Biotechnology

Biotechnology is the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.

Biotechnology today is used in primary production, health and industry. Platform technologies such as genetic modification, DNA sequencing, bioinformatics and metabolic pathway engineering have commercial uses in several application fields. The main current uses of biotechnology in primary production are for plant and animal breeding and diagnostics, with a few applications in veterinary medicine. Human health applications include therapeutics, diagnostics, pharmacogenetics to improve prescribing practices, functional foods and nutraceuticals, and some medical devices. Industrial applications include the use of biotechnological processes to produce chemicals, plastics, and enzymes, environmental applications such as bioremediation and biosensors, methods to reduce the environmental effects or costs of resource extraction, and the production of biofuels. Several applications, such as biopharmaceuticals, in vitro diagnostics, some types of genetically modified crops, and enzymes are comparatively “mature” technologies. Many other applications have limited commercial viability without government support (e.g. biofuels and biomining) or are still in the experimental stage, such as regenerative medicine and health therapies based on RNA interference.

Why is biotechnology important?

Biotechnology offers current and potential future technological solutions for many of the health and resource-based problems facing the world. As a generic technology, research in biotechnology creates tools and inventions with multiple uses. The applications of biotechnology expand from primary production, to health and industry, and could result in the emergence of a “bioeconomy” where biotechnology contributes to a significant share of economic output.

Biotechnology can help to improve the supply and environmental sustainability of food, feed and fibre production, improve water quality, provide renewable energy, improve the health of animals and people, and help maintain biodiversity by detecting invasive species. Yet biotechnology is unlikely to fulfil its potential without appropriate regional, national and, in some cases, global policies to support its development and application.

How has biotechnology changed in recent years?

In the mid 2000s, biotechnology probably contributed to less than 1% of GDP in the OECD countries. In contrast, the potential economic value of biotechnology is much greater than this. In 2004, primary production, health and industrial sectors that either used biomass or applied biotechnology accounted for 5.6% of the GDP of the European Union and 5.8% of the GDP of the United States.

Research in biotechnology has advanced rapidly since the early biotechnology discoveries of the mid-1970s. Industrial biotechnology has achieved spectacular new growth and interest in recent years, mainly as a result of global interest in biofuels. Research in biomedical and health innovation has generated knowledge, tools and techniques that have vastly improved the drug research and development process. Despite the tremendous advances in knowledge and technology, many developments remain “emergent” in the sense that they have not yet been translated or fully integrated into industrial processes, healthcare systems and medical practice.

What are the main policy issues?

The shape of the future bioeconomy will depend on breakthroughs in basic and applied research in the biological sciences; but also on innovations in governance systems, regulations and business models.

In health innovation, government policies are deemed important in: communicating a vision of the public policy objectives in health and innovation and developing a roadmap for the future; creating incentives for R&D; providing sustainable financing for shared research infrastructures; fostering translation of public research; in fostering openness, co-operation and networking; educating researchers for an interdisciplinary scientific future; updating the regulatory environment; building dialogue and public trust; ensuring privacy and security of personal data and samples; promoting the development of standards.

Many drivers of biotechnology arise from the global challenges of climate change, the ageing population and energy and food security. Despite the desire to apply biotechology to such challenges across diverse sectors, there are still many barriers to its growth and optimal uptake across industry.

List of recent OECD reports

- OECD (2013a), *Recommendation of the OECD Council on Assessing the Sustainability of Bio-based Products.* OECD Publishing, Paris. (http://webnet.oecd.org/OECDACTS/Instruments/ShowInstrumentView.aspx?Inst... [1])
- OECD (2013b), *Policies for Bioplastics in the Context of a Bioeconomy*. OECD Publishing, Paris.
- OECD (2013c), *Biotechnology for the Environment in the Future: Science, Technology and Policy*, OECD Publishing. doi: 10.1787/5k4840hqhp7j-en
- OECD (2013d), *Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability*, OECD Publishing. doi: 10.1787/9789264194243-en
- OECD (2013e), *Emerging Trends in Biomedicine and Health Technology Innovation: Addressing the Global Challenge of Alzheimer's*, OECD Publishing. doi: 10.1787/5k44zcpt65vc-en
- OECD (2013f), *Public Health in an Age of Genomics*, OECD Publishing. doi: 10.1787/5k424rdzj3bx-en
- OECD (2012) *Knowledge Networks and Markets in Life Sciences*, OECD, Paris
- OECD, (2011a) *Future Prospects for Industrial Biotechnology*, OECD, Paris. ISBN 978-92-64-11956-7, 137 pp.
- OECD (2011b) Industrial Biotechnology and Climate Change: Opportunities and Challenges, OECD, Paris, 20 pp.
- OECD (2011c) Collaborative Mechanisms for Intellectual Property Management in the Life Sciences, OECD, Paris.

Links
[1] http://webnet.oecd.org/OECDACTS/Instruments/ShowInstrumentView.aspx?InstrumentID=283&InstrumentPID=298&Lang=en&Book=False