



THE NATURE OF DESIGNING BIOLOGY

Design direction 2020

A new wave of biotechnology is splitting the waters in biodesign, with each camp having different ideas about their relationships with Nature.

As younger generations change their lifestyles to avoid climate disaster, the commercial reach and emotional meaning of biodesign reaches new highs.

Christina Haxholm, January 2020
7 min. read

Design has maybe always had an interest and love for the natural world. We have designed our own versions of clever, biological systems (bio-mimicry), our own rendering of natural beauty and sensorial experience (bio-philial), and for some time now, the use of living material, so-called 'moist-media', has been on the rise.

The high level of awareness around climate change, and the daunting realisation that we are already living with climate change, is fuelling an emotional need to reconsolidate with nature; to become it's carer, to see ourselves as natural beings, and even to become catalysts of evolution. (Just think of Jurassic Park, and the fascination with the idea of re-animating dinosaurs).

In this spirit, an important distinction is forming in the bio-design community; Co-design vs. Co-evolution.

For a designer with no special knowledge of biology and science, and no access to research teams and labs, the most accessible road to biodesign is likely to guide already existing biological systems or organisms, to exist and grow within a designed framework. A form of co-design.

This is the approach of Blast Studio (The Biological Laboratory of Architecture and Sensitive Technologies). They create furniture and interior design from mycelium (fungi), grown on a 3D printed scaffold, made from recycled coffee cups. Mycelium, which is the root network of fungi, will "eat away" at the organic material in the scaffold, and transform the material into a structurally strong, lightweight and hydrophobic material. The shape and product is designed by humans, but the material, and the look of the surface, is created by nature.





In the column of co-evolution, designers and scientists, often in collaboration with each other, are not keeping to the facilitation of biological processes - they are modifying them. Introducing alternative genes and genetic functions into biological processes, resulting in materials we've never seen before, creating true material evolution. The turn reflects the search for a meaningful relationship with nature, that is not a step back in time, but inclusive of technological development.

One designer taking the leap from co-design to co-evolution, is Jen Keane. Her Central Saint Martins graduate project "This is Grown", features a shoe grown from microbial cellulose, a fairly simple and reproducible process. In 2019, a synthetic biology professional was introduced to the project, which resulted in version 2.0: "This is GMO" - a genetic alteration to the bacteria that produces the cellulose, meaning that the bacteria now also produces the pigment melanin, also found in skin, hair and squid ink. The result: a completely black version of the otherwise translucent material.

From top: Photosynthetic microorganisms by Post Carbon Lab; Lovely Trash by Studio Blast. Left: This is GMO by Jen Keane

As we see climate change take its toll on the Amazonas and Australia through massive wildfires, we call on our politicians to create progressive and uncompromising legislation, to ban or regulate plastics, oil, excessive emissions, unsustainable production of material goods, etc.

The World Economic Forum's Global Shapers Survey 2017 revealed that, already at that time, Climate Change was the no. 1 worry of millennials, with 78.1 percent saying that they would be willing to change their lifestyle to protect the environment.

When elected governments aren't acting fast enough, and when the Friday for futures is over, what's a frightened Millennial or Gen Z to do? On those days, it can feel like most of our democratic power is actually buying power. Younger generations are looking for purpose driven brands, are hyper aware of greenwashing and false advertising, and are open to lifestyle changes for the sake of the biosphere.

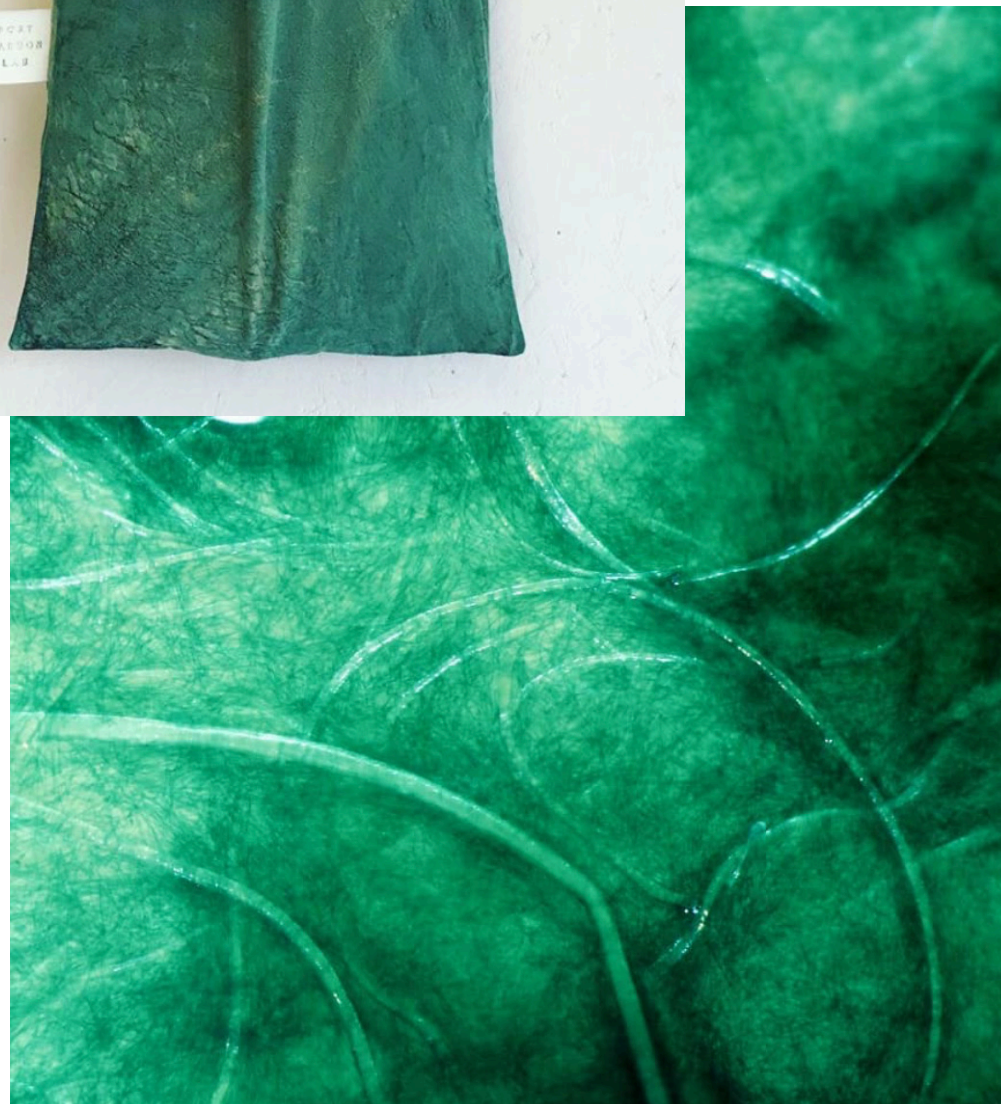
After having experimented with biodesign on a conceptual level, designers are taking notice of the rising acceptance towards the idea of living with other biological systems

- accepting perishable materials and fleeing ownership as an alternative to the everlasting promise of plastic, tanned leather, or even digital technology - and we are seeing conceptual studios and upcoming designers creating business models around their ideas, some of them scaling into big business.

One such venture is Nanollose - in a process not too far from that of Jen Keane, they produce microbial cellulose from agricultural waste, which is then transformed into rayon, a fiber already massively used in the textile industry. The process of creating microbial or bacterial cellulose has been on the rise in recent years, and we have seen not a few exhibitions including the material, often made using kombucha. To turn the cellulose into Nanollose, it goes through the already well established rayon process, which liquifies the cellulose, enabling it to be spun into a fiber. The reason to even create microbial cellulose is the potential yield; A cotton production at the size of a soccer field would yield 0.5 tons of material per year, and a bamboo rayon production would yield 12 tons of material. A microbial cellulose farm of the same size would yield 115 tons of material per year, because of the fast growth rate. Adding that the growth medium of the microbial cellulose is agricultural waste, this co-(bio)design venture is looking a lot more sustainable than its conventional rayon counterparts.



Left and below: Photosynthetic microorganisms by Post Carbon Lab



At a smaller level, before mentioned Blast Studio is currently running a Kickstarter campaign, offering their mycelium designs in the form of vases, stools and chairs. The mycelium material is unfamiliar, to some weird looking, and carries a scent, much unlike most objects we normally bring into our homes. But after the growth process is over the material is dried, and so is not really alive any longer.

The product offered by sustainability research studio Post Carbon Lab on the other hand, is alive. The care of it, is up to the consumer.

Post Carbon Lab coats textiles with photosynthetic microorganisms, creating objects that are alive and will survive, as long as you create the right conditions for it, in terms of light and moisture, as you would for any houseplant. In return, the coating does what any plant would - turn carbon dioxide into oxygen through photosynthesis.

The wear and care of items that are actually alive may not be an easy step for consumers, and the products that would allow one to, are often out of reach. But as younger generations are promising to change their behaviours, Post Carbon Lab is calling for brand collaborations, and for people to test their service pilot. “We want to allow the public to help us generate data in a real life scenario, and collect these data to further define our research directions”, Explains Dian-Jen Lin, co-founder of Post Carbon Lab.

“There is definitely an emotional element within our service pilot, and I think that already serves as a filter, because if people are not interested in changing their behaviour, or the relationship they have with their current garments, then they wouldn’t be in touch with us. But often we get inquiries where people are at least interested in sustainability. And then we are very honest with them in terms of what kind of care routine it would require, and what kind of changes might occur during maintenance.”

Fashion, textile and interior brands looking to expand their sustainable offering, might learn a lot about the possibilities for carbon neutrality, as well as changing consumer behaviour within the scope of using biodesign in daily life, from the research of Post Carbon Lab.

Looking back to the idea of co-evolution, where designers are not only facilitating natural processes, but altering them to create new results, we'll find more famous examples of biodesign, such as Bolt Threads bioengineered spidersilk, or Modern Meadow's bioengineered leather, Zoa. Both are examples of ventures creating materials that are animal-free, but genetically identical to that of animals. We see this type of materials make their way into our wardrobes, when brands like Stella McCartney and Adidas uses them to create products.

The technology for genetic modification has become much more accessible. The 2019 american documentary Human Nature, as well as the Netflix series Unnatural Selection, is making CRISPR gene-editing technology understandable, and making the work of biohackers and synthetic biologists alike, visible.

Bioengineered, cruelty-free materials are challenging our views of how humans should exist in nature, and how much power we should have in the evolution of nature, inside and outside the lab. That conversation is very powerful, and one that I have explored for a while. (www.christinahaxholm.com/ma-regenesis-of-fur)

But what these materials are not doing, is challenging the way we consume. They are set up to replace existing materials in existing supply chains, and while they do offer a much less energy and resource intensive, and more ethical, alternative, they don't really challenge how much we consume, and why.





One project in particular is highlighting a need for us to fuse our insatiable need for digital technology, in this case data storage, with natural systems, in this case DNA. Grow Your Own Cloud is an initiative working on storing the World's data in the DNA of plants. Although data storage in "the cloud" seems fluffy to most, the reality is that data centers currently occupy large areas of land, and consumes huge amounts of electricity. Today, global data centres use as much energy as the entire UK.

Although Grow Your Own Cloud does not reveal their specific method, the idea of bio-storage is not completely new, and is normally said to involve the method of breaking up data into small pieces of code, that is formatted to fit the four letter (A, T, C, G) nature of DNA, and creating synthetic DNA that holds the coded information, which is then introduced to a plant. Plants have some of the largest known genomes on Earth, and so the DNA structure of plants has the potential to store huge amount. This process may sounds imaginary, but according to the company, it is possible for someone to store data like PDF's or photos, in a plant for generations, even creating backups through pollination and seeding, and then downloading the data using nanopore technologies, which allow for the reading back of genetic information almost instantly.

The vision is to develop a new type of cloud, which is organic rather than silicon, and emits oxygen rather than CO2. Imagine securing data in data forests, instead of data centres.

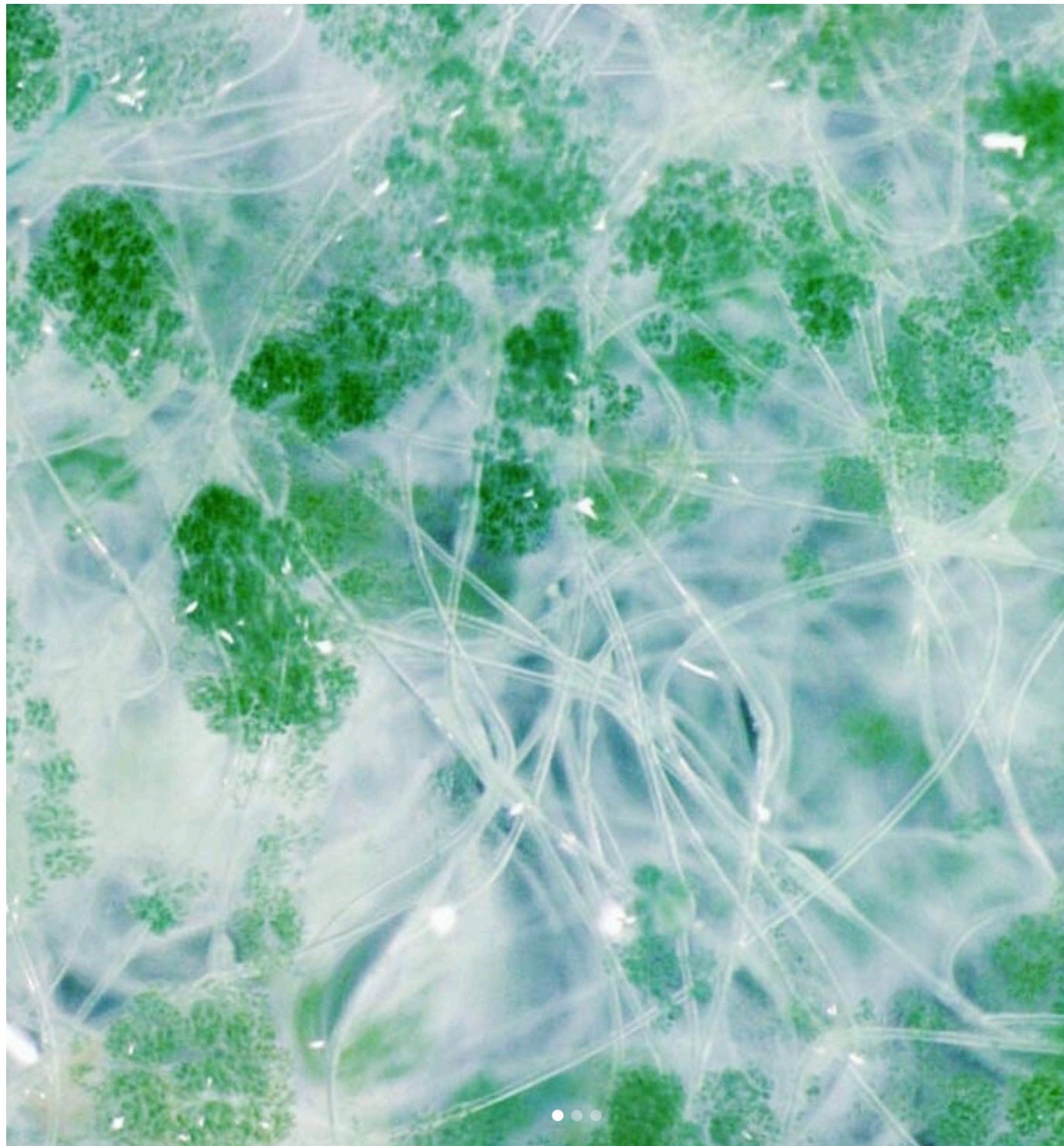
This type of bio-cloud stores data in a format that does not become obsolete, and has the potential to store all of the Worlds current data, in just one kilogram of DNA.

Grow Your Own Cloud is asking people to consider whether technology could become a living organism in a wider ecosystem of the Earth. And they ask us; “Can we shift from models of technology that exploit the Earth’s resources, to regenerative models?”



Above: Microsilks by Bolt Threads, design by Adidas x Stella McCartney; Zoa by Modern Meadow; Grow Your Own Cloud

There is a growing opportunity to get involved with the material revolution, new (digital) services or sensorial experiences that comes with biodesign - whether your customers align more with the idea of Co-design, or Co-evolution.



NOTES

1. As biodesign moves into a commercial and scalable space, take an active approach to learning how and if your community is prone to accepting living systems as a part of daily life. Circular economy and the culture of subscription based ownership is well suited to this premise.

2. Consider your own attitude towards biodesign. Do you prefer to facilitate the natural processes that already exist, or are you open to genetic modification and the risks and benefits it brings? Being transparent and factual about your position and reasoning can help to further define the path for this design direction, and developing technologies.