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Education:

Ph.D. Chemical Engineering University of Minnesota, Twin Cities	2003
M.S. Microbial Engineering University of Minnesota, Twin Cities	1998
B.S. Biochemistry *magna cum laude* University of Minnesota, Twin Cities	1996

Professional Positions:

Professor, Department of Chemical and Biological Engineering Montana State University, Bozeman	2016-
Associate Professor, Department of Chemical and Biological Engineering Montana State University, Bozeman	2011-2016
Assistant Professor, Department of Chemical and Biological Engineering Montana State University, Bozeman	2005-2011

Awards:

- MSU College of Engineering Award for Excellence in Teaching: 2015.
- Center for Biofilm Engineering Researcher of the Year: 2012.
- MSU Merit Award: 2011, 2012, 2014, 2015, 2016, 2017.
- MSU Award for Excellence: 2010, 2013, 2016, 2021.
- MSU College of Engineering Award for Excellence in Research: 2010.
- MSU President's Excellence in Teaching Award, student nomination: 2009, 2014.

Mentored personnel, graduate researchers: 14

Mentored personnel, undergraduate researchers: 26

Mentored personnel, post-doctoral researchers and research staff: 9

Courses Taught:

- EChem 328 Chemical Reactor Kinetics, 3 credits.
- EChem 407 Chemical Engineering Thermodynamics II, 2 credits.
- EChem 411 Senior Design I, 2 credits.
- EChem 412 Senior Design II, 2 credits.
- EBio 438 Bioprocess Engineering, 3 credits.
- EBio 591 Quantitative Metabolic Systems Biology and Engineering, 3 credits.

- EGen 694 Graduate Proposal Writing, 2 credits.
- DGED 610 Geobiological Systems Science I: Foundations, 3 credits.
- DGED 611 Geobiological Systems Science II: Applications, 3 credits.

Research Activities:
(Google Scholar Metrics (7/13/21): 3340 citations, H-index = 33, i10-index = 54)

1. Hunt, K.A. Mallette, N., Peyton, B.M., Carlson, R.P. (2021) *In silico* analysis of functionalized hydrocarbon production using Ehrlich pathway and fatty acid derivatives in an endophytic fungus. *Journal of Fungi*. In press.
2. Tafur Rangel, A.E., Rios Guzman, W.L. Mejia Perez, D.E., Ojeda Cuellar, C.E., Carlson, R., Gomez Ramirez, J.M., Gonzalez Barrios, A. F. (2021) *In silico* design for systems-based metabolic engineering for the bioconversion of valuable compounds from industrial by-products. *Frontiers in Genetics*, 12: 633073.
3. Pulukkody, A. C., Yung, Y.P., Donnarumma, F., Murray, K.K., Carlson, R.P., Hanley, L. (2021) Spatially resolved analysis of Pseudomonas aeruginosa biofilm proteomes measured by laser ablation sample transfer. *PLOS One*, *in press*.
4. Patel, A., Carlson, R.P., Henson, M.A. (2021) *In silico* Analysis of Synthetic Multispecies Biofilms for Cellobiose-to-Isobutanol Conversion Reveals Design Principles for Stable and Productive Communities. *Biochemical Engineering Journal. In press*.
5. Hammarlund, S.P., Gedeon, T., Carlson, R.P., Harcombe, W. (2021) Limitation by a shared mutualist promotes coexistence of multiple competing partners. *Nature Communications*. 12, 619. doi.org/10.1038/s41467-021-20922-0.
6. McGill, S.L.,Yung, Y., Hunt, K.A., Henson, M.A., Hanley, L., Carlson, R.P. (2021) *Pseudomonas aeruginosa* reverse diauxie is a multidimensional, optimized, resource utilization strategy. *Scientific Reports*. 11, 1457. doi.org/10.1038/s41598-020-80522-8
7. Park, H., Patel, A., Hunt, K.A., Henson, M.A., Carlson, R. P. 2020. Artificial consortium demonstrates emergent properties of enhanced cellulosic-sugar degradation and biofuel synthesis. *npj Biofilms Microbiomes. 6, 59 (2020). https://doi.org/10.1038/s41522-020-00170-8*
8. Mahout, M., Carlson, R.P., Peres, S. (2020) Answer Set Programming for computing constraints-based elementary flux. *Processes. 8(12) 1649, doi.org/10.3390/pr8121649*.
9. Hulkova, M., Soulkupova, J., Carlson, R.P., Marsalek, B. (2020) Interspecies interactions can enhance *Pseudomonas aeruginosa* tolerance to surfaces functionalized with silver nanoparticles. in *Colloids and Surfaces B: Biointerfaces. 192: 111027*. doi.org/10.1016/j.colsurfb.2020.111027
10. Zhang, T. Parker, A., Carlson, R.P., Stewart, P.S., Klapper, I. (2020) Flux-Balance Based Modeling of Biofilm Communities. Processes. *Multiscale Model. Simul.* 18(2), 1025-1052. doi.org/10.1137/18M1234096
11. Jay, Z.J., Hunt, K.A. Chou, K.J., Schut, G.J., Maness, P.C., Adams, M.W.W., Carlson, R.P. (2020) Integrated thermodynamic analysis of electron bifurcating [FeFe]-hydrogenase to inform anaerobic metabolism and H_2 production. *Biochemica Biophysica Acta Bioenergetics. 1861;* 148087. 10.1016/j.bbabio.2019.148087
12. Park, H., McGill, S.L., Arnold, A. D., Carlson, R.P. (2020) Pseudomonad reverse carbon catabolite repression, interspecies metabolite exchange, and consortial division of labor. *Cellular and Molecular Life Sciences. 77, 395-413*. 10.1007/s00018-019-03377-x
13. Yung, Y., McGill, S.L., Chen, H., Carlson, R.P., Hanley, L. (2019) Reverse Diauxie Phenotype in Pseudomonas aeruginosa Biofilm Revealed by Exometabolomics and Label-Free Proteomics. *npj Biofilms and Microbiomes*. 5, 31. 10.1038/s41522-019-0104-7

14. Carlson, R.P., Sauro, H.M. (2019) Special Issue: Methods in Computational Biology. *Processes* 7(4): 205. 10.3390/pr7040205
15. Patel, A., Carlson, R.P., Henson, M. (2019) *In silico* Metabolic Design of Two-strain Biofilm Systems Predicts Enhanced Biomass Production and Biochemical Synthesis. *Biotechnology Journal.* 14:7, 1800511. 10.1002/biot.201800511
16. Schepens, D., Carlson, R.P., Heys, J., Beck, A.E., Gedeon, T. (2019) Role of resource allocation and transport in emergence of cross-feeding in microbial consortia. *Journal of Theoretical Biology*. 467, 150-163. 10.1016/j.jtbi.2019.01.030
17. El-Mansi, M., Stephanopoulos, G., Carlson, R.P. (2019) Chapter 6: Flux Control Analysis and Stoichiometric Network Modeling: Current trends and future prospects. *Fermentation Microbiology and Biotechnology* 4th ed. pp. 91-116. (eds E. M. T. El-Mansi, Jens Nielsen, David Mousdale, Ross P. Carlson) CRC/Taylor and Francis Inc. London. 10.1201/9780429506987
18. Beck, A.E., Hunt, K.A., Carlson, R.P. (2018) Measuring Cellular Biomass Composition for Computational Biology Applications. *Processes* 6(5), 38. 10.3390/pr6050038
19. Hunt, K.A., Jennings, R. deM. Inskeep, W.P., Carlson, R. P. (2018) Multiscale analysis of autotroph-heterotroph interactions in a high-temperature microbial community. *PLoS Computational Biology*, 14(9):e1006431. 10.1371/journal.pcbi.1006431
20. Gumulya, Y., Boxall, N.J., Khaleque, H.N., Santala, V., Carlson, R.P., Kaksonen, A.H. (2018) In a Quest for Engineering Acidophiles for Biomining Applications: Challenges and Opportunities. *Genes*, 9(2), 116. 10.3390/genes9020116
21. Carlson, R.P., Beck, A.E., Phalak, P., Fields, M.W., Gedeon, T., Hanley, L., Harcombe, W.R., Henson, M.A., Heys, J.J. (2018) Competitive resource allocation to metabolic pathways contributes to overflow metabolisms and emergent properties in cross feeding microbial consortia. *Biochemical Transactions.* 46: 269. 10.1042/BST20170242
22. Beck, A.E., Bernstein, H.C., Carlson, R.P. (2017) Stoichiometric network analysis of cyanobacterial acclimation to photosynthesis-associated stresses identifies heterotrophic niches. *Processes* 5 (2), 32. 10.3390/pr5020032
23. Ledbetter, R., Garcia-Costas, A.M., Lubner, C.E., Mulder, D.W., Tokmina-Lukaszewska, M., Artz, J.H., Patterson, A., Magnuson, T., Jay, Z. J., Duan, H. D., Miller, J., Plunkett, M.H., Hoben, J.P., Barney, B.M., Carlson, R.P., Miller, A.F., Bothner, B., King, P.W., Peters, J.W., Seefeldt, L.C. (2017) The Electron Bifurcating FixABCX Protein Complex from *Azotobacter vinelandii*: Generation of Low-Potential Reducing Equivalents for Nitrogenase Catalysis. *Biochemistry* 56 (32), 4177-4190. 10.1021/acs.biochem.7b00389
24. El Moustaid, F., Carlson, R.P., Villa, F., Klapper, I. (2017) Photorespiration and Rate Synchronization in a Phototroph-Heterotroph Microbial Consortium. *Processes*. 5(1), 11. 10.3390/pr5010011
25. Schepens, D., Beck, A.E., Heys, J.J., Gedeon, T., Carlson, R.P. (2017) The Benefits of Resource Partitioning and Division of Labor in Microbial Consortia. *Advances in Systems and Synthetic Biology* (editors P. Amar, F. Kepes, V. Norris). EDP Sciences Publishing. pp 137-148. ISBN 978-2-7598-2116-7
26. Schoen, H., Hunt, K.A., Strobel, G., Peyton, B., Carlson, R.P. (2017) Carbon chain length of biofuel- and flavor-relevant hydrocarbons produced by lignocellulolytic fungal endophytes vary with culturing temperature. *Mycosciene.* 58(5) 338-343. 10.1016/j.myc.2017.03.005
27. Venters, M., Carlson, R.P., Gedeon, T., Heys, J. (2017) Effects of Spatial Localization on Microbial Consortia Growth. *PLOS ONE*. 12(1) e0168592. 10.1371/journal.pone.0168592

28. Hunt, K.A., Jennings, R. deM. Inskeep, W.P., Carlson, R. P. (2016) Stoichiometric modelling of assimilatory and dissimilatory biomass utilisation in a microbial community. *Environmental Microbiology*, 18(12) 4946-4960. 10.1111/1462-2920.13444
29. Beck, A.E., Hunt, K.A., Bernstein, H.C., Carlson, R.P. (2016) Interpreting and designing microbial communities for bioprocess applications, from components to interactions to emergent properties. *Biotechnology for Biofuel Production and Optimization*, 407-432
30. Carlson, R.P., Oshota, O., Shipman, M., Casserta, J.A., Hu, P., Saunders, C.W., Xu, J., Reeder, N., Richards, A., Pettigrew, C., Peyton, B.M. (2016) Integrated molecular, physiological and in silico characterization of two *Halomonas* isolates from industrial brine. *Extremophile*s 20(3) 261-274.
31. Phalak, P., Chen, J., Carlson, R.P., Henson, M.A. (2016) Metabolic modeling of a chronic wound biofilm consortium predicts spatial partitioning of bacterial species. *BMC Systems Biology*. 10:90. doi.org/10.1186/s12918-016-0334-8
32. Phalak, P., Chen, J., Carlson, R.P., Henson, M.A. (2016) Spatiotemporal Metabolic Modeling of a Chronic Wound Biofilm Consortium. *IFAC-PapersOnLine*. 49:26: 32-37.
33. Salinas, D., Cody, D., McCuthchen, C., Carlson, R.P., Mumey, B., June, R. (2016) Combining Targeted Metabolomic Data with a Model of Glucose Metabolism: Toward Progress in Chondrocyte Mechanotransduction. *PLOS ONE*. 12(1) E0168326. 10.1371/journal.pone.0168326
34. 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.
35. Singh, D., Carlson, R.P., Fell, D.A., Poolman, M. (2015) Modelling metabolism of the diatom *Phaeodactylum tricornutum*. *Biochemical transactions*. **43**(6): 1182-1186.
36. Folsom, J.P., Parker, A., Carlson, R.P. (2014) Physiological and Proteomic Analysis of *Escherichia coli* Iron-Limited Chemostat Growth. *Journal of Bacteriology*. 196: 2748-2763.
37. Ammons, M.C.B., Tripet, B.P., Carlson, R.P., Kirker, K.R., Gross, M.A., Stanisich, J.J., Copié V. (2014) Quantitative NMR Metabolite Profiling of Methicillin-Resistant and Methicillin-Susceptible *Staphylococcus aureus* Discriminates between Biofilm and Planktonic Phenotypes. *Journal of Proteome Research*. 13(6): 2973-2985.
38. Hunt, K.A., Folsom, J.P., Taffs, R.L., Carlson, R.P. (2014) Complete enumeration of elementary flux modes through scalable demand-based subnetwork definition. *Bioinformatics*. 30: 1569-1578.
39. Bernstein, H.C., Carlson, R.P. (2014) Design, construction and characterization methodologies for synthetic microbial consortia. *Methods in Molecular Biology*. 1151: 49-68.
40. Mallette, N., Pankratz, E.M., Parker, A.E., Strobel, G.A., Busse, S.C., Carlson, R.P., Peyton, B.M. (2014) Evaluation of Cellulose as a Substrate for Hydrocarbon Fuel Production by Ascocoryne sarcoides (NRRL 50072). *Journal of Sustainable Bioenergy Systems*. 4(1): ID 44247.
41. Bernstein, H.C., Kesaano, M., Moll, K., Smith, T., Gerlach, R., Carlson, R.P., Miller, C.D., Peyton, B.M., Cooksey, K.E., Gardner, R.D., Sims, R.C. (2014) Direct measurement and characterization of active photosynthesis zones inside wastewater remediating and biofuel producing microalgal biofilms. *Bioresource Technology*. 156: 206-215.
42. 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.
43. 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.

44. Bhardwaj, C., Cui, Y., Hofstetter, T., Liu, S.Y., Bernstein, H.C., Carlson, R.P., Ahmed, M., Hanley, L. (2013) Differentiation of microbial species and strains in coculture biofilms by multivariate analysis of laser desorption postionization mass spectra. *Analyst*. 138: 6844-6851.
45. Valenzuela, J., Carlson, R.P., Gerlach, R., Cooksey, K., Peyton, B.M., Bothner, B., Fields, M.W. (2013) Nutrient resupplementation arrest bio-oil accumulation in Phaeodactylum tricornutum. *Applied Microbiology and Biotechnology*. 97: 7049-7059.
46. 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.
47. Mus, F., Toussaint, J.P., Cooksey, K.E., Fields, M.W., Gerlach, R., Peyton, B.M., Carlson, R.P. (2013) Physiological and Molecular Analysis of Carbon Source Supplementation and pH Stress Induced Lipid Accumulation in the Marine Diatom *Phaeodactylum tricornutum*. *Applied Microbiology and Biotechnology*. 97: 3625-3642.
48. 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.
49. Carlson, R.P., Oshota, O.J., Taffs, R. (2012) Systems analysis of microbial adaptations to simultaneous stresses. *Subcellular Biochemistry*. 64: 139-157.
50. Blaze, M.T., Ayin, B., Carlson, R., Hanley, L. (2012) Identification and Imaging of Peptides and Proteins on *Enterococcus faecalis* Biofilms by Matrix Assisted Laser Desorption Ionization Mass Spectrometry. *Analyst*. 137: 5018.
51. Mallette, N., Knighton, W.B., Strobel, G.A., Carlson, R.P., Peyton B.M. (2012) Resolution of volatile fuel compound profiles from *Ascocoryne sarcoides*: a comparison by proton transfer reaction-mass spectrometry and solid phase microextraction gas chromatography-mass spectrometry. *AMB Express*. 2:23.
52. Valenzuela, J., Mazurie, A., Carlson, R.P., Gerlach, R., Cooksey, K., Peyton, B.M., Fields, M.W. (2012) Potential role of multiple carbon fixation pathways during lipid accumulation in *Phaeodactylum tricornutum*. *Biotechnology for Biofuels* 5:40.
53. 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.
54. Gardner, R., Cooksey, K. Mus, F., Macur, R., Moll, K.,Eustance, E., Carlson, R.P. Gerlach, R., Fields, M.W., Peyton, B.M. (2012) Use of Sodium Bicarbonate to Stimulate Triacylglycerol Accumulation in the Chlorophyte *Scenedesmus* sp. and the diatom *Phaeodactylum tricornutum*. *Journal of Applied Phycology. 24: 1311-1320.*
55. El-Mansi, M., Stephanopoulos, G., Carlson, R.P. (2011) Chapter 7: Flux Control Analysis and Stoichiometric Network Modeling: Basic Principles and Industrial Applications. *Fermentation Microbiology and Biotechnology* pp. 165-190. (eds M. El-Mansi, C.F.A. Bryce, A.L. Demain, A.R. Allman) CRC/Taylor and Francis Inc.
56. Carlson, R.P., Taffs, R.L. (2010) Molecular-level tradeoffs and metabolic adaptations to simultaneous stressors. *Current Opinion in Biotechnology*. 21: 1-7.
57. 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.
58. 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.
59. Carlson, R.P. (2009) Decomposition of complex microbial behaviors into resource-based stresses. *Bioinformatics*. 25: 90-97.
60. Carlson, R.P. Taffs, R. (2009) Molecular level *in silico* analysis of mass and energy flows in microbial communities. *Geochim Cosmochim Acta* 73 (13), A193-A193.

61. Arce, F.T., Carlson, R.P., Monds, R.J., Veeh, R., Hu, F.Z., Stewart, P.S., Lal, R., Ehrlich, G.D., Avci, R. (2009) Nanoscale structural and mechanical properties of nontypeable *Haemophilus influenzae* biofilms. *Journal of Bacteriology*. 191: 2512-2520.
62. 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.
63. Gasper, G., Carlson, R.P., Akhmetov, A., Moore, J., Hanley, L. (2008) Laser Desorption 7.87 eV Postionization Mass Spectrometry of Antibiotics in *Staphylococcus epidermidis* Bacterial Biofilms. *Proteomics*. 8: 3816-3821.
64. Carlson, R.P. (2007) Metabolic systems cost-benefit analysis for interpreting network structure and regulation. *Bioinformatics*. 23: 1258-1264.
65. Carlson, R., Srienc, F. (2006) Gene dosage effects on polyhydroxyalkanoate production in *Saccharomyces cerevisiae*. *Journal of Biotechnology*. 124: 561-573.
66. Trinh, C.T., Carlson, R., Wlaschin, A.P., Khodursky, A., Srienc, F. (2006) Design, construction, and performance of the most efficient *E. coli*. *Metabolic Engineering*. 8: 628-638.
67. Wlaschin, A.P., Trinh, C.T., Carlson, R., Srienc, F. (2006) The fractional contributions of elementary modes to the metabolism of *Escherichia coli* and their estimation from reaction entropies. *Metabolic Engineering*. 8(4) 338-352.
68. Zhang, B., Carlson, R., Srienc, F. (2006) Engineering the Monomer Composition of Polyhydroxyalkanoates Synthesized in *Saccharomyces cerevisiae*. *Applied and Environmental Microbiology*. 72(1): 536-543.
69. Kacmar, J., Carlson, R., Balogh, S. Srienc, F. (2006) Automated staining and quantification of poly-3-hydroxybutyrate (PHB) in *Saccharomyces cerevisiae* and *Ralstonia eutropha* cell populations using flow cytometry. *Cytometry*. 69(1): 27-35.
70. Carlson, R., Wlaschin, A., Srienc, F. (2005) Kinetic studies and biochemical pathway analysis of anaerobic poly(R)-3-hydroxybutyric acid synthesis in *Escherichia coli*. *Applied and Environmental Microbiology*. 71: 713-720.
71. Vijayasankaran, N., Carlson, R., Srienc, F. (2005) Metabolic pathway structure for recombinant protein synthesis in *E. coli*. *Applied Microbiology and Biotechnology*. 68(6) 737-746.
72. Vijayasankaran, N., Carlson, R., Srienc, F. (2005) Synthesis of Poly[(R)-3-hydroxybutyric acid] in the Cytoplasm of *Pichia pastoris* under Oxygen Limitation. *Biomacromolecules*. 6(2): 604-611.
73. Zhang, B., Carlson, R., Pederson, E., Witholt, B., Srienc, F. (2005) Novel synthesis routes for polyhydroxyalkanoic acids with unique properties. *Polymer Biocatalysis and Biomaterials*. 900: 292-301.
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75. Carlson, R., Srienc, F. (2004) Fundamental *Escherichia coli* biochemical pathways for biomass and maintenance energy production: Creation of overall flux states. *Biotechnology and Bioengineering*. 86(2): 149-162.
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