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Synopsis

INDUSTRIAL BIOTECHNOLOGY

QUESTIONS TODAY FOR
TOMORROW'S NEEDS

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Industrial biotechnology: tackling challenges today to ensure a sustainable future

On 14 and 15 February 2016, researchers and businesspeople from around the world met for a B-Debate on the present and future of industrial biotechnology.

It is clear that current levels of consumption of fossil fuels, like coal and oil, are unsustainable from an ecological standpoint. However, this is also true from an ethical point of view, as future generations will suffer the effects of the pollution taking place right now.

Biotechnology can substitute many chemical processes for greener, more sustainable and eco-friendly ones that use renewable raw materials. One example is making more biodegradable plastics with carbohydrate derivatives instead of oil derivatives. Another is biofuel.

One of the most promising fields is medicine, safely and efficiently producing drugs that are more and more effective in various arenas, such as cardiovascular conditions, cancer and infectious disease.

To review the state of white biotechnology (focusing on chemical products and power) and red biotechnology (for drug development), several world-renowned figures met on 14 and 15 February 2016 for the debate entitled [Industrial Biotechnology. Questions Today for Tomorrow's Needs](#) organized by B-Debate –an initiative of [Biocat](#) and the ["la Caixa" Foundation](#) to promote scientific debate– along with the [Autonomous University of Barcelona](#) (UAB) and the Red de Biotecnología Industrial Integrativa (RBII).

SOME NOTEWORTHY ISSUES PENDING:

- Ensuring the sustainability of natural resources and the impact of industrial activities on the environment
- Researching more efficient new drugs that promote personalized medicine while also being affordable for healthcare systems
- Improving collaboration between the public and private sectors
- Positioning Corporate Social Responsibility as a key element in all of these processes

1. TOWARDS A CIRCULAR ECONOMY?

The circular economy is a concept that advocates for a model that ensures sustainability, so that products, materials and resources like water and power stay within the economy as long as possible. It also calls for limiting production of resources as much as possible.

One of the seven strategic goals set under Europe 2020 is for the continent to effectively use these resources to generate growth and employment. However, as discussed by Suren Erkman, professor in the Faculty of Geosciences and Environment at the University of Lausanne (Switzerland), "We still have a long way to go before we reach a circular economy, which is more than just recycling. And biotechnology can play a key role."

The flexibility of processes is key in this field, as mentioned by Javier Velasco-Álvarez, CEO of Granada-based company NEOL Bio. The goal is to develop advanced biofuels (especially for planes), construction materials, biomaterials and biosurfactants, which are active substances on the surface of liquids, that can act as detergents or emulsifiers to help mix two different substances.

One of the most promising applications is the use of CO₂ as a raw material to manufacture a wide range of products, including organic carbonates (for car bodies), acetylsalicylic acid (aspirin), soft drinks, decaffeinated coffee or methanol as a substitute for gasoline.

Professors Pau Ferrer and Francesc Gòdia, of the Autonomous University of Barcelona, were the scientific leaders for this session. In their opinion, industrial biotechnology has huge potential, with numerous tools that can be applied to everything from producing chemicals to immunotherapy.

"It is key to have a global view and use digital platforms because, although it isn't yet clear if this will be an evolution or a revolution, it is clear that industrial biotechnology will play a key role in the new paradigm of the industry of the future," they stressed.

2. INCREASINGLY PERSONALIZED MEDICINE

Biotechnology has played an essential role in many areas of development for many years now. One example can be seen in antibiotics, explained José Luis García, research professor at the Spanish National Research Council (CSIC). "They have saved millions of lives and are a more important revolution than mobile phones," he highlighted.

Now, nearly 100 years after Fleming discovered penicillin, personalized medicine is starting to become a reality thanks to the reduced cost of DNA analysis. The goal is to give patients the precise treatment needed at just the right time.

“Many drugs on the market aren’t effective, which has led to a silent revolution, moving from chemical drugs to biologicals,” announced Professor [Mathias Uhlen](#) of the Royal Institute of Technology (KTH) in Stockholm (Sweden).

“Proteins are the building blocks of life. And more than 98% of drugs are based on them. That’s why we launched a project in 2003 to [map all human proteins](#). Two months ago, we published a Pathology Atlas of the most important types of cancer, with data from 10,000 patients,” he explained.

This publication will be followed by others over the coming years focusing on the location of proteins in human tissue, cells and mouse brains. They are also working to determine which proteins have alternative expression in diseases (with cancer as the main goal) and which metabolic pathways are active in different tissues and diseases. Similar initiatives are currently being promoted by companies like Microsoft, Facebook and Google.

3. EUROPE, COMMITTED TO INDUSTRIAL BIOTECHNOLOGY

Industrial biotechnology is a reality, with turnover in Europe estimated at €32 billion in 2013. Furthermore, as indicated by [James Philip](#), political analyst at the Organization for Economic Cooperation and Development (OECD), roughly 50 countries around the world already have bioeconomic strategies in place.

As highlighted by [Christine Lang](#), managing director of German company Organobalance, many everyday objects, like tires, detergents, medical implants or drugs, are already bioprocessed. The new technology and products we will soon be using include building façades made of algae manufactured in bioreactors, recyclable façades printed in 3-D, and materials like biosteel, made of spider webs.

“Several factors are necessary to take another step forward. These include more mature processes, such as bioreactors, more investment in new infrastructures, and more awareness among consumers that these products exist. The challenge lies in whether they’re prepared to pay a bit more for them,” recognizes Lang.

‘Cell factories’, according to Professor Uhlen, could play a key role in saving the planet. Using new genome-editing tools like CRISPR-CAS9, new genes can be inserted (or erased) to obtain photosynthetic bacteria.

“This way, we could develop industrial fuels produced directly by these photosynthetic bacteria with the aim of making fossil fuels no longer economically viable,” was his outlook for the future.

The advantages of these new fuels are noteworthy: they would have no carbon footprint, use only sun, water and CO₂, could be stored, wouldn't need new infrastructures (they could take advantage of existing ones), would make all countries equally sustainable in terms of energy and provide extremely cheap energy, further transforming society.

As Professor Gòdia reminded those present, the debate today focuses on “whether biofuels will replace oil or if it is better to combine the two. And whether we should bank on high value-added chemicals above biofuels. It is clear that energy is a key element: we have a long way to go in the field of biorefineries. And we have to improve communication with society, as well.”

4. THE RESPONSIBILITY OF BUSINESSES AND GOVERNMENTS

Companies are preparing for the transformations underway. For example, in the field of drug development with new biologicals or biosimilars, which are drugs created through biotechnology, comparable to an innovative drug whose patent has expired.

“Our challenge is to transfer knowledge of how structures work to establish quick, scalable processes through drug launch. They are highly complex processes because manufacturing depends on living systems,” explained [Ralf Schumacher](#), head of Bioprocesses and Pharmaceutical Development in the Biologicals Development Unit at Germany company Boehringer Ingelheim.

Corporate Social Responsibility (CSR) is also gaining ground in this area. [Børge Diderichsen](#), vice-president of the Danish laboratory Novo Nordisk, gave some details on actions the company is working on in this field, like producing low-cost insulin in developing countries and launching programs to fight gestational diabetes and childhood type-1 diabetes.

“At the same time, we have responsibilities in terms of the environment to minimize the negative impact of our factories, so that we produce more and more with less water and energy and producing less CO₂,” he highlighted.

Additionally, the government, as the one footing the bill, is looking for better results in terms of health in a sustainable environment. “The new biodrugs require a significant

amount of innovation today, and this must increase. This is why we have launched a program to improve access to innovative drugs in Catalonia,” stressed Josep Torrent-Farnell, director of Medicine for the Servei Català de la Salut (CatSalut) and Professor of Clinical Pharmacology and Therapeutics at the Autonomous University of Barcelona (UAB). In his mind, public-private partnership is key.

For Jordi Naval, director of Fundació Bosch i Gimpera and co-founder of Aelix Therapeutics, the innovation ecosystem must be based on three key components: academic research, investors (public and private) and industry to license or acquire technology. Additionally, there must be technology transfer offices, specialized suppliers and entrepreneurs, and experienced start-ups.

“Society pays me to do research and researchers, in theory, provide solutions. But, in reality, what we’re producing is articles in scientific journals. We have the responsibility to provide solutions, like new drugs or industrial processes, that add value,” Naval pronounced.