

DANIELLE TULLMAN ERCEK

Curriculum Vitae

RESEARCH INTERESTS

My group is interested in controlling the movement of materials across biological membranes, with a goal of enabling and enhancing the production of pharmaceuticals, biofuels, and materials in microbes. Manipulating the transport of electrons, small molecules, and even signals across these cellular boundaries is a vital component of most synthetic biology applications, and we are developing the tools and methods to engineer membrane proteins and other protein superstructures to meet this grand challenge.

EDUCATION

Doctor of Philosophy in Chemical Engineering

University of Texas at Austin, 2006

Dissertation: Characterization and Engineering of the Twin-Arginine Translocation Pathway in *Escherichia coli* (Advisor: George Georgiou).

Bachelor of Science in Chemical Engineering, Biotechnology Specialization

Illinois Institute of Technology, Chicago, 2000

EMPLOYMENT

July 2016 – present — **Associate Professor, Northwestern University**

Department of Chemical and Biological Engineering, McCormick School of Engineering

Concurrent positions:

2016 – present — Faculty, Center for Synthetic Biology

2016 – present — Faculty, Chemistry of Life Processes

2016 – present — Investigator, Engineering Biology Research Consortium

July 2009 – June 2016 — **Assistant Professor, University of California Berkeley**

Department of Chemical and Biomolecular Engineering, College of Chemistry

Concurrent positions:

2011 – 2016 — Staff Scientist, Lawrence Berkeley National Laboratory, Molecular Biophysics and Integrated Bioimaging

2011 – 2016 — Faculty, Synthetic Biology Institute

2010 – 2016 — Faculty, Chemical Biology Graduate Program

2010 – 2016 — Core Faculty, Joint Graduate Group in Bioengineering

2010 – 2016 — Faculty, Quantitative Biosciences Institute

2009 – 2016 — Affiliate Principal Investigator, Synthetic Biology Engineering Research Center

November 2008 – June 2009 – **Post-doctoral Researcher, Lawrence Berkeley National Laboratory**

Project: Investigating the Role of Carbohydrate-Binding Modules on Cellulose Hydrolysis. (Advisors: Rajat Sapro and Blake Simmons)

January 2007 – October 2008 – **Post-doctoral Researcher, University of California – San Francisco**

Project: Reprogramming the *Salmonella* Type III Secretion System for Heterologous Protein Production. (Advisor: Christopher Voigt)

August – December 2000 – **Undergraduate Research Assistant, Illinois Institute of Technology**

Project: Squeeze Flow Modeling of Viscoelastic Fluids. (Advisor: David C. Venerus)

May – August 1998 – **Engineering Intern, Titanium Metals Corporation**

Project: Modeling of the Vacuum Arc Remelting Process for Titanium Alloys. (Advisor: Charles Clay)

HONORS AND AWARDS

Searle Leadership Award, 2015
Merck Chair in Biochemical Engineering, 2015-2016
Exxon Knowledge Build Award, 2015-2016
National Academy of Engineering - Frontiers of Engineering invited attendee, 2014
NSF CAREER Award, 2012
Hellman Family Faculty Fund Award, 2012
Paper of the Year, Journal of the Taiwan Institute of Chemical Engineers, 2010
Charles Wilke Endowed Chair in Chemical Engineering, 2009 - 2014
National Science Foundation Graduate Research Fellow, 2002-2005
Howard Hughes Medical Institute Predoctoral Fellowship Alternate, 2002
National Institute of Health Predoctoral Training Grant, 2001-2002

RESEARCH ACTIVITIES: PUBLICATIONS IN CHRONOLOGICAL ORDER

Bolded names indicate co-authors that were undergraduate researchers

1. DeLisa M.P., Tullman D., Georgiou G. (2003) "Folding quality control in the export of proteins by the bacterial twin-arginine translocation pathway." *Proc. Natl. Acad. Sci. USA* **100**: 6115-20.
2. Lee, P.A., Tullman-Ercek D., Georgiou G. (2006) "The bacterial twin-arginine translocation pathway." *Ann. Rev. of Microbiol.* **60**: 373-95.
3. Tullman-Ercek D., DeLisa M.P., Kawarasaki Y., **Iranpour P.**, Ribnicky B., Palmer T., Georgiou G. (2007) "Export pathway selectivity of *Escherichia coli* twin-arginine translocation signal peptides." *J. Biol. Chem.* **282**(11): 8309-16.
4. Temme K.T., Salis H., Tullman-Ercek D., Levskaya A., Hong S.H., Voigt C.A. (2008) "Induction and relaxation dynamics of the regulatory network controlling the type III secretion system encoded within *Salmonella* pathogenicity island I." *J. Mol. Biol.* **377**:47-61.
5. Fisher A.C., Kim J.Y., Tullman-Ercek D., Henderson L.A., DeLisa M.P. (2008) "Exploration of twin-arginine translocation for expression and purification of correctly folded proteins in *Escherichia coli*." *Microbial Biotechnol.* **1**(5):403-15.
6. Widmaier D.W., Tullman-Ercek D., Mirsky E.A., Hill R., Govindarajan S., Minshull J., Voigt C.A. (2009) "Engineering the *Salmonella* type III secretion system to export spider silk monomers." *Mol. Syst. Biol.* **5**:309.
7. Lee Y.F., Hsieh H.Y., Tullman-Ercek D., Chiang T.K., Turner R.J., Lin S.C. (2010) "Enhanced translocation of recombinant proteins via the Tat pathway with chaperones in *Escherichia coli*." *J. Taiwan Inst. Chem. Eng.* **41**(5):540-6. [Awarded Paper of the Year for this journal.]
8. Bokinsky G., Peralta-Yahya P.P., George A., Holmes B.M., Steen E.J., Dietrich J., Soon Lee T., Tullman-Ercek D., Voigt C.A., Simmons B.A., Keasling J.D. (2011) "Synthesis of three advanced biofuels from ionic liquid-pretreated switchgrass using engineered *Escherichia coli*." *PNAS.* **108**(50): 19949-54.
9. Glasgow J.E., Capehart S.L., Francis M.B., Tullman-Ercek D. (2012) "Osmolyte-mediated encapsulation of proteins inside MS2 viral capsids." *ACS Nano* **6**(10):8658-64.
10. Kim E.Y., Tullman-Ercek D. (2012) "Engineering nanoscale protein compartments for synthetic organelles." *Curr. Opin. Biotechnol.* **24**(4):627-32.

11. Fisher M.A., Tullman-Ercek D. (2013) "Change, exchange, and rearrange: protein engineering for the biotechnological production of fuels, pharmaceuticals, and other chemicals." *Curr. Opin. Biotechnol.* **24**(6):1010-6.
12. Reyes-Ortiz V., Heins R.A., Cheng G., Kim E.Y., **Vernon B.C., Elandt R.B.**, Adams P.A., Sale K.L., Hadi M.Z., Simmons B.A., Kent M.S., Tullman-Ercek D. (2013) "Addition of a carbohydrate-binding module enhances cellulase penetration into cellulose substrate." *Biotechnol. Biofuels* **6**(1):93.
13. Tullman-Ercek D. (2013) "An assay for the bacterial sweet spot." *Biotechnol. J.* **8**(12):1377-8. [Invited commentary]
14. Fisher M.A., Boyarskiy, S., **Yamada M.R., Kong N.**, Bauer, S.A., Tullman-Ercek D. (2014) "Enhancing tolerance to short-chain alcohols by engineering *Escherichia coli* AcrB to secrete the non-native substrate n-butanol." *ACS Syn. Bio.* **3**(1):30-40. [Cover article January 2014; Featured in C&ENews September 2013.]
15. Kim E.Y., Tullman-Ercek D. (2014) "A rapid flow cytometry assay for the relative quantification of protein encapsulation into bacterial microcompartments." *Biotechnol. J.* **9**(3): 348-54.
16. Glasgow J.E., Tullman-Ercek D. (2014) "Production and applications of engineered viral capsids." *Applied Microbiol. Biotechnol.* **98**(13):5847-58.
17. Kim E.Y., Slininger M.Y., Tullman-Ercek D. (2014) "The effects of time, temperature, and pH on the stability of Pdu bacterial microcompartments." *Prot. Sci.* **23**(10):1434-41.
18. Metcalf K.J., **Finnerty C.**, Azam A., **Valdivia E.**, Tullman-Ercek D. (2014) "Using transcriptional control to increase titer of secreted heterologous proteins by the type III secretion system." *Appl. Environ. Microbiol.* **80**(19):5927-34.
19. Kim E.Y., Jakobson C.M., Tullman-Ercek D. (2014) "Engineering transcriptional regulation to control Pdu bacterial microcompartment formation." *PLOS One* **9**(11):e113814.
20. Tullman-Ercek D. (2015) "Metabolism: 'Channeling' Hans Krebs." *Nat. Chem. Biol.* **11**(3):180-1. [Invited commentary]
21. Glasgow J.E., Asensio M.A., Jakobson C.M., Francis M.B., Tullman-Ercek D. (2015) "The influence of electrostatics on small molecule flux through a protein nanoreactor." *ACS Syn. Bio.* **4**(9):1011-9.
22. Boyarskiy S., Tullman-Ercek D. (2015) "Getting pumped: Membrane efflux transporters for enhanced biomolecule production." *Curr. Opin. Chem. Biol.* **28**:15-9.
23. Jakobson C.M., Kim E.Y., Slininger M.F., Chien A., Tullman-Ercek D. (2015) "Localization of proteins to the 1,2-propanediol utilization microcompartment by non-native signal sequences is mediated by a common hydrophobic motif." *J. Biol. Chem.* **290**(40):24519-33.
24. Boyarskiy S, Davis López S, **Kong N**, Tullman-Ercek D. (2016) "Transcriptional feedback regulation of efflux protein expression for increased tolerance to and production of n-butanol." *Metab. Eng.* **33**: 130-7.
25. Azam A., Tullman-Ercek D. (2016) "Type-III secretion filaments as scaffolds for inorganic nanostructures." *J. R. Soc. Interface* **13**(114):20150938.
26. Azam A., Metcalf K.J., **Li C.**, Tullman-Ercek D. (2016) "Type III secretion as a generalizable strategy for the development of peptide-based biomaterials." *Biotechnol. Bioeng.* (In press).

27. Jakobson C.M., Tullman-Ercek D. (2016) "Dumpster diving in the gut: bacterial microcompartments as part of a host-associated lifestyle." *PLoS Pathogens* 12(5):e1005558.

28. Jakobson C.M., **Chen Y.**, Slininger M.F., **Valdivia E.**, Kim E.Y., Tullman-Ercek D. (2016) "Tuning the catalytic activity of subcellular nanoreactors." *J. Mol. Biol.* 28(15):2989-96.

29. Asensio M., Morella N., Jakobson C.M., Hartman E.C., Glasgow J.E., Sankaran B., Zwart P.H., Tullman-Ercek D. "A single-point mutation in the capsid protein alters the assembled geometry of the bacteriophage MS2 capsid." *Nano Letters* (In press).

Submitted

S1. Slininger M.F., Jakobson C.M., Tullman-Ercek D. "Shell protein engineering to control small molecule transport in a bacterial microcompartment." (In revision).

S2. Glasgow A.A., Wong H.T., Tullman-Ercek D. "Identifying a dual role for *Salmonella* protein SipD in increasing protein secretion." (In revision).

S3. Metcalf K.J., Bevington J.L., **Rosales S.L.**, **Valdivia E.**, Tullman-Ercek D. "Proteins adapt a functionally active conformations in the media following type III secretion." (Submitted).

S4. Lopez, S.D., Griffith D.A., **Tabakh H.**, Tullman-Ercek D. "Enhanced tolerance toward carboxylic acids by transporter of polyamines (Tpo1) of *Saccharomyces cerevisiae*." (In revision).

PROFESSIONAL ACTIVITIES

Seminars and Conference Presentations: 48 invited talks by Tullman-Ercek and >100 additional conference presentations (>30 talks) by Tullman-Ercek and lab members on ongoing research.

Professional Organizations – Membership:

American Institute of Chemical Engineers, American Chemical Society, Society of Biological Engineers, Synthetic Biology Practices Working Group (past), American Society for Microbiology (past)

Professional Service Activities:

ACS Synthetic Biology, Editorial Board Member, 2011 – present

American Chemical Society, National Meeting Area Coordinator, 2014, Theme Committee 2013, Session Chair, 2013

American Institute of Chemical Engineers, Annual Meeting Session Chair, 2010 – present

American Society of Microbiology, Annual Meeting Plenary Session Organizer, 2012

Ad hoc Reviewer of >30 papers in past four years, for journals such as Nature Chemical Biology, Nature Chemistry, ACS Synthetic Biology, Journal of the American Chemical Society, Biotechnology and Bioengineering, and Chemical Engineering Science.

Ad hoc Grant Reviewer and Review Panelist on 8 panels in past four years, for agencies such as National Science Foundation and Department of Energy, and the Biotechnology and Biological Sciences Research Council (United Kingdom)

University Service – Department of Chemical and Biomolecular Engineering at University of California Berkeley:

Committee member for undergraduate research awards, undergraduate education, faculty searches, colloquium organization, and graduate admissions

Chair of Graduate Admissions

Undergraduate academic advisor for cohorts of ~20 – 30 students per semester

Public Service:

Conversations in Synthetic Biology, Invited panelist, 2015
Building with Biology, Chabot Center event presenter, 2015
Tullman-Ercek D. "From the Periodic Table to the Dinner Table" *Mom the Chemistry Professor* Eds. Cole R., Marzabadi C., Webster G., Woznack K. Cham:Springer, 2014. 113-128.
Bay Area Science Festival, Energy Biosciences Institute Booth, 2012 and 2014
Bay Area Science Festival, Co-organizer of Energy Biosciences Institute Booth, 2011
Soroptimist Club of San Francisco, Invited speaker, 2011
Bay Area Science Café, Invited speaker, 2011
Diablo Valley College International Exchange Center, Mentor and host of one to two international undergraduates per semester, 2010 – 2016

TEACHING AND MENTORING

Courses Taught as Primary Instructor, Department of Chemical and Biomolecular Engineering:

170A: Biochemical Engineering I, 3 units, taught three times with class sizes ~50 students
170B: Biochemical Engineering II. 3 units, taught three times with class sizes ~20 students
C270: Protein Engineering (Graduate elective). 3 units, taught three times with class sizes ~35 students
141: Chemical Engineering Thermodynamics. 4 units, taught twice with class sizes of ~130 students

Supervised Students – Postdoctoral Researchers:

Dr. Douglas Griffith (PhD Biochemistry, University of Kent, UK), January 2016 to present.
Dr. Georg Basler (PhD Bioinformatics, University of Potsdam, Germany), July 2015 to present.
Dr. Michael Fisher (PhD Molecular Biology, Princeton University), 2009 to 2013 (Current: Postdoc, Rutgers).

Supervised Students – Graduate Students:

Taylor Dickman, Chemical and Biological Engineering, 2016 to present.
Han-Teng Wong, Plant and Microbial Biology, 2015 to present.
Emily Hartman, Chemistry, 2015 to present.
Lisa Burdette, Chemical Engineering, 2014 to present.
Marilyn Slininger, Chemical Engineering, 2012 to present.
Christopher Jakobson, PhD Candidate in Chemical Engineering, 2012 to present.
Kevin Metcalf, PhD in Chemical Engineering, 2010 to 2016.
Norma Morella, Plant and Microbial Biology, 2015.
Stephanie A. Davis Lopez, PhD in Chemistry, 2011 to 2015 (Current: Scientist at Kiverdi).
Anum Azam, PhD in Bioengineering, 2011 to 2015 (Current: Postdoc at UCSF, Kortemme Lab).
Sergey Boyarskiy, PhD in Bioengineering, 2010 to 2015 (Current: Scientist at Intrexon/REG).
Michael Asensio, MS Bioengineering, 2013 to 2015 (Current: Scientist at Gigagen).
Jeff E. Glasgow, PhD Chemistry, 2010 to 2014 (Current: Postdoctoral researcher, Stanford University, Cochran lab).
Vimalier Reyes-Ortiz, PhD Bioengineering, 2009 to 2013 (Current: Process Engineer, Advent Engineering Services; Previous: Postdoctoral researcher, Joint Bioenergy Institute).
Edward Y. Kim, PhD Chemical Engineering, 2008 to 2013 (Current: Postdoctoral researcher, NIH, Ramamurthi lab).

42 undergraduate researchers were also trained under my supervision, of whom 12 went on to graduate school, and 12 are still completing their bachelor's degrees.