

A NOVEL APPROACH TO BIOTECHNOLOGY

THE TOOLS FOR A FUTURE PROOF FOOD SYSTEM

FOOD 2030: NUTRITION, CIRCULARITY, INNOVATION



Providing adequate nourishment to the growing world population is one of the greatest challenges of this century. As a result, more research is being dedicated to achieving global food security through common and new tools and technologies. This brings co-benefits to address challenges in climate change and food safety issues. The development of biotechnological tools on the knowledge of genome, its sequencing and modification, opens the possibility of new applications and implementations.

SPECIFIC R&I BREAKTHROUGH TOPICS

Current agricultural practices cannot cope with the increasing demand for food production. Innovative solutions are required to increase productivity and nutritional quality, while ensuring sustainability and environmentally friendly methods. Advancements in food biotechnology, such as genetic engineering and sequencing, and microbiome research and application, have allowed big steps forward. The multidisciplinary field of synthetic biology has the potential to deliver novel agri-food applications. The EU defines synthetic biology as the application of science, technology, and engineering to facilitate and accelerate the design, manufacture and/or modification of genetic materials in living organisms (European Commission, 2014). Synthetic biology uses all available technologies for genetic modification, in combination with mathematical modelling and simulation, but in particular aims at faster and easier processes. Both microbiome and synthetic biology research have emerged and become successful from the convergence of multiple disciplines.

EXPECTED IMPACT

Microbiomes have a key role in human, plant, animal and, ultimately, planetary health. Microbiome technology has the potential to minimise the environmental footprint of food production and sustainably increase the quality and quantity of farm produce with less resource-based inputs, while having a positive influence on human health. Synthetic biology approaches are expected to contribute substantially to improving agricultural productivity, food quality and production, while ideally attaining a sustainable and cost-efficient practice (Roel & Zurbruggen, 2020). Priority objectives of synthetic biology are to improve plant growth, increase crop yield even under difficult conditions like drought, increase nutritional value, reduce fertiliser usage, and enable photoautotrophic production of pharmaceuticals, food ingredients and biofuels.

MARKET OPPORTUNITIES / CHALLENGES

Within the realms of biotechnology, knowledge of microbiome and synthetic biology have enormous potential in our modern world, for a wide spectrum of beneficial applications.

These include;

- Improving food security by quickly engineering resistant plant types
- Bioremediation of polluted or contaminated soil and water
- Provision of secondary metabolites for nutraceutical, pharmaceutical and industrial purposes
- Use genome engineering to increase the impact of food on microbes
- Increase human, animal, plant and soil health by microbial engineering and beneficial microbe selection.

Risk issues have been raised in relation to human health, socioeconomic and ethical impacts - especially when genome engineering is applied. Public concerns address the uncertainties associated with the long-term impacts on health and environment, including increased allergenicity, as has been the case with genetically modified microorganisms and other novel foods. Novel applications may negatively impact existing supply chains, affecting, for example, traditional producers of plants used for drug supply. Bioethical concerns have been raised together with the potential for misuse of a technology, implying bioterrorism or bioterror.

EXAMPLE REFERENCES

European Commission (2014): Final opinion on Synthetic Biology I-III
https://ec.europa.eu/health/scientific_committees/emerging/opinions_en#others Jin, S; Clark, B; Kuznesof, S; Lin, X; Frewer, LJ (2019): Synthetic biology applied in the agrifood sector: Public perceptions, attitudes and implications for future studies, Trends in Food Science & Technology, 91, 454-466, <https://doi.org/10.1016/j.tifs.2019.07.025>.
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ASSOCIATED TRENDS IN FIT4FOOD2030 (URL)

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|---|--|
| ○ Malnutrition | ○ Alternative protein sources |
| ○ Scarcity of natural resources | ○ Functional foods including pro and prebiotics. |
| ○ Genome engineering | ○ Free from products |
| ○ Novel food | ○ Food waste recovery up-cycling/waste cooking. |
| ○ Natural preservatives and milder processing methods | |

ASSOCIATED CASES IN FIT4FOOD2030 (URL)

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| ○ Mosa meat | ○ Finless foods |
| ○ Impossible foods | ○ Sugarlogix |
| ○ Ecofeed | ○ MiraculeX |
| ○ Perfect day | ○ Memphys Meats |
| ○ Geltor | ○ Clara food |
| ○ Toast Ale | |
| ○ Kiverdi | |