Investors and politicians are increasingly focusing on sustainable biotechnology. Rising demand for products like cultured meat could be accompanied by major EU investments in the biotech sector.

The post-pandemic biotech opportunity

GREEN DEAL Surveys show that despite COVID-19, climate change and sustainability still matter to consumers – perhaps even more than ever before. The European Commission has proposed investing more than a third of the €750bn earmarked for its 'NextGenerationEU' post-COVID-19 recovery programme into building a sustainable economy. Along with the well-established 'red' biotech sector in healthcare, green biotech companies also stand to benefit significantly.

There's been a lot written recently about how the pandemic, while sounding the death knell in many industries, is driving biotech to new heights. This is especially true for developers of vaccines and therapeutics, of course, but less is said about the opportunities also opening up for young companies in other areas, particularly those involved in the food industry and the circular economy. In the shadow of economic decline during the pandemic, policymakers are mobilising billions to support the bioeconomy and biotechs in a range of fields across Europe in a post-pandemic world.

Back in 2019, the European Commission (EC) headed by President Ursula von der Leyen declared climate protection and sustainability to be among the EU's core concerns, and with the Green Deal presented in December, the EU is meant to become a role model for the world. The Commission formulated ambitious goals, among others to make the EU climate-neutral by 2050. According to EC estimates, this will require around a trillion euros in investment over the next decade. The money is to come from the EU, its member states and private companies. The EC President chose big words for the policy, saying the Green Deal aims to become Europe's "man on the moon moment".

The COVID-19 pandemic is now being billed as a trigger for the EC to push forward Green Deal plans for billions in green investments. In her September State of the Union address, von der Leyen first tightened up the climate target. By 2030, the bloc now wants to reduce greenhouse gas emissions by up to 55% instead of 40%. She also announced a huge reconstruction plan to mitigate the economic consequences of the pandemic that will provide €750bn for the NextGenerationEU programme. And 37% of that, or around €278bn, is to go towards financing the Green Deal. The Commission also wants to raise 30% of the money for NextGenerationEU with the help of green bonds. Plans envision €14.6bn from the programme flowing into the Horizon Europe research programme, which would have a total budget of €91.1bn. The European Council originally proposed just €5.4bn and €85.5bn respectively. The final decision was to be taken after we go to press in mid-November.

> The European Green Deal is much more than just a programme to reduce emissions.

However, the Green Deal is not only intended to be an environmental or climate protection programme. In her speech, von der Leyen said: "The European Green Deal is much more than just a programme to reduce emissions. It is about the systematic modernisation of our entire economy, society and industry. It is about creating a better, stronger world." The Commission has defined nine policy areas for the Green Deal: climate action to achieve climate targets, measures to protect ecosystems (biodiversity), clean energy, an environmentally friendly construction sector (buildings and renovation), the promotion of environmentally friendly means of transport, combating pollution, sustainable production cycles in industry, a sustainable food chain ('from farm to fork') and sustainable agriculture. The biotech sector is well placed to drive most of the fundamental transformations from the current system. The opportunities are huge.

But how will the funding be distributed to and among biotech companies? One instrument that the EU wants to employ to make its economy more sustainable is the European Circular Bioeconomy Fund (ECBF) – the first venture fund focusing on bioeconomy and circular bioeconomy in Europe. It kicked off operations in October with a financing round for a Dutch and a German start-up. To date, the ECBF has raised €82m, with the main investor the European Investment Bank (EIB). Also on board are Pre Zero International GmbH (waste and recycling), Corbion NV (bio-based chemicals

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and polymers) and Hettich Beteiligungen GmbH (investor with a focus on sustainable companies and services). The goal is to hit €250m by August 2021, €100m of which has been promised by the EIB.

The fund's CEO Michael Brandkamp is convinced there is a significant market for sustainably produced goods: "The transformation to a bioeconomy will not be driven primarily by politics, but by consumers. If you go to the supermarket today, you already see many products that are sustainable. Many companies are already active in the area. We now have to develop them further." Past financing schemes have revealed the promise of the approach. French firm Ynsect SAS, which extracts proteins from insects, raised more than €300m to grow its business. Swedish company Oatly AB, which produces oat milk and other products, has raised €200m. "These are the first precursors. They show what's possible," Brandkamp thinks. "And we hope this will spread to other areas such as agricultural technology or packaging."

The €10bn initiative

Another EU funding effort is the Joint Initiative on Circular Economy (JICE), which brings together the EIB and five national development banks from France, Italy, Spain, Poland and Germany. Launched in 2019, the initiative aims to invest a total of €10bn over five years to accelerate the transition to a circular economy. JICE provides loans, equity investment, guarantees, innovative financing structures and technical assistance. The initiative announced at the end of October that the first €2.7bn have already been invested. One beneficiary was Italy-based Novamont S. p. A., a company that produces a range of products, including bio-based chemicals.

The proposals are a positive signal for the biotech industry. "We welcome

EFIB: A showcase for biotech startups

BIOECONOMY Consumers are demanding sustainably produced raw materials in food, fashion and cosmetics production. Young startups show what's already possible. Here are a few examples.

CellulaREvolution: The UK-based company with seven employees, which was founded in 2019 as a spin-out from Newcastle University, focuses on cell culturing technologies. Its novel approach moves away from traditional batch culture to a continuous culture system where cells are produced non-stop. The technique could have an impact in the production of cultured meat, biologics and cell therapies. What makes the approach unique? The company says batch culture technologies are simply not able to meet the demand for cells – a downside it says its continuous technology can address.

Better Nature: Another firm founded the same year in the UK that has 10 employees. It produces a meat substitute. Through its tempeh fermentation process, soybeans bind together to form a meaty block that's high in protein and fibre. The original fermentation method is 300 years old. So what makes the approach unique? "As the world's first and only company focused on tempeh fermentation, we believe we are in a unique position to leverage this biotransformative process to produce meat alternatives that consumers are looking for," the company claims.

Arbiom: Founded in 2011 and based in France and the US, Arbiom has more than 30 employees. Its technology platform integrates proprietary fermentation technology and enhanced microorganism strains to convert wood into nutritional feed and food ingredients. Arbiom's first commercial product is a sustainable protein source for improved aquaculture, animal and human nutrition. What makes the approach unique? "Arbiom brings knowledge creation in the field of wood pretreatment and fermentations on wood hydrolysates to create a SCP, a protein-rich ingredient for feed and food applications," the company claims.

Picture: Marcel Gnauk/pixabay

Blue Gene Technologies: The UK-based company founded in 2015 is a biotech start-up based at the Imperial College Incubator in London. Applying synthetic biology, bioinformatics and what it calls 'advanced molecular biology know-how', BlueGene's speciality is developing unique microbial strains and technologies for bio-conversions of low-cost starting compounds to high-value chemicals and the production of novel chiral precursors for use in organic syntheses. So what makes its approach unique? "Robust, versatile bioconversion process allows production of a unique range of biodyes – without use of toxic solvents, heavy metals or production of toxic wastes or side reactions," the company claims.

Cellulosic Technologies: A German company with three employees, Cellulos-

that the initial proposal for the future EU budget mentioned the bioeconomy as a budget item for the first time," says Dirk Carrez, Executive Director of the Bio-based Industries Consortium (BIC). "The EU Green Deal specifically cites the bio-based sector as a partner to tackle challenges in areas such as climate change, oceans, cities and soil. One example is the proposed Circular Bio-based Europe (CBE) partnership, which has the potential to realise many of the objectives of the EU Green Deal for industries in our sector, including biotech companies." But Carrez also thinks there's still a long way to go. "The EU must now live up to its ambitions, putting action to words," he says. "And this includes creating a level playing field for bio-based vs. fossil-based products." Does he think the financial resources are enough to achieve the ambitious Green Deal goals? "The bio-based industries are key for realising the EU's Green Deal and beyond, whether it includes the contribution of bio-based projects to UN SDGs, reducing dependency on fossil-based resources through creation of novel bio-based products from bio-waste and industrial side streams, or pioneering new circular bio-based value chains," he believes. "As an emerging sector, the next proposed EU public-private partnership for a Circular Bio-based Europe under Horizon Europe is crucial to solidifying and accelerating the progress already made," he says, adding that "the bio-based industry can enable additional sustainable investments and attract companies to invest in Europe. To trigger more private investment (and keep investment in the EU) and generate green growth we continue to work on how we can better combine public and private funding beyond a CBE, such as the ESIF or Just Transition Fund." BIC represents the private sector in a Public-Private Partnership (PPP) with the European Commission, the Bio-

ic Technologies has developed a patented process for industrial-scale fermentation to produce commercial quantities of ultra-pure bacterial microcellulose polymer, along with a bio-organic acid. Its customers are companies in the food and beverage, beauty and homecare sectors. What makes its approach unique? "Our mission is to improve billions of lives through BioInnOvation by 'chemdesign', using advanced machine-learning based molecular dynamics and computational chemistry," the company claims.

Chaincraft: A Dutch company founded in 2010, Chaincraft – which has 15 employees – has developed a platform technology to produce sustainable and circular fatty acids for the agrifood and chemical & materials industries. In its biotechnological process, different types of organic residues are converted into short and medium-chain fatty acids. What makes the approach unique? "Organic waste is currently incinerated, landfilled or converted at low efficiency and high cost into biogas. Our technology is substantially more economical and sustainable than all these options," the company claims.

Xtrem Biotech: Founded in 2013, the Spanish company with just two staff has developed its first biostimulant product. It's based on patented, non-GMO micro-organisms, isolated from natural ecosys-

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tems, that have been selected for their ability to stimulate a plant's growth and protect it from infection. Additionally, it offers services like microbiologic analysis. What makes the approach unique? "Our first product in the market is based on a extremophile microorganism able to be grown with lower nutrient input. It produces exclusive metabolites, and is able to live in much more difficult conditions," the company claims.

SilicoLife: A Portuguese company founded in 2010 that now has 15 employees, SilicoLife designs optimised microorganisms and novel pathways for industrial biotechnology applications that are based on AI and synthetic biology approaches. The goal is the sustainable production of specific target compounds such as chemicals, food ingredients or biopolymers. What makes the approach unique? "SilicoLife's approach is distinct, as it uses rational design methodologies to increase the efficiency of our wet lab activities, taking advantage of the latest advances in AI and synthetic biology in combination with biological knowledge," the company claims.

Peace of Meat: Based in Belgium and founded 2019, Peace of Meat has 12 staff. It's a B2B supplier of cultured fat that is produced directly from animal cells. Its primary product can be added either to plant-based meat substitutes or cultured meat. What makes the approach unique? "Animal fat is the missing ingredient for plant-based meats that is responsible for the meatiness (taste and texture) of an alternative meat product that carnivores are craving for," the company claims.

Galatea Biotech: An Italian company founded in 2013 that has two employees. Galatea Biotech's core technology is based on using renewable biomasses – preferentially residual – as feedstocks that it can valorize through microbial fermentation and biocatalysis. The company focuses on the bioplastic and biomaterials markets. What makes the approach unique? "We have a microbial-based process of production for polylactic acid at PCT stage (Italian patent)", the company claims. ■

Biotech companies demand regulatory changes in the EU.

based Industries Joint Undertaking (BBI JU). The BBI JU, operating under Horizon 2020, which was conceived as one of the pillars of the EU's Bioeconomy Strategy (2012), was set up to ease the transformation of renewable, natural resources into bio-based products through a programme of research and innovation activities.

One big player in the BBI JU is Danish biotech Novozymes, which has annual sales totalling more than DKK14bn. "Novozymes welcomes the European Green Deal and its ambition to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy," say Klaus Pellengahr, Managing Director of Novozymes Berlin GmbH. "This new growth strategy is a great opportunity to accelerate bioeconomy across Europe. Industrial biotechnology has been highlighted by the Commission as one of the key enabling technologies, and Novozymes believes that biological solutions have a role to play in this transition." The Danish enzyme and biopharma ingredients maker also sees significant opportunities for agriculture and the food industry. "Along with the Farm-to-Fork Strategy, Novozymes sees great potential for industrial biotechnology to contribute to the Green Deal objectives, including climate neutrality by 2050," Pellengahr says.

Rethinking regulations

But money isn't the only factor in the equation. For the biotech sector to really prosper, regulatory changes are also necessary. Current policy frameworks slow down time to market for biological solutions, as companies have to follow regulations written for the fossil-based market. "If the EU wants a transformation of the economy," says Pellengahr, "there is clearly a need to develop regulatory frameworks based on the enabling technologies we want to see in the market."

There's no question that in the present crisis, politicians and corporate representatives all see great opportunities for biotech companies. But what about customers? Are they ready for what biotechs could offer? A range of surveys seem to confirm that climate protection and sustainability have remained particularly important issues for many people even during the pandemic. As the EU's most populous country – and therefore one of its biggest markets – Germany is an important bellwether nation in the bloc. In a representative study, opinion research institute Forsa recently interviewed over 1,000 Germans, and found that 59% were of the opinion that climate change still has a greater impact on the economy and society than the pandemic. 23% considered the two crises equally dangerous.

At the end of April, market research institute Ipsos confronted nearly 30,000 people worldwide with the following statement: "In the economic recovery after COVID-19, it's important that government actions prioritise climate change." 65% of those surveyed responded with "strongly agree" or "tend to agree". 71% of those surveyed said they strongly agreed with or tended to agree with the statement that the climate crisis is "at least as dangerous" as the coronavirus crisis.

Demands on politicians and governments are one thing. Responsible consumer behaviour is the other. So how willing are people really to change? According to a study by the Boston Consulting Group (BCG), 90% of more than 3,200 respondents from eight countries – including France and the UK – said they've been equally or even more concerned about the environment since the COVID-19 outbreak. 95% said that their own behaviour can contribute to more environmental protection. And up to 30% say this conviction has grown even stronger since the pandemic began.

But even before last January, many people indicated in surveys that they considered climate change to be the greatest challenge we face. In October 2019, the European Investment Bank surveyed more than 30,000 citizens in the EU, China and the US. In the EU, 47% of respondents considered climate change to be our "biggest challenge", followed by access to a health system and unemployment. In China, the result was even

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clearer. There, 73% considered climate change to be the biggest challenge, followed by access to a healthcare system and the financial crisis. In the US, climate protection only placed second (39% of respondents). Access to the healthcare system was in first, while political stability placed third.

In addition, significantly more than half of all respondents believe that climate change can still be stopped. In the surveys, people not only emphasised that they wanted to consume more sustainably. They said they were also attempting to do so – for example, by buying sustainably produced food.

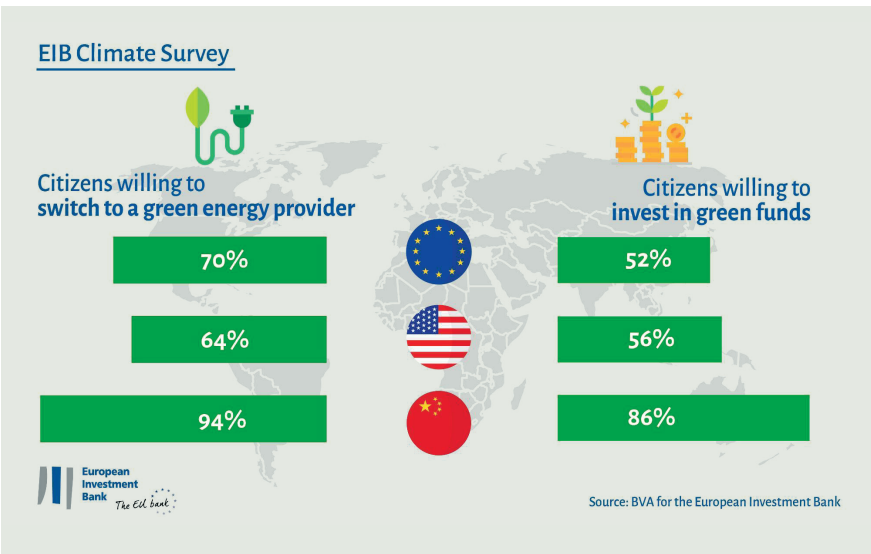
Consumer demands

According to a study carried out by Germany's Federal Environment Agency (UBA), sales of meat alternatives have been growing at annual rates of 30% for around the past ten years. Researchers from the University of Bath, Ipsos and the Université Bourgogne Franche-Comté carried out studies that claim to have observed "substantially large markets for cultured meat in Germany and France." This and events like the spectacular IPO of US company Beyond Meat are showing that meat produced using biotechnology also has great potential. For biotech companies in the agricultural and food sector, that potential presents significant market opportunities in B2C.

Biotech companies involved in the food sector are economically interesting on the one hand because products are already matching customer needs, but also because they offer great potential for reducing greenhouse gas (GHG) emissions, which means they could help countries hit mandated targets. "The global food system accounts for nearly a third of global total GHG emissions," says a new study published in Science from researchers at the University of Oxford, the University of Minnesota, the University of California, the Stanford University and the Woods Institute for the Environment in Stanford. "Major sources of emissions include land clearing and deforestation for agriculture and livestock production, production and use of fertilizers, and combustion of fossil fuels in food production and supply chains," the scientists concluded.

EFIB is a showcase opportunity for biotech startups

So to what extent will in-vitro meat and raw materials based on fermentation impact the future? The digital European Forum for Industrial Biotechnology & the Bioeconomy (EFIB), which took place in October, showed just how interesting and lively the biotech food business is at the moment. 31 startups that produce alternatives to meat, for example, were on hand with presentations. UK-based company Better Nature, which uses fermentation to produce proteins, took home the laurels in the EFIB startup competition.



Advanced molecular biology

Among the other companies on hand were Blue Gene Technologies, which is applying synthetic biology, bioinformatics and advanced molecular biology know-how to develop unique microbial strains and technologies for the bio-conversion of low-cost starting compounds to high-value chemicals and the production of novel chiral precursors for use in organic synthesis. Its products are sustainable colorants for the food and textile industry. And Denmark-based Kaffe Bueno also drew attention. It utilises coffee by-products like spent coffee grounds as a platform to produce functional foods and beverages, nutraceuticals and ingredients for personal care.

Agriculture and food are far from the only focus in the EU at the moment. An interesting example for circular economy is French Carbios SAS. The biotech company is trying to pave the way to an extensive recycling of plastic. Its core technique is depolymerisation of PET by enzymes, followed by a repolymerisation of the monomers. In other words, the production of new PET containers made of 100% recycled PET.

The opportunities offered by biotechnology have been discussed for decades, and always seemed just around the corner. That's led to severe disappointment of expectations and hopes when they didn't materialise. In Europe, it's somehow turned into a given that the really spectacular biotech IPOs happen in the US. But this time it feels like a change is coming, and today's opportunities look better than ever before. Consumers are increasingly demanding sustainably produced goods and politicians are now willing to channel huge sums into the bioeconomy in general and to facilitate private investments in biotech companies in particular. Let's hope the sector can seize the day. ■

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