

SARAH KRONHEIM

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Education

Doctor of Philosophy Candidate in Biochemistry

2016 – Present

University of Toronto

Bachelor of Science in Biochemistry and Molecular Biology

2009 – 2013

University of Maryland, Baltimore County

Research Experience

Ph.D. Researcher

September 2016 – Present

University of Toronto, Department of Biochemistry, Toronto, ON Canada

- Developed and optimized a phage propagation assay using *Streptomyces*-specific phages and *Streptomyces coelicolor* to determine the effect of compounds on phage propagation
- Optimized purification of compounds from whole cell extracts of several species of *Streptomyces* via HPLC and characterized the impact of resulting compounds on phage infection using a set of assays to isolate the stages of the phage lifecycle
- Sequenced, annotated, and bioinformatically analyzed genomes of 12 isolated phages that infect *Streptomyces* and characterized their infection phenotype and host range
- Discovered an anti-phage function of *Streptomyces* xenogenic silencing proteins and a role for phage-encoded xenogenic silencing proteins in overcoming anti-phage defense using plaque assays and heterologous expression of phage proteins in *Streptomyces*
- Discovered the mechanism which two phage proteins overcome anti-phage defense by *Streptomyces* xenogenic silencers via protein expression and co-purification experiments, electrophoretic mobility shift assays, and bioinformatic analysis
- Mentored, trained, and lead projects for 3 undergraduate and 4 rotation students

Formulation Associate I

May 2016 – August 2016

National Institutes of Health – Vaccine Production Program, Gaithersburg, MD

- Optimized PEG solubility assay protocol via literature review, modification of assay protocol, and research into liquid handling machines
- Determined optimal solubility conditions for several vaccine candidates via PEG solubility assay
- Trained a new hire on PEG solubility assay

Research Assistant

2015 – 2016

Fina BioSolutions, Rockville, MD

- Optimized purification of proteins via affinity (Nickel, eXact, Heparin-like resin) and ion exchange (Q, DEAE resin) liquid chromatography and analyzed resulting proteins with ELISA, SDS-PAGE, Western blot, and spectrophotometry

- Transformed and expressed plasmids in *E. coli* in a 1L fermentor and ran tangential flow filtration (TFF) to concentrate and buffer exchange protein samples for purification
- Drafted SOP and Batch Record for a purification process, experimental and batch record keeping

Research Assistant

Summer 2012, 2013 – 2015

US NewWin, Rockville, MD

- Analyzed plasmids using PCR and agarose gel electrophoresis, transformed plasmids into *E. coli*, and expressed proteins from *E. coli* using a 1L fermentor
- Purified proteins from *E. coli* using affinity chromatography and analyzed using SDS-PAGE, BCA, Bradford, and colorimetric activity assays
- Copyedited product information sheets and business e-mails distributed to clients

Publications

- **Kronheim, Sarah.**, Daniel-Ivad, M., Duan, Z., Hwang, S., Wong, A., Mantel, I., Nodwell, J.R., and Maxwell, K.L. "A Chemical Defence against Phage Infection." *Nature*, vol. 564, no. 7735, Dec. 2018, pp. 283–286.

Talks

- **Kronheim, Sarah** and Maxwell, KL (06/2022). A phage-encoded Lsr2-like protein overcomes host LsrL-mediated phage defence in *Streptomyces venezuelae*. International Symposium on the Biology of Actinomycetes Conference. Toronto, ON.
- **Kronheim, Sarah**, Daniel-Ivad M, Duan Z, Wong A, Mantel I, Nodwell JR, and Maxwell KL (08/2019). A small molecule anti-phage defense system in *Streptomyces*. Molecular Genetics of Bacteria and Phage conference. Maddison, WI, USA.
- **Kronheim, Sarah**, Daniel-Ivad M, Duan Z, Wong A, Mantel I, Nodwell JR, and Maxwell KL (09/2019). A chemical defence against phage infection. University of Toronto Department of Biochemistry departmental retreat, Top Publication. Orillia, ON.
- **Kronheim, Sarah**, Daniel-Ivad M, Duan Z, Wong A, Mantel I, Nodwell JR, and Maxwell KL (01/2019). Small molecules provide a novel anti-phage defense mechanism in *Streptomyces*. MicrobeTO seminar series. Toronto, ON.
- **Kronheim, Sarah**, Daniel-Ivad M, Duan Z, Wong A, Mantel I, Nodwell JR, and Maxwell KL (2017). Small molecule anti-phage defense mechanisms in *Streptomyces*. University of Toronto Department of Biochemistry departmental retreat. Innisfil, ON.

Posters

- **Kronheim, Sarah**, "A phage-encoded Lsr2-like protein overcomes host Lsr2-mediated phage defence in *Streptomyces venezuelae*," Presented at the Canadian Society of Microbiologists annual conference 2022, Guelph, ON.

- **Kronheim, Sarah.**, Daniel-Ivad, M., Duan, Z., Wong, A., Mantel, I. Nodwell, J.R., and Maxwell, K.L. "*Small molecule anti-phage defense mechanisms in Actinomycetes.*" Poster presented at the Canadian Society of Microbiologists annual conference 2017, Waterloo, ON.
- Oganessian, N., Van Druff, J., Robb, F. Ollivault-Shiflett, M., **Kronheim, S.**, Simon, R., and Lees, A. "*Characterization of EcoCRMTM, an E. coli Expressed CRM197 Conjugate Vaccine Carrier Protein.*" Poster presented at the World Vaccine Congress 2016 by Dr. Andrew Lees.

Honors and Awards

- Ontario Graduate Scholarship 2019-2020
 - \$15,000
 - University of Toronto Biochemistry Top Publication 2018
 - \$500
 - Best first author paper by a graduate student in the department
 - University of Toronto Fellowship 2016-2017
 - \$12,000
 - Phi Beta Kappa National Honor Society 2013
 - UMBC Premier Award Merit Scholarship 2009-2013
 - \$15,000 per year for 4 years
 - ≥ 3.5 GPA requirement
 - UMBC President's Honors List each semester (4.0 GPA) 2009-2013
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Volunteer and Community Activities

Organizer Phage Canada Virtual Conference Summer 2020

- Participated in group organization of 2020 Phage Canada virtual conference
- Managed the zoom meeting and ensured the correct slides were in place at the proper time for Symposium 4
- Planned and executed social games including trivia at Symposia 1 and 4

Hospital Elder Life Program Volunteer October 2016 – April 2018 Toronto Western Hospital, Toronto, ON

- Visited elderly inpatients to assess their condition and entertain them with conversation, newspapers, and card games

Assistant Karate Instructor Fall 2006 – Summer 2016 Hill's Hitters and Ring Dragon Karate Clubs, Silver Spring, MD

- Instructed adults and children in the basics of karate, both individually and in groups

Participant, Captain, Secretary, Match Secretary Fall 2009 – Spring 2013 UMBC Women's Rugby Football Club, Baltimore, MD

- Captain: designed and led club practices between coaches, directed players on the field, encouraged attendance at practices and games (Spring, 2011- Spring 2013)
- Secretary: took notes at club executive board meetings, contributed ideas to the running of the club including recruiting efforts and fundraising (Spring 2011- Fall 2012)
- Match Secretary: communicated with other college club teams to set up match schedules each semester, planned social gatherings for the club (Fall 2010 – Spring 2011)