Poster 13

Development of Dynamic Multi-Layered Bioprocess Models

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Advances in experimental technologies in conjunction with the increasing number of sequenced genomes permitted uncovering new molecular interactions aiding in the characterization of individual cellular components.

Until recently, in bioprocess engineering, cells were modeled as black box entities responsible for consuming substrates and producing certain compounds, ignoring the underlying biological mechanisms. Nonetheless, the development of cellular mechanistic dynamic models has been hampered by the lack of specific experimental data and imprecise knowledge of the mechanistic rate laws underlying several reactions. This fact hardens the applicability of engineering concepts to cellular systems.

Even incomplete cellular models provide valuable insights to help consolidate ongoing efforts in Biotechnology, namely, the growing tendency in industry to replace chemical synthesis techniques by biotechnological ones. These tendencies are driven by sustainability and profitability concerns, regarding the production of certain chemical compounds like bulk chemicals and pharmaceuticals.

It is important to bear in mind that the metabolism of wild-type microorganisms is geared to its survival and reproduction without engaging in the production of compounds outside this scope. Thus, the metabolism usually has to be modified in order to meet the desired industrial outcome, typically the overproduction of a target compound.

In this work an optimization algorithm based on Evolutionary Computation approaches was previously developed in order to enhance the production of a target metabolite based on a dynamic metabolic model.

An extension of mechanistic Escherichia coli model is currently being developed in order to study how to improve the production of industrial relevant compounds.

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