Caroline Ring

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EDUCATION

Ph.D. in Biomedical Engineering   *September 2014*
Duke University, Durham, NC
Dissertation Title: *Uncertainty in the Bifurcation Diagram of a Model of Heart Rhythm Dynamics*

- Dissertation work: **Improved techniques** to **include real-world population variability in computational** models of cardiac electrophysiology, allowing more realistic, **clinically-relevant interpretation** of model results. **Uncertainty quantification** and **sensitivity analysis** techniques: **polynomial chaos** and **Monte Carlo**. Statistical methods including **Bayesian inference**, **non-parametric** methods including **kernel density estimation, hypothesis testing, ANOVA/ ANCOVA, multiple and nonlinear regression. Developed data analysis algorithms and tools** using MATLAB, R, Python, Mathematica, shell scripting, awk. Developed **novel visualizations of variability** in model results using MATLAB and Adobe Illustrator.

- Other work: **Model development** of ion channel mutation effects on heart rhythm (**Hodgkin-Huxley style** model of ionic current, incorporated into existing detailed models of cardiac action potential); estimated model parameters from experimental data. Also worked with **cellular automaton** model of cardiac conduction and **Markov chain** models of ion channels.

M.S. in Biomedical Engineering   *May 2010*
Duke University, Durham, NC
Poster Presentation: "Action Potential Duration Variability in Pharmacologically Induced Long QT Syndrome Type 1"

- Performed *in vitro* imaging of cardiac action potentials (APs) to study the interaction of Long QT Syndrome Type 1 and adrenergic stimulation. **Developed graphical data analysis tool** in MATLAB for **signal processing** and analysis of experimental AP data; **improved usability and flexibility** over previously used LabView tool.

B.S. in Physics   *May 2004*
University of North Carolina at Greensboro, Greensboro, NC

RELATED EXPERIENCE

Programmer and Data Analyst   *2004 – 2005*
Mediwave Star Technology, Greensboro, NC

- With no previous FORTRAN knowledge, was given approximately 1500 lines of existing FORTRAN code for ECG and heart rate analysis. Within 4 weeks, was **developing algorithms for signal processing and data analysis** with new assignments from Chief Science Officer at least weekly.

- **Accelerated algorithm prototyping at least 50%** within 4 weeks after migrating to Python (with no previous Python knowledge), working by e-mail and phone with New Mexico team member.
- **Wrote successful SBIR grant application** with Chief Science Officer and local and remote team members. **Trained two new hires** in FORTRAN and Python data analysis.

Junior Editor (Independent Contractor)   *2011; 2014*
American Journal Experts; Durham, NC

- **Copyedited confidential, unpublished bioengineering manuscripts** from international authors with limited English proficiency before submission to American and British journals. Performance consistently rated 4.25 or better on a 5-point scale.
- **Consistently met 24- and 72-hour deadlines** for multiple weekly assignments. **Worked with managing editors and translators throughout the U.S.** using only electronic communication.

SOFTWARE AND PROGRAMMING SKILLS

Programming, Scripting, and Markup Languages

C	Python	TeX/LaTeX
C++	awk	HTML/CSS
FORTRAN (F77 and F90)	bash/csh shell scripting	

Mathematics, Statistics, and Scientific Software

MATLAB	Numbers (Apple Productivity Apps)
R	Excel (Microsoft Office)
Mathematica	
LabView	

Visualization, Design, and Presentation Software

Adobe Illustrator	Pages (Apple Productivity Apps)
Adobe Photoshop	Keynote (Apple Productivity Apps)
	Word (Microsoft Office)
	PowerPoint (Microsoft Office)

TEACHING EXPERIENCE

Duke University, Durham, NC

Teaching Assistant, "Methods of Cellular Molecular Transport"   *2010*
Prepared and presented lectures, prepared and evaluated small-group computer modeling projects, held regular office hours for small-group tutoring, graded all written work, including final exam papers.

Teaching Assistant, "Signals and Systems"   *2007*
Held regular office hours for small-group tutoring and graded all written work, including final exam papers.

Teaching Assistant, "Introduction to Biomedical Engineering"   *2006*

Taught laboratory methods, prepared and gave laboratory demonstrations, and guided students through *in vitro* and computational laboratory projects. Held regular office hours for small-group tutoring and graded all written work, including final exam papers.

University of North Carolina at Greensboro, Greensboro, NC
Mathematics Tutor for Special Student Services   *2002 - 2004*
Tutored college students in algebra and calculus, one-on-one. Received weekly training in effective teaching methods.

PUBLICATIONS AND PAPERS

Caroline L. Ring, Wanda Krassowska Neu, and Omar M. Knio. "Uncertainty in the Bifurcation Diagram of Cardiac Action Potential Duration." In *Dynamics Days US 2014: Book of Abstracts*, page 139, 2014. **http://www.ddays2014.gatech.edu/booklet.pdf**
Caroline L. Ring, David Schaeffer, and Wanda Krassowska Neu. "Effect of strength-interval relationship on cardiac rhythm dynamics in a one-dimensional mapping model." In *Dynamics Days 2011: Abstracts*, pages 32-33, 2011. **http://www.math.duke.edu/conferences/DDays2011/abstracts.pdf**
Caroline L. Ring, Salim F. Idriss, and Wanda Krassowska Neu. "Variability of action potential duration in pharmacologically induced long QT syndrome type 1." In *Conference proceedings : Annual International Conference of the IEEE Engineering in Medicine and Biology Society IEEE Engineering in Medicine and Biology Society Conference*, vol. 2009, pp. 4520-4522, 2009.

AWARDS

Medtronic Predoctoral Fellowship, *Duke University*   *2005 – 2006*
Graduate Women in Science Foundation Fellowship, *Duke University*   *2008 – 2009*

PROFESSIONAL AND ACADEMIC MEMBERSHIPS

- IEEE
    - IEEE Engineering in Medicine and Biology Society
    - IEEE Professional Communication Society
    - IEEE Women in Engineering
- Graduate Women in Science (GWIS/Sigma Delta Epsilon), Rho Tau chapter
- Phi Beta Kappa
- Sigma Pi Sigma/Society of Physics Students

LANGUAGES

English: native language
French: speak, read, write with limited working proficiency