

Abraham G. Beyene

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EDUCATION

University of California, Berkeley

Chemical and Biomolecular Engineering Graduate Program
Ph.D. Candidate (Expected May 2020)
GPA 4.00/4.00

University of Maryland, Baltimore County

Bachelor of Science in Chemical Engineering (May 2008)
Summa Cum Laude, Phi Beta Kappa

HONORS AND AWARDS

2017 – 2019	Society for Neuroscience-Neuroscience Scholars Program Associate
2016 – 2019	NSF Graduate Research Fellow
2015 – 2016	UC Berkeley Chancellor's Fellow
2007 – 2008	ExxonMobil Technical Merit Scholarship (Awarded to most outstanding summer intern)
2006 – 2008	Meyerhoff Scholar (Merit based full scholarship)

PEER-REVIEWED PUBLICATIONS

1. Del Bonis-O'Donnell, J.T., Page, R.H., **Beyene, A.G.**, Tindall, E.G., McFarlane, I.R., Landry, M.P. Dual Near-Infrared Two-Photon Microscopy for Deep-Tissue Dopamine Nanosensor Imaging. *Adv. Funct. Mater.* (2017), 27, 1702112
2. **Beyene, A.G.**, McFarlane, I.R., Pinals, R.L., Landry, M.P. Stochastic Simulation of Dopamine Neuromodulation for Implementation of Fluorescent Neurochemical Probes in the Striatal Extracellular Space. *ACS Chem. Neurosci.* (2017) 8(10), 2275-2289
3. Del Bonis-O'Donnell, J.T., **Beyene, A.G.**, Chio, L., Demirer, G.S., Yang, D., Landry, M.P., Engineering Molecular Recognition with Bio-mimetic Polymers on Single Wall Carbon Nanotubes. *Journal of Visualized Experiments* (2017), e55030.
4. **Beyene, A.G.**, Demirer, G.S., and Landry, M.P. Nanoparticle-Templated Molecular Recognition Platforms for Detection of Biological Analytes. *Curr. Protoc. Chem. Biol.* (2016) 8:1-27
5. Vasudevan, V., Stratton, R.W., Pearson, M.N., Jersey, G.R., **Beyene, A.G.**, Weissman, J.C., Rubino, M., and Hileman, J.I., Environmental Performance of Algal Biofuel Technology Options *Environmental Science & Technology* (2012) 46 (4), 2451-2459

MANUSCRIPTS UNDER PREPARATION OR UNDER REVIEW

6. **Beyene, A.G.**, Alizadeh-Mojarad, A., Kral, P., Vukovic, L., Landry, M.P., Tuning Fluorescence Modulation of Dopamine Optical Nanoprobes through Exciton Bandgap Engineering. 2017 (*Submitted*)
7. **Beyene, A.G.**, Delevich, K., Del Bonis-O'Donnell, J.T., Wilbrecht, L., Landry, M.P., Spatiotemporally Resolved Imaging of Evoked Dopamine Release in the Brain Extracellular

Space. 2017 (*Manuscript In Preparation*)

PATENTS

1. Landry M. P., Wilbrecht, L., **Beyene, A. B.**, O'Donnell J.T.D. Near-Infrared probes for modulatory neurotransmitter imaging in brain tissue. U.S. Provisional patent filed September 2016

CONFERENCE PAPERS

1. Near-infrared Nanosensors for Brain Imaging of Modulatory Neurotransmitters, **Abraham G. Beyene**, Kristen Delevich, Linda Wilbrecht, Markita P. Landry, Society for Neuroscience Annual Meeting, Washington D.C. 2017 (**Poster**)
2. Engineering Excitons for Brain Imaging of Modulatory Neurotransmitters, **Abraham G. Beyene** and Markita P. Landry, AVS 64th International Symposium and Exhibition, Tampa, FL. 2017 (**Invited oral**)
3. Nanoparticle Polymer Conjugates for Near-Infrared Neurotransmitter Detection, **Abraham G. Beyene**, Kristen Delevich, Linda Wilbrecht, and Markita P. Landry. American Institute of Chemical Engineers Annual Meeting, San Francisco, CA. 2016 (**Oral**)
4. Application of Process Modeling to Abnormal Event Detection in Process Units, **Abraham G Beyene**, ExxonMobil Research and Engineering Annual Meeting, Fairfax, VA. 2013 (**Oral**)
5. Process Simulation for Steam Crackers: A Case Study for Operator Training, **Abraham G Beyene**, ExxonMobil Technology Series Seminar, Fairfax, VA. 2009 (**Poster**)
6. Calcium Dynamics in the Extracellular Space of Neural Tissue, **Abraham G Beyene** and Mariajose Castellanos, UMBC Undergraduate Research and Creative Achievement Day, Baltimore, MD. 2008 (**Poster**)

ACADEMIC RESEARCH EXPERIENCE

University of California Berkeley: Chemical and Biomolecular Engineering
Markita Landry, Primary Advisor. (2015 – Present)

Current areas of research:

- Development of novel fluorescent nanosensors for dopamine to image concentration dynamics at spatial and temporal scales currently not achievable with existing tools
- Imaging of *in vivo* (*animal models*) and *ex vivo* (*acute brain slices*) dynamics of the modulatory neurotransmitter dopamine in normal and disease states
- Development of two-photon imaging system for imaging of dopamine neuromodulation in awake and behaving animal models

General areas of interest:

- Development of novel fluorescent reporters for biogenic amine neuromodulators (dopamine, serotonin) and their downstream effector molecules (cAMP, PKA, G-Protein complexes)
- Interrogations of neuromodulation in diverse brain systems using fluorescent molecular probes in cell cultures, acute tissue preparations and, when possible, animal models

Accomplishments to date:

- Developed a non-linear, three-dimensional stochastic simulation of dopamine dynamics in striatal extracellular space that accurately recapitulates the underlying *in vivo* dynamic behavior of dopamine volume transmission. Using simulation, elucidated nanosensor kinetics and imaging parameters *necessary* for *in vivo* imaging of dopamine neuromodulation using fluorescent nanosensors (*first author publication in ACS Chem. Neurosci.*)
- Using polymer functionalized carbon nanotube probes, demonstrated, for the first time, spatially and temporally resolved sensing of evoked dopamine release in the dorsal striatum of mouse acute brain slice preparations (*manuscript in preparation, first author*)
- Developed a method to tune the exciton bandgap in polymer templated carbon nanotube optical probes, and used method to synthesize fluorescent probes optimized for endogenous dopamine imaging (*manuscript submitted, first author*)
- Demonstrated that dopamine recognition by nanoparticle based fluorescent probes can be elicited by non-linear excitation of the probe and that the dopamine recognition process remains agnostic to linear vs. non-linear excitation, presaging use for deep brain imaging (*third author publication in Adv. Funct. Mater.*)
- Lead author of a protocol paper on synthesis and applications of nanoparticle-templated fluorescent optical probes (*Protocols in Chemical Biology*)
- Advanced to Ph.D. candidacy after having successfully completed all chemical engineering graduate course requirements with a 4.00 GPA and an A+ grade in Chemical Kinetics

TEACHING EXPERIENCE

- Served as graduate student instructor (GSI) for CHE 142, an undergraduate course in chemical kinetics and reaction engineering
- Prepared material for and lead two discussion sections each week (25 students each) where I complete practice problems to help students better understand the concepts covered in lecture (~ 8 hrs. per week)
- Prepared homework problem sets and detailed solutions each week that is tailored to enhancing student understanding of material covered in lecture (~ 10 hrs. per week)
- Lead two office hours per week where I provide personal attention to help students with homework problem sets and projects, and help prepare students for exams (~ 2hrs. per week)
- Served as undergraduate teaching assistant for introductory physics (PHY 121) and Statics (ENES 110) courses where I held two office hours per week (~ 4 hrs. total) and helped students with homework problem sets and assisted them prepare for exams

LEADERSHIP AND SERVICE

Summary: I continuously seek volunteer opportunities that allow me to combine my passion for teaching with my desire to serve as a role model for minority students of high school age. As a minority and an immigrant, I recognize that I have a unique opportunity to guide, inspire and mentor youth that have little access to the personal and economic support they need to make informed decisions, and to navigate, compete and excel in academia.

- Oakland Unified School District (OUSD) volunteer as tutor for high school Mathematics and Chemistry (2016-Present)
- Volunteer for Oakland International High School, an OUSD school, as mentor for minority students of immigrant and low-income background (2016-Present)
- Volunteer for Expanding Visions, an ExxonMobil employee volunteer program for employees to serve as tutors and mentors in local public schools of Fairfax County, VA. (2012-2013) (Recognized with *Leadership Award* from ExxonMobil for service)

PAST PROFESSIONAL EXPERIENCE (2008 to 2015)

Summary: I worked in several positions of increasing responsibility at **ExxonMobil**, including in research and development (team member), in development and deployment of advanced technologies in manufacturing plants (team member and team leader), and as process engineer at Torrance refinery in California.

Roles, Responsibilities and Accomplishments

- **Process Engineer**, Torrance Refinery, ExxonMobil Refining (**Oct 2014 to Jul 2015**)
 - Process engineer responsible for day to day operation of the refinery's utilities operations (water, electrical power, steam) and the alkylation unit
 - Lead for refinery energy efficiency activities, including monitoring energy critical process units in the plant, and identifying key energy efficiency and optimization opportunities
- **Research and Development Lead** for Operator Guidance Technology (**May 2013 to Oct 2014**)
 - Leader for research and development in abnormal process event detection and diagnosis technology
 - Developed a new type of fault detection model that adapts to changing process conditions in refining and chemical plants, reducing model redevelopment and sustainment costs
- **Project Lead** for deployment of technologies for fault/abnormal event detection in petrochemical processes (**Feb 2012 to May 2013**)
 - Developed statistical and first principles mathematical models, and heuristics, to detect abnormalities in process units in refineries and chemical plants
 - Developed and successfully deployed such technology in several refinery technology areas, including distillation, hydroprocessing, alkylation, cracking, coking and sulfur/amine treating units
 - Successfully managed multi-disciplinary team members in matters of technical detail and project execution (typical team: plant operators, process engineers, control/application engineers, system engineers)
 - Oversaw implementation of more than 10 projects in 5 refineries in USA (Baton Rouge, Beaumont, Torrance), Canada (Strathcona) and Europe (Rotterdam) (typical application on a process unit yields ~\$0.5M/yr. in benefits by reducing unplanned capacity loss and improving optimization)
- **Research Engineer** for ExxonMobil Algae Biofuels Project System Analysis Group (**Oct 2009 to Feb 2012**)
 - Developed techno-economic models for various biofuels production schemes and identified key economic drivers that are critical to program success
 - Evaluated environmental performance of biofuels from algae, and performed Life Cycle Assessment (LCA) to determine green house gas emissions and fresh water use
 - Evaluated the economic and environmental feasibility of novel processing schemes for biofuels production from algal biomass using aforementioned tools/techniques
 - Provided research guidance for biofuels R&D program in the area of photo-bio reactor design, biomass harvesting and oil recovery
- **Simulation Engineer** for ExxonMobil Dynamics Simulations Group (**Aug 2008 to Oct 2009**)
 - Developed robust simulations of various petrochemical process units from first principles for the purposes of developing training simulators for engineers, operators and technical staff
 - Developed and implemented simulations for hydrotreating, distillation, and ethylene cracking units at three refining and chemical processing units of ExxonMobil
 - Simulations served as training platforms for new technicians and operators on which training of response to and correction of process anomalies can be carried out