What's Hot in Synthetic Biology Right Now?

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Since my earliest introduction to synthetic biology, I have seen the field change dramatically. What was once a domain mainly associated with producing human pharmaceuticals is now a diverse and thriving industry tackling some of the biggest challenges facing society, from producing enough food to feed the growing population to mitigating climate change.

I was lucky enough to attend SynBioBeta in Oakland earlier this year – the first in-person version of this meeting since 2019 – where I saw first-hand a wide range of solutions being developed in synthetic biology. Here's what caught my eye.

The power of mushrooms

One of the first things I noticed from this year's conference was the amazing range of applications using fungi. Fungi have been used in food products for many years, including traditional fermented foods as well as meat substitutes like Quorn. Now, with advances in synthetic biology, the uses of fungi are expanding into exciting new areas. Materials company Ecovative showcased their work using mycelium – a fungus consisting of a mass of thread-like fibers – to create a range of sustainable materials, including a cruelty-free leather alternative and plastic-free, compostable foams for packaging.
Through spin-off company MyForestFoods, the same technology is being used to produce gourmet meat alternatives. Their meat-free bacon product MyBacon has almost become synonymous with the real thing and sold out of every production run when it launched in November 2020. Tasters being handed out at SynBioBeta were also flying off the platters!

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Their special interest group Mycology for Architecture focuses specifically on using fungi as a building material, thanks to its shock-absorbent, durable, water- and fire-resistant and insulating properties. They are using mycelium to create a range of structures, including panels, tiles, flooring and even furniture.

I was also interested to see how the natural properties of fungi can be engineered to break down the carbon-fluorine bonds that are responsible for the persistence of PFAS – chemicals that can stay in the environment for thousands of years. Fungi do this naturally, but with synthetic biology the process can be massively accelerated.

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Sustainability at the forefront

Sustainability was a hot topic at SynBioBeta, with many companies showcasing their approaches to solving the problems of environmental degradation. Innovative bio-solutions company Biomason exhibited their "concrete" blocks, made using naturally occurring bacteria that create cement-like materials. What would in nature take thousands of years can now take place over a matter of days, without the carbon footprint of traditional cement.

Synthetic biology is also being used to create more sustainable consumer materials. Carbon-negative firm Rubi presented their work using cell-free enzymatic synthesis to create viscose fibers for fashion, an industry responsible for 10% of annual global carbon emissions.

Using CO2 as a feedstock was a popular theme, including work by Cemvita Factory, whose microbial pathways aim to remove a gigaton of CO2 from the atmosphere by 2050. I was particularly interested to find out about their work in biomining. Right now, they're engineering microorganisms to increase metal removal during bioremediation. These microbes also use CO2 for their growth, making the process overall carbon negative.

Future frontiers in Synthetic Biology

On a personal level, SynBioBeta is the first in-person conference I have attended since the COVID-19 pandemic, and it was fantastic to see so much growth in this area.

As CEO of ERS Genomics, I am particularly interested in how CRISPR gene editing is fueling developments in synthetic biology, and I was delighted to see so many attendees excited about the applications being made possible by this technology.

Five to ten years ago, synthetic biology was an important but relatively niche biotechnology tool. Today it is a thriving industry. CRISPR has played an important part in catalyzing this transition and has become an essential tool for companies in this space. CRISPR by no means made synthetic biology, but it has certainly taken the field to new heights and helped solve new problems.

Looking to the future, I'm confident that the field of synthetic biology will continue to grow, paralleling the early days of the life sciences industry. But, unlike early progress in the life sciences, the problems we need to solve now are different. Attention has shifted from human health to include the huge environmental and sustainability challenges we are facing.

With the United States being ranked 43rd in the latest Environmental Performance Index, we need to do more to protect our precious natural environment. But these issues transcend borders, which is why I was so excited to see groups from all over the world presenting their diverse solutions using the shared tools of synthetic biology.

After attending SynBioBeta, I feel hopeful that these tools, including the precision gene editing made possible by CRISPR, will provide the solutions we need – helping us to produce more food without using more land, create more sustainable materials, reduce pressure on natural resources, and remove toxins from the environment – and sooner rather than later.