorial.*

    ★ High-impact paper: 54 citations since 2019 (36.0 per year; journal impact factor = 18.95) ★

11. Ali RL[*3], Hakim JB[*1], **Boyle PM**, Zahid S, Sivasambu B, Marine JE, Calkins H, Trayanova NA, Spragg DD. Longitudinal Study Using MRI-Derived Atrial Models Reveals Changes in Arrhythmogenic Propensity of the Fibrotic Substrate after Atrial Fibrillation Ablation. Cardiovasc Res. 2019;115(12):1757-1765.

12. Roney CH, Pashaei A, Meo M, Dubois R, **Boyle PM**, Trayanova NA, Cochet H, Niederer SA, Vigmond EJ. Universal atrial coordinates applied to visualisation, registration and construction of patient specific meshes. Med Imag Anal. 2019;55:65-75.

13. Yu JK, Franceschi WH[1], Huang Q[1], Pashakhanloo F, **Boyle PM**, NA Trayanova. Comprehensive, Multiscale Framework for Simulating Cell Therapy in the Whole Heart. Nat Sci Rep. 2019; 9:9238.

14. Cartoski MJ, Nikolov PP, Prakosa A, **Boyle PM**, Spevak PJ, Trayanova NA. Computational Identification of Ventricular Arrhythmia Risk in Pediatric Myocarditis. Pediatr Cardiol. 2019;40(4):857-864.

15. **Boyle PM**[*], Franceschi WH[*1], Constantin M, Hawks C, Desplantez T, Trayanova NA, Vigmond EJ. New insights on the cardiac safety factor: Unraveling the relationship between conduction velocity and robustness of propagation. J Mol Cell Cardiol. 2019;128:117-128.

16. Prakosa A, Arevalo HJ, Deng D, **Boyle PM**, Nikolov PP, Ashikaga H, Blauer JJ, Ghafoori E, Park CJ, Blake RC, 3rd, Han FT, MacLeod RS, Halperin HR, Callans DJ, Ranjan R, Chrispin J, Nazarian S, Trayanova NA. Personalized virtual-heart technology for guiding the ablation of infarct-related ventricular tachycardia. Nat Biomed Eng. 2018;2:732-740. *With editorial.*

★ High-impact paper: 82 citations since 2018 (31.7 per year; journal impact factor = 18.95) ★

17. Trayanova NA, **Boyle PM**, Nikolov PP. Personalized Imaging and Modeling Strategies for Arrhythmia Prevention and Therapy. Curr Opin Biomed Eng. 2018;5:21-28.

18. Hakim JB*[1], Murphy MJ*[1], Trayanova NA, **Boyle PM**. Arrhythmia dynamics in computational models of the atria following virtual ablation of re-entrant drivers. Europace. 2018;20:iii45-iii54.

19. Cochet H, Dubois R, Yamashita S, Al Jefairi N, Berte B, Sellal JM, Hooks D, Frontera A, Amraoui S, Zemoura A, Denis A, Derval N, Sacher F, Corneloup O, Latrabe V, Clement-Guinaudeau S, Relan J, Zahid S, **Boyle PM**, Trayanova NA, Bernus O, Montaudon M, Laurent F, Hocini M, Haissaguerre M, Jais P. Relationship Between Fibrosis Detected on Late Gadolinium-Enhanced Cardiac Magnetic Resonance and Re-Entrant Activity Assessed With Electrocardiographic Imaging in Human Persistent Atrial Fibrillation. JACC Clin Electrophysiol. 2018;4:17-29. *With editorial.*

★ High-impact paper: 71 citations since 2018 (21.3 per year; journal impact factor = 1.96) ★

20. **Boyle PM***, Murphy MJ*[1], Karathanos TV, Zahid S, Blake RC, 3rd, Trayanova NA. Termination of re-entrant atrial tachycardia via optogenetic stimulation with optimized spatial targeting: insights from computational models. J Physiol. 2018;596:181-196.

21. **Boyle PM**, Karathanos TV, Trayanova NA. Cardiac Optogenetics: 2018. JACC Clin Electrophysiol. 2018;4:155-167.

22. **Boyle PM**, Hakim JB[1], Zahid S, Franceschi WH[1], Murphy MJ[1], Vigmond EJ, Dubois R, Haissaguerre M, Hocini M, Jais P, Trayanova NA, Cochet H. Comparing Reentrant Drivers Predicted by Image-Based Computational Modeling and Mapped by Electrocardiographic Imaging in Persistent Atrial Fibrillation. Front Physiol. 2018;9:414.

23. **Boyle PM**, Hakim JB[1], Zahid S, Franceschi WH[1], Murphy MJ[1], Prakosa A, Aronis KN, Zghaib T, Balouch M, Ipek EG, Chrispin J, Berger RD, Ashikaga H, Marine JE, Calkins H, Nazarian S, Spragg DD, Trayanova NA. The Fibrotic Substrate in Persistent Atrial Fibrillation Patients: Comparison Between Predictions From Computational Modeling and Measurements From Focal Impulse and Rotor Mapping. Front Physiol. 2018;9:1151.

24. Deng D*[3], Murphy MJ*[1], Hakim JB, Franceschi WH, Zahid S, Pashakhanloo F, Trayanova NA, **Boyle PM**. Sensitivity of reentrant driver localization to electrophysiological parameter variability in image-based computational models of persistent AF sustained by a fibrotic substrate. Chaos. 2017;27:093932.

★ High-impact paper: 39 citations since 2017 (10.6 per year; journal impact factor = 2.64) ★

25. Deo M, Weinberg SH, **Boyle PM**. Calcium Dynamics and Cardiac Arrhythmia. Clin Med Insights Cardiol. 2017;11:1179546817739523.

26. **Boyle PM**, Zahid S, Trayanova NA. Using personalized computer models to custom-tailor ablation procedures for AF patients: are we there yet? Expert Rev Cardiovasc Ther. 2017;15:339-341.

27. Zahid S*, Cochet H*, **Boyle PM***, Schwarz EL[1], Whyte KN[1], Vigmond EJ, Dubois R, Hocini M, Haissaguerre M, Jais P, Trayanova NA. Patient-derived models link re-entrant driver localization in atrial fibrillation to fibrosis spatial pattern. Cardiovasc Res. 2016;110:443-54. *With editorial.*

★ High-impact paper: 168 citations since 2016 (34.2 per year; journal impact factor = 8.17) ★

28. Bruegmann T*, **Boyle PM***, Vogt CC, Karathanos TV, Arevalo HJ, Fleischmann BK, Trayanova NA, Sasse P. Optogenetic defibrillation terminates ventricular arrhythmia in mouse hearts and human simulations. J Clin Invest. 2016;126:3894-3904.

★ High-impact paper: 95 citations since 2016 (20.8 per year; journal impact factor = 11.86) ★

29. Zahid S, Whyte KN[1], Schwarz EL[1], Blake RC, 3rd, **Boyle PM**, Chrispin J, Prakosa A, Ipek EG, Pashakhanloo F, Halperin HR, Calkins H, Berger RD, Nazarian S, Trayanova NA. Feasibility of using patient-specific models and the "minimum cut" algorithm to predict optimal ablation targets for left atrial flutter. Heart Rhythm. 2016;13:1687-98.

★ High-impact paper: 62 citations since 2016 (13.3 per year; journal impact factor = 5.73) ★

30. Roney CH, Bayer JD, Zahid S, Meo M, **Boyle PM**, Trayanova NA, Haissaguerre M, Dubois R, Cochet H, Vigmond EJ. Modelling methodology of atrial fibrosis affects rotor dynamics and electrograms. Europace. 2016;18:iv146-iv155.

★ High-impact paper: 73 citations since 2016 (16.5 per year; journal impact factor = 4.05) ★

31. Priest JR, Gawad C, Kahlig KM, Yu JK, O'Hara T, **Boyle PM**, Rajamani S, Clark MJ, Garcia ST, Ceresnak S, Harris J, Boyle S, Dewey FE, Malloy-Walton L, Dunn K, Grove M, Perez MV, Neff NF, Chen R, Maeda K, Dubin A, Belardinelli L, West J, Antolik C, Macaya D, Quertermous T, Trayanova NA, Quake SR, Ashley EA. Early somatic mosaicism is a rare cause of long-QT syndrome. Proc Natl Acad Sci U S A. 2016;113:11555-11560.

32. Karathanos TV, **Boyle PM**[†], Trayanova NA[†]. Light-based Approaches to Cardiac Arrhythmia Research: From Basic Science to Translational Applications. Clin Med Insights Cardiol. 2016;10:47-60.

33. Karathanos TV, Bayer JD, Wang D, **Boyle PM**[†], Trayanova NA[†]. Opsin spectral sensitivity determines the effectiveness of optogenetic termination of ventricular fibrillation in the human heart: a simulation study. J Physiol. 2016;594:6879-6891.

34. **Boyle PM**, Zahid S, Trayanova NA. Towards personalized computational modelling of the fibrotic substrate for atrial arrhythmia. Europace. 2016;18:iv136-iv145.

35. Arevalo HJ, **Boyle PM**, Trayanova NA. Computational rabbit models to investigate the initiation, perpetuation, and termination of ventricular arrhythmia. Prog Biophys Mol Biol. 2016;121:185-94.

36. Campos FO, Shiferaw Y, Prassl AJ, **Boyle PM**, Vigmond EJ and Plank G. Stochastic spontaneous calcium release events trigger premature ventricular complexes by overcoming electrotonic load. Cardiovasc Res. 2015;107:175-83.

37. **Boyle PM**, Karathanos TV, Trayanova NA. "Beauty is a light in the heart": the transformative potential of optogenetics for clinical applications in cardiovascular medicine. Trends Cardiovasc Med. 2015;25:73-81.

38. **Boyle PM**, Karathanos TV, Entcheva E, Trayanova NA. Computational modeling of cardiac optogenetics: Methodology overview & review of findings from simulations. Comput Biol Med. 2015;65:200-8.

39. Ambrosi CM[*], **Boyle PM**[*], Chen K, Trayanova NA, Entcheva E. Optogenetics-enabled assessment of viral gene and cell therapy for restoration of cardiac excitability. Nat Sci Rep. 2015;5:17350.

40. Zamiri N, Masse S, Ramadeen A, Kusha M, Hu X, Azam MA, Liu J, Lai PF, Vigmond EJ, **Boyle PM**, Behradfar E, Al-Hesayen A, Waxman MB, Backx P, Dorian P, Nanthakumar K. Dantrolene improves survival after ventricular fibrillation by mitigating impaired calcium handling in animal models. Circulation. 2014;129:875-85.

41. Trayanova NA, **Boyle PM**, Arevalo HJ, Zahid S. Exploring susceptibility to atrial and ventricular arrhythmias resulting from remodeling of the passive electrical properties in the heart: a simulation approach. Front Physiol. 2014;5:435.

42. Trayanova NA, **Boyle PM**. Advances in modeling ventricular arrhythmias: from mechanisms to the clinic. Wiley Interdiscip Rev Syst Biol Med. 2014;6:209-24.

43. Karathanos TV[*], **Boyle PM[*]**, Trayanova NA. Optogenetics-enabled dynamic modulation of action potential duration in atrial tissue: feasibility of a novel therapeutic approach. Europace. 2014;16 Suppl 4:iv69-iv76.

44. **Boyle PM[*]**, Park CJ[*], Arevalo HJ, Vigmond EJ, Trayanova NA. Na^+ current reduction unmasks a structure-dependent substrate for arrhythmogenesis in the normal ventricles. PLoS One. 2014;9:e86947.

45. **Boyle PM**, Entcheva E, Trayanova NA. See the light: can optogenetics restore healthy heartbeats? And, if it can, is it really worth the effort? Expert Rev Cardiovasc Ther. 2014;12:17-20.

46. **Boyle PM**, Williams JC, Ambrosi CM, Entcheva E, Trayanova NA. A comprehensive multiscale framework for simulating optogenetics in the heart. Nat Commun. 2013;4:2370.

★ High-impact paper: 97 citations since 2013 (12.6 per year; journal impact factor = 12.12) ★

47. **Boyle PM**, Veenhuyzen GD, Vigmond EJ. Fusion during entrainment of orthodromic reciprocating tachycardia is enhanced for basal pacing sites but diminished when pacing near Purkinje system end points. Heart Rhythm. 2013;10:444-51. *With editorial.*

48. **Boyle PM**, Masse S, Nanthakumar K, Vigmond EJ. Transmural IK(ATP) heterogeneity as a determinant of activation rate gradient during early ventricular fibrillation: mechanistic insights from rabbit ventricular models. Heart Rhythm. 2013;10:1710-7. *With editorial.*

49. Trayanova NA, O'Hara T, Bayer JD, **Boyle PM**, McDowell KS, Constantino J, Arevalo HJ, Hu Y, Vadakkumpadan F. Computational cardiology: how computer simulations could be used to develop new therapies and advance existing ones. Europace. 2012;14 S5:v82-v89.

50. **Boyle PM**, Madhavan A[1], Reid MP[1], Vigmond EJ. Propagating unstable wavelets in cardiac tissue. Phys Rev E Stat Nonlin Soft Matter Phys. 2012;85:011909.

51. Romero D, Sebastian R, Bijnens BH, Zimmerman V, **Boyle PM**, Vigmond EJ, Frangi AF. Effects of the purkinje system and cardiac geometry on biventricular pacing: a model study. Ann Biomed Eng. 2010;38:1388-98.

52. Ghaly HA, **Boyle PM**, Vigmond EJ, Shimoni Y, Nygren A. Simulations of reduced conduction reserve in the diabetic rat heart: response to uncoupling and reduced excitability. Ann Biomed Eng. 2010;38:1415-25.

53. Deo M, **Boyle PM**, Kim AM, Vigmond EJ. Arrhythmogenesis by single ectopic beats originating in the Purkinje system. Am J Physiol Heart Circ Physiol. 2010;299:H1002-11.

54. **Boyle PM**, Vigmond EJ. An intuitive safety factor for cardiac propagation. Biophys J. 2010;98:L57-9.

55. **Boyle PM**, Deo M, Plank G, Vigmond EJ. Purkinje-mediated effects in the response of quiescent ventricles to defibrillation shocks. Ann Biomed Eng. 2010;38:456-68.

56. Bishop MJ, **Boyle PM**, Plank G, Welsh DG, Vigmond EJ. Modeling the role of the coronary vasculature during external field stimulation. IEEE Trans Biomed Eng. 2010;57:2335-45.

57. Vadakkumpadan F, Rantner LJ, Tice B, **Boyle PM**, Prassl AJ, Vigmond E, Plank G, Trayanova N. Image-based models of cardiac structure with applications in arrhythmia and defibrillation studies. J Electrocardiol. 2009;42:157 e1-10.

★ High-impact paper: 104 citations since 2009 (8.5 per year; journal impact factor = 1.36) ★

58. Deo M, **Boyle PM**, Plank G, Vigmond E. Arrhythmogenic mechanisms of the Purkinje system during electric shocks. Heart Rhythm. 2009;6:1782-9.

Conference proceedings and other non-journal articles *(Fully refereed publications)*

1. Vigmond EJ, **Boyle PM**, Leon L, Plank G. Near-real-time simulations of biolelectric activity in small mammalian hearts using graphical processing units. Conf Proc IEEE Eng Med Biol Soc. 2009;2009:3290-3.
2. Ghaly H, **Boyle PM**, Vigmond E, Nygren A. Reduced conduction reserve of the propagating cardiac impulse in the diabetic rat heart: a model study. Conf Proc IEEE Eng Med Biol Soc. 2008;2008:5926-9.
3. Deo M, **Boyle PM**, Plank G, Vigmond E. Role of Purkinje system in cardiac arrhythmias. Conf Proc IEEE Eng Med Biol Soc. 2008;2008:149-52.
4. **Boyle PM**, Deo M, Vigmond EJ. Behavior of the Purkinje system during defibrillation- shocks. Conf Proc IEEE Eng Med Biol Soc. 2007;2007:419-22.

Conference proceedings and other non-journal articles *(Refereed by abstract only)*

1. **Boyle PM**, Chen ZH, Falasca Zamponi A, Lassen MCH, Mayfield JJ, Rumer C, Skaarup KG, Arvanitis P, Braunschweig F, Chatterjee NA, Fohner A, Johnson GR, Poole JE, Biering-Sørensen T, Linde CM, Blomstrom-Lundqvist CM, Maleckar MM, Sridhar AM. Artificial Intelligence Can Identify Risk of Death in COVID-19 Patients Using 12-lead Intake ECG Alone. *Accepted for feature poster presentation at the 2021 Scientific Sessions of the Heart Rhythm Society (July).*
2. Gonzalo A, Augustin CM, García-Villalba M, Martínez-Legazpi P, Flores O, Bermejo J, McVeigh E, Kahn AM, Plank G, Akoum N, del Álamo JC, **Boyle PM**. Multi-Physics, Patient-Specific Computational Modeling of Left Atrial Electrophysiology Biomechanics and Hemodynamics Reveals Mechanistic Connections Between Fibrotic Remodeling and Thrombosis Risk. *Accepted for poster presentation at the 2021 Scientific Sessions of the Heart Rhythm Society (July).*
3. Ali SY, Millare B, Bradley R, Ali RL, **Boyle PM**, Salvador M, Fedele M, Aronis K, Paliwal N, Prakosa A, Roney CH, Vigmond EJ, Niederer SA, Trayanova NA. Rapid and Robust Mapping of Clinical Data on Personalized Volumetric Atrial Morphologies. *Accepted for poster presentation at the 2021 Scientific Sessions of the Heart Rhythm Society (July).*
4. Bifulco SF, Scott, GD, Sarairah S, Birjandian Z, Roney CH, Niederer SA, Mahnkopf C, Kühnlein P, Mitlacher M, Tirschwell D, Akoum N, **Boyle PM**. Personalized Computational Modeling Identifies Embolic Stroke of Undetermined Source Patients with Potential Arrhythmic Substrate. Circulation, 2020;142(3S), A14899.
5. Bifulco SF, Sarairah S, Birjandian Z, Roney CH, Niederer SA, Mahnkopf C, Kühnlein P, Mitlacher M, Tirschwell D, Akoum N, **Boyle PM**. Patient-Specific Computational Modeling Reveals Pre-Clinical Arrhythmic Substrate for Atrial Fibrillation in Cryptogenic Stroke Patients. Heart Rhythm, 2020;17(5):S206-7. [e-Poster link]
6. Ochs A, Karathanos TV, Trayanova NA, **Boyle PM**. Optogenetic Stimulation Using GtACR1 Facilitates Termination of Reentrant Atrial Arrhythmia with Very Low Light Energy Requirements: A Computational Study. Heart Rhythm, 2020;17(5):S641. [e-Poster link]
7. **Boyle PM**, Kwan KT, Scott GD, Sarairah S, Birjandian Z, Akoum N. Side-by-side Comparison of Two Methods for Characterizing Atrial Fibrosis Assessed by Late Gadolinium Enhancement MRI: What is the Optimal IIR Threshold? Heart Rhythm, 2020;17(5):S150. [e-Poster link]
8. Bifulco SF, Sarairah S, Birjandian Z, Roney CH, Niederer SA, Mahnkopf C, Kühnlein P, Mitlacher M, Tirschwell D, Akoum NW, **Boyle PM**. Patient-Specific Computational Modeling

Identifies Cryptogenic Stroke Patients with the Fibrotic Substrate for Atrial Fibrillation Perpetuation. Circulation, 2019;140:(1S), A16280.

9. Ali RL, Shade J, Hakim JB, Basile D, Sivasambu B, Marine JE, Spragg DD, **Boyle PM**, Calkins H, Trayanova NA. Computational Atrial Models Derived From Late Gadolinium Enhanced MRI Predict Recurrence Of Atrial Fibrillation After Pulmonary Vein Isolation. Heart Rhythm, 2019;16(5):S373.
10. Aronis KA, Prakosa A, Berger RD, **Boyle PM**, Chrispin J, Ju S, Marine JE, Sinha SK, Tandri H, Ashikaga H, Trayanova NA. Clinical And In Silico Assessment Of Pro-arrhythmic Potential Of The Noninfarcted Left Ventricular Myocardium In Patients With Ischemic Cardiomyopathy. Heart Rhythm, 2019;16(5):S149.
11. O'Hara RP, Prakosa A, Binka E, Cartoski MJ, **Boyle PM**, Trayanova NA. Personalized Virtual Hearts Improve Sudden Cardiac Death Risk Stratification in Hypertrophic Cardiomyopathy. Heart Rhythm, 2019;16(5):S59.
12. Shade JK, Cartoski MJ, Nikolov P, Prakosa A, Doshi AN, Olivieri L, **Boyle PM**, Trayanova NA. Ventricular Tachycardia (VT) Risk Assessment In Adults With Repaired Tetralogy Of Fallot (rTOF) Using Personalized Virtual Heart Models. Heart Rhythm, 2019;16(5):S223.
13. Ali RL, **Boyle PM**, Hakim JB, Zahid S, Sivasambu B, Marine JE, Calkins H, Spragg DD, Trayanova NA. Computational Atrial Models Derived from Late Gadolinium Enhanced MRI Predict Which Atrial Fibrillation Patients Are More Likely to Benefit from Substrate Modification In Addition to Pulmonary Vein Isolation. Circulation, 2018;138:(1S), A16015.
14. Cartoski MJ, Nikolov P, **Boyle PM**, PJ Spevak, Trayanova NA. MRI-based Ventricular Arrhythmia Risk Stratification In Children With Myocarditis. Heart Rhythm, 2018;15(5):S3656.
15. Roney C, Pashaei A, Meo M, Dubois R, **Boyle PM**, Trayanova NA, Cochet H, SA Niederer. Universal Atrial Coordinates For Visualisation, Registration And Construction Of Patient Specific Geometries. Heart Rhythm, 2018;15(5):S137.
16. Prakosa A, Cartoski MJ, **Boyle PM**, O'Hara RP, Pashakhanloo F, Coppini R, Pradella S, Zimmerman S, Abraham MR, Maurizi N, Olivotto I, Trayanova NA. Ventricular Arrhythmia in Hypertrophic Cardiomyopathy: Novel Arrhythmia Risk Stratification Using T1 Mapping, LGE-MRI, and Computational Modeling, Circulation, 2017;136:(1S), A16889.
17. Cartoski MJ, Nikolov P, **Boyle PM**, PJ Spevak, Trayanova NA. Personalized Risk Stratification for Ventricular Arrhythmia in Pediatric Patients with Myocarditis via Image-Based Computational Simulations, Circulation, 2017;136:(1S), A15442.
18. **Boyle PM**, Zahid S, Franceschi WH, Murphy MJ, Prakosa A, Zghaib T, Balouch M, Ipek EG, Chrispin J, Berger RD, Ashikaga H, Marine JE, Calkins H, Nazarian S, Spragg DD, Trayanova NA. Reentrant Drivers of Persistent AF Identified by Personalized Computational Modeling Correlate to Rotors Observed Clinically by Intracardiac Mapping: A Pilot Study. Heart Rhythm, 2017;14(5):S260.
19. Yu JK, Franceschi WH, **Boyle PM**, Trayanova NA. Electrotonic interactions between ventricular myocytes and injected hiPSC-derived cardiomyocytes increase cardiac ectopy: insights from a 3D human computational model. Heart Rhythm, 2017;14(5):S52-3.
20. Yu JK, Franceschi WH, **Boyle PM**, Trayanova NA. Increased clustering of hiPSC-derived cardiomyocyte distribution increases the likelihood of cardiac ectopy: insights from a realistic human model of post-MI ventricular tachycardia. Heart Rhythm, 2017;14(5):S147.

21. Cartoski MJ, Reymann M, Nikolov P, Prakosa A, **Boyle PM**, Spevak PJ, Trayanova NA. Risk Stratification for Ventricular Arrhythmia in Patients with Hypertrophic Cardiomyopathy via MRI-Based Computational Simulations. J Cardiovasc Magn Reson, 2017;19:(S1), P213.

22. Cartoski MJ, Prakosa A, Nikolov P, **Boyle PM**, PJ Spevak, Trayanova NA. Risk Stratification for Ventricular Arrhythmia in Patients With Repaired Tetralogy of Fallot via Image-Based Computational Simulations: A Pilot Study. Circulation 2016;134:(1S), A11921.

23. **Boyle PM**, Zahid S, Schwarz EL, Whyte KN, Vigmond EJ, Dubois R, Haissaguerre M, Hocini M, Jais P, Cochet H, Trayanova NA. Emergent Mechanisms of AF Sustenance After Failed Reentrant Driver Ablation: Insights From MRI-Based Personalized Atrial Models. Heart Rhythm, 2016;13(5):S4056.

24. **Boyle PM**, Zahid S, Schwarz EL, Whyte KN, Vigmond EJ, Dubois R, Haissaguerre M, Hocini M, Jais P, Cochet H, Trayanova NA. Cell- And Tissue-Level Changes Resulting from Fibrosis Need to Be Represented In Personalized Atrial Models To Correctly Reproduce Clinical Outcomes In AF Patients. Heart Rhythm, 2016;13(5):S5412.

25. **Boyle PM**, Murphy MJ, Blake RC, Zahid S, Karathanos TV, Wang D, Whyte KN, Schwarz EL, Entcheva E, Trayanova NA. Optogenetic Termination of Reentrant Atrial Arrhythmia Could Be Enabled By Localized, Long-Duration, Low Energy Light Pulses Applied Endocardially: A Computational Study, Heart Rhythm, 2016;13(5):S1767.

26. Zahid S, **Boyle PM**, Schwarz EL, Whyte KN, Vigmond EJ, Dubois R, Haissaguerre M, Hocini M, Jais P, Cochet H, Trayanova NA. Machine Learning Identifies Relationship between Reentrant Driver Locations and Fibrosis Spatial Patterns in Patient-Specific Models of Human Atria. Heart Rhythm, 2016;13(5):S370.

27. Zahid S, **Boyle PM**, Schwarz EL, Whyte KN, Vigmond EJ, Dubois R, Haissaguerre M, Hocini M, Jais P, Cochet H, Trayanova NA. Reentrant Drivers simulated from MRI-based patient-specific models correlate to drivers mapped clinically with ECGI. Heart Rhythm, 2016;13(5):S2978.

28. Zahid S, Whyte KN, Schwarz EL, **Boyle PM**, Chrispin J, Blake RC, Prakosa A, Ipek EG, Halperin HR, Calkins H, Berger RD, Nazarian S, Trayanova NA. Prediction of Optimal Ablation Targets for Left Atrial Flutter in Patient-Specific Models using the Minimum Cut' Algorithm. Heart Rhythm, 2016;13(5):S1212.

29. Yu JK, O'Hara T, **Boyle PM**, Priest JR, Dubin AM, Ashley E, Trayanova NA. Mosaic expression of a novel SCN5a mutation (V1762L) in Purkinje cells may underlie 2:1 AV block and left bundle branch block observed in an infant with LQTS. Heart Rhythm, 2016;13(5):S455.

30. **Boyle PM**, Murphy MJ, Karathanos TV, Wang D, Zahid S, Whyte KN, Schwarz EL, Entcheva E, Trayanova NA. Pulse Duration Determines Efficacy of Arrhythmia Termination via Targeted Optogenetic Stimulation. Biophys J, 2016;110(3):585a.

31. Yu JK, **Boyle PM**, O'Hara T, Priest JR, Ashley E, Trayanova NA. Somatic Mosaicism of Novel SCN5a Mutation in Purkinje System May Underlie 2:1 Block in an Infant with Long QT Syndrome. Biophys J, 2016;110(3):527a.

32. Zahid S, Whyte KN, Schwarz EL, Prakosa A, **Boyle PM**, Barcelon B, Fukumoto K, Chrispin J, Ipek EG, Habibi M, Suzuki T, Halperin HR, Calkins H, Berger RD, Nazarian S, Trayanova NA. Feasibility of Using MRI-based, Patient-Specific Simulations to Predict Ablation Targets in Human Left Atrial Flutter. Heart Rhythm, 2015;12(5):S113.

33. Zahid S, **Boyle PM**, Schwarz EL, Whyte KN, Vigmond EJ, Dubois R, Haissaguerre M, Hocini M, Jais P, Cochet H, Trayanova NA. Stability of Reentrant Sources and Ablation Targeting in Fibrotic Human Atria with Persistent Atrial Fibrillation. Heart Rhythm, 2015;12(5):S116.
34. **Boyle PM**, Karathanos TV, Wang D, Zahid S, Whyte KN, Schwarz EL, Calkins H, Nazarian S, Entcheva E, Trayanova NA. Spatial Distribution of Light-Sensitive Cells and Density of Illumination Sources Determine Effectiveness of Optogenetics-Based Termination of Atrial Fibrillation in a Simulation Study. Heart Rhythm, 2015;12(5):S4078.
35. Cochet H, Dubois R, Relan J, Zahid S, Aljefairi N, Yamashita S, Sellal J, Berte B, Amraoui S, Denis A, Derval N, **Boyle PM**, Trayanova NA, Sacher F, Hocini M, Jais P. Relationship between rotor activity and fibrosis in persistent atrial fibrillation: a combined noninvasive mapping and MRI study. Heart Rhythm, 2015;12(5):S512.
36. Karathanos TV, **Boyle PM**, Bayer JD, Wang D, Trayanova NA. Opsin Spectral Sensitivity Determines the Effectiveness of Optogenetics-Based Defibrillation. Biophys J, 2015;108(2):148a.
37. Zahid S, **Boyle PM**, Malamas P, Vadakkumpadan F, Dubois R, Vigmond EJ, Haissaguerre M, Hocini M, Jais P, Cochet H, Trayanova NA. Reentrant Sources in Persistent Atrial Fibrillation Are Located in Regions with Specific Spatial Patterns of Fibrosis. Circulation 2014;130:(2S), A13235.
38. Vigmond EJ, **Boyle PM**. A Quantitative Validation of the Safety Factor for Cardiac Impulse Propagation. Heart Rhythm, 2014;11(5):S3345.
39. J Yu, **Boyle PM**, Ambrosi CM, Trayanova NA, Entcheva E. High-Throughput Contactless Optogenetic Assay for Cellular Coupling: Illustration by ChR2-Light-Sensitized Cardiac Fibroblasts and Cardiomyocytes. Circulation 2013;128:(2S), A14943.
40. Vigmond EJ, **Boyle PM**, Masse S, Nanthakumar K. Activation Rate Gradients During Early VF Are Determined By Transmural IK(ATP) Heterogeneity. Heart Rhythm, 2013;10(5):S253.
41. Campos F, Shiferaw Y, Prassl A, **Boyle PM**, Vigmond EJ, Plank G. Preferred Locations of Calcium-Mediated Triggered Activity. Heart Rhythm, 2013;10(5):S441.
42. **Boyle PM**, Williams JC, Entcheva E, Trayanova NA. Spatial Distribution of ChR2 Affects Optical Stimulation Efficiency in Cardiac Tissue. Heart Rhythm, 2012;9(5):S182.
43. **Boyle PM**, Veenhuyzen GD, Vigmond EJ. Why Isn't Fusion During Entrainment of Orthodromic Reciprocating Tachycardia More Diagnostically Useful? Heart Rhythm, 2012;9(5):S3256.
44. **Boyle PM**, Williams JC, Entcheva E, Trayanova NA. A Computational Framework for Simulating Cardiac Optogenetics. Comp Cardiol, 2012;39:5-8.
45. **Boyle PM**, Veenhuyzen GD, Vigmond EJ. Computer Simulation of Supraventricular Tachycardias with Pseudo-ECG Recordings. Can J Cardiol, 2010;26, 90D-91D.
46. **Boyle PM**, Masse S, Nanthakumar K, Vigmond EJ. Purkinje-Myocardial Coupling Determines Reentry Type in Simulations. Heart Rhythm, 2010;7(5):S288.
47. Deo M, **Boyle PM**, Plank G, Vigmond EJ. Modeling the Effects of Conduction System Disorders on Cardiac Rhythm. Heart Rhythm, 2009;6(5):S41920.
48. Deo M, **Boyle PM**, Plank G, Vigmond EJ. Role of Purkinje System in Arrhythmogenesis and Maintenance. Heart Rhythm, 2008;5(5):S212.

Parts of books (chapters in edited books)

1. Trayanova NA, **Boyle PM**, *Modeling the Aging Heart*, in Zipes D, Jalife J, Stevenson W (Eds.), "Cardiac Electrophysiology: From Cell to Bedside, 7e," Philadelphia, PA: Elsevier, ISBN 978-0-323-44733-1, 2017.
2. NA Trayanova, **Boyle PM**, *Cardiac Arrhythmias: Mechanistic Knowledge and Innovation from Computer Models*, in A Quarteroni (Ed.), "The Cardio-Circulatory System: from Modeling to Clinical Applications," Lausanne, Switzerland: Springer International, ISBN 978-3-319-05229-8, 2015.
3. Vigmond EJ, **Boyle PM,** Deo M, *The Role of the Purkinje System in Defibrillation*, in NA Trayanova (Ed.), "Cardiac Defibrillation: Mechanisms, Challenges, and Implications," Rijeka, Croatia: InTech, ISBN 978-953-307-666-9, 2011.
4. Bishop MJ, Arevalo HJ, **Boyle PM**, Trayanova NA, Vigmond EJ, Plank G, *Cardiac Computational Electrophysiology: Modeling Tissue and Organ*, in GS Wagner, O Pahlm (Eds.), "Cardiovascular Multimodal Image-Guided Diagnosis and Therapy," New York, NY: McGraw-Hill Professional, ISBN 0-071-61346-3, 2011.

Journal issues edited

1. **Guest Editor (2016)**, *Clin Med Insights Cardiol*, "Ca^{2+} Dynamics and Cardiac Arrhythmias."

Patents granted or under review

1. Systems & methods for atrial fibrillation treatment and risk assessment. US Patent No. 10,687,898 **granted June 23,2020**. Inventors: Trayanova NA, **Boyle PM**, and Zahid S.
2. Using patient-specific modeling of the heart for risk stratification of ventricular arrhythmia in patients with hypertrophic cardiomyopathy via image-based computational simulations, (No. 62/453,917, filed 2017-02-02, Provisional).
3. Using patient-specific modeling of the heart for risk stratification for ventricular arrhythmia in patients with repaired tetralogy of Fallot via image-based computational simulations, (No. 62/417,903, filed 2016-11-04, Provisional).
4. Systems and methods for simulation prediction of targets for catheter ablation of left atrial flutter in patients with atrial structural remodeling, (No. 15/573,292, filed 2015-05-12, Pending)

Publications or Book Chapters Submitted and In Revision

de Groot NMS, Shah D, **Boyle PM**, Anter E, Deisenhofer I, Deneke T, van Dessel P, Doessel O, Dilaveris P, Heinzel F, Kapa S, Lambiase P, Lumens J, Platonov P, Ngarmukos T, Pablo J, Olaya-Sanchez A, Takahashi Y, Valdigem B, van der Veen AJ, Vernooij K, Casado-Arroyo R. Critical appraisal of technologies to assess electrical activity during atrial fibrillation. *In revision (Europace).*

Aronis KN, Prakosa A, Berger RD, **Boyle PM**, Chrispin J, Ju Suyeon, Marine JE, Sinha S, Tandri H, Ashikaga H, Trayanova NA. "Characterization of the electrophysiologic remodeling of patients with ischemic cardiomyopathy by clinical measurements and computer simulations coupled with machine learning." *In revision (Front Physiol).*

Boyle PM, Trayanova NA, *Modeling the Aging Heart*, in Jalife J, Stevenson W (Eds.), "Cardiac Electrophysiology: From Cell to Bedside, 8e." *In revision*. (Book chapter, invited)

Publications or Book Chapters Submitted and Under Peer Review

Boyle PM, Sarairah S, Kwan KT[1], Scott GD[1], Mohamedali F[1], Ordovas KG, Prutkin J, Robinson M, Sridhar A, Akoum N. LGE-MRI Quantification of Atrial Fibrosis: Side-by-Side Comparison of Two Widely Used Methods. *Under review (Circ Cardiovasc Imag).*

Li G, Zhang DM, Yin T, Lipovsky CE, Huang L, Hicks SC, Brumback BD, Jimenez J, **Boyle PM**, Rentschler SL. Acute GSK-3 inhibition modulates human cardiac electrical substrate. *In submission.*

O'Hara RP, Binka E, Prakosa A, Zimmerman SL, Cartoski MJ, **Boyle PM**, Trayanova NA. Assessment of Sudden Death Risk Due to Arrhythmia in Patients with Hypertrophic Cardiomyopathy using Personalized Heart Models based on T1 Mapping and Late Gadolinium Enhancement Cardiovascular Magnetic Resonance Imaging. *In submission.*

Bifulco SF[2] and **Boyle PM**. *Computational Modeling & Simulation of the Fibrotic Human Atria*, in Regnier R, Childers M (Eds.), "Methods in Molecular Biology: Familial Cardiomyopathies". *In submission.* (Book chapter, invited)

OTHER SCHOLARLY ACTIVITY

Invited lectures, seminars, and webinars

1. Visiting scholar lecture series at Bad Krozingen Institute for Experimental Cardiovascular Medicine (University Heart Center Freiburg), *Modeling & Simulation of Cardiac Systems: Expanding the Interface Between Bioengineering and Cardiology*, Sep 2021 (scheduled).
2. University of Manitoba BME Seminar Series, *Using Computational Modeling & Simulation to Anticipate Catastrophic Future Events*, Jan 2021, Winnipeg, MB (delivered remotely).
3. Cardiovascular Health Research Unit Work-in-Progress Series, *Modeling & Simulation of Cardiac Systems: Expanding the Interface Between Bioengineering and Cardiology*, Jan 2021, Seattle WA.
4. Institute for Stem Cell and Regenerative Medicine Research Update, *Cardiac Systems Simulation (CardSS) Laboratory Overview*, Oct 2020, Seattle WA.
5. King's College of London Cardiac Electro-Mechanics Research Group (CEMRG) e-Lecture series, *Modeling & Simulation of Cardiac Arrhythmia*, Jul 2020, London, UK (delivered remotely).
6. Center for Reproducible Biomedical Modeling Online Cell Modeling Seminar, *Modeling Cardiac Tissue Electrophysiology*, Mar 2020, Seattle WA, recording available online [link].
7. UW Cardiovascular Grand Rounds, *Modeling and Simulation of Cardiac Arrhythmia,* Feb 2020, Seattle WA, recording available online [link].
8. 13th Western A-Fib Symposium, *MRI-Based Computational Modeling of Fibrotic Substrate in Cryptogenic Stroke*, Feb 2020, Park City Utah.
9. 6th UC Davis Cardiovascular Symposium, *Frontiers of Cardiac Systems Simulation*, Feb 2020.
10. Johns Hopkins University Computational Cardiology Lab Seminar Series, *New Work from the Cardiac Systems Simulation Lab at UW,* Nov 2019, Baltimore MD.
11. UW Breakfast Club Seminar Series, *Understanding Arrhythmia Mechanisms and Exploring New Frontiers for Clinical Treatment*, Sep 2018, Seattle WA.
12. UW Bioengineering Department Seminar Series, *New Frontiers in Arrhythmia Research: The Emergent Power of Computational Cardiology*, Feb 2018, Seattle WA.
13. Carleton University (IEEE Ottawa Section Seminar Series), *New Frontiers in Arrhythmia Research: The Emergent Power of Computational Cardiology*, Nov 2017, Ottawa ON.
14. King's College London, *Engineering Radical New Approaches for the Treatment of Heart Rhythm Disorders*, Jul 2017, London UK.

15. McMaster University, *Engineering Radical New Approaches for the Treatment of Heart Rhythm Disorders*, May 2017, Hamilton ON.
16. Ryerson University, *Engineering Radical New Approaches for the Treatment of Heart Rhythm Disorders*, Apr 2017, Toronto ON.
17. University of British Columbia (Laszlo Lecture Series), *Engineering Radical New Approaches for the Treatment of Heart Rhythm Disorders*, Nov 2016, Vancouver BC.
18. Bonn University, *Personalized Modelling of Patient Hearts: Brave New Waves in Cardiac Arrhythmia Treatment*, Jul 2016, Bonn, Germany.
19. University of Calgary, *Computational Modeling of the Heart: Life on the Cutting Edge of Cardiac Arrhythmia Research*, Jan 2016, Calgary AB.
20. McGill University, *Computational Modeling of the Heart: Life on the Cutting Edge of Cardiac Arrhythmia Research*, Oct 2015, Montreal QC.
21. Libin Cardiovascular Research Institute, *Patient-specific modeling to unveil mechanistic insights on perpetuation and ablation of persistent atrial fibrillation*, Jun 2015, Calgary AB.
22. Medical University of Graz, *Beauty is a Light in the Heart: The Transformative Potential of Optogenetics for Clinical Applications in Cardiovascular Medicine*, Mar 2015, Graz, Austria.
23. Bordeaux University, *Simulating Optogenetic Control of the Heart*, Sep 2012, Pessac, France.
24. Libin Cardiovascular Research Institute, *Computational Biophysics and Cardiac EP*, Apr 2011, Calgary AB.
25. Johns Hopkins University, *The Peculiar Purkinje System*, Feb 2011, Baltimore MD.
26. Simula Research Laboratory, *The Peculiar Purkinje System*, Sep 2010, Oslo, Norway.
27. Pompeu Fabra University, *Modelling the Purkinje System's Response to Shocks*, Sep 2008, Barcelona, Spain.

Presentations given at conferences

1. **Boyle PM**, "Computational Modeling for Personalized Medicine in EP," *Heart Rhythm Society Annual Scientific Sessions*, July 2021, Boston, MA.
2. Bifulco SF, […], **Boyle PM**, "Personalized Computational Modeling Identifies Embolic Stroke of Undetermined Source Patients with Potential Arrhythmic Substrate," *SIAM Conference on Dynamical Systems*, May 2021, online.
3. **Boyle PM** et al., GtACR1 Optogenetic Stimulation can Efficiently Terminate Arrhythmia: Computational Proof-of-Concept. *Biomedical Engineering in Society Annual Meeting*, Oct 2020, online.
4. **Boyle PM**, "Computational Models of Cardiac Arrhythmia," *American Association of Physicists in Medicine Annual Meeting*, Jul 2019, San Antonio TX.
5. **Boyle PM** et al. "A Novel Framework for Performing Biophysically Realistic but Computationally Inexpensive Simulations for Assessment of Arrhythmia Susceptibility in Patient-specific Models of the Atria Derived from LGE-MRI," *Heart Rhythm Society Annual Scientific Sessions*, May 2019, San Francisco CA.
6. **Boyle PM**, "Novel Approaches to Arrhythmia Therapy: Optogenetics," *Heart Rhythm Society Annual Scientific Sessions*, May 2019, San Francisco CA.
7. **Boyle PM**, "How to build your own lab: The very first steps," *Gordon Research Seminar on Cardiac Arrhythmia Mechanisms*, Apr 2019, Lucca, Italy.

8. **Boyle PM**, "Optogenetics as a transformative approach to anti-arrhythmia treatment," *American Heart Association Annual Scientific Sessions*, Nov 2018, Chicago IL.
9. **Boyle PM**, "Optogenetics as a transformative approach to anti-arrhythmia treatment," *Heart Rhythm Society Annual Scientific Sessions*, May 2018, Boston MA.
10. **Boyle PM**, "The Early Career EP Town Hall: A Q&A session with experts on all things fellowship and early career," *American Heart Association Annual Scientific Sessions*, Nov 2017, Anaheim CA.
11. **Boyle PM**, "Characterizing Uncertainty in Computational Models of the Fibrotic Atria," *Workshop on Mathematical Methods in Cardiac Electrophysiology*, Nov 2017, Ottawa ON.
12. **Boyle PM**, "Modeling Electrophysiology at the Cell and Tissue Scales," *CARPentry Summer School at Medical University of Graz*, Jul 2017, Graz, Austria.
13. **Boyle PM**, "Patient-Specific Simulations of Atrial Arrhythmia Enable Precision Catheter Ablation," *Gordon Research Conference on Cardiac Arrhythmia Mechanisms*, Feb 2017, Ventura CA.
14. **Boyle PM**, "Modeling in Understanding Arrhythmogenesis," *Stanford Biodesign New Arrhythmia Technologies Retreat*, May 2016, Stanford CA
15. **Boyle PM** et al., "Local Complexity of the Fibrosis Spatial Pattern Determines the Locations of Stable Reentrant Sources in Persistent AF: Analysis from Patient-Specific Models," *Heart Rhythm Society Annual Scientific Sessions*, May 2015, Boston MA.
16. **Boyle PM** et al., "Prevalence of Regions with Highly Intermingled Fibrotic and Non-Fibrotic Tissue is a Better Predictor of Arrhythmia Inducibility Than Total Fibrosis Burden: Analysis of Patient-Specific Models of Persistent AF," *Heart Rhythm Society Annual Scientific Sessions*, May 2015, Boston MA.
17. **Boyle PM** & Trayanova NA, "Spatial Distribution of Light-Sensitive Cells Determines Effectiveness of Optogenetics-Based Termination of Atrial Arrhythmias," *Biomedical Engineering Society Annual Meeting*, Oct 2014, San Antonio TX.
18. **Boyle PM** & Trayanova NA, "Modeling of Defibrillation," *American Heart Association Annual Scientific Sessions*, Nov 2013, Dallas TX.
19. **Boyle PM**, "Simulating Optogenetic Control of the Heart," SIAM Conference on Computational Science and Engineering, Feb 2013, Boston MA.
20. **Boyle PM**, Williams JC, Entcheva E and Trayanova NA, "A Computational Framework for Simulating Cardiac Optogenetics," *Computing in Cardiology*, Sep 2012, Krakow, Poland.
21. **Boyle PM**, "Ventricular Electrical Synchrony During Simulations of Cardiac Biophysics," *INTERFACE: CAMBAM's Industrial Day at McGill University*, Oct 2010, Montreal QC.
22. **Boyle PM**, "Ventricular Electrical Synchrony During Simulations of Cardiac Biophysics," *Methods and Applications of Cardiac Electromechanical Models*, Oct 2009, Graz, Austria.
23. **Boyle PM**, "Simulating the Atrioventricular Node and an Accessory Pathway in a Ventricular Model," *MITACS Annual Conference*, Jun 2009, Fredericton NB.
24. **Boyle PM**, "Simulating the Atrioventricular Node and an Accessory Pathway in a Ventricular Model," *Canadian Medical and Biological Engineering Society*, May 2009, Calgary AB.
25. **Boyle PM**, Vigmond EJ, "Modelling the Cardiac Purkinje System and its Response to Shocks," *Computers in Cardiology*, Sep 2008, Bologna, Italy.

Guest lectures in university classes

1. EP Clinical Conference, *Optogenetics Update*, Mar 2021, Seattle WA.
2. BIOEN 530, *Personalized Computational Modeling Identifies Embolic Stroke of Undetermined Source Patients with Potential Arrhythmic Substrate*, Feb 2021, Seattle WA.
3. BIOEN 498/599, *Personalized Computational Modeling Identifies Embolic Stroke of Undetermined Source Patients with Potential Arrhythmic Substrate*, Oct 2020, Seattle WA.
4. ENGR 543, *Clinical Studies & Trials for Bioengineers*, Feb 2020, Seattle WA (via Zoom).
5. EP Clinical Conference, *Cardiac Optogenetics*, Mar 2020, Seattle WA.
6. ENGR 215, *My Path to a Career in Research: Cardiac Systems Simulation*, Feb 2020, Seattle WA.
7. BIOEN 299, *Cardiac Systems Simulation*, Nov 2019, Seattle WA.
8. BIOEN 530, *Optogenetics as a Novel Approach to Arrhythmia Therapy*, Nov 2019, Seattle WA.
9. BIOEN 498/599, *Targeted ablation of persistent atrial fibrillation*, Oct 2019, Seattle WA.
10. EP Clinical Conference, *Computational Simulation of Cardiac Arrhythmia*, Jul 2019, Seattle WA.
11. BIOEN 498/599, *Cardiac Optogenetics: Potential Applications*, Oct 2018, Seattle WA.
12. *Hodgkin and Huxley Models*, Nov 2009/2010, Calgary AB.
13. *Application of Trellis Coding on the TigerSHARC DSP*, Feb 2007, Calgary AB.

Professional society memberships

Biomedical Engineering Society, 2020-present

Heart Rhythm Society, 2013-present

American Heart Association, 2013-present

IEEE, 2007-2019

Association of Professional Engineers and Geoscientists of Alberta, 2005-present

Other

Peer reviewer of 40+ articles for the following publications: Am J Physiol Heart Circ Physiol; Biophys J; Circ Arrhythm Electrophysiol; Circ Res; Comp Biol Med; eLife; Europace; Front Physiol; Heart Rhythm; IEEE Trans Biomed Eng; Inform Med Unlocked; Int J Numer Meth Biomed Eng; J Biophotonics; J Mol Cell Cardiol; Med Biol Eng Comput; PLoS One; PLoS Comp Biol; Prog Biophys Mol Biol; Nat Sci Rep

Guest editor for PLoS Comp Biol

TRAINEES

Current Doctoral Students

- 2019-present: Savannah Bifulco (Chair), status: post-candidacy (★ BCTG T32 Scholar ★)
- 2019-present: Alex Ochs (Chair), status: post-candidacy
- 2020-present: Chelsea Gibbs (Chair), status: pre-candidacy (★ NSF Fellowship ★)

Current Master's Students:

- 2019-present: Zih-Hua (Amber) Chen, status: final exam scheduled (2021-05-10)

Current Cardiology Research Fellows:

- 2020-present: Dr. Jake Mayfield (co-supervised with Dr. Arun Sridhar)
- 2019-present: Dr. Fima Macharet (co-supervised with Dr. Nazem Akoum)

Other significant student supervision

- UW BioE Capstone Project Advisor: Griffin Scott, Kelly Zhang
- UW BioE Capstone Project Co-advisor: Kelsey Luu, Parker Ruth (★ NSF Fellowship ★)
- UW BioE BS/MS Students (research for credit): Lahari Gorantla
- UW Undergraduate Research Assistants: Carter Anderson, Matthew Halim, Sanika Joshi, Kirsten Kwan, Farzana Mohamedali
- At JHU: faculty mentor for 10+ undergraduates; research supervisor for 10+ undergraduates
- At U of C: research supervisor for 3 undergraduates

Supervised postdoctoral fellows

- 2017-2018: Dr. Rheeda Ali, JHU Institute for Computational Medicine
- 2016-2017: Dr. Dongdong Deng, JHU Institute for Computational Medicine

Graduate student committee membership

- 2020-present: General exam GSR for Robin Nance (UW Epidemiology; Supervisor: Heckbert)
- 2020-present: Qualifying exam committee (Chair) for Kalen Robeson (UW BioE; Supervisors: Regnier and Davis)
- 2019-present: Preliminary exam committee for Justin Lee (UW MolES; Supervisor: Berndt)
- 2019-present: Qualifying exam committee for Veronica Porubsky (UW BioE; Supervisor: Sauro)
- 2019-present: General & final exam GSR for John Uehlin (UW ECE; Supervisor: Rudell)
- 2017: PhD exam committee for David Hunter, PhD (JHU BME; Supervisor: Tung)

DOCUMENTATION OF TEACHING EFFECTIVENESS

Courses Taught & Student Evaluations

Course	Title	Quarter	Credit Hours	Enrolled	Course Evals.	Item 1	Item 3	Item 4	Overall Adj. Med.
BIOEN 509A	Bioengineering Departmental Seminar	Spring, 2021 via Zoom	1	21	-	-	-	-	-
BIOEN 509B	Bioengineering Departmental Seminar	Spring, 2021 via Zoom	1	45	-	-	-	-	-
BIOEN 400	Fundamentals of bioengineering design (online)	Spring, 2021 via Zoom	3	74	-	-	-	-	-

BIOEN 509A	Bioengineering Departmental Seminar	Winter, 2021 via Zoom	1	26	7	4.5	4.4	4.4	4.5
BIOEN 509B	Bioengineering Departmental Seminar	Winter, 2021 via Zoom	1	24	47	4.6	4.6	4.5	4.5
BIOEN 400	Fundamentals of bioengineering design (online)	Spring, 2020 via Zoom	3	69	59	4.2	4.9	4.8	4.6
BIOEN 400 w/ Dr. Lutz	Fundamentals of bioengineering design	Spring, 2019	3	71	41	3.1	4.4	4.2	3.6
BMEN 409 **(Calgary)**	Bioelectricity	Winter, 2010	2.5h/wk	13	7	-	-	-	4.7

Pedagogical Training Activities (incl. in Justice, Equity, Diversity, and Inclusion)

- Attended: *Affirmative Action*, UW BioE JEDI Discussion (May, 2021)
- Attended: *Race is Not Biological*, UW BioE JEDI Discussion (Apr, 2021)
- Completed: *Managing Identity-Based Conflict in the STEM Learning and Research Environment.* UW ISCRM DEI Workshop Series (Dec, 2020).
- Completed: *Examining the history and current manifestations of racism and anti-blackness and their place in science.* UW ISCRM DEI Workshop Series (Oct-Nov, 2020).
- Completed: *Evidence-Based Teaching Program, Phase I: Exploration.* UW CT&L (2018).
- Completed: *University Teaching 101 (5-week Coursera MOOC).* JHU School of Ed. (2014).
- Completed: *Instructional Skills Workshop (4-day training course)*. University of Calgary Taylor Institute for Teaching & Learning (2010).

Other Teaching Contributions

- Helped develop new data science option for UW bioengineering graduate program (2018)
- Deliver two lectures per year as part of UW's Clinical Cardiac Electrophysiology Fellowship training program; peer feedback survey results available upon request (2019-present)

Teaching Awards, Nominations for Teaching Awards

- Teaching Assistant Excellence Award, 2007-08, University of Calgary
- Teaching Excellence Award (Shortlist), 2007, University of Calgary

SERVICE

Service to the Department of Bioengineering [prior institutions also noted]

- Curriculum Committee, member 2019 to present
- Graduate Admissions Committee, member 2018 to present
- Ad-hoc committee on incorporating trainee feedback in faculty evaluation, member 2018
- **[JHU BME]:** Journal Club Coordinator, NIH T32 pre-doctoral training program in Computational Medicine
- **[JHU BME]:** Marketing Committee, member 2015-18
- **[Calgary]:** ECE Engineering Graduate Students' Association, President 2008-10.

Service to the College of Engineering or the School of Medicine [prior institutions also noted]

- UW CREST (Department of Surgery, Division of Healthcare Simulation Science), Member of search committee for Mathematical Physiology Modeler (2021)
- UW Clinical Cardiac Electrophysiology Fellowship program, Interviewer 2019-present
- UW General Cardiology Fellowship program, Interviewer 2019-present
- **[JHU]:** Homewood Postdoctoral Association, President 2012-13
- **[Calgary]:** Engineering Faculty Promotions Committee, member 2005
- **[Calgary]:** Engineering Academic Appointment and Review Committee, member 2005
- **[Calgary]:** Students' Academic Assembly, Engineering Representative (elected) 2004-05

Service to the University of Washington [prior institutions also noted]

- UW Institute for Stem Cell and Regenerative Medicine (ISCRM) Symposium, invited chair for "Lightning Talks," 2021
- UW ISCRM Joint Leadership Team (JLT), member 2020 to present
- UW Center for Cardiovascular Biology Steering Committee, member 2020 to present
- UW Institute for Translational Health Sciences Collaboration Innovation Award, reviewer 2019
- **[Calgary]:** Graduate Students' Association Finance Committee, 2005-06, chair 2010-11
- **[Calgary]:** Graduate Students' Association Bylaws Standing Committee, 2009-11
- **[Calgary]:** Graduate Students' Association Representatives' Council, 2008-11

Service to Professional Societies and Other Relevant Service

- **Heart Rhythm Society (HRS):**
  - Annual Scientific Sessions Abstract Reviewer, 2021 to present
  - HRS Explorers Work Group, 2020 to present
  - Late-Breaking Clinical Trials Review Committee, member 2018 to present
  - Annual Scientific Sessions Program Committee, member 2017 to present
  - Travel Awards Committee, member 2016 to present
  - Emerging Leaders Community of Practice, member 2015 to present
- **Frontiers in Physiology: Comp Physiol Med,** Associate Editor 2018 to present
- **U of C Idea Exchange Tour,** "From Sci-fi to Reality: The Next Frontier of Medicine," Invited Moderator & session contributor, Canadian Embassy in Washington DC, 2018.
- **Fields Institute Workshop on Mathematical Methods in Cardiac Electrophysiology**, Session Chair: "Uncertainty & Estimation," 2017
- **JHU Institute for Computational Medicine Annual Retreat,** session chair 2014-18
- **Canadian Medical and Biological Engineering Conference,** student activities coordinator 2009
- **Alberta Biomedical Engineering Conference,** organizing committee member 2006-08

International, National, or Governmental Service

- **BC Regenerative Medicine Network** (Dragon's Den Trainee Stipend Competition; 2021)
- **American Heart Association** (Fellowship Cardiac Electro study section; 2019-present)
- **National Institutes of Health** (ESTA study section; invited early career reviewer, 2018)
- **Mitacs Accelerate** (Expert Reviewer for Research Partnership Proposals, 2016)