

Craig LaBoda

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Education

Ph.D. in Electrical and Computer Engineering

March 2017

Duke University

Durham, NC

Dissertation: Devices and Design Strategies for Building Scalable Integrated Molecular Circuits

Certificates: College Teaching, Nanoscience

M.S. in Electrical and Computer Engineering

May 2013

Duke University

Durham, NC

Relevant Courses: Int. Molecular Systems, Quantum Mechanics, Adv. In Photonics

GPA: 3.98

B.S. in Electrical Engineering

May 2011

Boston University

Boston, MA

GPA: 3.96; summa cum laude

Research Experience

PhD Candidate

Sept 2011 – May 2017

Self-Assembled Systems Lab

Duke University

- Designed and fabricated a resonance energy transfer nanoassembly that uses upconverting nanoparticles to convert low energy excitons into high energy excitons
- Developed a new form of molecular-scale logic using the dark states of fluorescent molecules to dynamically tune exciton flow in resonance energy transfer circuits
- Built two separate time-correlated single photon counting optical setups, including one with two picosecond pulsed sources, visible and NIR, both with tunable wavelengths and delays

Research Assistant

June 2011 – Aug 2011

Cross-disciplinary Integration of Design Automation Research

Boston University

- Created two algorithms that automatically generate fully permutable genetic circuits by placing recombinase sites at specific locations within a DNA plasmid
- Wrote an open source Java application called Trumpet that enables synthetic biologists to use the above algorithms; integrated Trumpet into the Clotho CAD software suite
- Presented this research at the 2011 International Genetically Engineered Machines Competition regional jamboree where we won a gold medal

Interdisciplinary Undergraduate Capstone Researcher

Sept 2010 – May 2011

Optical Characterization and Nanophotonics Laboratory

Boston University

- Assembled the first interdisciplinary BME/ECE senior capstone research team at Boston University, which has since expanded to include all disciplines in the engineering school
- Designed and fabricated Si-SiO₂ chips with optimized SiO₂ thickness for interferometrically enhanced fluorescence measurements of DNA microarrays
- Quantified fluorescent enhancement by capturing Influenza A derived DNA from lysed canine cells

Kenneth R. Lutchen Distinguished Fellow

Jan 2010 – Sept 2010

Nano-DNA Lab

Boston University

- Synthesized high density DNA microarrays for capturing and organizing DNA origami
- Operated and maintained a lithographic DNA Maskless Array Synthesizer

Publications

LaBoda, C. (2017). Devices and Circuit Design Strategies for Building Scalable Integrated Molecular Circuits. Ph.D. Dissertation. Duke University.

Bhatia S., **LaBoda, C.**, Yanez V., Haddock T., and Densmore, D. (2016). Permutation Machines. *ACS Synthetic Biology*. 5:827-834.

LaBoda, C. and Dwyer, C. L. (2016). Upconverting Nanoparticle Relays for Resonance Energy Transfer Networks. *Advanced Functional Materials*. 26:2866-2874.

LaBoda, C., Duschl, H., and Dwyer, C. L. (2014). DNA-Enabled Integrated Molecular Systems for Computation and Sensing. *Accounts of Chemical Research*. 47:1816-1824.

Monroe, M. R., Reddington, A. P., Collins, A. D., **LaBoda, C.**, Cretich, M., Chiari, M., Little, F. F., Ünlü, M. S. (2011). Multiplexed Method to Calibrate and Quantitate Fluorescence Signal for Allergen-Specific IgE. *Analytical Chemistry*. 83:9485-9491.

Monroe, M. R., Reddington, A. P., Collins, A. D., **LaBoda, C.**, Cretich, M., Chiari, M., Little, F. F., Ünlü, M. S. (2011). Multiplexed, Rapid, Point of Care Device to Quantify Allergen-Specific IgE. *Proceedings of the 2011 International Conference on Optical MEMS and Nanophotonics*. 231-232.

Posters and Presentations

LaBoda, C. and Dwyer, C. L. (2016). Upconverting Nanoparticle Relays for Signal Restoration in Resonance Energy Transfer Networks. Poster presented at 2016 Foundations of Nanoscience: Self-Assembled Architectures and Devices. Snowbird, Utah.

LaBoda, C. (2016). How do we build computers at the molecular scale? Talk presented at the GradX 2016. Durham, North Carolina.

LaBoda, C. and Dwyer, C. L. (2015). Signal Restoration in Resonance Energy Transfer Logic. Talk presented at the 2015 Duke University Electrical and Computer Engineering Graduate Student Workshop. Durham, North Carolina.

LaBoda, C. and Dwyer, C. L. (2014). Upconverting Nanoparticle Based Resonance Energy Transfer Relays. Poster presented at 2014 Foundations of Nanoscience: Self-Assembled Architectures and Devices. Snowbird, Utah.

LaBoda, C. and Dwyer, C. L. (2013). Upconversion in Resonance Energy Transfer Logic. Poster presented at 2013 Duke ECE Graduate Workshop. Durham, North Carolina.

LaBoda, C., Ferreira, M., Canevari, M. (2011). A Multidisciplinary and Collaborative Design Environment for Synthetic Biology. Co-presented talk at 2011 International Genetically Engineered Machines Competition. Indianapolis, Indiana.

Awards and Fellowships

Best Talk at Duke's Electrical and Computer Engineering Graduate Student Workshop	2015
Graduate Teaching Award for Outstanding Course Administration	2015
International Genetically Engineered Machine Competition Best Software Tool	2011
Michael F. Ruane Award for Excellence in Senior Capstone Design, Boston University	2011
Senior Capstone Design Excellence Award, Boston University	2011
Kenneth R. Lutchen Distinguished Fellowship, Boston University	2010

Teaching Experience

Instructor of Record Summer 2016
Digital Systems, Undergraduate Course Duke University

- Taught daily lectures regarding combinational and sequential logic design
- Students designed an entire pipelined processor in Verilog over the course of six weeks

Co-Instructor of Record Fall 2015
Integrated Molecular Systems, Graduate Course Duke University

- Developed a lab section in which students fabricate and characterize integrated molecular circuits composed of DNA and fluorescent molecules
- Wrote and taught weekly lectures regarding the principles of molecular computation

Teaching Assistant (TA) Fall 2014
Computer Architecture, Undergraduate Course Duke University

- Managed a team of 15 undergraduate TAs for this course of more 140+ students
- Graded exams and designed rubrics for all homework assignments

Teaching Assistant Spring 2014
Digital Systems, Undergraduate Course Duke University

- Led weekly meetings to coordinate and assist five undergraduate and Master's student TAs
- Translated all course assignments, including the final project outline, from VHDL to Verilog
- Graded exams and homework assignments while holding weekly office hours

Teaching Fellow Spring 2011
Introduction to Electronics, Undergraduate Course Boston University

- Led weekly lab sessions regarding active electronic devices and graded homework

Leadership and Outreach

Invited ECE Day Judge Spring 2013 – 2016
ECE Senior Design Competition Boston University

- Evaluated and awarded senior undergraduates based on their capstone design projects

Founder Spring 2016
Student Seminar Exchange Duke University

- Created a program that allows graduate students to invite students from other universities to visit Duke and give research seminars

Invited Group Leader and Speaker Fall 2015
TA Training Workshop Duke University

- Prepared fellow graduate students to be TAs by leading them through situational exercises

Charter Member*Student Advocacy Group*

Fall 2015

Duke University

- Held bi-weekly discussions for students coping with the difficulties of graduate student life

Workshop Co-Organizer*2013 Duke ECE Graduate Workshop*

Spring 2013

Duke University

- Designed and printed the conference booklet, developed the poster/presentation schedule, created the application forms and website, and decided upon and invited guest speakers

Professional Memberships

- International Society for Nanoscale Science, Computation and Engineering Student Member
- IEEE Student Member
- Tau Beta Pi
- Eta Kappa Nu

References

Chris Dwyer, Associate Professor

Duke University, Electrical and Computer Engineering

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Douglas Densmore, Associate Professor

Boston University, Electrical and Computer Engineering

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M. Selim Ünlü, Associate Dean for Research and Graduate Programs

Boston University, Electrical and Computer Engineering

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