

Synthetic Biology in Europe

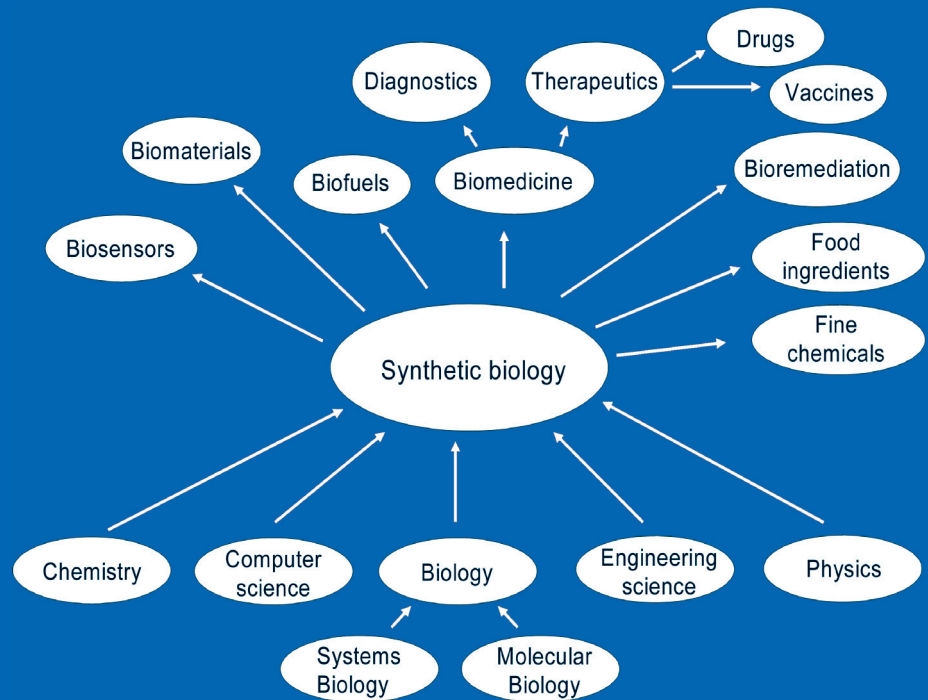
Synthetic Biology is an emerging field at the intersection of life sciences and engineering. It benefits from the output of various disciplines. The field is promoted by the EU to increase collaboration between the European working groups and different disciplines.

What is Synthetic Biology about?

Synthetic Biology uses nucleic acid elements or complex systems that are pre-defined and chemically synthesised in the laboratory by a modular approach. This approach aims to:

1. engineer and study biological systems that do not exist as such in nature, and
2. use this approach for:
 - achieving better understanding of life processes,
 - generating and assembling functional modular components,
 - developing novel applications on processes.

Registries such as the Registry of Standard Biological Parts hosted at the Massachusetts Institute of Technology, USA (http://partsregistry.org/Main_Page) play an important role in the advancement of Synthetic Biology.



Knowledge transformation via Synthetic Biology

Potential

Synthetic Biology covers the following applications:

1. Biomedicine
2. Cheaper synthesis of biopharmaceuticals
3. Sustainable chemical industry by efficient biotransformation
4. Environment
5. Energy
6. Production of smart materials/ biomaterials
7. Security: counter-bioterrorism

The TESSY process

The goal of TESSY is to develop a European Strategy for Synthetic Biology. This is based on:

- a roadmap with essential steps in regulation, funding, public sector integration and scientific milestones,
- a common understanding and awareness of Synthetic Biology and its potentials and achievements.



TESSY-Consortium

Fraunhofer Institute for Systems and Innovation Research, Karlsruhe, Germany; European Science Foundation, Strasbourg, France; ATG biosynthetics GmbH, Merzhausen, Germany; University of Freiburg, Department of Biology, Freiburg, Germany

Researcher

Synthetic Biology opens the horizon for a new research methodology that allows the quick composition of new complex structures and biological applications. The interdisciplinary character of Synthetic Biology creates a high demand for collaboration among different scientific disciplines.

Funders

The truly interdisciplinary nature of Synthetic Biology, together with its emerging character, calls for the rethinking of traditional funding mechanisms. Ways need to be explored to break down the classical disciplinary borders and to maximise the integration of different disciplines, on both a national and a European level. It is desirable to foster community building in each European country and to complement this with European level approaches which aim to integrate research strengths scattered across Europe. The technological component of Synthetic Biology and its high potential for application open up the possibility to strengthen research between academia and industry, thereby striving towards translation of basic science to application.

Industrial Synthetic Biology

The objective of Synthetic Biology is to provide modular molecular tool-boxes applicable for speeding up any R&D in the design of biological systems. The expectation is to reduce costs by marketing these applications earlier, thus achieving early return on investment for life science companies.

This feature makes Synthetic Biology attractive for all industries with high innovation pressure, e.g. the Pharmaceutical Industry; for improving product cycle management; and for filling the product pipeline with new therapeutics and diagnostics.

Synthetic Biology has the potential to cre-

ate new applications out of all life science fields, including improved healthcare leading to individualized, highly efficient medicine with low side effects; the deployment of Synthetic Biology methodology in environmental technologies; and the design of non-food plants. Synthetic Biology is also a promising avenue for providing a more efficient supply of bio-energy and improve nutrition in quality and quantity.

Public

Synthetic Biology holds a number of promises to secure or improve quality of life. On the other hand there are potential and perceived risks due to deliberate or accidental damage. In addition, ethical issues related to the nature of living beings are arising. In order to ensure the successful development of this new scientific field it is necessary to gather information about its risks and to devise adequate bio-safety strategies to minimize them. The public is encouraged to act as a partner in the development of clear guidelines for Synthetic Biology and to get involved in the respective ethical debates.

Policy

Synthetic Biology raises questions with respect to IP regulation, the guidance and regulation of risk assessment, ethics of life, and the prevention of misuse. These issues need to be taken up by national and international political agendas. Discussions with stakeholders at a European level could form a first step in this policy process.

Further information

TESSY website: www.tessy-europe.eu

Database: www.synthetic-biology.info

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Previous and ongoing EU activities

- BIOMODULAR H2: Engineered Modular Bacterial Photoproduction of Hydrogen
- BioNano-Switch: A Biological Nanoactuator as a Molecular Switch for Biosensing
- CELLCOMPUT: Biological Computation Built on Cell Communication Systems
- COBIOS: Engineering and Control of Biological Systems: a New Way to Tackle Complex Diseases and Biotechnological Innovation
- EMERGENCE: Coordination puts synthetic biology on firm footing
- EUROBIOSYN: A modular platform for biosynthesis of complex molecules
- FuSyMEM: Functional Synthetic Membranes for GPCR based Sensing
- HYBLIB: Human monoclonal antibodies from a library of hybridomas
- NANOMOT: Synthetic Biomimetic Nanoengines: a Modular Platform for Engineering of Nanomechanical Actuator Building Blocks
- NEONUCLEI: Self-assembly of synthetic nuclei: key modules for semibiotic chemosynthetic systems
- NETSENSOR: Design and Engineering of gene networks to respond to and correct alterations in signal transduction pathways
- ORTHOSOME: An Orthogonal Episome: an Artificial Genetic System Based on a Novel Type of Nucleic Acids
- PROBACTYS: Programmable Bacterial Catalysts
- SynBioComm: Towards a European Synthetic Biology Community
- SYNBIOLGY: An Analysis of Synthetic Biology Research in Europe and North America
- SYNBIOSAFE: Safety and ethical aspects of synthetic biology
- SYNTHCELLS: Approaches to the Bioengineering of Synthetic Minimal Cells