

Preface

The special volume “Biosystems Engineering” reflects an emerging field of applied research that aims at a system-level understanding of biological systems toward their targeted design and improvement. To obtain system-wide insight, interdisciplinary approaches are applied, which integrate expertise from biologists, engineers, and computer scientists, who have developed powerful analytical methods, modelling concepts, and information technologies for this challenging task. With the increasing need for sustainable production of fuels and chemicals from renewable resources, a major focus in this area is on the optimization of biotechnological production strains and processes. Of specific importance hereby is the consideration of the microorganism as a part of the bioprocess in its entirety.

In this regard, the different contributions of this volume provide an outstanding review of novel tools, methods, and concepts in the field of biosystems engineering, a still young, but yet powerful direction of interdisciplinary research. Part I “Creating Superior biocatalysts” of this volume highlights how system-wide analysis, modelling and understanding of gene regulation, metabolic networks, and fluxes open a new era for rational design and optimization of superior production strains, one of the key pre-requisites for bio-based production of pharmaceuticals, chemicals, materials, and fuels. This includes the introduction of systems and synthetic metabolic engineering approaches as well as industrial application examples. Part II “Linking Cellular Networks and Bioprocesses” illustrates concepts and tools which are based on models and experiments to investigate metabolic networks in correlation with the cell environment. In addition to the introduction of fundamental strategies introducing thermodynamic principles as well as different modelling approaches to metabolic network simulation, different examples directly address the link of cells and bioreactors providing fascinating and valuable insights into the interaction between cellular metabolism and process environment.

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Christoph Wittmann
Rainer Krull

Biosystems Engineering II

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Wittmann, C.; Krull, R. (Eds.)

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