

# CAMILLE Z. MCAVOY

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## EDUCATION

### California Institute of Technology

PhD, Department of Chemistry, GPA: 3.7/4.0

Pasadena, CA

June 2018

### Massachusetts Institute of Technology

B.S. Double Major Chemistry and Chemical Engineering, Minor Biology, GPA: 4.5/5.0

Cambridge, MA

June 2012

## RESEARCH EXPERIENCE

### INDUSTRIAL

#### Ionis Pharmaceuticals

Senior Scientist, Developmental Chemistry

Carlsbad, CA

July 2018 - Present

- Optimize oligonucleotide drug synthesis for yield and purity through variation and characterization of such parameters as coupling conditions, sulfurization reagent and conditions, capping method, and temperature.
- Improve oligonucleotide purity through development of reversed phase chromatography and anion exchange chromatography methods.
- Perform coupling reactions to modify oligonucleotides for specific targeting.
- Analyze oligonucleotide products via ion-pair high performance liquid chromatography paired with mass spectrometry.
- Present research through Process Research presentations and Developmental Chemistry Reports.

#### Biogen Idec

Intern, Protein Formulation

Cambridge, MA

Jun. - 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.

Rahway, NJ Intern, Process Chemistry

Jun. - 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.

#### Pfizer Pharmaceuticals

Intern, Research API and Research Analytics

Groton, CT

Jun. - 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 and PowerPoint presentation to lab group.

### ACADEMIC

#### Caltech Department of Chemistry, Graduate Researcher

Advisor: Dr. Douglas Rees

Pasadena, CA

Nov. 2016-Present

- 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: Dr. 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 $\beta$ <sub>40</sub>) 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 and two high school researchers to express, purify, and characterize cpSRP43 mutants.
- Membrane protein chaperone research secured a National Institutes of Health R01 grant of approximately \$1 million.
- Published work in *PNAS* and *JBC*.

**MIT Department of Organic Chemistry, Undergraduate Researcher**

Cambridge, MA

Advisor: Dr. Stephen L. Buchwald

Sept. 2010-May 2012

- 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, Undergraduate Researcher**

Cambridge, MA

Advisor: Dr. Jean-François P. Hamel

Feb. - May 2012

- 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.

**TEACHING EXPERIENCE****Caltech Department of Chemistry**

Pasadena, CA

Biochemistry (2013, 2015, 2016), Biophysical Chemistry (2013, 2014, 2015), General Chemistry (2013), Chemistry Lab (2012)

- Organized weekly recitations and office hours, prepared problem set and exam questions, graded assignments.
- Received an outstanding teaching assistant (TA) award for biochemistry instruction.

**TECHNICAL SKILLS**

**Experimental:** Chemistry: Oligonucleotide Synthesis (AKTA oligopilot), Oligonucleotide Purification (AKTA Avant 25), IP-HPLC-UV, FTIR (KBr pellet, BioCell, ReactIR), UV-Vis Spectroscopy, NMR (Varian, Bruker), GC, HPLC, LC-MS, TLC, Flash Column Chromatography, Biotage, Glovebox.

Biology: Bacterial Cloning, PCR, Miniprep, 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.

**Computational:** Microsoft Office, ChemBioDraw, Matlab, PyMOL, KaleidaGraph, Inkscape, HDX Workbench.

**PUBLICATIONS**

- **C. Z. McAvoy**, A. Siegel, S. Piskiewicz, E. Miaou, M. Yu, T. Nguyen, A. Moradian, M. Sweredoski, S. Hess, and S. Shan. (2018) Two Distinct Sites of Client Protein Interaction with the Chaperone cpSRP43. *JBC*.
- F.-C. Liang, G. Kroon, **C. Z. McAvoy**, C. Chi, P. E. Wright, and S. Shan. (2016) Conformational dynamics of a membrane protein chaperone enable spatially regulated substrate capture and release. *PNAS*, **113**, 12.
- M. A. McGowan, **C. Z. McAvoy**, S. L. Buchwald. (2012) Palladium-Catalyzed N-Monoarylation of Amidines and a One-Pot Synthesis of Quinazoline Derivatives. *Organic Letters*, **14**.

**SELECTED PRESENTATIONS**

- **C. McAvoy**, F.-C. Liang, T. Nguyen, E. Miaou, S. Piskiewicz, and S. Shan. (2017) Dynamics of Membrane Protein-Chaperone Interaction. Poster Presentation at the Protein Society Annual Symposium, Montreal, Canada.
- **C. McAvoy**. (2015) Inter-domain Dynamics of an ATP-Independent Chaperone. Center for the Chemistry of Cellular Signaling Seminar Series. California Institute of Technology.
- **C. McAvoy**, I. Chen, N. Consul, L. Song, K. Lee, J. Kucharski, and J.-F. P. Hamel. (2012) Development of methodology for the hydrolysis pretreatment of sorghum during the biofuel production process. Society for Industrial Microbiology Conference.
- **C. McAvoy**, S. Ali, B. Fors, S. L. Buchwald. (2011) Palladium-Catalyzed Cross-Coupling of Ortho-Substituted Aryl Iodides with Amides. MIT 150 Chemistry Symposium and Undergraduate Research Symposium.

**AWARDS/HONORS**

Finn Wold/Protein Science Travel Award	May 2017
Caltech Microbiology Travel Grant Award	Apr. 2017
Philanthropic Education Organization (P.E.O.) Scholar	Mar. 2015
NIH/NRSA Training Grant Fellow	July 2013 - July 2015
Mike and Stella Banich Chemistry and Chemical Engineering Fellowship	Jun. 2014
Honorable Mention, National Science Foundation Graduate Research Fellowship Program	Mar. 2013

**ACTIVITIES**

Vice President, Caltech Women in Chemistry	Jun. 2016-Jun. 2018
Caltech Chemistry Club Outreach	May-Dec. 2013
President, National Society of Collegiate Scholars, MIT	Sept. 2010-May 2012