

CYNTHIA H. COLLINS

Assistant Professor

Department of Chemical & Biological Engineering

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RESEARCH INTERESTS: Polymicrobial communities, protein engineering/directed evolution, intercellular communication, systems and synthetic biology, biofilms, metabolic engineering

EDUCATION

- 2006** California Institute of Technology, Pasadena, CA
Ph.D., Biochemistry and Molecular Biophysics
Thesis advisor: Frances Arnold
Dissertation: Directed evolution of the quorum-sensing transcriptional regulator LuxR
- 2000** University of Toronto, Toronto, ON, Canada
Honours B.Sc. with High Distinction, Chemistry and Biochemistry

PROFESSIONAL EXPERIENCE

- 2008-present** *Assistant Professor*, Department of Chemical and Biological Engineering, Rensselaer Polytechnic Institute.
- 2006-2008** *Postdoctoral Scholar*, Surette Research Group, Department of Microbiology and Infectious Diseases, University of Calgary, Calgary, AB, Canada.

AWARDS AND HONORS

- Entrepreneurship course development grant, Rensselaer Polytechnic Institute (2009)
- Alberta Ingenuity Post-doctoral Fellowship (2006-2008)
- ASM Travel Grant to attend the ASM conference on cell-cell communication in bacteria in Banff, Canada (2004)
- Institute Graduate Fellowship, California Institute of Technology (2000-2001)
- NSERC Undergraduate Student Research Award (1999)
- Dean's List, University of Toronto, 1996-2000

PUBLICATIONS

Peer-Reviewed Manuscripts Published

1. Pai, A., Tanouchi, Y., Collins, C.H., and You, L.C., (2009). Engineering multicellular systems by cell-cell communication. *Curr. Opin. Biotechnol.* **20**, 461-70.
2. Balagaddé, F.K., Song, H., Ozaki, J., Collins, C.H., Barnet, M., Arnold, F.H., Quake, S.R., and You, L. (2008). A synthetic *Escherichia coli* predator-prey ecosystem. *Mol. Sys. Biol.* **4**, 187.
3. Collins, C.H., Leadbetter, J.R., and Arnold, F.H. (2006). Dual selection enhances the signaling specificity of a variant of the quorum-sensing transcriptional activator LuxR. *Nat. Biotechnol.* **24**, 708-712.
4. Basu, S., Gerchman, Y., Collins, C.H., Arnold, F.H. and Weiss, R. (2005). A synthetic multicellular system for programmed pattern formation. *Nature* **434**, 1130-1134.
5. Collins, C.H., Arnold, F.H. and Leadbetter, J.R. (2005). Directed evolution of *Vibrio fischeri* LuxR for increased sensitivity to a broad spectrum of acyl-homoserine lactones. *Mol. Microbiol.* **55**, 712-23.
6. Yokobayashi, Y., Collins, C.H., Leadbetter, J.R., Weiss, R. and Arnold, F.H. (2003). Evolutionary design of genetic circuits and cell-cell communications. *Advances in Complex Systems* **6**, 37-45.
7. Collins, C.H., Yokobayashi, Y., Umeno, D. and Arnold, F.H. (2003). Engineering proteins that bind, move, make and break DNA. *Curr. Opin. Biotechnol.* **14**, 371-8.
8. Jaikaran, D.C., Collins, C.H., and MacMillan, A.M. (2002). Adenosine to inosine editing by ADAR2 requires formation of a ternary complex on the GluR-B R/G site. *J. Biol. Chem.* **277**, 37624-37629.

PRESENTATIONS

Invited Talks and Seminars

1. Wadsworth Center, New York State Department of Health, Albany, NY (October 2009).
2. Synthetic Biology for Metabolic Engineering, Society for Industrial Microbiology Annual Meeting (July 2009).
3. NSF workshop on Molecular Communication: Biological Communications, Arlington, Virginia (February 2008).
4. University of Calgary, Bacterial Pathogenesis Research Group, Calgary, AB, Canada (April 2007).
5. Rensselaer Polytechnic Institute, Department of Chemical and Biological Engineering, Troy, NY (March 2007).

Contributed to National/International Meetings

1. Collins, C.H. (speaker), and Surette, M.G. "Construction and transcriptional analysis of a tunable polymicrobial community." International Workshop on Defining Issues in Biofuels R&D (2008), Calabria, Italy (poster).
2. Collins, C.H. (speaker), and Surette, M.G. "Construction and transcriptional analysis of a tunable polymicrobial community." Gordon Research Conference on the Metabolic Basis of Ecology (2008), Biddeford, Maine, (poster).
3. Collins, C.H. (speaker), and Surette, M.G. "Construction and transcriptional analysis of a tunable polymicrobial community." AIChE Annual Meeting (2007), Salt Lake City, Utah.

4. Collins, C.H. (speaker), and Surette, M.G. "Construction and transcriptional analysis of a tunable polymicrobial community." International Conference on Systems Biology (2007), Long Beach, California, (poster).
5. Collins, C.H. (speaker), Leadbetter, J.R., and Arnold, F.H. "Laboratory evolution of *Vibrio fischeri* LuxR yields variants with increased sensitivity to a broad spectrum of acyl-homoserine lactones." ASM Cell-cell communication in bacteria conference (2004), Banff, Alberta, Canada (poster).
6. Collins, C.H. (speaker), Leadbetter, J.R., and Arnold, F.H. "Directed evolution of LuxR-mediated transcriptional activation." FASEB Summer Research Conference on Mechanism and Regulation of Prokaryotic Transcription (2003), Saxtons River, Vermont (poster).

TEACHING ACTIVITIES

Courses Developed and Taught

CHME 4430/6430 Introduction to Biochemical Engineering (G/UG): Fall 2009.

CHME 4170 Biotechnology and Bioprocessing Laboratory (UG, seniors): Taught Spring 2009, 2010.

CHME 4961/6961 Systems and Synthetic Biology (G/UG): Spring 2010. This interdisciplinary course was cross-listed in chemical engineering, chemistry, biology, biomedical engineering and electrical, computer and systems engineering. Cynthia Collins and Agung Julius (ECSE) developed this course.

RESEARCH ADVISING ACTIVITIES

Ph.D. Students (4)

- Woo Seong Kim (ChBE), expected 2012, "Quorum sensing and motility in polymicrobial biofilms."
- Jasmine Shong (ChBE), expected 2012, "Directed evolution of the quorum-sensing repressor EsaR."
- Avathamsa Athirasala (ChBE), expected 2013, "Polymicrobial systems for bio-energy production." (Co-advised with Jonathan Dordick)
- Sandeep Chilukuri (ChBE), expected 2013, "Physical Interplay of motility and chemical signaling in populations of bacteria." (Co-advised with Patrick Underhill)
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Undergraduate Research Projects (5)

Sarah Whitfield
Hannah MacDonald
Melissa Winsten

Zachary Young
Eleana Manousthakis

Thesis Committee Member (3)

- Biochemistry and Biophysics: 1 Ph.D.
- Chemical and Biological Engineering: 2 Ph.D., 1 M.S.
- Environmental Engineering: 1 Ph.D.

PROFESSIONAL ACTIVITIES AND SERVICE

National and International

- Proposal Referee
 - National Science Foundation panel: 2008, 2009, 2010
 - Research Council of Norway: 2008
- American Institute of Chemical Engineers (AIChE)
 - Chair for Systems Biotechnology Session at Annual Meeting (2008, 2009)
 - Co-chair for Protein Engineering Session at Annual Meeting (2009)
- American Chemical Society (ACS)
 - Co-chair for Biophysical and Biomolecular Processes: Protein Folding and Biophysical Characterization at ACS National Meeting (2009)
- Journal Referee: *Applied Microbiology and Biotechnology*, *Nucleic Acids Research*, *Canadian Journal of Microbiology*, *Biochemical Engineering Journal*, *Biotechnology and Bioengineering*, *Chemical Engineering Science*
- Professional Societies: AIChE, American Chemical Society (ACS), American Society for Microbiology (ASM), Society for Industrial Microbiology (SIM)

University and College Service

- School of Engineering Freshman Orientation
- International Genetically Engineered Machine (iGEM) competition, Founder and Faculty Advisor (2008-present)
- Search Committee: Kodak Chair, Department of Civil and Environmental Engineering (2009-2010)

Department of Chemical and Biological Engineering Service

- Graduate admissions committee (2009-present)
- Departmental Seminar Coordinator (Spring 2009, Spring 2010)
- van Ness Award Lecture Coordinator (2009)
- Class of 2012 Advisor (2008-present)

CURRENT FUNDING

- NASA, Research Opportunities for Fundamental Space Biology Investigations in Microbial, Plant and Cell Biology (PI Collins, co-Is Dordick and Plawsky), "Gravitational effects on quorum sensing and biofilm formation." \$279,000, 06/2009 – 06/2012.
- NASA, Research Opportunities for Fundamental Space Biology Investigations in Microbial, Plant and Cell Biology (PI Collins, co-Is Dordick and Plawsky), "Gravitational effects on quorum sensing and biofilm formation – flight component" \$106,199 12/2009 – 11/2011.