



Biotech potential set to soar with the help of digital technology

Microbes and fungi have long been nature's helpers in producing fine food, drinks and medicine, but new digital technologies could unlock far greater potential for the European biotech sector.

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Beer may not be the answer to all of life's problems, but the science behind it could help decarbonise industrial processes and clean up the environment.

Biotechnology, which uses living organisms to create different products or processes, remains important in today's production of food and drink. But it is also increasingly used for a wide range of industrial products, including medicines, where it combines ancient principles with cutting-edge technology.

Ancient wisdom, modern processes

'We've used biotechnology for thousands of years to make cheese, to make beer, to make wine,' said Michael O'Donohue, an expert in microbial enzymes and industrial biotechnology at France's National Research Institute for Agriculture, Food and Environment (INRAE).

Now O'Donohue, who leads an EU-funded project called [Bioindustry 4.0](#), together with a team of biotech experts from 10 European countries, are exploring how the same biotechnology principles can be used to create chemicals or clean up industrial waste with a far smaller environmental impact than traditional methods.

'We're not working with processes that operate in aggressive environments like, for instance, the chemical industry,' said O'Donohue, highlighting a major positive aspect of biotech.

Little workhorses

Biotech has already transformed our lives, far beyond improving the taste of beer. Modern advances started with the use of fungi in the early 20th century to make life-saving antibiotics. Today, biotech remains crucial for making medicines.

As O'Donohue explained, 'the workhorses of biotechnology at an industrial level are mainly yeast and filamentous fungi.'

But because yeasts can be unpredictable in what compound, and how much, they produce, Bioindustry 4.0, which runs until December 2026, will use digital technology to improve the consistency of biotech outcomes.

An upside of biotechnology is that it can offer a cleaner alternative to traditional chemical manufacture.

While many industrial processes require high temperatures and hazardous chemicals, in biotechnology, most cells live between 30°C and 40°C, enjoy mild pH conditions, thrive in water-based liquids, and do not produce dangerous or poisonous substances.

The concept has already been proven. Businesses in Europe use natural processes to produce colour pigments and replace chemical colouring agents, which can help reduce the colossal use of water by the textile sector.

Biotech companies can also produce fuels and useful chemicals from agricultural waste or even from exhaust gas released by industrial plants.

Limiting inconsistencies

But the use cases are limited because yeast, fungi and bacteria, unlike synthetic chemicals, can behave in unexpected ways and that's not good enough for much of modern industry, where consistency is key.

'We're talking about industrial processes, so the name of the game is always costs, efficiency and reproducibility,' said O'Donohue. 'We want the same results every time we run a bioprocess. This is what happens, for instance, in car manufacturing.'

Bioindustry 4.0 aims to fix this shortcoming through the use of digital technology. 'It is a challenge to bring these two technologies together, but it is also a massive opportunity for biotechnology to go faster,' O'Donohue said.

Some of the research partners, for example, are developing real-time sensors to be fitted in bioreactors, where microbes are grown in suspended solutions. The sensors can track microbial growth and the production of compounds and alert researchers if they need to intervene, for example, by adding more sugar.

Playing catch-up

Biotech is a major global industry worth [€720 billion](#) in 2021, but Europe currently lags behind the US. The European Commission describes biotechnology as "one of the most promising technological areas of this century" and has taken steps to boost it in Europe.

'The US is the big player. They take 60% of the cake,' said O'Donohue. 'We've identified several weaknesses in Europe for biotech. We've got a fragmented landscape, which makes it quite tricky, if you are developing biotechnology, to know what is available and where.'

Nevertheless, O'Donohue said, the potential is there. 'Europe was the birthplace of modern biotechnology. We have a lot of infrastructure. We have a lot of expertise.'

Bioindustry 4.0 builds on the work of [PREP-IBISBA](#), another EU-funded project, which ran until the end of 2023 and aimed to smooth the process of sharing research facilities for industrial biotechnology.

The project team produced [IBISBA](#), a research infrastructure concept that allows access to cutting-edge facilities to test, for example, the precise content of new materials produced by microbes.

By tapping into IBISBA, researchers can be quickly guided to the right expertise or equipment.

Building the market

The concept has already been put to work, assisting young European companies such as Calidris Bio, a Belgian start-up that aims to manufacture high-quality protein using fewer resources.

‘We want to bring it to the market as an ingredient to replace fishmeal and soy that at the moment is not grown sustainably,’ said Lieve Hoflack, a co-founder of Calidris Bio.

But producing the protein is just half the battle. A new product must be tested for safety, taste and nutritional value.

‘With IBISBA, we found a place with the right equipment, the right expertise and also the right mindset to bring our process to the next step,’ said Hoflack.

The European Commission has said it aims to boost biotechnology to combat climate change and resource scarcity. It is working towards an EU Biotech Act and aims to promote regulatory sandboxes to test novel approaches in a controlled environment for a limited amount of time, under regulatory supervision.

It will also work towards streamlining regulations and establishing an EU Biotech Hub to help companies navigate the regulatory seas and pinpoint support for scaling up their enterprises.

‘We need to help European science stay in the race and help our innovators find support, especially during their first steps,’ said O’Donohue.

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- [PREP-IBISBA](#)
- [EU bioeconomy research and innovation](#)
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