1093-92-85 **Tianyu Zhang*** (zhang@math.montana.edu), **Breana Pabst**, **Isaac Klapper** and **Philip S Stewart**. *General Theory for Integrated Analysis of Growth, Gene, and Protein Expression in Biofilms.*

A theory for analysis and prediction of spatial and temporal patterns of gene and protein expression within microbial biofilms is derived. The theory integrates phenomena of solute reaction and diffusion, microbial growth, mRNA or protein synthesis, biomass advection, and gene transcript or protein turnover. Case studies illustrate the capacity of the theory to simulate heterogeneous spatial patterns and predict microbial activities in biofilms that are qualitatively different from those of planktonic cells. Specific scenarios analyzed include an inducible GFP or fluorescent protein reporter, a denitrification gene repressed by oxygen, an acid stress response gene, and a quorum sensing circuit. Though here the analyses have been limited to simultaneous interactions of up to two substrates and two genes, the framework applies to arbitrarily large networks of genes and metabolites. Extension of reaction-diffusion modeling in biofilms to the analysis of individual genes and gene networks is an important advance that dovetails with the growing toolkit of molecular and genetic experimental techniques. (Received August 01, 2013)