

CAMILLE Z. MCAVOY

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EDUCATION

California Institute of Technology

PhD Candidate, Chemistry; Emphasis: Biological Chemistry, GPA: 3.7/4.0

Pasadena, CA

Expected June 2018

Relevant Coursework: Biochemistry of Macromolecules, Neurobiology, Bioorganic Chemistry of Proteins, Biology of Cancer, Macromolecular Machines, Enzymology, Responsible Conduct of Research, Programming for the Biological Sciences Bootcamp (Python)

Massachusetts Institute of Technology

B.S. double major Chemistry and Chemical Engineering with biomedical concentration, Minor Biology

Cambridge, MA

GPA: 4.5/5.0

June 2012

Relevant Coursework: Biochemistry I, II and Lab, Organic Chemistry I, II, Advanced and Lab, Chemical and Biological Reaction Engineering, Experimental Biology Lab, Genetics, Biology of Bacteria Seminar, Neuroscience and Society

RESEARCH EXPERIENCE

ACADEMIC

Caltech Department of Chemistry

Graduate Researcher

Pasadena, CA

Nov. 2016-Present

Advisor: Douglas Rees

- Characterizing biocatalyzed carbon-carbon bond formation mechanisms for industrial synthesis applications using metalloenzyme nitrogenase with representative substrate methyl isonitrile.
- Developed understanding of structural biology strategies at the West Coast Protein Crystallography Workshop.

Advisor: Shu-ou Shan

Dec. 2012-Oct 2016

- Characterized structure-function relationship of plant-derived membrane protein chaperone cpSRP43 capable of preventing aggregation of amyloid-beta ($A\beta_{40}$) peptides found in Alzheimer's.
- Used cpSRP43 as a co-expression chaperone in *E. coli* to increase expression of membrane proteins, which are often very challenging to study because of their low expression.
- Trained two undergraduate researchers and two high school researchers to clone, express, purify, and characterize cpSRP43 mutants, resulting in co-authorship of these researchers on multiple publications.
- Membrane protein chaperone research secured a National Institutes of Health R01 grant of approximately \$1 million.
- Published work in *PNAS*; submitted a second manuscript to *JBC*; third manuscript is in preparation.

MIT Department of Organic Chemistry

Research Assistant

Cambridge, MA

Sept. 2010-May 2012

Advisor: Stephen L. Buchwald

- Developed palladium-catalyzed carbon-nitrogen cross-coupling methodologies for the synthesis of drug-like molecules using amidine salts with aryl halides as well as amides with ortho-substituted aryl iodides.
- Applied these methodologies to perform one-pot synthesis of pharmaceutically useful quinazoline derivatives.
- Published work in *Organic Letters* and presented a poster at the MIT Chemistry Research Symposium.

MIT Department of Biological Chemical Engineering

Student, Chemical Engineering Project Lab

Cambridge, MA

Feb. - May 2012

Advisor: Jean-François P. Hamel

- Increased biofuel yield from sorghum flour hydrolysis by 300% through optimization of heating apparatus, mixing impeller type, temperature, and reaction time.
- Presented poster at the Society for Industrial Microbiology and Biotechnology Conference in Washington DC.

MIT Department of Physical Chemistry

Research Assistant

Cambridge, MA

Feb. - May 2010

Advisor: Robert Field

- Worked to construct a slit-jet vacuum chamber to be used for chirped pulse experiments by putting together the components of the chamber, making measurements and technical drawings, designing and constructing a unistrut frame, and researching optics to be used.
- New chamber will be used to study molecular structures and intramolecular dynamics.

MIT AgeLab*Research Assistant, Age Suit Calibration*Cambridge, MA
June - Dec. 2009Advisor: Rozanne Puleo

- Developed a protocol of biometric tests for assaying the efficacy of the Age Gain Now Empathy System (AGNES), a full body suit that simulates the physical restrictions of age.
- AGNES has appeared in the New York Times (Natasha Singer, "In a Graying Population, Business Opportunity," 2011) and US News & World Report (Dennis Thompson, "High-Tech Suit Lets You Know What It's Like to Be Old," 2011).

INDUSTRIAL**Biogen Idec***Intern, Protein Formulation*Cambridge, MA
June - Aug. 2012

- Studied whether secondary structure analysis via FTIR could be utilized for monitoring Factor IX Fc (hemophilia drug candidate) protein damage under various stress conditions to ensure drug stability during shipping.
- Presented research poster at Biogen Idec Intern Poster Session and via PowerPoint presentation to lab group.

Merck & Co.*Intern, Process Chemistry*Rahway, NJ
June - Aug. 2011

- Developed one-pot Negishi cross-coupling methodology for C-C bond formation between crude thiazole zinc chloride mixture and various aryl bromides using RuPhos precatalyst with yield of 55-99%.
- Synthesized trisubstituted olefins via cross-coupling with yields of 55-74%.
- Presented research poster at Merck Intern Symposium.

BASF, The Chemical Company*Extern, Agricultural Chemistry*Research Triangle Park, NC
Jan. - Feb. 2011

- Studied environmental fate metabolism (hydrolysis, photolysis, and soil metabolism) using ^{14}C radioactive labeling and liquid scintillation counting to track the metabolic breakdown of a parent agricultural product molecule.

Pfizer Pharmaceuticals*Intern, Research API and Research Analytics*Groton, CT
June - Aug. 2010

- Performed two-step reductive amination reactions toward the synthesis of an ophthalmology target in order to study the effect of substrate electron density on reaction time using online FTIR and Raman spectroscopy to monitor reaction kinetics.
- Confirmed product formation via UPLC-MS and NMR and established standard operating procedures for using online spectroscopy tools for real time reaction monitoring.
- Presented research poster at Pfizer Intern Symposium; poster was also presented at Pfizer Global RA Symposium and GPC Forum; presented PowerPoint presentation to lab group.

TEACHING EXPERIENCE**Caltech Department of Chemistry***Head Teaching Assistant, Introduction to Biochemistry*Pasadena, CA
Oct. - Dec. 2013, 2015, 2016

Instructor: John Richards (2013), Scott Virgil (2015), Judith Campbell and Carl Parker (2016)

- Led a group of three graduate and two undergraduate teaching assistants (TA's).
- Prepared problem set and exam questions and graded problem sets and exams; organized a weekly recitation and conducted weekly office hours; organized reviews for the midterm and final.
- Interfaced between professors, TA's, and students to organize all course content (lectures, recitations, reviews, and assignments), and was honored for my TA work through an outstanding TA award and an invitation to a Caltech Academics and Research Committee (ARC) lunch.

Caltech Department of Chemistry*Teaching Assistant, Biophysical Chemistry: Thermodynamics*Pasadena, CA
Apr. - Jun. 2013, 2014, 2015

Instructor: Doug Rees

- Conducted recitations and review sessions for exams, conducted weekly office hours, graded problem sets and exams.

Caltech Department of Chemistry*Recitation Teaching Assistant, General Chemistry*Pasadena, CA
Jan. - Mar. 2013

Instructors: Sarah Reisman and Geoffrey Blake

- Conducted a weekly recitation section reviewing concepts from lecture and practicing problems similar to those found in assignments.

- Formulated problems for quizzes and exams and conducted weekly office hours.

Caltech Department of Chemistry

Teaching Assistant, *Fundamental Techniques of Experimental Chemistry*

Instructor: Jeffrey Mendez

Pasadena, CA
Oct. - Dec. 2012

- Oversaw students running chemistry experiments in an introductory lab course on a weekly basis.
- Graded weekly assignments, provided constructive feedback on technical understanding and scientific writing performance, and held weekly office hours.

TECHNICAL SKILLS

Experimental: Biology: Bacterial Cloning, PCR, Miniprep, QuikChange site-directed mutagenesis, Gel electrophoresis (agarose, SDS-PAGE), Bacterial Cell Culture (E. Coli and Azotobacter vinelandii), Protein Purification (soluble proteins, membrane proteins, anaerobic proteins), FPLC (AKTA and Bio-Rad), Dialysis, Lyophilization, Western Blot, EPR, NEM Alkylation, Fluorescence Anisotropy, Kinetic Light Scattering Assay, CD, Optical Microscopy. Chemistry: FTIR (KBr pellet, BioCell, ReactIR), UV-Vis Spectroscopy, NMR (Varian, Bruker), Raman spectroscopy, GC, HPLC, LC-MS, TLC, Flash Column Chromatography, Biotage, Glovebox.

Computational: Windows and Mac, Microsoft Office, SPSS, ChemBioDraw, Matlab, Mathematica, Java, iC software (for ReactIR), PyMOL, KaleidaGraph, Python, Inkscape, GIMP, HDX WorkBench, EndNote.

Language: Conversational speaking and reading knowledge of Spanish. Studied abroad in Madrid Jan.-Feb. 2010.

Machining: Basic machine and construction skills: drill press, hand drill, soldering, wire-cutting.

PUBLICATIONS

Camille Z. McAvoy, Fu-Cheng Liang, Vinh Lam, Gerard Kroon, Emily Miaou, Patrick Griffin, Peter Wright, and Shu-ou Shan. (2017) An ATP-Independent Chaperone Undergoes an Unfolded-Folded Transition Upon Substrate Binding. (manuscript in preparation)

Camille Z. McAvoy, Samantha Piskiewicz, Emily Miaou, Sonja Hess, and Shu-ou Shan. (2017) Two Distinct Sites of Client Protein Interactions in A Membrane Protein Chaperone. (submitted to JBC)

Fu-Cheng Liang, Gerard Kroon, **Camille Z. McAvoy**, Chris Chi, Peter E. Wright, and Shu-ou Shan. (2016) Conformational dynamics of a membrane protein chaperone enable spatially regulated substrate capture and release. *PNAS*.

Meredeth A. McGowan, **Camille Z. McAvoy**, Stephen L. Buchwald. (2012) Palladium-Catalyzed N-Monoarylation of Amidines and a One-Pot Synthesis of Quinazoline Derivatives. *Organic Letters*, 14, 3800-3803.

Camille Z. McAvoy. (2012) Palladium-Catalyzed C-N Cross-Coupling Reactions Toward the Synthesis of Drug-Like Molecules. Undergraduate Thesis. Massachusetts Institute of Technology.

PRESENTATIONS

Camille McAvoy, F-C. Liang, T. Nguyen, E. Miaou, S. Piskiewicz, and S-o. Shan. (2017) Dynamics of Membrane Protein-Chaperone Interaction. Poster Presentation at the Protein Society Annual Symposium, Montreal, Canada.

Camille McAvoy. (2016) Inter-domain Dynamics of an ATP-Independent Chaperone. Structural Biology Meeting. California Institute of Technology.

Camille McAvoy. (2015) Inter-domain Dynamics of an ATP-Independent Chaperone. Center for the Chemistry of Cellular Signaling Seminar Series. California Institute of Technology.

Camille McAvoy, George Liang, Thang Nguyen, Emily Miaou, and Shu-ou Shan. (2015) Inter-domain Dynamics of an ATP-Independent Chaperone. Biology and Biological Engineering Retreat, California Institute of Technology.

Fu-Cheng Liang, **Camille McAvoy**, Samantha Piskiewicz, and Shu-ou Shan. (2015) Inter-domain Dynamics of a Novel Chaperone Enable Effective Capture of Membrane Protein Substrates. American Biophysical Society Meeting. Baltimore.

Camille McAvoy. (2014) Understanding and Engineering cpSRP43 for Rescuing Protein Aggregates. Biolunch Presenter for Bi 251abc, NIH Trainee, California Institute of Technology.

Camille McAvoy, Ignatius Chen, Nikita Consul, Lina Song, Kyumin Lee, Jorge Kucharski, and Jean-François P. Hamel. (2012) Development of methodology for the hydrolysis pretreatment of sorghum during the biofuel production process. Society for Industrial Microbiology Conference.

Camille McAvoy, Lori Karpes, Mark Brader. (2012) FTIR Secondary Structure Analysis of rFIXFc Under Stress in Solution and Lyophilized Forms. Biogen Idec Intern Symposium.

Camille McAvoy, Siraj Ali, Brett Fors, Stephen L. Buchwald. (2011) Palladium-Catalyzed Cross-Coupling of Ortho-Substituted Aryl Iodides with Amides. Poster presented at both the MIT Undergraduate Chemistry Research Symposium and the MIT 150 Undergraduate Research Opportunities Program (UROP) Symposium.

Camille McAvoy and Michael Luzung. (2011) Negishi Cross-Coupling of Thiazole Zinc Reagent with Aryl Bromides. Merck Intern Symposium.

Camille McAvoy, Mark Barrila, Raymond Chen, Dan Bowles. (2010) Studying Reductive Amination via in-situ Reaction Monitoring: A practical application of online IR and Raman technologies. Pfizer Intern Symposium.

CONFERENCES ATTENDED

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| Protein Society Annual Symposium. (2017) | Montreal, Canada |
| West Coast Protein Crystallography Workshop. (2017) | Asilomar, CA |
| Moving Targets 2016: Disease-Driven Aging. (2016) | Los Angeles, CA |

AWARDS/HONORS

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| Protein Science Travel Award | May 2017 |
| Caltech Microbiology Travel Grant Award | Apr. 2017 |
| Outstanding TA Award | Dec. 2016 |
| Philanthropic Education Organization (P.E.O.) Scholar | Mar. 2015 |
| Mike and Stella Banich Chemistry and Chemical Engineering Fellowship | Jun. 2014 |
| NIH/NRSA Training Grant Fellow | July 2013 - July 2015 |
| National Science Foundation Graduate Research Fellowship Program Honorable Mention | Mar. 2013 |
| Robert and Sara-Ann Sanders Scholar, MIT | Sept. 2008 - May 2012 |
| St. Petersburg Times Barnes Scholar | Sept. 2008 - May 2012 |
| Robert Byrd Honors Scholar | Sept. 2008 - May 2010 |
| National Advanced Placement Scholar | June 2008 |
| National Merit Finalist | Dec. 2008 |
| Sunshine State Scholar Regional Alternate | Dec. 2008 |
| Valedictorian, Frank W. Springstead High School | Jun. 2008 |

ACTIVITIES

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| Caltech Y Washington DC Science Policy Trip | Dec. 2016 |
| <i>Social Media Chair</i> , Caltech Women in Chemistry | Jun. 2016-Present |
| Caltech Y Photo Contest Finalist | May 2016 |
| <i>Mentor</i> to Summer Undergraduate Research Fellowship (SURF) students in Shu-ou Shan lab | Mar. 2014-Mar. 2016 |
| <i>Secretary</i> , Caltech Catalina Community Associates (Graduate Social Planning Committee) | Feb. 2014-Present |
| <i>Member</i> , Caltech Women in Chemistry | Dec. 2013-Present |
| <i>Mentor</i> , Women Mentoring Women | Sept. 2013-Present |
| <i>Big Sibling/Mentor</i> , Caltech Chemistry Big Sibling/Little Sibling Program | Jun. 2013-Jun. 2015 |
| <i>Information Guide Volunteer</i> , Huntington Library | Jun. 2013-Dec. 2013 |
| <i>Mentor</i> to High School Summer Researchers in Shu-ou Shan lab | Jun. - Aug. 2013 |
| Caltech Chemistry Club Outreach: Elementary, Middle and High School Chemistry Demonstrations | May-Dec. 2013 |
| <i>Mentee</i> , Women Mentoring Women | Oct. 2012 - Aug. 2013 |
| <i>President</i> , National Society of Collegiate Scholars, MIT | Sept. 2010-May 2012 |
| <i>Mentor</i> , PLUS Mentor Program | Feb. 2011 - May 2011 |
| <i>Member</i> , Community Catalyst Leadership Program | Sept. 2010 - May 2011 |

Staff Writer, The Tech (MIT Newspaper)
Member, Society for Women Engineers, MIT
Member, MIT Undergraduate Biochemistry Association

Jun. 2009 - Mar. 2010
Sept. 2009 - May. 2011
Dec. 2008 - May 2010

PROFESSIONAL MEMBERSHIPS

Associate Member, Sigma Xi, The Honor Society for Scientists and Engineers
Member, American Chemical Society
Member, American Institute of Chemical Engineers

May 2012 - Present
Sept. 2010-Present
Sept. 2010-Present