



CULTURE OF CULTURES

Gleaning from the microbial world

Diva Gohil 2021-23

View from my room in
Navi Mumbai, India



The city you can see
across the view from
my balcony

PREFACE

I was born and brought up in Mumbai, one of the biggest metropolitan cities in India, but the places that I've always sought after were spaces that were close to nature. I sought so much inspiration from her. From taking care of the herb garden in my balcony to keeping bird feeders-I've always seen myself trying to integrate nature into my life. The view from my room is special and unlike anything you might get to witness in Mumbai. Watching the sun set into the water body that harbours mangroves integral to the ecosystem that is home to many seasonal animals made me realise the importance of Nature and all her components.

Similarly, during my undergrad internship I chose to immerse myself in a completely different ecosystem-the mountains. I visited the a nondescript village nestled amidst the craggy peaks of Kargil. Hunderman settlement has an unusual architecture, coexisting with the mountain ranges instead of working against the force of Nature. This reminded me that we need to not see Nature as a resource for us to extract, but more as a collaborator.

“Other small beings issue an invitation to dwell for a time right at the limits of ordinary perception. All it requires of us is attentiveness. Look in a certain way and a whole new world can be revealed.”

-Robin Wall Kimmerer, Kimmerer, R. W. (2003)

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GLOSSARY

- 1. Scoby:** Scoby stands for Symbiotic Culture of Bacteria & Yeast. The slimy microbial blob found floating at the air-liquid interface is used to “start” the fermentation process for kombucha. Also called the Pellicle or The Mother or more scientifically called bacterial cellulose.
- 2. Bio-design:** Bio-design is the use of living organisms in design. Its processes can be used in the creation of fashion, textiles, furniture and architecture. Nonprofits, design institutes and medical institutes.
- 3. Fermentation:** The chemical breakdown of a substance by bacteria, yeasts, or other microorganisms, typically involving effervescence and the giving off of heat.
- 4. Bio-materials:** Bio-materials refers to a material derived from, or produced by biological organisms like plants, bacteria, fungi and other life forms.
- 5. Polymerisation:** The process of monomers forming chain and networks.
- 6. Microbiome:** The collection of all microbes, such as bacteria, fungi, viruses, and their genes, that naturally live on our bodies and inside us.

The Issue

Our society's pattern of overconsumption of goods is intimately tied to the pressing issue of climate change and the unsustainable depletion of non-renewable resources. This connection is also in the personal choices we make every day. The production, transportation, and disposal of goods contribute significantly to greenhouse gas emissions. According to the United Nations Environment Programme (UNEP), the global production and consumption of goods account for about 45% of total greenhouse gas emissions. (Emissions Gap Report, 2022)

Consider the carbon footprint of fast fashion, an industry notorious for its environmental impact. The production of clothing, often using resource-intensive materials like cotton and synthetic fibres, accounts for 10% of global carbon emissions. Additionally, the transportation of these goods across long distances only exacerbates carbon emissions. The burning of fossil fuels for energy, transportation, and manufacturing not only releases carbon dioxide but also contributes to air pollution and environmental degradation. The International Energy Agency (IEA) reports that global energy-related CO₂ emissions reached a staggering 33.1 gigatonnes in 2019, with fossil fuels representing the largest share. (Emissions – Global Energy & CO₂ Status Report 2019 – Analysis - IEA, 2019)

Moreover, the extraction of non-renewable resources often leads to devastating ecological consequences. Mining operations, for instance, can result in deforestation, habitat destruction, and water pollution. The World Wildlife Fund (WWF) highlights that mining for materials such as coal, oil, and gas is a significant driver of habitat loss, causing irreparable harm to biodiversity. (A warning sign: where biodiversity loss is happening around the world, 2021)

While these statistics demonstrate the magnitude of the problem, it's crucial to remember that our individual choices and behaviours also contribute to this larger issue. Each time we buy a product without considering its environmental impact, we indirectly support the overconsumption of goods and the unsustainable use of resources.

By becoming more mindful consumers and making informed decisions, we can actively reduce our carbon footprint. Opting for durable goods, supporting sustainable brands, and embracing a circular economy mindset that promotes recycling and reusing can all contribute to mitigating the negative effects of overconsumption on climate change and non-renewable resource depletion.

It's time to recognize our personal role in this interconnected web of overconsumption, climate change, and resource extraction. Through conscious choices, we can pave the way towards a more sustainable and equitable future, preserving our planet's resources for generations to come.



Chris LeBoutillier, Unsplash

APPROACH

To immerse myself in the realm of bio-design, I eagerly sought out communities engaged in this upcoming field. Within New York City, I discovered spaces like Genspace, a community bio-lab in Brooklyn, where bio-design principles were put into practice. Actively participating in community projects, facilitating thought-provoking discussions, and attending relevant conferences. **I sought to absorb all the collective wisdom of these communities.**

Bio-design represents a significant advancement beyond mere biology-inspired approaches to design and fabrication. It goes beyond biomimicry and the obscure realm of "green design," encompassing the deliberate integration of living organisms as vital components in the design process, enhancing the functionality of the final product. By surpassing the realm of imitation and mimicry, bio-design engenders a paradigm shift towards integration and forging novel materials and collaborative avenues with nature.

With the ongoing climate crisis, bio-design assumes ever-increasing significance by adding to the existing industrial systems with biological processes. This shift is particularly crucial given that products derived from fossil fuels and plastics currently adhere to a linear life cycle, culminating in their ultimate destination; the landfill. Bio-design seeks to disrupt this linear trajectory, ushering in a transformative circular life cycle for products.

Incorporating frameworks such as critical ecology, along with other feminist and anti-colonial systems, my exploration expanded beyond the realm of incorporating living matter. It extended to an examination of the evolving notions of nature that we collectively share.

This work lies at the intersection of biology, design and the communal aspect of Scoby. Combining these three aspects has been vital for the success of this project.

In Collaboration with:



Mombucha



Scoby in science

A brief introduction to biomaterials

“Biomaterials are those materials— be it natural or synthetic, alive or lifeless, and usually made of multiple components— that interact with biological systems. Biomaterials are often used in medical applications to augment or replace a natural function.”

-Nature.com (Skipper, 2023)

Biomaterials are inherently non-toxic in nature and are biodegradable since they are living materials or are made of organic substances. My initial foray into this world was through watching videos or by reading on-going research papers. It was only upon relocating to New York City that I had the opportunity to engage in hands-on experimentation with these fascinating materials. I was so grateful to have come across Genspace, a community bio-lab that was welcoming of people from different backgrounds and encouraged curiosity driven experimentation rather than solution driven ones. This is fostered by encouraging

people who haven't received formal education lead community projects.

My journey began with creating bioplastics in the comfort of my own kitchen. Using easily accessible ingredients such as glycerin, vinegar, and clay, I was able to make a non-toxic alternative to plastic, one of the most environmentally damaging substances on our planet. This experience propelled me further, igniting my curiosity about the vast potential of other biomaterials. **I wanted to know what are other biomaterials that could be alternatives to other harmful materials that I can make at home?**

Bioplastics made out of
clay, glycerin and
vinegar



Through my involvement with Genspace, I had the privilege of assisting Nikki Romanello, a biomaterial practitioner, for a four week biomaterial crash course.

Nikki Romanello teaching biomaterials at Genspace



(Pictured right and above) Nikki making substrate for Scoby to grow in

I delved into a diverse range of biomaterials, including slime mold and Scoby, acquiring a broad foundation of knowledge in this field. Working alongside Nikki was enriching since it gave me an abridgement of biomaterials and their uses. and eventually led me to Slow Factory, the organization with which she was associated.

Located in Upstate New York, Slow Factory is a nonprofit working towards climate justice. They offered me the opportunity to serve as a lab assistant during the subsequent summer. Nikki was working on a project involving the growing and cultivating bacterial cellulose or Scoby, to produce leather. This endeavour entailed integrating natural dyes, as well as non-toxic and natural additives, in the hopes of creating a fully biodegradable and toxin-free leather alternative.



MY JOURNEY WITH SLOW FACTORY

The summer of growing culture

Slow Factory is a climate justice organization and environmental & social justice nonprofit organization. They aim to create social equity through educational programming, regenerative design, and materials innovation. The lab grew bacterial cellulose or Scoby, harvested them and explored treatments that would make the material as close to synthetic leather without using harmful additives. They worked out of was located in a remote location Upstate, a completely different landscape than NYC. Often even encountering deers on my way to the lab, I felt joyously reconnected to Nature again. I spent my time watching the bacterial and



yeast colony grow-ensuring the temperature was the right and they were well fed. The Scoby were grown in large rectangle vats for a larger surface area. We needed to keep track of the experiments and decided to name the Scobies. Our star Scoby was called Piper who grew evenly throughout but my favourite was called Ronak, named after Nikki's childhood friend. This seemingly inert material was actually brimming with life and soon became my cherished companions. Some days, I would have more bacterial interactions than human ones. It opened up a fascinating new world which I saw immense value in.

As a social designer, gleaning different ways in which different organisms coexisted to create harmonious systems was extremely inspiring. This is what I wanted to continue to bring into my practice as a designer.

As I continued to conduct more experiments, it became clear that the material's unique properties afforded it to be fit for the fashion industry. I wondered what the world would look like if we harnessed the properties of Scoby to grow in the shape of the container. We could grow clothes in the patterns they had to be stitched in, potentially creating no fabric waste.

But this was also more than a scientific exploration; it was a transformative journey that reshaped my perception of nature and her power to tackle the pressing challenges of our time. I realised that waste creation and excessive production is a human invention. Nature uses her resources in the most efficient manner, leaving no waste. The harmonious attunement to the microbial needs left me with a profound understanding of nature's prowess—a revelation that I hope would guide my path.

What was even more fulfilling was the dedication of Slow Factory to their values which aligned deeply with the values I wanted to imbue in my work. They refused to add in any artificial plastic mix-ins and strived to make the leather a 100% plastic free even though that was more intensive and difficult to standardize.

Bacterial Cellulose

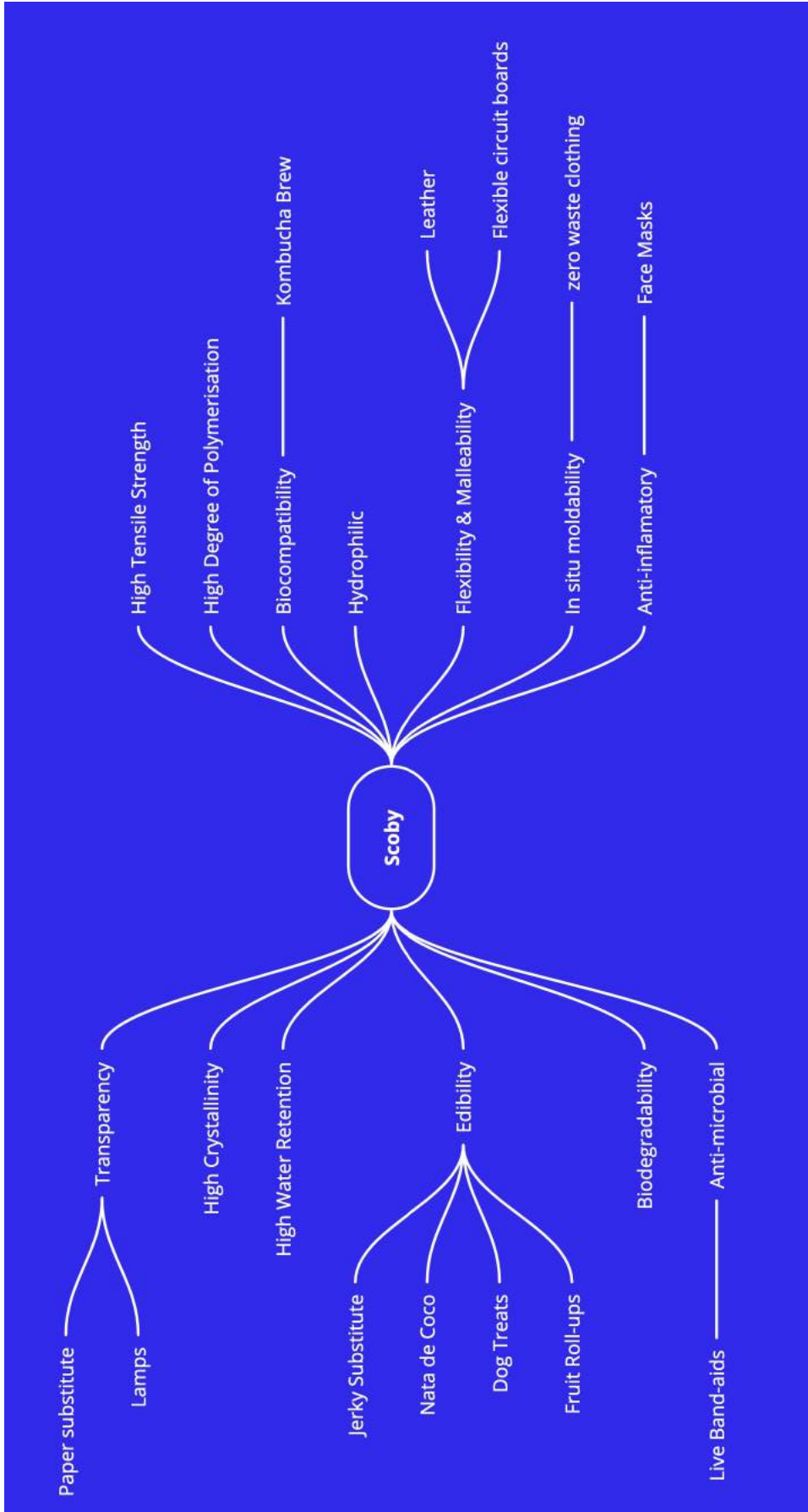
Scoby or Bacterial Cellulose is an organic compound that is recognised as a multifaceted biomaterial with many different applications such as making leather, dog treats, fruit roll-ups and even has shown properties to absorb harmful chemicals. Recently, researchers have even experimented and turned it into a flexible electric circuit board. **Leveraging the distinguishing properties of this material enables us to develop novel solutions to environmental problems.**

Hence, understanding the properties of Scoby is essential. Some of the properties of Scoby that I have observed during my time experimenting with are listed in the table (left).

When making leather out of Scoby, the high water retention and hydrophilic properties were a disadvantage. But the same properties were extremely helpful when used in wound healing. After understanding the properties of Scoby, I realized the versatility of the material and mapped out properties that lead to different uses of Scoby. (Page 12)

Scoby property	Definition
High degree of polymerisation	High melting temperature & high mechanical strength
High tensile strength	Not prone to breakage easily
Transparency	After drying, the material displays transparency that depends on the thickness
High crystallinity	High degree of hardness when dried
High water retention	The material retains water when growing
Hydrophilic	Tends to attract water even after completely dried
Edibility	Can be eaten dry or when growing
High flexibility & malleability	Can be tuned into sheets
In-situ moldability	Grows in the shape of the container it is grown in, creating zero waste
Anti-microbial	Fends off harmful microbes
Anti-inflammatory	Retains moisture, making it anti-inflammatory

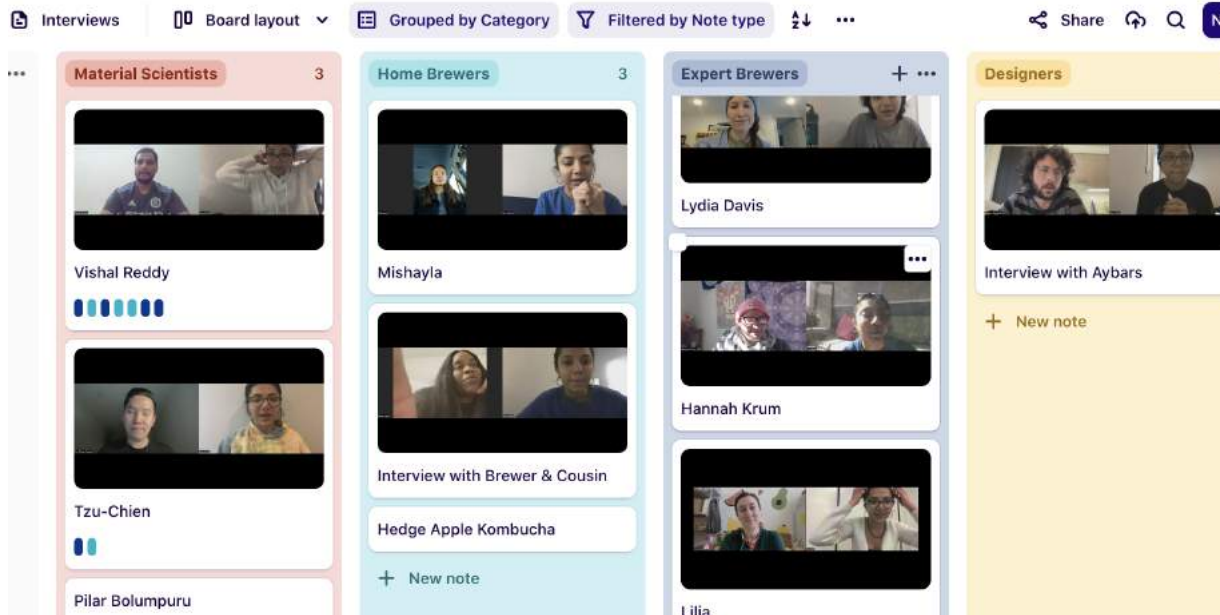
Application of Scoby due to the various properties displayed by the material



SCOBY CULTURE

As I was introduced to Scoby through material exploration, I chose to go deeper and explore Scoby by talking to people who work with this Scoby culture professionally in their lives like Mechanical Engineers, Fashion Designers and even Chemical Engineers. I conducted semi-structured interviews to gain insights into their practices and needs. I spoke to 4 engineers, 3 fashion designers and 3 chemical engineers. From these discussions, several common needs within the Scoby experts emerged.

One material scientist, who works in a materials innovation company that produces 100% plastic-free leather from Scoby, highlighted the barriers to popularizing this material and the challenges in the production process. Regarding the prevalent issue of greenwashing, he emphasized the importance of shared values, stating, "There are people who don't share the same philosophy, but it is absolutely necessary for them to share the same values."



"Lack of education, I guess. You have spoiled expectations based on all the existing artificial petrochemical products we use, that (biomaterial alternatives) it has to be perfect."

"Let's say there is a color shift due to exposure to sunlight or other products, people won't accept that."

Another material scientist, who works on creating living materials with Scoby, expressed the need for impactful science and design, stating

"A lot of science, although they're very exciting in a scientist's eyes, don't really create real impact."

He also emphasized the importance of making biological engineering more approachable and accessible for artists to create what they envision.

A material designer from Materiom, a materials research company, stressed the importance of making knowledge accessible and the need for comprehensive policies and regulations to support the development and adoption of biomaterials. She highlighted the role of the maker and open-source community in sharing knowledge and making it more accessible.

Based on the gathered insights, I identified key barriers to address in my thesis:

1. **Increased awareness about biomaterial alternatives:** There is a lack of awareness among the general public about less harmful alternatives to existing products. More learning opportunities and educational initiatives are needed.
2. **Access to knowledge and ongoing experiments:** Individuals new to the field find it challenging to access knowledge and information, which hinders innovation. Open-source knowledge platforms can facilitate learning and collaboration.
3. **Mindset changes in material consumption:** There is a need to shift expectations and perceptions of natural materials, moving away from the notion that they must perform identically to their synthetic counterparts. Companies face pressure to meet current industry standards of perfection, which is not always realistic for biomaterials.

By addressing these barriers, we can foster greater awareness, knowledge sharing and mindset changes, ultimately promoting the wider adoption and acceptance of biomaterial alternatives.

SCOBY IN KOMBUCHA



As mentioned earlier, I was introduced to the material through the lens of a materials researcher. I didn't realize that Scoby existed in our daily lives already within the reach of people-as Kombucha.

After speaking to material scientists, I spoke to home-brewers as well as small scale kombucha brewers that offer their product to local consumers. I also came across really insightful research papers that spoke about the home brewing kombucha community and the social relations/ values that this process engenders among them.

COMMUNITY 2

The second phase of my research involved conducting interviews and engaging with home brewers, a community deeply involved in the process of brewing kombucha. The kombucha community primarily interacts and troubleshoots brewing issues on platforms such as Subreddits and Facebook groups. Through these interviews, I aimed to understand their experiences and whether their perception of kombucha brewing had evolved over time.

To collect data, I distributed online forms through online groups and established contact with smaller-scale brewing companies and kombucha practitioners who conduct workshops to teach brewing techniques. As I delved further into the brewing culture surrounding kombucha, it became evident that it encompassed more than just the beverage itself. **It represented an act of caring that extended beyond the individual, highlighting the mutual interdependence on a multispecies level.**

Moreover, the properties of the Scoby seemed to directly influence brewer behavior. The regenerative nature of the Scoby fostered a tendency among brewers to share it with others, treating it as a "superfluous commodity."

Given that the kombucha brewing process is slow and requires careful steps to maintain the culture's vitality, brewers developed an appreciation for slower processes. Fermentation, being a multi-species symbiotic event, was often described by brewers as an intricate collaboration of countless living organisms, akin to a beehive. **This emphasis on collaboration underscored the importance of reciprocity and giving back.**

Additionally, as kombucha is a prosumer good—made and consumed by the same individual—the notion of "taking care of the kombucha and it taking care of you" gained significance. This heightened attentiveness to the well-being of the microbes demonstrated brewers' inherent capacity to care for nonhuman entities. These values fostered a natural inclination among brewers towards more sustainable and inclusive practices. **By being attuned to the needs of the Scoby, brewers displayed a heightened sense of responsibility and developed a non-anthropocentric ethic of caring.**

I call these "Bacterial Values"

Through my research, I was introduced to Rich Awn, the owner of Mombucha, who exemplifies how brewing kombucha can instill values that shape a business model.

“Mombucha operates at a human scale, challenging the industrialisation of kombucha by adhering strictly to traditional brewing methods. It serves as a proof of concept that a beverage business can flourish while prioritising both people and the planet. In addition, Rich utilises the space to foster community by providing a shared kitchen for individuals engaged in mutual aid activities.”
(Awn, n.d.)

Rich Awn, owner
of Mombucha



Images sourced from Mombucha website

Bacterial Values

Material properties

Infinitely regenerative

Slow growth

A multi-specie process

Symbiotic culture

A living culture

Value infrastructure

Sharing & Abundance mindset

Patience

Collaboration

Interconnectedness

Care & Kinship

“It has a name and I take care of it. I joke that my Scoby is several pets that have a **hive mind.**”

-Alexandra, 6 month old homebrewer

“I nourish the Scoby, it produces probiotic bacteria and antioxidants, which improve my digestion and health. I care for my kombucha and Scoby, and they care for me.”

-Homebrewer for 2 years

Critical Ecology

“Cis-hetero—white supremacy, colonialism, and modern capitalism are long-term ecological processes disproportionately harming Black and Brown bodies and the planet. Western Earth and environmental science does not — and as it functions, cannot—address these processes.”

-Dr. Suzanne Pierre (Pierre, 2019)

As I tried to navigate what the kombucha culture values mean and look like in the world and its systems. I came across the concept of Critical Ecology, a concept crafted by Dr. Suzanne Pierre, who studied soil microbiomes and is a biogeochemist. She studies the social precursors that lead to these anthropogenic environmental harms. Understanding real-life practices and structures that promote and maintain social and such environmental disparities.

The Critical Ecology Lab aims to deepen our understanding of how these processes shaped society and the planet by giving voice to questions/actions grounded in a more expansive understanding of global change, called "critical ecology". **What are these social drivers of environmental change?**

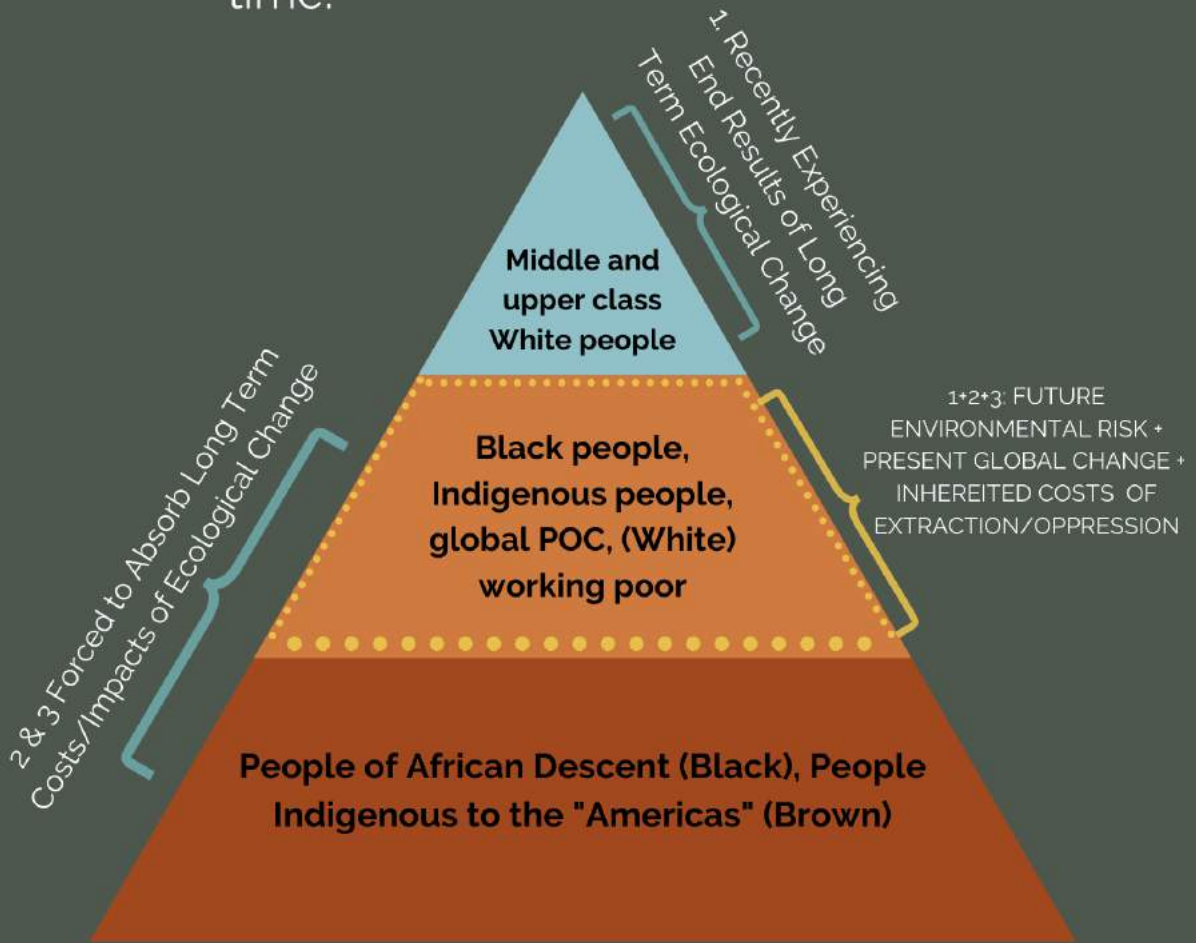
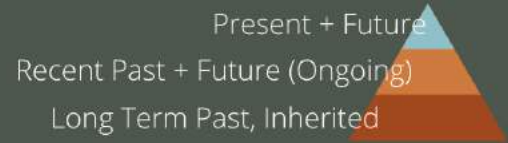
Along with this theory and other books that speak about the same influences of capitalism and colonialism and the mindsets that lead to environmental degradation like the current leather industry landscape.

“Imagining the human since the rise of capitalism entangles us with ideas of progress and with the spread of techniques of alienation that turn both humans and other beings into resources. Such techniques have segregated humans and policed identities, obscuring collaborative survival.”

-Tsing, *Mushroom at the end of the World* (Tsing, 2015, p. 19)

Critical Ecology Framework
developed by Dr. Suzanne Pierre

How white supremacist
processes disproportionately
impact people & the Earth over
time.



Applying Critical Ecology to the leather industry

After learning about the framework, I looked back and applied it to the leather industry to understand the characteristics that have made it unsustainable.

Leather production has a long-standing history dating back over 7,000 years, initially utilizing leftover animal skins as a by-product for clothing. The traditional process involves tanning the animal skin with chemicals to preserve and render it suitable for various applications. Tanning agents commonly include vegetable tannin derived from tree bark, as well as fish and animal oils along with salt. ("Leather," n.d.)

During the 18th century, leather gained widespread popularity, particularly due to the demands of industrialization for softer and more flexible materials. This necessitated a departure from the slower and harder vegetable dyeing process. The introduction of chromium tanning marked a significant shift in the leather production landscape, offering faster and more cost-effective methods. However, this method involved the use of harsh chemicals that had adverse effects on both the environment and workers involved in the process.



Image from Unsplash by mikedabell

Presently, the leather industry boasts a staggering market size of \$408 billion USD. (Grand View Research, n.d.)

It has transitioned from being a by-product of the animal industry to a co-product, leading to unintended consequences for the environment, animals, and local communities. Daily slaughtering of cows and veals to produce footwear and handbags is accompanied by the increasing

utilization of exotic leathers sourced from snakes, alligators, crocodiles, and even ostriches, putting these species at risk of endangerment. The rearing of cattle for leather production contributes significantly to greenhouse gas emissions, accounting for an estimated 14.5% annually. (Food and Agriculture Organization of the United Nations, n.d.)

Additionally, by 2021, approximately 70% of the Amazon rainforest had been cleared to create pastures or cultivate feed crops, further exacerbating environmental concerns. (Roy, 2023)

The leather industry is notorious for using workforce from the global south to execute intensive processes like tanning. These chromium-based tanning processes involve the use of large quantities of heavy metals, posing risks to both human health and the environment. Runoff from these tanneries contaminates nearby waterways, adversely impacting the surrounding ecosystems and human populations residing in those areas.



Image by Larry C. Price. India, 2016

Moreover, the detrimental effects of leather production extend to the well-being of tannery workers. These individuals frequently suffer from severe chemical burns resulting from their handling of carcinogenic substances in the factories. In fact, a research paper indicates that tannery workers face a 50% higher risk of pancreatic cancer due to chemical exposure. (Rastogi et al., 2007)

These findings highlight the multifaceted negative impacts of leather production, encompassing environmental degradation, animal welfare concerns, and risks to the health and safety of those employed in the industry.

Characteristics of unsustainable practices

After taking into consideration these practices, I listed characteristics of such industries that are unsustainable.

1. **Short-sighted:** This mindset is characterized by a focus on short-term gains and immediate satisfaction, without considering the long-term consequences of our actions. Short-sighted thinking may prioritize economic growth and individual profit over the health and well-being of the environment and future generations.
2. **Scarcity-based:** A scarcity-based mindset views resources as limited and scarce, leading to a "use it or lose it" mentality.
3. **See nature as a resource:** This mindset views nature primarily as a resource to be exploited for human benefit, rather than as a complex and interconnected system that sustains all life on Earth. This can lead to unsustainable practices such as deforestation, habitat destruction.
4. **Individualistic:** An individualistic mindset prioritizes individual rights and freedoms over the collective good, and downplays the social and ecological impacts of individual actions. This can lead to waste generation and pollution.

BACTERIAL VALUES

1. **Sharing & Abundance mindset:** Due to people seeing Scoby as a superfluous material since they keep regenerating, people tend to willingly share their growing Scobys with their friends and family members.
2. **Patience:** Fermentation is a slow process and it takes time. Observing the growth of Scoby, people have a new-found appreciation for slower processes and develop more patience.
3. **Collaboration & Interconnectedness:** Fermentation is a multi-specie process, Yeast and Bacteria come together for a symbiotic and harmonious process. This display of collaboration also emphasises the importance of inclusivity and how interconnectedness is essential for survival.
4. **Care & Kinship:** The process of growing bacterial cellulose is imbued with care. You have to attune yourself to being beyond just human which forms a bond and develops kinship.

After taking into consideration the lack of knowledge among home brewers about Scoby, I arrived at a research question that guided my first few prototypes:

How might we leverage kombucha brewing practices to create wonderment and build a community that experiments with Scoby to develop sustainable practices.

PROTOTYPE 1

Brew book for kombucha home brewers

The insight:

- Home brewers tend to form attitudes of care and reciprocity towards their brew. After coming across insightful research papers on the culture around kombucha home brewing, namely, *Kombucha culture & Why would I fry & eat my SCOBY?* Which mentions the engendering of common shared values among kombucha brewers. I wanted to understand at what point in the process this happens and how I can amplify it. I collected answers to an online form that inquired about their brewing journey.
- Collected answers showed me that the bond between the home brewers and their brew is only fostered after a year of brewing and the intentionality behind it.

Goal:

- To introduce new and existing home brewers to view brewing as grounds to connect with the bacterial world.

How:

- To introduce mindful kombucha brewing* through the book

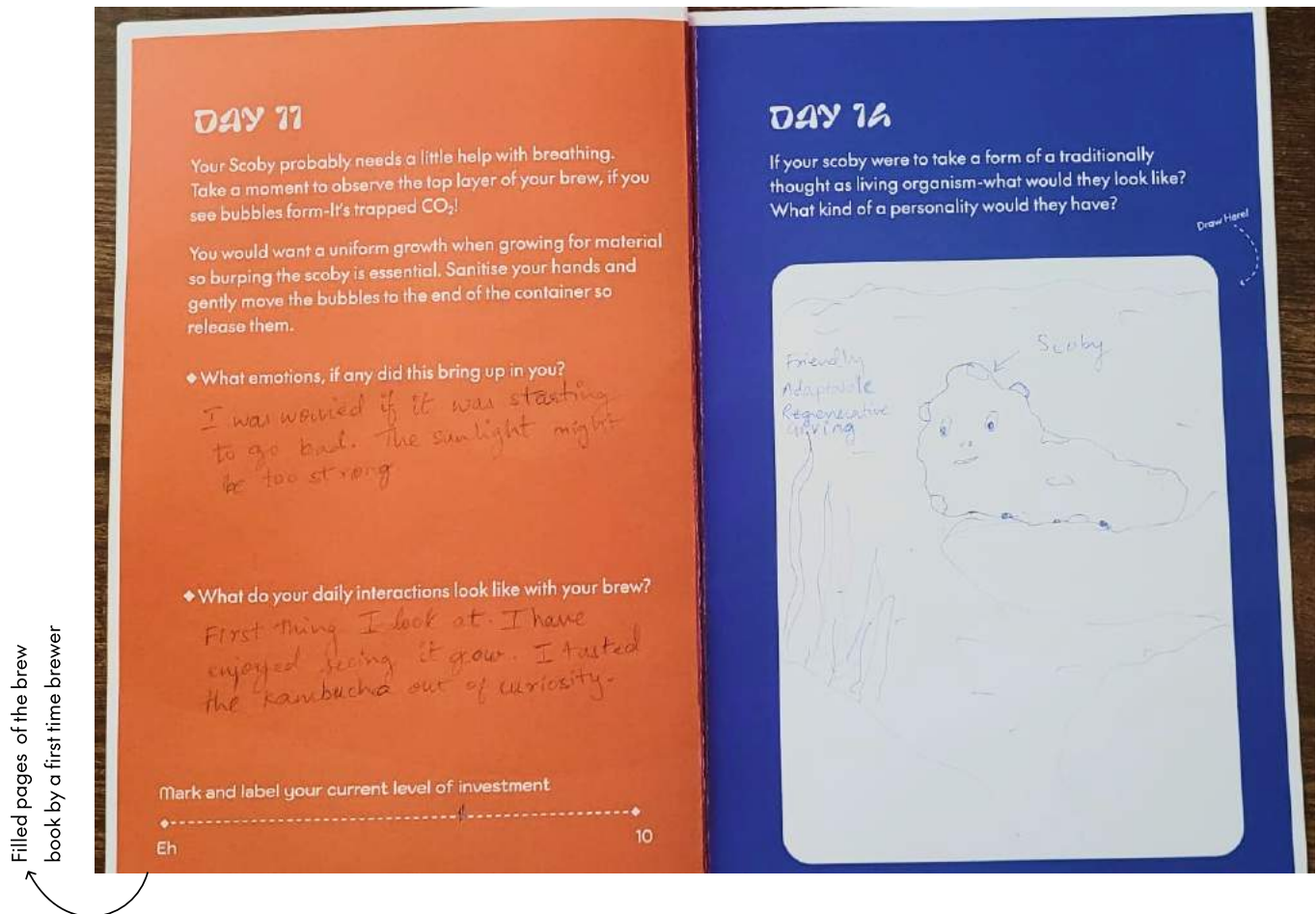
*mindful kombucha brewing refers to the practice of actively engaging and noticing the process of brewing to facilitate a relationship between the microbial culture in the brew and brewer.

Inspiration:

- The Brew-Book was born from my personal journey of cultivating Scoby for leather and the Kombucha community. It was an endeavour to forge bonds from the beginning of the brewing journey.

In the leather-growing process, we utilised large shallow vats to maximise surface area, while traditional kombucha brewing takes place in jars to accommodate larger volumes. To encourage participant engagement and awareness of the culture, I suggested using shallow containers with ample surface area. These shallow vessels became gateways to immersive encounters, inviting them to witness the culture's intricate growth.

The book also built rituals like burping the Scoby and noticing emotions that were evoked during the process. This journey concluded by inviting participants to envision their brew or Scoby as a traditional living being and explore its personality, allowing them to extract values gained from observing their Scoby's growth.



Things I learnt:

- There might be an information overload for new brewers since the process of fermentation is not easy to grasp.
- Brewers appreciated watching their SCOBY grow.
- Getting busy with life/ finding no time to check in on the brew was their biggest challenge and concern during the process.
- Prefacing this as a brew book garnered interest more from people looking to brew kombucha and so the interest in filling out the brew book wasn't sustained. Maybe reframing this as a way of engaging with a new world or as a supplemental part to an existing experience would be better.

PROTOTYPE 2

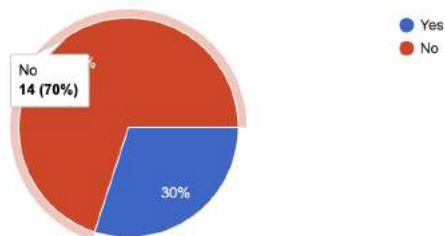
Online Workshop (home brewers)

The insight:

- Home-brewers haven't put their pellicle (Scoby is called the pellicle in the brewer community) for other uses but are not averse to exploring new ways to use their pellicle.
- "Maker and open source community has been key to me from my early career." Quote from scientist at Materiom, a materials research company
- Existing material libraries are catered to industry experts and leave out people who experiment at home. They are focused mainly on material uses.
- Home brewers aren't aware of the versatile uses or the properties that enable these versatile uses of the pellicle.
- Showing people how to make a final product out of their pellicle is not the best way to go.

Have you used your pellicle for other purposes before?

20 responses



Goal:

- To help home-brewers understand the different properties of the pellicle and help home brewers channel their knowledge and lived experiences as well as personal practice into experimenting with their pellicle.

How:

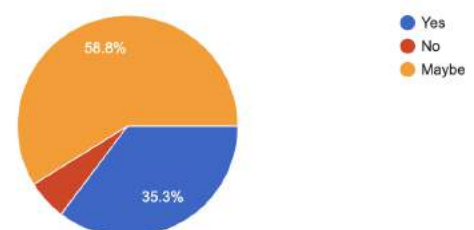
- Having an online workshop among home brewers that gives them a better understanding of the pellicle.
- Providing them space to engage in resources about the ongoing research, that is easy to understand and conduct in your home.

Inspiration:

- One of the home brewers who was a herbalist used their pellicle as a live bandaid for their husband's half amputated foot.

If No, would you want to explore different ways to use your pellicle?

17 responses



After the first few prototypes, I arrived at a new how might we statement that accommodated more than just home-brewers to anyone who wanted to expand their sustainable practice:

How might we realize the potential of the bacterial world to harness them and move away from existing extractive practices?

PROTOTYPE 3

In-Person Workshop (scooby curious people)

The insight:

- There is minimal chances of engagement with the bacterial world so as to recognise and notice them in order to realize their potential
- Bacterial world goes unnoticed and is often ignored.
- Existing research about the material properties of scoby uses a lot of jargon that makes this information inaccessible to people.

Goal:

- To generate wonderment and create curiosity among people who are looking to new ways of being sustainable about the bacteria and biomaterial world.

How:

- Having an in person workshop among people looking to deepen their sustainability practice.
- Giving them hands-on experience with the material and providing them with the bacterial culture to take and experiment on their own at home.
- Providing them with prompts and discussion in the end to encourage them gleaning from the bacterial world and realize ways in which they can.

Things I learnt:

- People became quickly curious about the bacterial world
- People hesitated adopting a scoby because of the time and responsibility that comes with the culture
- People had a new-found way at looking towards the bacterial culture
- Even if they didn't take the culture home, they wanted to know more about biomaterials and showed appreciation for "bacterial values"
- Reframing the way I talk about Scoby. In this workshop I emphasized how Scoby needs to be taken care of which deterred people from taking one back home but in reality they are resilient and can survive on their own for a while. Reframing them to be more as collaborators would be a more encouraging approach.





"There are always more sustainable ways of doing things even if it means looking into the unlikeliest of places (like bacterial culture!)"



“There is much more magic waiting for us to explore outside of human society. Bring me away from human-centralised mindset for a while”

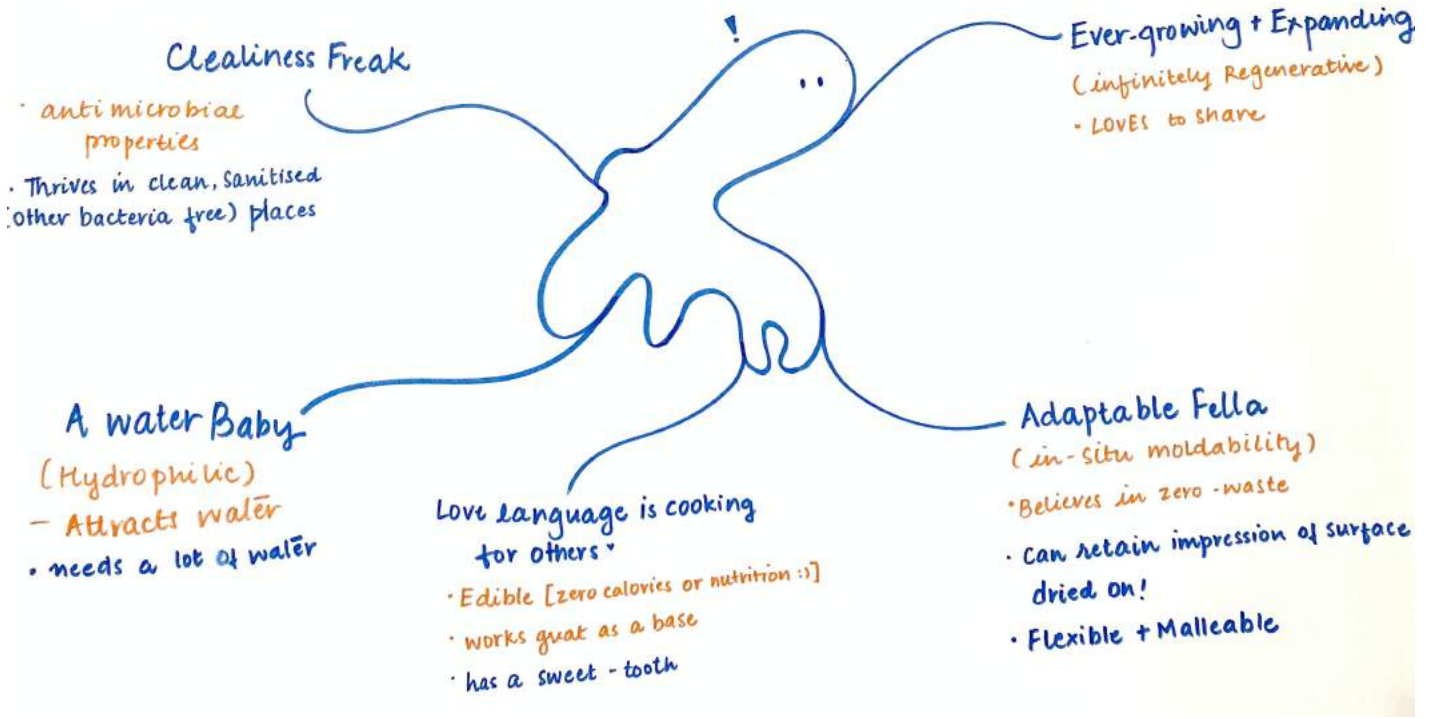


CULTURE OF CULTURES

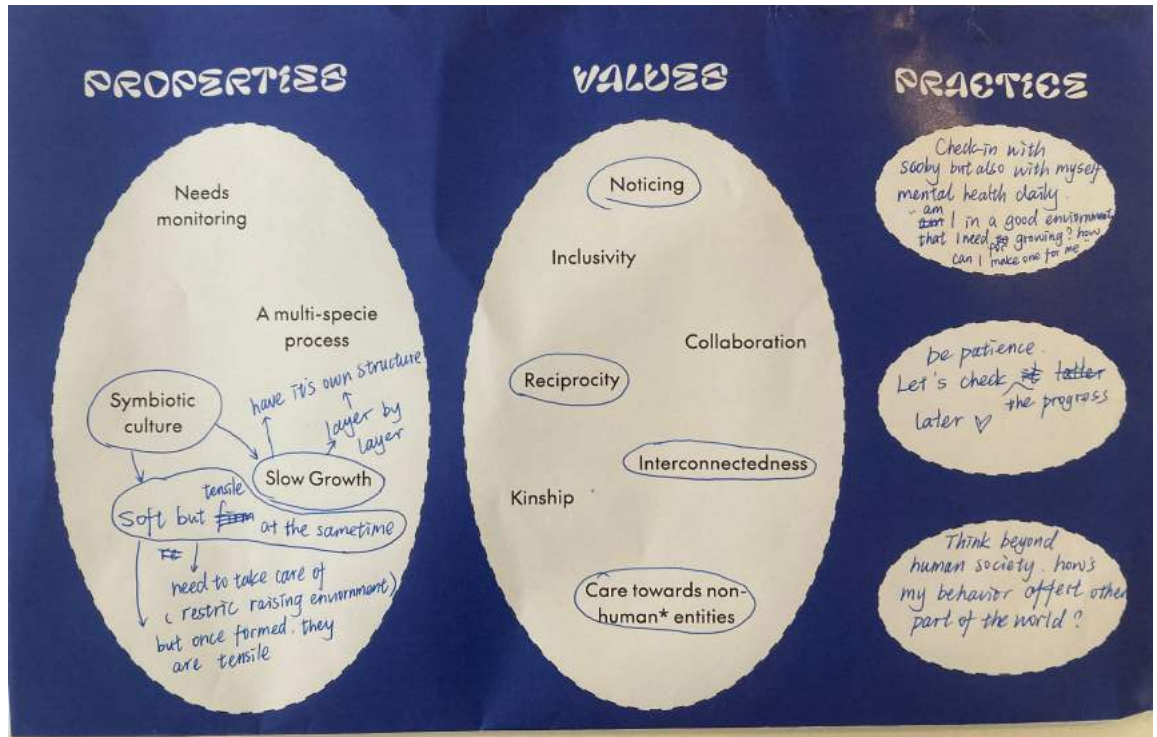
An approach for practitioners to talk about biomaterials to create wonderment that might lead to behavioural change.

Through the workshops conducted, I developed an outline that ensures effective communication of Scoby that can be applied to other biomaterials like Mycelium & Bioplastics

- 1. Intimate and Informal Setting:** To facilitate a conducive learning environment, the workshop embraced an informal and intimate setting. This approach encouraged participants to feel comfortable asking questions and actively engaging in the learning process.
- 2. Creating a Biomaterial Character:** Recognizing that introducing biomaterials can be overwhelming, I employed the power of visual representation. I created a biomaterial character with distinct personality traits aligned with its properties. This visual aid helped participants grasp concepts more easily and fostered a sense of connection and empathy towards the culture.
- 3. Demonstration:** Biomaterials possess multiple uses unlike their synthetic counterparts designed for specific purposes. Highlighting this, I conducted practical and interactive demonstrations to showcase real-life applications of the material. For instance, I demonstrated how to dye and dry Scoby to create colored leather, enabling participants to witness its versatility firsthand.
- 4. Thinking Prompts:** The workshop culminated with thought-provoking prompts that invited participants to contemplate their relationship with nature and consider the elements required to foster a culture of using biodegradable materials. These prompts encouraged introspection and sparked a deeper connection to sustainability.
- 5. Taking the Culture Home:** To address the challenge of sourcing Scoby, participants were given the opportunity to take one home, along with a book that I had created during the initial prototype. This empowered them to continue their exploration of biomaterials beyond the workshop.
- 6. Reflective Worksheet:** Following the workshop, participants were provided with a reflective worksheet where they circled the properties of Scoby that they learnt about, the values that they noticed occurring and how they can implement that as a daily practice in their life



This attendee mentioned that they will cultivate a practice of thinking beyond human society and understand the implication of their behavior to the other part of the world.



Theory of Change

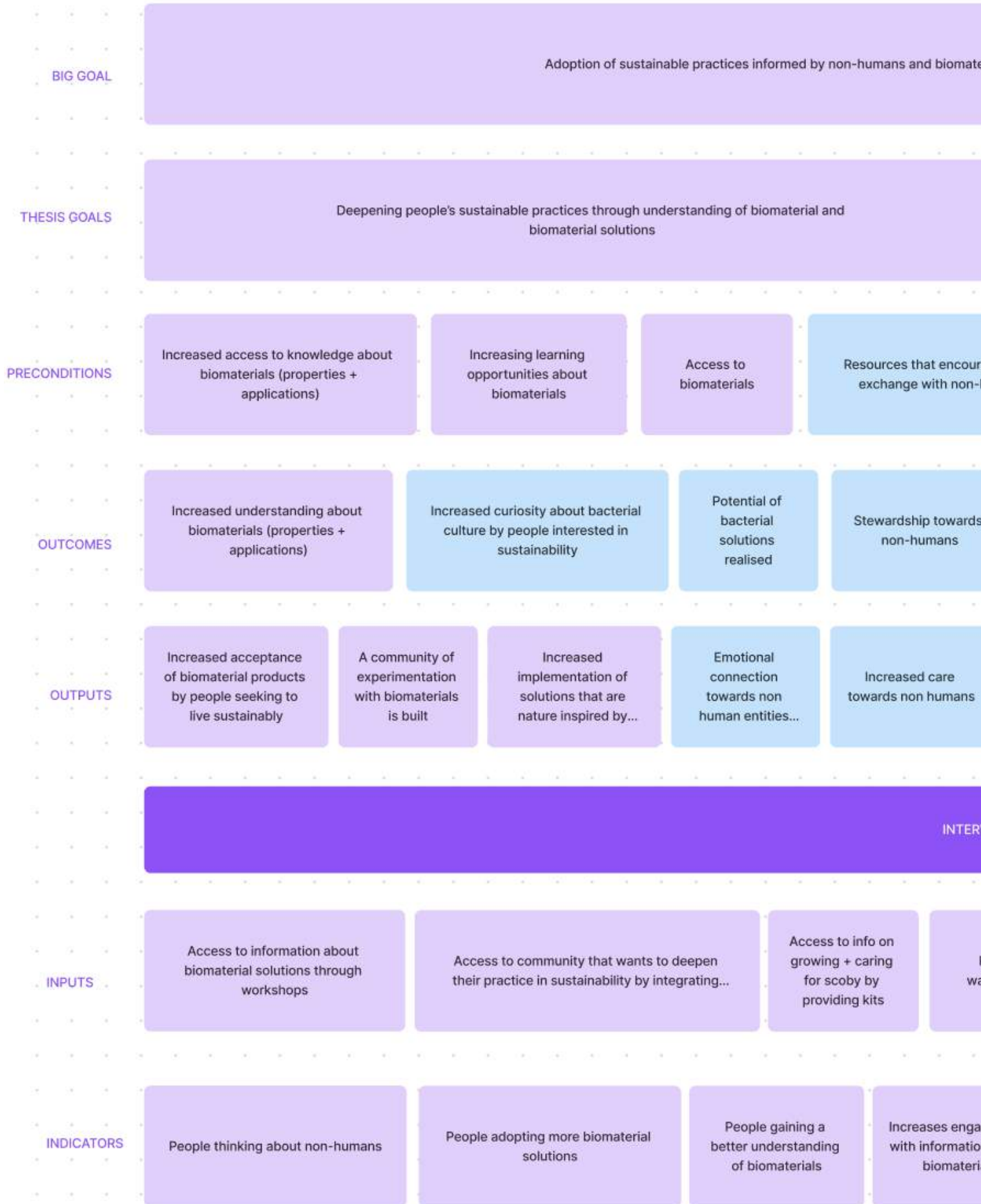
My Thesis focuses on the potential of biomaterials, specifically Scoby (society of bacteria and yeast), as an alternative and sustainable material. However, there are several key themes that need to be addressed in order to fully realise the potential of biomaterials and foster innovation in this field.

Firstly, there is a lack of knowledge and awareness regarding biomaterials among individuals who interact with it primarily for brewing kombucha. Many people are unaware of the diverse applications and properties of Scoby, limiting its utilisation.

Secondly, existing information about biomaterials often adopts a material/chemical science perspective and employs technical jargon, making it inaccessible to a wider audience. This lack of accessible information hinders innovation and prevents individuals from realising the full potential of biomaterials in their own practices.

Thirdly, there is a need to foster curiosity and demonstrate how biomaterial solutions can be applicable to people's lives. Instead of solely focusing on the final product, it is important to provide individuals with the tools and knowledge to apply biomaterials in their own sustainable practices.

Lastly, the process of caring for non-human entities, such as Scoby, instills values of care and reciprocity, which can serve as a catalyst for behavior change and deepen individuals' sustainable practices.



...y people interested in sustainability to reduce reliance on extractive consumerist practices

Value exchange between human and non-humans

Increased understanding of the value of biomaterials and non-humans

Increased value of caring towards non-humans

Increase in rate of innovation of biomaterial products and solutions

Increased biomaterial informed products in the market

Increased integration of sustainable alternatives in daily life

Instilling non-human values in their daily lives

Increased use of biomaterial products and solutions

Increased peer to peer learning and sharing of innovation with biomaterials

Increased grant funding from government

Increased visibility of non-humans

Increased exposure to biomaterials

Increased knowledge about potential of biomaterials

Reflection of non-human values in their daily lives

Increased importance of adoption of biomaterial solutions

Humanising bacterial culture

ON CULTURE OF CULTURE

...ng biomaterials to people who deepen their sustainable practice...

Creating space for reflection on non-human values

Access to knowledge about biomaterial properties

platform to share and learn from a diverse set of people experimenting with biomaterials

People signing up for more workshops about different biomaterial

People sharing their grown culture with friends

People realising the values of the non-human world

increased online sharing of experimentation

People taking brew-kits home

Measurement & Evaluation

My initial idea for the workshop was to provide every participant with the bacterial culture to take home and experiment with. However, as I delved deeper into the process, I realised the importance of making this choice to adopt a Scoby an active decision rather than a mandatory requirement. Throughout the journey of growing the Scoby cultures myself, I developed a certain attachment to them, and I wanted to ensure that they found purposeful homes.

With this shift in mindset, the participants' willingness to adopt a Scoby became a meaningful metric of success for the workshop.

Other evaluation questions I wanted to keep in mind were:

1. Can participants accurately explain the properties, benefits, and potential applications of Scoby?
2. Are participants able to identify the environmental advantages of using biomaterials over traditional materials?
3. Have participants experienced a shift in their mindset regarding natural materials?
4. Are participants more inclined to consider sustainable alternatives after engaging with the intervention?
5. Are participants continuing to engage with biomaterials beyond the intervention?

Parts of the workshop that felt accessible:

“The great storytelling behind the concept and then the hands-on interaction with the material. + a very open and warm atmosphere prompting discussion.”

“The intimate and informal setting plus the simple and lucid explanations.”

Parts of the workshop that were inspiring + engaging:

“How everyone, no matter from what background was able to come together and enjoy exploring the new topic and find value in it.”

“I thoroughly enjoyed when everyone shared their ideas of different uses for the biomaterial especially lamp shade material.”

Some of the key takeaways of the participants:

“That eco material can be so “easily” made from home kitchen with proper knowledge, which is yet well-known among ppl and should be widely promoted like this workshop greatly did.”

“There are much more magic waiting us to explore outside of human society. Bring me away from human-centralized mind set for a while!”

Things participants wished there was more of:

“More of.. previously explored materials and what goes wrong and why certain ‘prototypes’ aren’t usable maybe”

“Would have been cool to see sample of scoby products!”

“More hands on working with the material but maybe that's for another workshop!”

I also asked participants what they did not receive in this workshop and what could’ve been better. Many mentioned samples of other applications, which I thought was a great idea.

A series of the workshops about biomaterials felt like the right way to sustain this community.

CULTURED WORLDS

After completing my initial prototype, I reached out to other practitioners that hold exhibits and workshops in NYC and are involved in teaching and discussing biomaterials in various capacities. I shared details about my intervention with them and received positive feedback on the approach. One of the practitioners I connected with was from Tiny Farm Labs, According to the information provided on the website, The organisation aims to promote sustainable farming practices and educational initiatives. They were working on a project involving educational characters related to nature-based materials but were facing challenges in effectively conveying the attributes and properties of biomaterials in an easily understandable manner. (Kumar, 2017)

This exchange highlighted the relevance and potential impact of my intervention, as it addressed the need for accessible communication of biomaterial properties. By creating characters that embody these properties and attributes, the workshop toolkit can effectively convey complex concepts to a wider audience. The positive feedback from fellow practitioners further validated the importance and effectiveness of this approach that I take in culture of cultures in promoting understanding and engagement with biomaterials.



Environmental Impact Assessment

The intervention speaks about sustainability and promoting a mindset that promotes it. I hope to keep in mind the importance of being intentional about the resources being used and accessed.

In-person workshop

Hosting an in-person workshop reduces the carbon footprint created by zoom calls but may pose a problem of transportation. Luckily, while promoting the workshop I walked around my neighbourhood and garnered interest from people living close by. The approach also emphasizes value in intimate home settings which create an informal learning environment, increasing the comfort levels of participants.

The brew book

The brew book is printed and uses printing equipment. I hope to reduce the harmful effects of this by taking inspiration from the Gene Zine created by Dr. Elizabeth Henaff, a computational biologist and a professor at NYU. In her edition of the Gene Zine, DNA from the Gowanus Canal (The microbiome of the Gowanus Canal has evolved bioremediation metabolisms that enable it to degrade many toxic compounds.) has been blotted onto the paper publication, and its reader instructed to tear it out and embed it in soil in need for remediation. Thus, the local microbiome can absorb and adopt the bioremediation functions developed by the Gowanus Microbiome. In the future, I hope to build more brew-books that also have this embedded in them.

I grow the Scoby that I distributed in jars that are reusable and encourage brewers to grow them in existing containers that are be found unused in their homes.



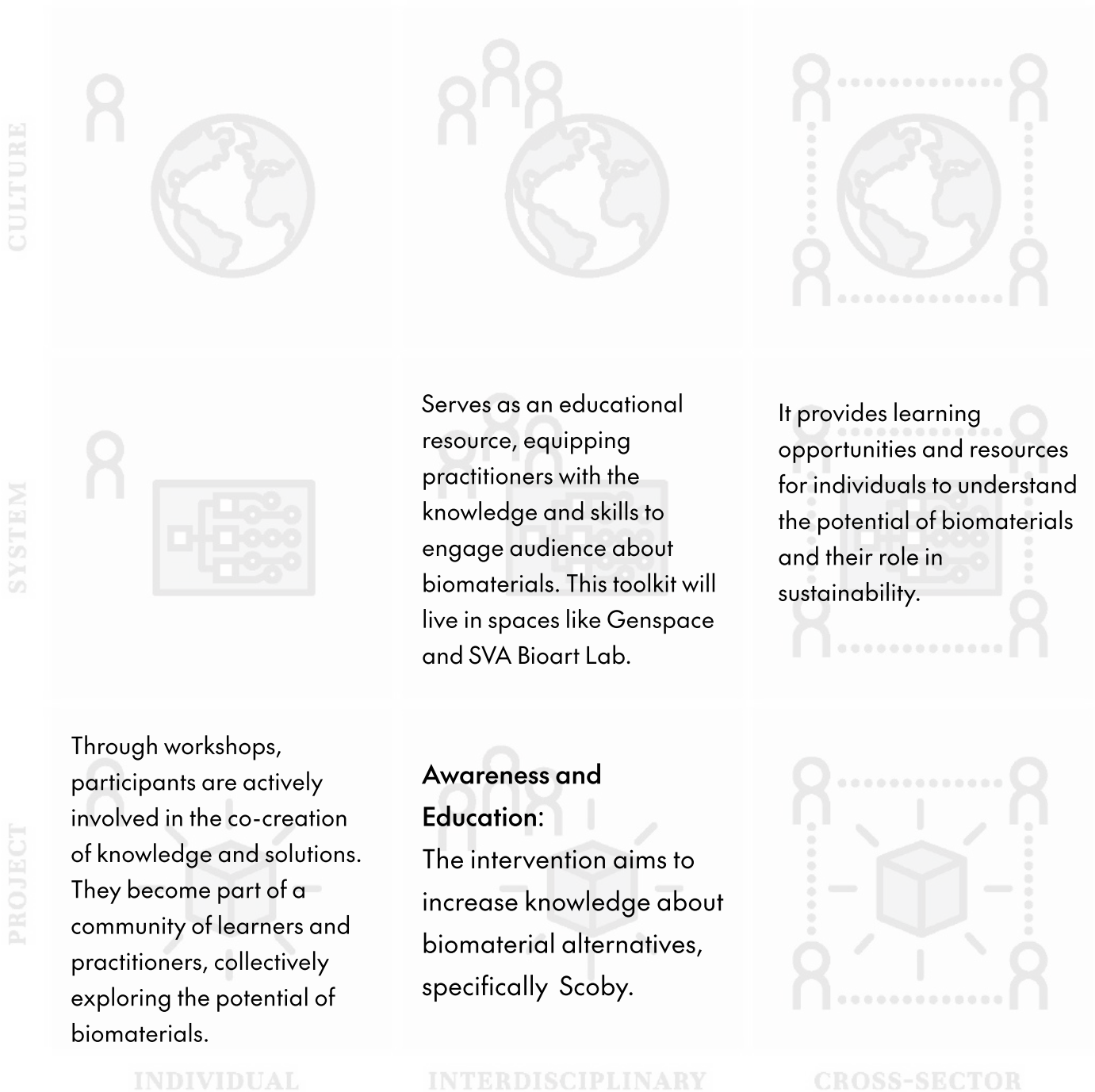
Gene zine by
Elizabeth Henaff



Scalability

Taking into account our learnings from the first semester, I would like to use the social design pathways formed by The Winter Institute, to map out the scalability of my project:

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(Source: Social Design Pathways)

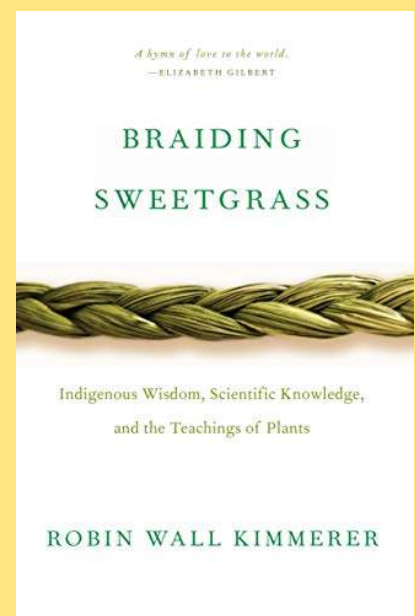
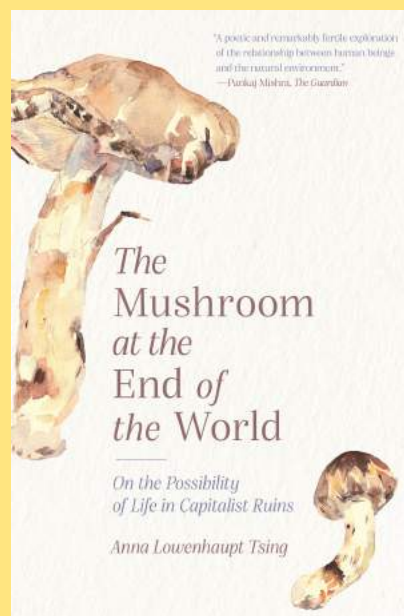
CLOSING THOUGHTS

The process of completing this thesis has been greatly transformational in ways that have been so impactful in my life. I am grateful for the partnerships and all the learning and guidance received through the way. My family & friends back home. My cohort members and faculty involved. This has been a journey and a half.

Thank you for sticking with me and believing in me.

- Ronak & Piper (Favourite star scobies)
- Nikki Romanello & Colin Vernon (Slowfactory)
- Rich Awn (Mombucha)
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- Suzanne Lee, Anna Tsing, Suzanne Pierre & Robin Wall Kimmerer for all the inspirational work
- Fellow bio-nerds Aradhita, Yatsuka (Genspace)
- Aditi Kapre, Janvi Ghatalia & Aprajita Chowdhry for all the support
- All my faculty and cohort members

Books that inspired me



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This work is a part of the graduate thesis project at the School of Visual Arts' Design for Social Innovation Masters Program. It has been created in collaboration with humans and non-humans alike. contact the designer below
divagohil03@gmail.com