

ELIJAH KARVELIS

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EDUCATION

Massachusetts Institute of Technology, Cambridge Doctorate, Biological Engineering Advisor: Bruce Tidor	<i>2018 - Present</i> GPA: 5.0/5.0
University of Illinois, Urbana-Champaign Bachelor of Science, Chemical Engineering	<i>2014 - 2018</i> GPA: 4.0/4.0
Highland Community College, Freeport IL Associate of Science, Physics	<i>2012 - 2014</i> GPA: 4.0/4.0

PROGRAMMING EXPERIENCE

Languages	Python, familiarity with Bash, MATLAB, C, Perl
Software and packages	CHARMM, Gaussian, PyTorch, TensorFlow, Scikit-learn, Pandas, OSPREY

TECHNICAL SKILLS

Dry Lab	Molecular simulations, machine learning, data science, protein design
Wet Lab	Tissue culture and confocal microscopy

RESEARCH EXPERIENCE

Computational Modeling and Engineering of Enzyme Catalysis <i>Graduate Research Assistant</i>	MIT 2019 - present
Performed QM/MM simulations of an enzyme attempting to convert its bound substrate to product, and developed a protein redesign strategy that uses turnover dynamics data, machine learning models, and multistate protein design algorithms to predict enzyme variants with increased catalytic activity.	

In vitro Modeling of Glioblastoma Invasion <i>Undergraduate Research Assistant</i>	UIUC 2016 - 2018
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Developed a microfluidic platform for modeling glioblastoma invasion in the context of a vascularized brain-mimetic hydrogel with tunable biochemical and biophysical properties. Presented results at multiple national conferences and symposiums.

Short-term projects

High-throughput profiling of barcoded double-gene mutants (UC Berkeley 2017 summer).
Controlled intestinal differentiation of hiPSCs (MIT 2015 summer).
Template-directed synthesis of branched polymer architectures (UIUC 2014 - 2015).
Computational analysis of theoretical organic catalysts (HCC 2013 fall).
Plasma speaker and coil gun construction (HCC 2013 - 2014).

INSTRUCTIONAL EXPERIENCE

Principles of Molecular Bioengineering (20.420) Teaching Assistant	<i>MIT Fall 2019</i>
Graduate level course for Biological Engineering students. Hosted office hours, graded exams, projects, and problem sets.	
Chemical Eng. Thermodynamics (ChBE 321) Teaching Assistant	<i>UIUC Spring 2018</i>
Included on list of “ranked as excellent” by students. Led weekly discussion section (problem-based lecture), hosted office hours, wrote and graded exams and problem sets.	
Chemical Reaction Engineering (ChBE 424) Teaching Assistant	<i>UIUC Fall 2017</i>
Graded problem sets.	
Mass Transfer Operations (ChBE 422) Teaching Assistant	<i>UIUC Spring 2017</i>
Wrote exams, substituted for discussion sections, graded exams and problem sets.	
Principles of Chem. Eng. (ChBE 221) Teaching Assistant	<i>UIUC Fall 2016</i>
Led weekly discussion section (problem-based lecture), hosted office hours, wrote and graded problem sets, graded exams.	
Design Project Mentor	<i>UIUC 2016 - 2018</i>
Met with and oversaw groups of engineering students working on the designs related to thermodynamics.	
C.A.R.E. Engineering Tutor	<i>UIUC 2016</i>
Tutored engineering students (in both group and 1-on-1 settings) in chemistry, math, physics, and chemical engineering. Led study halls for chemistry and exam review sessions for chemistry and physics.	

HONORS AND AWARDS

NSF GRFP: fellowship for research and doctoral studies funding	<i>2018 - 2021</i>
MIT Viterbi Fellow: research and doctoral studies funding	<i>2018</i>
Stamps Leadership Scholar: most generous and selective award offered by UIUC	<i>2014 - 2018</i>
Amgen Scholar - Berkeley: research experience scholarship	<i>2017</i>
Goldwater Scholar: nationally prestigious undergraduate award in STEM	<i>2016</i>
Phi Beta Kappa Inductee	<i>2016</i>
Bronze Tablet Recipient: designates top 3% of UIUC graduates	<i>2018</i>
Franklin A. Boyle Scholarship: merit-based award in UIUC Chem. Eng.	<i>2018</i>
Chem. Eng. Alumni Scholarship: merit-based award in UIUC Chem. Eng.	<i>2017</i>
Dale Willard and Arlene Jay Robb Endowed Scholarship: in UIUC College of LAS	<i>2017</i>
Carl R. Woese Research Scholarship: stipend for research at UIUC IGB	<i>2016</i>
Chancellor's Scholar: UIUC's highest honors program (125/7000 students)	<i>2014 - 2018</i>
James Scholar: UIUC honors program (top 20% of students)	<i>2014 - 2018</i>
Graduated with Honors: completion of HCC's honors program	<i>2014</i>
Summa Cum Laude: one of two HCC students to graduate with 4.0 GPA	<i>2014</i>
HCC Physical Science Award: one recipient in class	<i>2014</i>
Rotary Scholarship: two recipients from HCC	<i>2014</i>
Tim Milroy Basketball Scholarship: awarded for basketball and academics	<i>2014</i>

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Stamps Scholars National Foundation Program	2014 - present
Phi Beta Kappa Honors Society	2016 - present
Phi Theta Kappa Honors Society	2013 - 2014

OUTREACH

Momentum AI

Participated as an instructor for three students in the Momentum 4 Ukraine program.

Critter Camp Exotic Pet Sanctuary

Helped in the care and maintenance of over 200 abandoned exotic pets and animals.

PEER REVIEWED PUBLICATIONS

Karvelis, E., Swanson, C., Tidor, B. Substrate turnover dynamics guide ketol-acid reductoisomerase redesign for increased specific activity. *In preparation*.

Ngo, M. T., Karvelis, E., Harley, B. A. C. Multidimensional hydrogel models reveal endothelial network angiocrine signals increase glioblastoma cell number, invasion, and temozolomide resistance. *Integrative Biology*, 12(6):139-149. 2020. <https://doi.org/10.1093/intbio/zyaa010>

Ngo, M. T., Harley, B. A. C. The influence of hyaluronic acid and glioblastoma cell co-culture on the formation of endothelial cell networks in gelatin hydrogels. *Adv. Healthc. Mat.*, 6(22):1700687. 2017. (Acknowledged).

Marciel, A. B., Mai, D. J., Schroeder, C. M. Template-directed synthesis of structurally-defined branched polymer architectures. *Macromolecules*. 2015. (Acknowledged).

PRESENTATIONS

37th Annual Symposium of the Protein Society; Boston, MA: Karvelis, E., Tidor, B. *Relating Turnover Dynamics to Catalytic Efficiency Identifies Enzyme Mutants with Increased Activity*. Poster. July 14, 2023.

ACS Spring 2023; Indianapolis, IN: Karvelis, E., Tidor, B. *Turnover dynamics and machine learning guide redesigning KARI for increased catalytic activity*. Oral. March 29, 2023.

<https://acs.digitellinc.com/sessions/535607/view>

67th Biophysical Society Annual Meeting; San Diego, CA: Karvelis, E., Tidor, B. *Using turnover dynamics to redesign KARI for improved catalytic activity*. Oral. Feb. 21, 2023.

<https://doi.org/10.1016/j.bpj.2022.11.1754>

Molecular Machine Learning Conference; Cambridge, MA: Karvelis, E. *Modeling substrate turnover dynamics to guide the redesign of a natural enzyme for increased activity*. Poster. Oct. 21, 2022.

Bioengineering and Toxicology Seminar; Cambridge, MA: Karvelis, E. *A Dynamics-based Approach Toward Redesigning a Natural Enzyme*. Oral. April 8, 2022.

MIT Biological Engineering Retreat; Boston, MA: Karvelis, E., Tidor, B. *Redesigning a natural enzyme for enhanced activity*. Poster. March 25, 2022.

Bioengineering and Toxicology Seminar; Cambridge, MA: Karvelis, E. *Understanding and Re-engineering Enzymes Using Molecular Dynamics*. Oral. February 12, 2021.

Undergraduate Research Symposium; Urbana, IL: Karvelis, E., Ngo, M., Harley, B. *Modeling Glioblastoma Invasion with Microfluidic Chips*. Poster. April 13, 2018.

BMES National Conference; Phoenix, AZ: Karvelis, E. *Modeling Glioblastoma Invasion with Microfluidics*. Oral. Oct. 14, 2017.

Energy Biosciences Building Colloquium; Berkeley, CA: Karvelis, E. *High-throughput Identification of Genetic Interactions Using Barcoded Transposon Mutants*. Oral. Aug. 4, 2017.

Amgen Scholars Symposium; Berkeley, CA: Karvelis, E. *High-throughput Profiling of Barcoded Double Mutants*. Oral. Aug. 3, 2017.

Amgen Scholars Poster Symposium; Berkeley, CA: Karvelis, E., Wetmore, K., Price, M., Deutschbauer, A., Arkin, A. *High-throughput Profiling of Barcoded Double Mutants*. Poster. July 31, 2017.

Undergraudate Research Symposium; Urbana, IL: Karvelis, E., Ngo, M., Kamm, R., Harley, B. *Modeling Glioblastoma Using Microfluidics*. Poster. April 27, 2017.

BMES National Conference; Minneapolis, MN: Karvelis, E., Ngo, M., Gilchrist, A., Kamm, R., Harley, B. *Utilizing Microfluidics to Recapitulate the Microenvironment of Glioblastoma*. Poster. Oct. 8, 2016.

iBio Research Symposium; Urbana, IL: Karvelis, E. *Utilizing Microfluidics to Recapitulate the Microenvironment of Glioblastoma*. Oral. July 28, 2016.

Undergraduate Research Symposium; Urbana, IL: Karvelis, E., Arora, N., Sofman, M., Griffith, L. *Using Microwells for Controlled Intestinal Differentiation of iPS Cells*. Poster. April 21, 2016.

Emergent Behaviors of Integrated Cellular Systems Summer Interns Symposium; Cambridge, MA: Karvelis, E. *Controlling Differentiation of iPS Cells into Hindgut Using Microwells*. Oral. Aug. 13, 2015.

MIT Undergraduate Researchers Poster Symposium; Cambridge, MA: Karvelis, E., Arora, N., Sofman, M., Griffith, L. *Using Microwells for Controlled Intestinal Differentiation of iPS Cells*. Poster. Aug. 6, 2015.