

Biofuels



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Engineered microorganisms to make renewable fuels

In the future, biofuels and biofuel blends may help reduce the world's dependence on petroleum. Rather than refine fuel from oil in the ground, synthetic biologists are trying to modify living cells like algae, bacteria, and yeast to take in greenhouse gasses and produce bio-made fuels. Limited amounts of biologically produced fuels, like renewable diesel, are already commercially available.



Biomedicine



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Engineered enzymes to more efficiently produce medicines

Enzymes are required to industrially produce many of the most common medicines including antibiotics. Synthetic biologists are applying new methods to improve these enzymes in order to save energy and reduce waste in the production process. Medicines could be made less expensive if they are produced more efficiently.



Cancer Treatment



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Personalized mRNA drugs to fight cancer

Researchers have designed experimental drugs to treat some cancers using messenger RNA (mRNA)—the same technology used to develop the COVID vaccines. After sequencing a patient's tumors, mRNA vaccines might be produced to trigger an immune response. Since all cancers are slightly different, this approach potentially offers a personalized method for fighting cancers and possibly other diseases.



Synthetic Fragrances



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Natural fragrances from engineered microorganisms

Synthetic biology has been used to develop sustainable versions of fragrances used in personal products such as perfumes, scented soaps, hair products, and creams. The musk scent, for example, can now be made by engineered organisms rather than produced through bioreactors of petrochemicals. Sustainable biomanufacturing of scented compounds including rose oil, sandalwood, jasmine, and saffron can reduce the carbon footprint of the entire fragrance industry.



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Cleaning Products



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Green alternatives to current cleaning products

Many cleaning products contain ingredients derived from fossil fuels. Synthetic biology is being used to make “green” alternatives, including bio-detergents made from microbes, palm oil made by algae, and dishwashing soap that has bio-produced lipids for degreasing. Greener alternatives for the cleaning industry are becoming cost-effective and environmentally friendly alternatives for the cleaning industry.



Skin Care and Cosmetics



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Animal-free ingredients for skin care and cosmetics

Squalene and collagen are widely used ingredients in cosmetics such as creams, sunscreen, and lipstick. Until recently they could only be sourced from animals such as cows, pigs, and fish. Using an animal-free process, synthetic biologists have successfully produced these ingredients and even made variations of collagen that can increase production of other collagens and elastins when applied topically, resulting in more youthful skin.



Sports Equipment

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Algae-made foams for skis and snowboards

Synthetic biologists have programmed algae cells to biomanufacture an oil that can be converted into new kinds of polyurethane foams. The algae cells can be fine-tuned to adjust the flexibility, hardness, and impact resistance of the novel “plastics” they produce, leading to skis, snowboards, and surfboards that outperform traditional, petroleum-based products. In addition, the use of microalgae oil is a sustainable approach to manufacturing these materials with a significantly lower carbon footprint.



Bioengineered Apparel



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Eco-friendly materials for the fashion industry

Engineered microbes are improving or replacing the fabrics currently used for many apparels. For example, biosynthesis of water-repellent proteins and oils might someday fully replace toxic fluorinated compounds that are currently used in athletic and outerwear production. Animal-free leather is being produced in large sheets using mushroom mycelium. And yeast can be used to make spider silk which is woven into stronger and lighter fabrics.



Agriculture



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Smart plants to feed more people

A significant fraction of the world's population still faces food insecurity. This makes for an urgent need to ensure a future food system that is safe, secure, and plentiful. One approach to this goal is to increase yields from existing crops. Editing a plant's DNA can result in crop yields that are significantly improved. Alternatively, helpful soil microorganisms can be engineered to act as natural fertilizers for cereal crops such as corn, wheat, and rice. An added benefit of this approach is to reduce the need for chemical fertilizers.



Engineered Foods



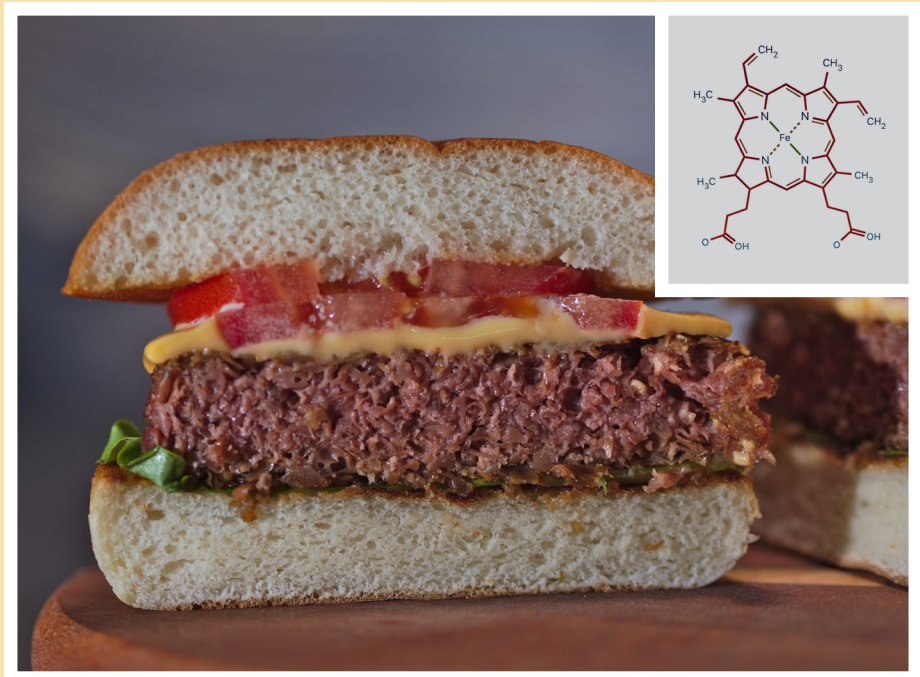
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Disrupting the food industry with novel plants and meats

Modern agriculture and farming have become more efficient in an effort to feed the world's growing population. Efficiencies have mostly centered on pest resistance as a way to increase crop yields and breeding for traits that can scale meat production. More recently, however, scientists have genetically modified foods including rice and tomatoes to increase their nutritional value, apples to reduce their browning, and salmon to grow more quickly and therefore reach market size faster. All of these foods are classified as GMOs, and consumers' willingness to consume them has been difficult to predict.



Plant-based Meat



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Yeast-made meat flavors

Heme is an iron-containing molecule found in plants and animals. It is part of what makes the meaty taste associated with beef steaks and burgers. Recently, yeast have been genetically engineered with the gene to make a version of the molecule that carries heme in some plants. This allows the heme molecules to be produced by yeast in bioreactors and then added to plant-based meats. Companies are using similar approaches to make molecules that improve the sponginess and juiciness of plant-based foods.

