Metabolic optimality: biological objectives beyond fast growth

A main goal of biological modeling is to integrate detailed biochemical information with biological knowledge to produce testable predictions and new biological hypothesis. Based on the premise that bacteria have maximized their growth performance along evolution, flux balance analysis (FBA) predicts biological phenotypes in term of metabolic flux distributions by using linear programming. Although the assumption of growth rate optimization is justifiable, the same argument may not be valid for genetically engineered knockouts or bacterial strains that have been not exposed to long-term evolutionary pressure, and are subject to continue environmental perturbation.

In this talk I will present the large advantages of using FBA for biological modeling, but also its limitations. Furthermore, through the detailed analysis of discrepancies between FBA predictions and real biological performance, several biological objectives beyond fast growth will be presented and contextualized. Taken together, it seems evident that bacterial performance responds by maximizing multiobjective functions.