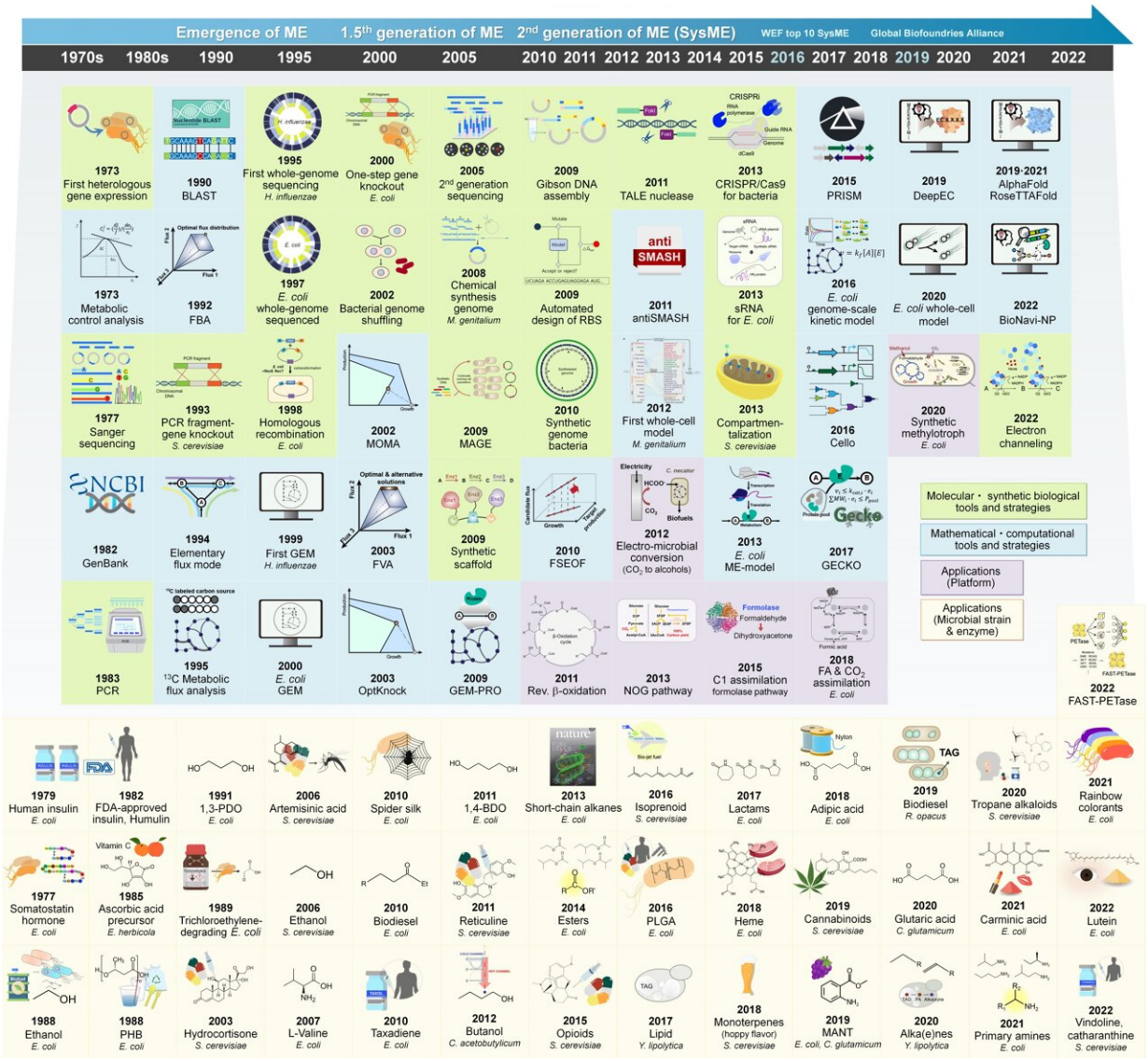
An overview of the 30-year history of metabolic engineering

January 25 2023



Metabolic engineering timeline. Credit: The Korea Advanced Institute of Science and Technology (KAIST)

A research team comprised of Gi Bae Kim, Dr. So Young Choi, Dr. In Jin Cho, Da-Hee Ahn, and Distinguished Professor Sang Yup Lee from the Department of Chemical and Biomolecular Engineering at KAIST have summarized the 30-year history of metabolic engineering, highlighting examples of recent progress in the field and contributions to sustainability and health. Their paper, "Metabolic engineering for sustainability and health," was published online in the 40th anniversary special issue of *Trends in Biotechnology* on January 10, 2023.

Metabolic engineering, a discipline of engineering that modifies cell phenotypes through molecular and genetic-level manipulations to improve cellular activities, has been studied since the early 1990s, and has progressed significantly over the past 30 years. In particular, metabolic engineering has enabled the engineering of microorganisms for the development of microbial cell factories capable of efficiently producing chemicals and materials as well as degrading recalcitrant contaminants.

This review article revisited how metabolic engineering has advanced over the past 30 years, from the advent of genetic engineering techniques such as recombinant DNA technologies to recent breakthroughs in systems metabolic engineering and data science aided by artificial intelligence.

The research team highlighted momentous events and achievements in metabolic engineering, providing both trends and future directions in the field. Metabolic engineering's contributions to bio-based sustainable chemicals and clean energy, health, and bioremediation were also reviewed. Finally, the research team shared their perspectives on the future challenges impacting metabolic engineering than must be overcome in order to achieve advancements in sustainability and health.

Distinguished Professor Sang Yup Lee said, "Replacing fossil resource-based chemical processes with bio-based sustainable processes for the production of chemicals, fuels, and materials using metabolic engineering has become our essential task for the future. By looking back on the 30+ years of metabolic engineering, we aimed to highlight the contributions of metabolic engineering to achieve sustainability and good health." He added, "Metabolic engineering will play an increasingly important role as a key solution to the climate crisis, environmental pollution, food and energy shortages, and health problems in aging societies."

More information: Gi Bae Kim et al, Metabolic engineering for sustainability and health, *Trends in Biotechnology* (2023). DOI: 10.1016/j.tibtech.2022.12.014

Provided by The Korea Advanced Institute of Science and Technology (KAIST)