

Debate 4 "Will the real revolution come from biotechnology?"

Biotechnologies are widely considered to have emerged in the 1970s following the discovery of DNA sequencing. With their roots in molecular biology, this range of technologies now exists alongside other fields such as bio-informatics and bio-nanotechnology. They relate to life sciences, or rather sciences applied to living organisms to help come up with new goods and services. Genes, proteins, molecules, cells and tissues are all used. This results in the development of new processes: bio-reactor fermentation, bio-refinement, bio-processing, molecular aquaculture bio-filtration etc.

One way to present the challenges faced by the bio-economy is to remember that it is an opportunity to reconcile growth and the environment. Indeed, biotechs can profoundly alter the planet's equations for: food supply (the issue of food security); energy dependence and climate; and natural resource availability. We only have one planet, but biotechs carry with them the hope of being able to multiply resources and limit our pressure on the environment.

For example, energy production from biomass makes it possible to solve the problem of finite fossil fuels and can even limit greenhouse gas emissions. Some lesser-known developments such as new batteries, artificial photosynthesis and the production of fuels by micro-organisms create opportunities which could radically change many areas of production. New biomass plants will emerge: bio-refineries will use it to produce food for humans and livestock as well as new materials and chemicals. This example, among many others, highlights the fact that the development of biotechnologies is dependent on four questions.

Market: At what price will these technologies be available? Will they be competitive with fossil fuel technologies since the development of the former will release pressure on the latter and at the same time become more competitive? This question can be resolved by funding research, introducing tax subsidy systems, and developing regulations.

Conflict of uses and objectives: How will the use of biomass conflict with other land uses, such as traditional agricultural production and especially forests destined for carbon storage?

Collective preferences: How socially acceptable are biotechnologies and how will situations of uncertainty be handled (the European precautionary principle is only one of the possible solutions)?

Technology appropriation: The development of biotechnologies will see a tremendous shift in its global value in the decades to come. Indeed, research is very costly, has increasing returns and facilitates the agglomeration of skills, whereas collective preferences are holding back research in some parts of the world. According to OECD technology indicators, the number of patent applications filed in the biotechnology sector over the last five years, for which data is available (2010-14), is more than 22,000 in the United States, 6,000 in Japan, 3,000 in Germany, around 2,500 in Korea, China and France, 2,000 in the United Kingdom and just over 1,000 in Canada and the Netherlands. The list of countries having filed more than 1,000 patents stops there. In other words, 5 countries hold a 70% share of all the biotech patents filed in the world over the last 5 years. By way of comparison, the top 5 countries in terms of conventional and non-conventional oil reserves only have a 60% world share.

Biotechnologies are therefore looking to change the world. Because they can be widely applied to multiple sectors, and dovetail with progress in the fields of information processing and miniaturisation, these technologies have a potential impact on our economies and societies that will probably surpass that of the IT revolution. Biotechnologies are expected to lead to significant productivity gains and thereby boost growth, making it more sustainable (by reducing its carbon footprint and the reliance on non-renewable resources). However, they raise profound questions about society and the appropriation of life sciences and technology. This is due to governments not paying enough attention - either by allowing a mistrust of progress to develop, or by letting market mechanisms prevail without taking sufficient account of the potential technological externalities. Finally, a further problem lies in working out a way to reconcile the need to share the benefits of future growth with the need to patent the living world, vital for nurturing innovation in these technologies.

This session aims to answer 4 questions:

- 1) Are we under- or overestimating the future impact of advances in biotechnologies on our societies?
- 2) Is the European precautionary principle compatible with the biotechnology revolution?
- 3) Are there industries that are likely to be excluded from the biotechnology revolution?
- 4) What role should public regulation play in guiding the development of biotechnologies?