



Synthetic Biology: The \$3.6 Trillion Science Changing Life As We Know It

Description

Synthetic biology (synbio) is a field of science that redesigns organisms in an effort to enhance and support human life. According to one projection, this rapidly growing field of science is expected to reach [\\$28.8 billion](#) in global revenue by 2026.

[As Visual Capitalist's Carmen Ang details below](#), **although it has the potential to transform many aspects of society, things could go horribly wrong if synbio is used for malicious or unethical reasons.** This infographic explores the opportunities and potential risks that this budding field of science has to offer.

How Synthetic Biology

Could Change Life as We Know It

Synthetic biology (synbio) is a field of science that redesigns organisms in a way that's useful for human life.



It has the potential to improve many facets of society, from the ways we produce food to how we detect and cure diseases.



But things could go horribly wrong, if synbio is used maliciously or unethically.



What is Synbio?

A Brief Explainer

Synbio involves editing and redesigning the biological components, systems, and interactions that make up life.

While genetic engineering transfers ready-made genetic material between organisms, synbio can build new genetic material from scratch.

The Possible Impact of Synbio

Synbio has a wide-range of applications that could transform society—and the global economy—as we know it.

A recent study found over 400 potential use cases, which could have a direct economic impact of up to **\$3.6 trillion** per year by 2030-2040.

\$3.6T

\$0.8T
Consumer products and services

\$0.3T
Materials and energy production

\$1.2T
Agriculture and food

\$1.3T
Human health and performance

Includes cellular agriculture, which is the production of agricultural products directly from cells rather than livestock or plants a.k.a **lab grown meat**.

Includes personalized services such as **genetic ancestry testing**, gene therapy, and skin aging treatments.

Synbio may also be utilized to produce **biofuel** more efficiently. For example, a microalgae is being developed that's "reprogrammed to produce clean energy in an economically feasible way."

Synbio has a wide range of medical applications, including the development of "**living drugs**" such as a yeast that produces anti-malaria treatments.

The Potential Risks of Synbio

Though potentially game-changing, the risks associated with synbio could be disastrous for the global population if not managed properly.

Unintended biological consequences

Synthetically made lifeforms, even those designed with the best intentions, don't always turn out according to plan. As well, tweaks to any biological system often have **ripple effects** across entire ecosystems or species.

Moral issues

Different **value systems** among the public make certain synbio applications (such as embryo editing) controversial. This could have massive cultural implications, and potentially **polarize entire communities**.

Unequal Access

Progress in synbio is happening quicker in **developed countries** versus developing. If this trend continues, access to these types of

What is Synthetic Biology?

We've covered the [basics of synbio](#) in previous work, but as a refresher, here's a quick explanation of what synbio is and how it works.

Synbio is an area of scientific research that involves editing and redesigning different biological components and systems in various organisms.

It's like genetic engineering but done at a more granular level—while genetic engineering transfers ready-made genetic material between organisms, synbio can **build new** genetic material from scratch.

The Opportunities of Synbio

This field of science has a plethora of real-world applications that could transform our everyday lives. A study by McKinsey found over [400 potential uses](#) for synbio, which were broken down into four main categories:

- Human health and performance
- Agriculture and food
- Consumer products and services
- Materials and energy production

If those potential uses become reality in the coming years, they could have a direct economic impact of up to **\$3.6 trillion** per year by 2030-2040.

1. Human Health and Performance

The medical and health sector is predicted to be significantly influenced by synbio, with an economic impact of up to **\$1.3 trillion** each year by 2030-2040.

Synbio has a wide range of medical applications. For instance, it can be used to manipulate biological pathways in yeast to produce an [anti-malaria treatment](#).

It could also enhance gene therapy. Using synbio techniques, the British biotech company Touchlight Genetics is working on a way to build [synthetic DNA](#) without the use of bacteria, which would be a game-changer for the field of gene therapy.

2. Agriculture and Food

Synbio has the potential to make a big splash in the agricultural sector as well—up to **\$1.2 trillion** per year by as early as 2030.

One example of this is synbio's role in cellular agriculture, which is when meat is created from cells directly. The cost of creating [lab-grown meat](#) has decreased significantly in recent years, and because

of this, various startups around the world are beginning to develop a variety of cell-based meat products.

3. Consumer Products and Services

Using synthetic biology, products could be tailored to suit an individual's unique needs. This would be useful in fields such as genetic ancestry testing, gene therapy, and age-related skin procedures.

By 2030-2040, synthetic biology could have an economic impact on consumer products and services to the tune of up to **\$800 billion** per year.

4. Materials and Energy Production

Synbio could also be used to boost efficiency in clean energy and biofuel production. For instance, [microalgae](#) are currently being “reprogrammed” to produce clean energy in an economically feasible way.

This, along with other material and energy improvements through synbio methods, could have a direct economic impact of up to **\$300 billion** each year.

The Potential Risks of Synbio

While the potential economic and societal benefits of synthetic biology are vast, there are a number of risks to be aware of as well:

- **Unintended biological consequences:** Making tweaks to any biological system can have ripple effects across entire ecosystems or species. When any sort of lifeform is manipulated, things don't always go according to plan.
- **Moral issues:** How far we're comfortable going with synbio depends on our values. Certain synbio applications, such as embryo editing, are controversial. If these types of applications become mainstream, they could have massive societal implications, with the potential to increase polarization within communities.
- **Unequal access:** Innovation and progress in synbio is happening faster in wealthier countries than it is in developing ones. If this trend continues, access to these types of technology may not be equal worldwide. We've already witnessed this type of access gap during the rollout of [COVID-19 vaccines](#), where a majority of vaccines have been administered in rich countries.
- **Bioweaponry:** Synbio could be used to recreate viruses, or manipulate bacteria to make it more dangerous, if used with ill intent.

According to a [group of scientists](#) at the University of Edinburgh, communication between the public, synthetic biologists, and political decision-makers is crucial so that these societal and environmental risks can be mitigated.

Balancing Risk and Reward

Despite the risks involved, innovation in synbio is happening at a rapid pace.

By 2030, most people will have likely eaten, worn, or been treated by a product created by synthetic biology, according to synthetic biologist [Christopher A. Voigt](#).

Our choices today will dictate the future of synbio, and how we navigate through this space will have a massive impact on our future—for better, or for worse.

by Tyler Durden

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