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| BIOGRAPHICAL SKETCH Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2. Follow this format for each person.  **DO NOT EXCEED FOUR PAGES.** | | | | |
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| NAME  Ross Carlson | | POSITION TITLE  Associate Professor of Chemical and Biological Engineering | | |
| eRA COMMONS USER NAME  ROSSCARLSON | |
| EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)* | | | | |
| INSTITUTION AND LOCATION | DEGREE  *(if applicable)* | | YEAR(s) | FIELD OF STUDY |
| University of Minnesota, Twin Cities | B.Sc. | | 1996 | Biochemistry |
| University of Minnesota, Twin Cities | M.S. | | 1998 | Microbial Engineering |
| University of Minnesota, Twin Cities | Ph.D. | | 2003 | Chemical Engineering |
| University of Minnesota, Twin Cities | Post-doc | | 2003-2004 | Systems Biology |
| Center for Biofilm Engineering, Bozeman | Post-doc | | 2004-2005 | Biofilms |

1. **Personal Statement.**

Carlson has a multidisciplinary education including degrees in biochemistry, microbiology and engineering; this background has strongly influenced his research interests and approaches. The Carlson laboratory integrates both *in silico* systems biology and bench top experiments to generate fundamental insight into medical, environmental and applied microbial processes. An overarching goal of these activities is to develop quantitative computational models that drive, organize and compile our experimental understanding. For example, the group has used *in silico* models of cellular economics and nutrient investment tradeoffs to guide chemostat and proteomics experiments that tested bacterial adaptation to a gradient of medically relevant iron limitation. Quantitatively consistent with the cellular economy predictions, the bacteria transitioned along a tradeoff surface ultimately fermenting glucose to lactic acid under completely aerobic conditions because that strategy represents the best physiological return on investment of limiting iron. The combination of theory and experiments has been extended from planktonic monocultures to consortia biofilms where the group is testing the ecological basis of competitive mass and energy fluxes between community members. The proposed research builds synergistically on the established strengths of the Carlson laboratory and its association with the MSU Center for Biofilm Engineering, a world renowned center for biofilm research. The novel research represents a multidisciplinary combination of *in silico* and experimental systems biology which will create powerful opportunities for developing rational microbial intervention strategies through linking omics data and physiological studies to multiscale computational models of consortia biofilms.

**B. Positions and Honors.**

**Positions**

1996 Fermentation Technician, Biotechnology Institute, St. Paul, MN

1996 - 1998 M.S. Graduate Research Associate, Friedrich Srienc, U of MN

1998 - 2003 Ph.D. Graduate Research Associate, Friedrich Srienc, U of MN

2003 - 2004 Postdoctoral Research Associate, Advisor: F. Srienc and A. Khodursky, U of MN 2004 - 2005 Postdoctoral Research Associate, Advisor: Philip Stewart, MSU, MT

2005 - 2011 Assistant Professor, Dept. of Chemical and Biological Engineering, MSU, MT

2011- present Associate Professor, Dept. of Chemical and Biological Engineering, MSU, MT

**Honors**

1998 - 2000 NIH Biotechnology Training Grant Fellow

2003 3M post-doctoral research grant in biotechnology

2010 Montana State University Award for Excellence

2010 MSU College of Engineering Award for Excellence in Research

2011 MSU Faculty Merit Award

2012 Center for Biofilm Outstanding Faculty of the Year

2012 MSU Faculty Merit Award

2013 Montana State University Award for Excellence

2015 MSU College of Engineering Award for Excellence in Teaching

C. Selected Peer-reviewed Publications (Selected from 45 peer-reviewed publications)

Most relevant to the current application

1. Folsom, J.P., Carlson R.P. (2015) Physiological, elemental composition, and proteomic analyses of Escherichia coli ammonium-limited chemostat growth with comparison to iron- and glucose-limited chemostat growth. Microbiology. 161: 1659-1970.
2. Beck, A., Hunt, K.A., Bernstein, H.C, Carlson, R.P. (2015) Interpreting and designing microbial communities for bioprocess applications, from components to interactions to emergent properties. Biotechnologies for Biofuel Production and Optimization. 1: In press.
3. Hunt, K.A., Folsom, J., Taffs, R., Carlson, R.P. (2014) Complete enumeration of elementary flux modes through scalable, demand-based subnetwork definition. *Bioinformatics*. In press.
4. Bernstein, H., Carlson, R.P. (2014) Design, construction and characterization methodologies for synthetic microbial consortia. *Methods in Molecular Biology*. In press.
5. Bernstein, H.C., Beam J.P., Kozubal, M.A., Carlson, R. P., Inskeep, W.P. (2013)  *In situ* Analysis of Oxygen Consumption and Diffusive Transport in High-temperature Acidic Iron Oxide Mats. *Environmental Microbiology*. 15: 2360-2370. doi 10.1111/1462-2920.12109.
6. Bhardwaj, C., Moore, J.F., Cui, Y., Gasper, G., Bernstein, H.C., Carlson, R.P., Hanley, L. (2013) Laser desorption VUV postionization MS imaging of a cocultured biofilm. *Analytical and Bioanalytical Chemistry*. 405: 6969-6977. doi 10.1007/s00216-012-6454-0
7. Cui, Y., Bhardwaj, C., Milasinovic, S., Carlson, R.P., Gordon, R.j., Hanley, L. (2013) Molecular imaging and depth profiling of biomaterials interfaces by femtosecond laser desorption postionization mass spectrometry. *Applied Materials and Interfaces*. 5: 9269-9275. doi 10.1021/am4020633
8. Bernstein, H., Carlson, R.P. (2012) Microbial Consortia Engineering for Cellular Factories: *in vitro* to *in silico. Computational and Structural Biotechnology Journal* 3(4) e201210017. doi [10.5936/csbj.201210017](http://dx.doi.org/10.5936/csbj.201210017)
9. Bernstein, H., Paulson, S., Carlson, R.P. (2012) Synthetic *Escherichia coli* consortia engineered for syntrophy demonstrate enhanced biomass productivity. *Journal of Biotechnology*. 157 159-166. doi 10.1016/j.jbiotec.2011.10.001
10. Carlson, R.P., Oshota, O.J., Taffs, R. (2012) Systems analysis of microbial adaptations to simultaneous stresses. *Subcellular Biochemistry*. 64: 139-157*.* doi 10.1007/978-94-007-5055-5\_7
11. Zuroff, T., Bernstein, H., Llyod-Randolfi, J., Jimenez-Taracido, L., Stewart, P.S., Carlson, R.P. (2010) Robustness analysis of culturing perturbations on *Escherichia coli* colony biofilm beta-lactam and aminoglycoside antibiotic tolerance. *BMC Microbiology*. 10: 185. doi10.1186/1471-2180-10-185
12. Taffs, R., Aston, J.E., Brileya, K., Jay, Z., Klatt, C.G., McGlynn, S., Mallette, N., Montross, S., Gerlach, R., Inskeep, W.P., Ward, D.M., Carlson R.P. (2009) In silico approaches to study mass and energy flows in microbial consortia: a syntrophic case study. *BMC Systems Biology* 3:114. doi 10.1186/1752-0509-3-114
13. Carlson, R.P. (2009) Decomposition of complex microbial behaviors into resource-based stresses. *Bioinformatics*. 25: 90-97. doi 10.1093/bioinformatics/btn589
14. Carlson, R.P., Taffs, R., Davison, W.M., Stewart, P.S. (2008) Anti-biofilm properties of chitosan coated surfaces. *Journal of Biomaterials Science: Polymer Edition*. 19: 1035-1046. doi 10.1163/156856208784909372
15. Carlson, R.P. (2007) Metabolic systems cost-benefit analysis for interpreting network structure and regulation. *Bioinformatics*. 23: 1258-1264. doi 10.1093/bioinformatics/btm082

#### D. Research Support

### Ongoing Research Support

NIH UO1 (PI: R. Carlson) 10/1/14 – 9/28/18

National Institutes of Health

“Predictive Multiscale Modeling of Microbial Consortia Biofilms”

Integrated computational and experimental analysis of biofilm consortia with focus on a medically important chronic wound system.

NSF DMA (PI: T. Gedeon, co-PI: R. Carlson) 8/1/14 - 7/30/18

National Science Foundation

“Emergent properties of synthetic microbial consortia”

Computational and experimental systems biology analysis of interacting microbial populations with a focus on engineered *E. coli* strains.

NSF MCB (PI: T. McDermott, co-PI R. Carlson) 10/1/14 - 9/30/17

National Science Foundation

“A Cellular Systems Analysis of Microbe-Arsenic Interactions”

Experimental and computational analysis of arsenic metabolism.

DOE EFC (PI: J. Peters, co-PI: R. Carlson) 9/1/14 - 8/31/18

U.S. Department of Energy

“Center for Biological Electron Transfer and Catalysis (BETCy)”

Analysis of electron flux distributions in bifurcating enzyme systems with applications to biofuels.

NSF CBET (PI: R. Carlson) 4/1/15 - 3/30/16

National Science Foundation

“Travel Award for US-based Scientists to Attend Metabolic Pathway Analysis 2015 in Braga, Portugal”

Travel grant to support the travel of 12 scientists to attend an international metabolic pathway analysis conference.