SCIEPublish

*Editorial*

# A New Phase of Synthetic Biology and A New Journal for Its Twin with Engineering for Biomanufacturing

**An-Ping Zeng [1,*] and Shang-Tian Yang [2,*]**

[1] Center of Synthetic Biology and Integrated Bioengineering, School of Engineering, Westlake University, Hangzhou, China

[2] Department of Chemical and Biomolecular Engineering, The Ohio State University, Columbus, OH, USA

* Corresponding author. E-mail: zenganping@westlake.edu.cn (A.-P.Z.); yang.15@osu.edu (S.-T.Y.)

Received: 13 December 2022; Accepted: 13 December 2022; Available online: 13 December 2022



Synthetic biology is an interdisciplinary and enabling technology for the next industrial revolution to transform industrial manufacturing into a green and sustainable one: biomanufacturing, which uses enzymes, cells, and microbial consortia for the production of bio-based products including chemicals, fuels, medicines, plastics, etc. in a bioprocess. As a disruptive and strategically important technology, it has received great attention around the world. With its broad applications in agricultural, chemical, food, medical, and material industries, biomanufacturing is projected to account for more than one third of the global manufacturing output and reach a market value of ~30 trillion USD by 2030. Synthetic biology and bioprocess engineering will thus play key roles in bioeconomy and in mitigating the impacts of climate change, energy and food shortages, and environmental pollution. Synthetic biology will also play a critical role in healthcare in today's aging society with growing population.

Driven by the promises and needs mentioned above and the rapid advances in engineering biology (genome sequencing and editing, gene synthesis, protein engineering, evolutionary engineering, etc.), AI (protein structure and function predictions, synthetic pathway design, etc.) and bioprocess engineering (including bio-foundry and other automated high-throughput systems), synthetic biology is entering a new phase of fast development to deliver solutions to global challenges. Engineering has placed critical roles in this context. A contemporary example is the fast development and large-scale production of vaccines against Covid-19, notably the new mRNA vaccine. Historically, the revolutionary development of penicillin as a life-saving medicine is also a masterpiece of collaboration work of microbiologists, chemists, and engineers. From the discovery of penicillin by Fleming (microbiologist) in 1928 to its initial commercial production in 1944, it was Florey (chemist) and Chain (engineer) who developed the sterile submerged cultivation process and product extraction method which made the large-scale penicillin production possible. The development of penicillin led to the birth of a new discipline Biochemical Engineering.

We strongly believe that an ever-closer collaboration of synthetic biologists and engineers is vital and urgently needed to catalyze the next industrial revolution and to redefine the discipline Biochemical Engineering. The move from fossil-based production of chemicals and fuels to bio-based ones is a part of the envisaged industrial revolution. Today only about 6% of the chemicals are produced from renewable resources, mainly starch and sugars, using a bioprocess. However, more than 60% of the chemicals used in our daily life can be produced biologically from abundant plant biomass and industrial wastes. Biorefining using lignocellulosic and gaseous (e.g., $CO_2$, CO, $H_2$) feedstocks can achieve zero greenhouse gas (GHG) emission without depleting limited resources on the planet in a circular bioeconomy for sustainable economic growth and development. Synthetic biology and bioprocess engineering together will provide bio-inspired solutions to overcome grand challenges in using lignocellulosic and C1 feedstocks in biorefineries using microorganisms ranging from bacteria, archaea to yeasts and microalgae.

https://doi.org/10.35534/sbe.2023.10001

The vast information contained in $>10^{30}$ microbial genomes defining metabolic and regulatory networks encoded by $>10^{34}$ individual genes in the biosphere remains to be exploited to benefit human life. Machine learning and high-throughput screening with novel biosensors and testing methods can enhance the power of synthetic biology in building bioprocesses from genetic parts programmed into cell-free systems, cell factories, and consortia to scale up for biomanufacturing at economically feasible product titer, rate, and yield for industrial application. New technologies are desperately needed in this regard. The lack-behind of technological development is to large extent due to the less appreciation of bioprocess and related engineering disciplines in line with synthetic biology. This journal intends to fill a gap and to enhance the twin of Synthetic Biology and Engineering for next generation biomanufacturing.