Recent Metabolic Modeling Advanced by Leveraging Stoichiometry, Thermodynamics and Kinetics with Constraint and Machine Learning-based Methods

Background

• Understanding the governing principles behind organisms’ metabolism and growth underpins their effective deployment as bioproduction chassis or feedstocks.
• The ever-increasing generation of ‘omics data has led to increasingly sophisticated quantitative tools to predict responses to external environmental factors and internal genotypic perturbations.

Approach

• This review examines the latest algorithmic advances integrating principles of stoichiometric, thermodynamic and kinetic methodology that are propelling metabolic modeling.
• It highlights the context of advances and describes each’s pertinence based on problem type and data availability.

Outcome

• This review covers recent approaches and imparts insight on promising areas for future advances.
• Extensive tables include all relevant algorithms, frameworks, and tools and summarize the types of tasks they perform, platform and licensing availability, example reference applications, and data requirements.

Significance

• This review provides a comprehensive review of recent advances and has detailed information on more than 90 recent frameworks and software tools.