EXPLORING LIVING SYSTEMS WITH MYCELIUM

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Aalto University + VTT

2022

INTRO

WORKING IN THE LAB

BIOFABRICATION

MYCELIUM

WORKSHOP

FUTURE LANDSCAPE

INTRO

Education

2005 – 2009	BA in Visual Communication (Costa Rica)
2016 – 2019	MA in Creative Sustainability (ARTS, Aalto University)
2022 –	Doctoral Candidate (CHEM, Aalto University)

Design background

Visual Design

UI & UX Design

Service & Strategic Design

Design Research

Material R&D

VTT

Aalto University

WORK WITH LIFE SCIENCES

Initial interactions with life sciences began with **Chemarts 2017** and my **MA thesis work** at VTT in 2018 where I explored mycelium as a leather-like material. Through this work I was introduced to scientific methods and fungal biology.

This initial MA work led to new findings for potential IP and became part of larger projects at VTT.

MA THESIS WORK

Bag (B. robillardoides – Version 2)

Jacket (B. robillardoides – Version 2)

Prosthetic (B. robillardoides – Version 2)

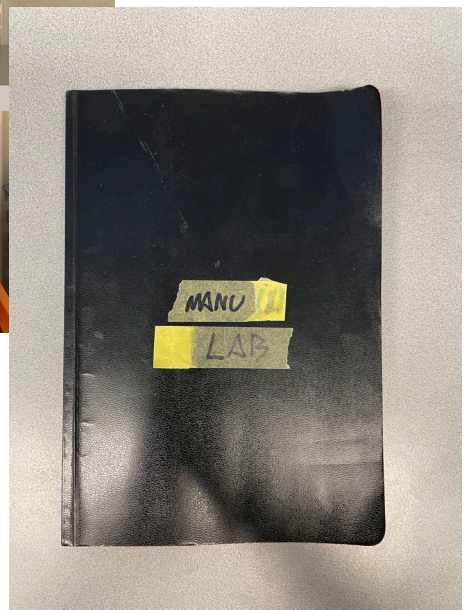
Packaging (P. chrysosporium)

Lampshade (B. robillardoides – Version 2)

Wound dressing (P. chrysosporium)

Vegan pill (P. chrysosporium)

WORKING IN THE LAB



PLAN, EXECUTE, OBSERVE & REPEAT

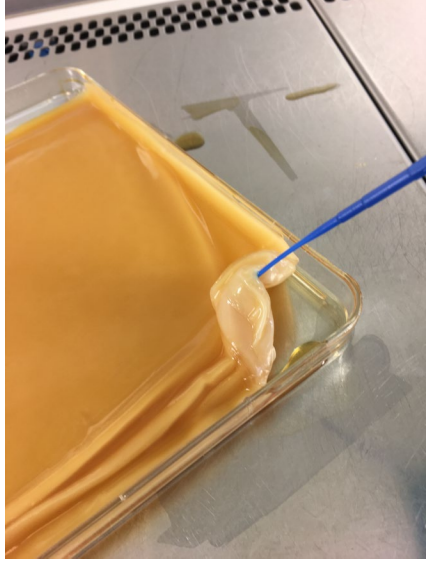
Note taking (Lab book)

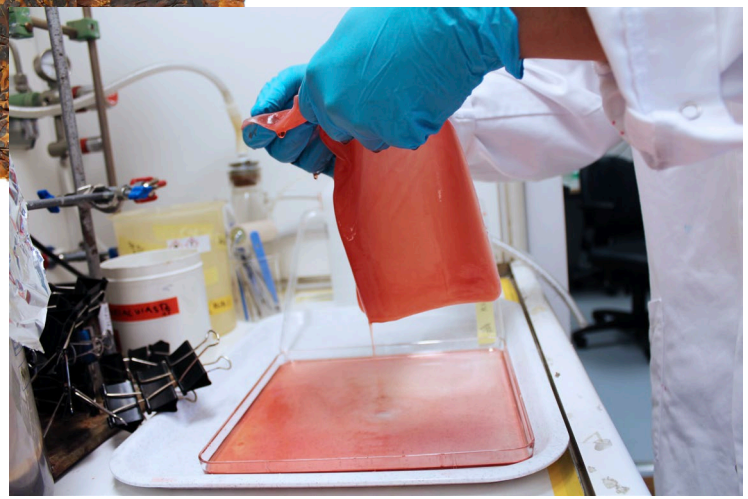
Photographing work

Planning experiments

Dealing with biological delays (e.g. contaminations)

Analyzing results (What went well? What went wrong? What can be changed?)





DESIGNING WITH MATERIALS (NOT FOR MATERIALS)

Experimenting new ways for material making (e.g. considering sustainability)

Embracing errors and ambiguity (Are there any opportunities for design?)

Learning to collaborate with the organism (What does it need? What does it like? How long does it take to grow?)

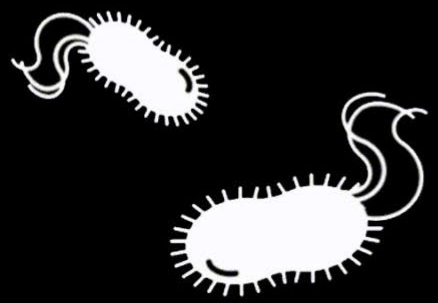
Asking yourself “what is it?” rather than “what does it do?

Application of design techniques and processes (e.g. 3D printing, laser-cutting, etc)

BIOFABRICATION

COLLABORATING WITH MICROBES

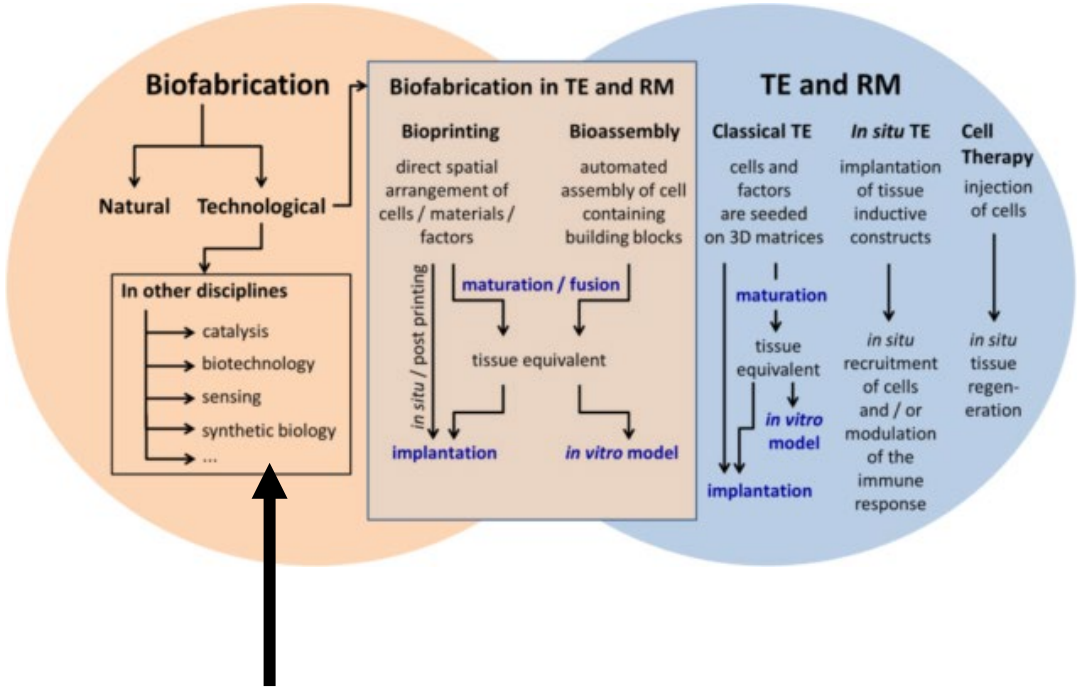
Mycelium



Bacteria

Yeast

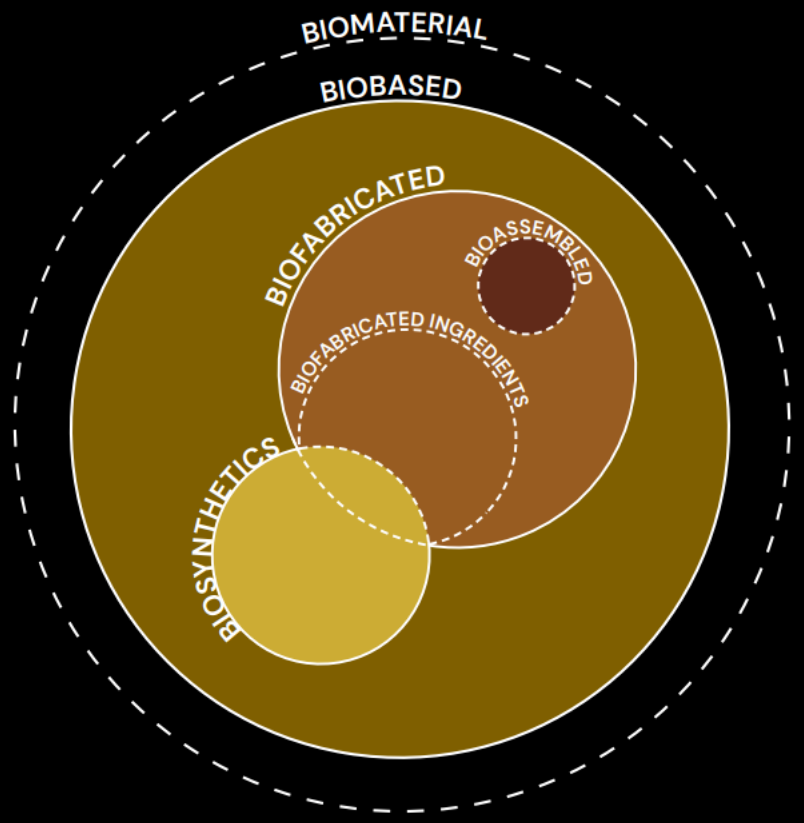
Algae



The harnessing of biological organisms to design and grow materials or finished products.

Fermentation, culturing, and engineering of **yeast, bacteria, fungi, algae,** and mammalian cells lend living materials new functional and aesthetic properties.

Source: https://healthymaterialslab.org/material-collections/biofabricated-materials#:~:text=The%20emerging%20class%20of%20biofabricated,new%20functional%20and%20aesthetic%20properties.



A NEW LEXICON FOR BOTH DESIGN AND BIOLOGY *(ONGOING)*

BIO DESIGN

Biodesign harnesses living materials, whether they are cultured tissues or plants, and embodies the dream of organic design: watching objects grow and, after the first impulse, letting nature, the best among all engineers and architects, run its course.

BIO MIMICRY

Biomimicry is a practice that learns from and is inspired by, or mimics the natural processes or strategies found in nature to solve human design challenges.

BIO BASED

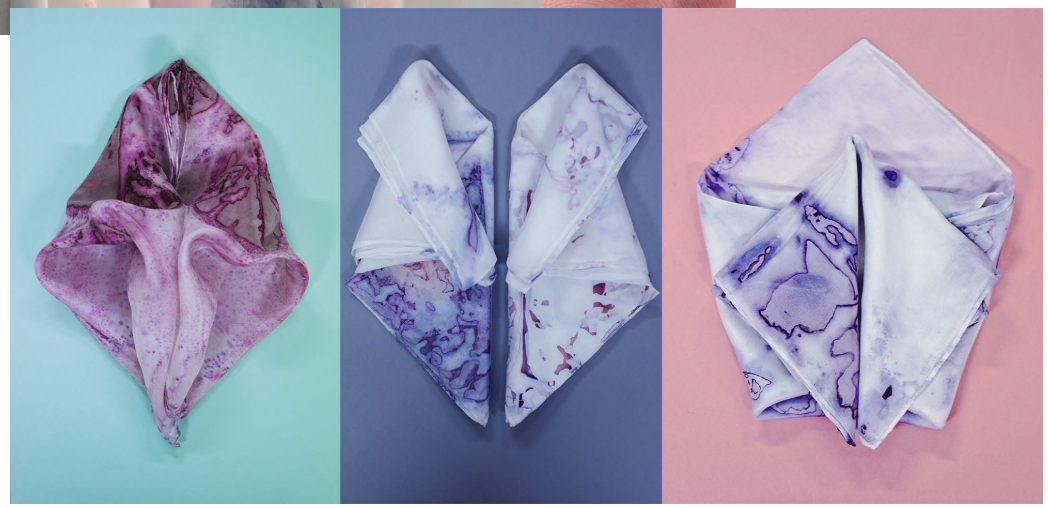
Bio-based products are defined as either wholly or partly derived from materials of biological origin. However, be aware that when 'biobased' is used as a descriptor, the material may only have a limited percentage of bio feedstock.

BIO MATERIAL

A material where some pre-existing biological content (predominantly from agricultural byproducts) undergoes processing such as pulverising, and is mixed with a binder to convert into a fibre or fabric.

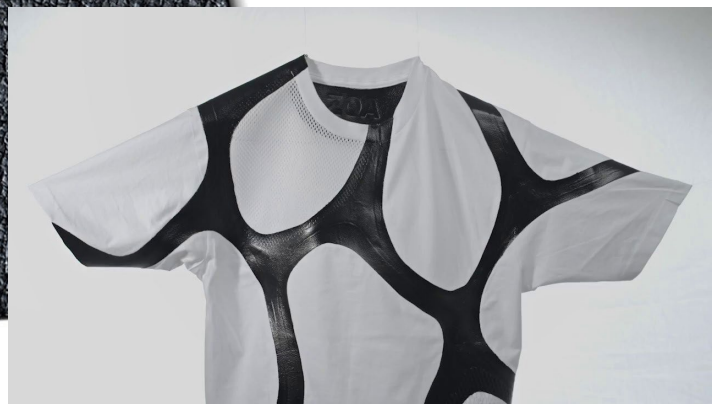
References: Biofabricate, William Meyers, Material Design Lab Denmark, Biomimicry Institute.

BIOFABRICATION



Natsai Audrey Chieza

ZOA (Modern Meadow)



BIOFABRICATION

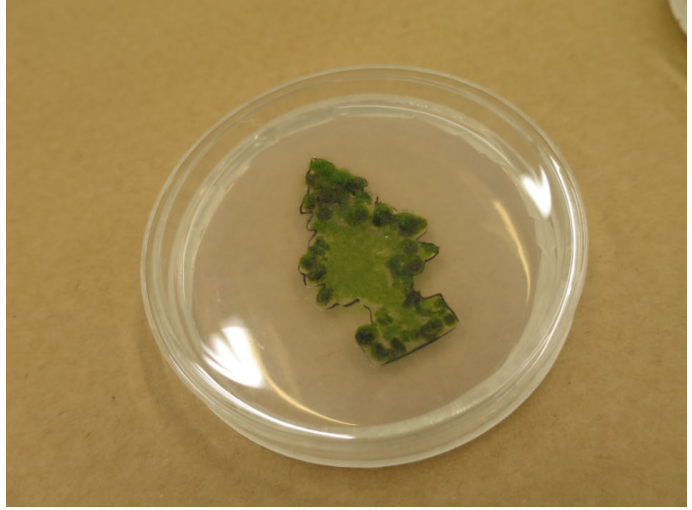
Mogu

Algiknit

Microsilk dress by Bolt Theads x Stella McCartney

Biocouture by Suzane Lee

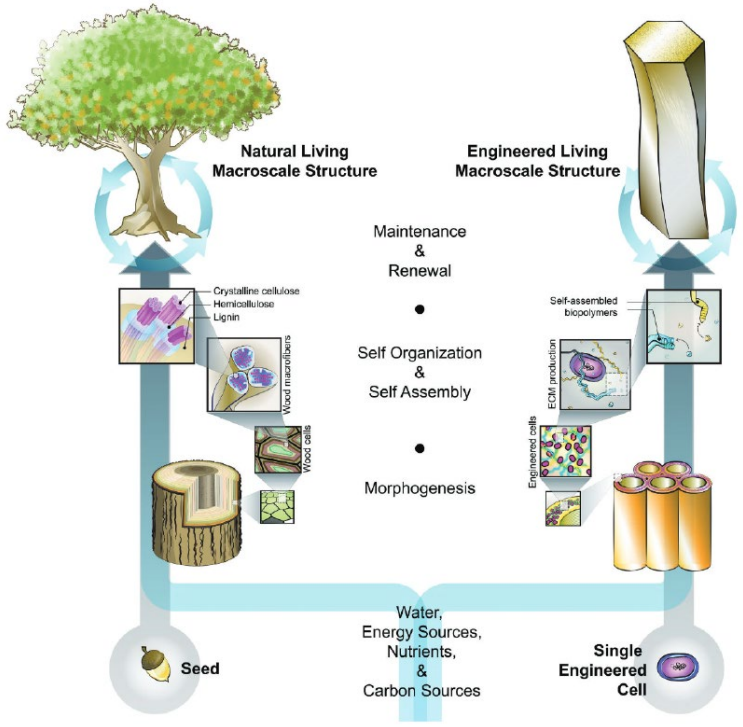
Korvaa — The Microbial Headset



Fragrant Moss by Anthony Evans (genetically modified strain of moss (Physcometrella patens) that is engineered to produce patchouli scent.

Engineering materials to make them autonomous, self-repairing and responsive to the environment

Engineered Living Macroscale Structure

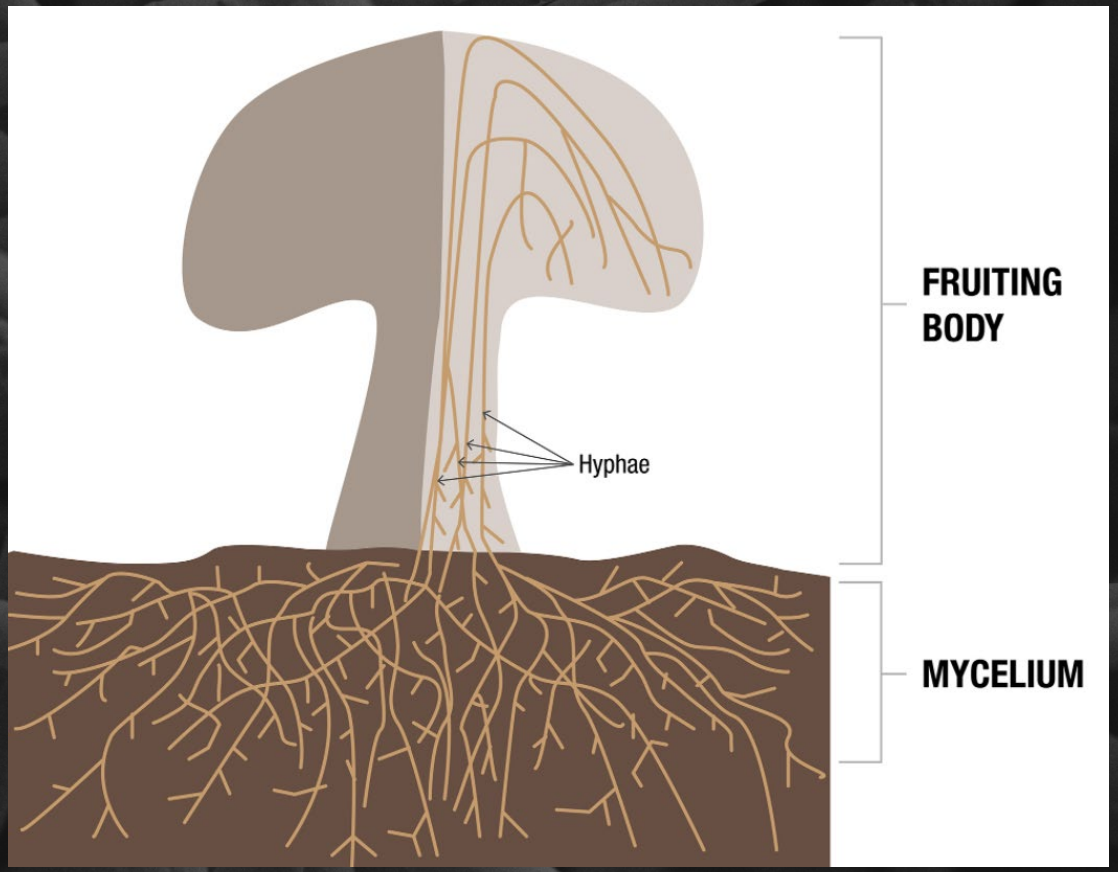


MIT, Printing objects that can incorporate living organisms

MYCELIUM

MYCELIUM

The vegetative part of a fungus, consisting of a network of filaments.

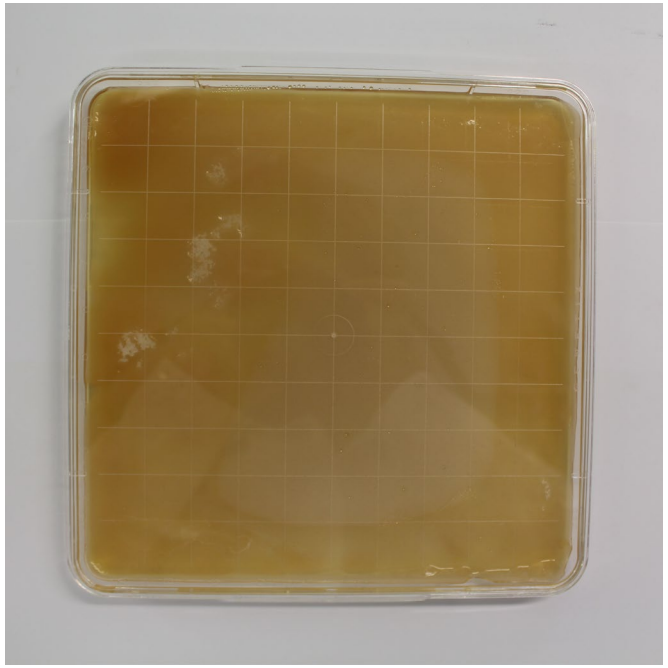


Schematic image from Paananen et al. ACS Focus, 2021

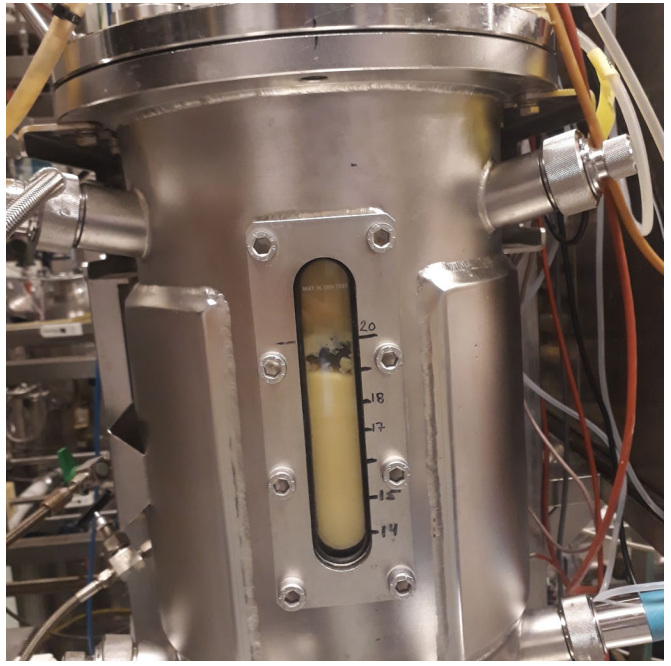
GROWING METHODS

SOLID STATE FERMENTATION

(E.g. hard and foam-like materials)



STANDING LIQUID FERMENTATION

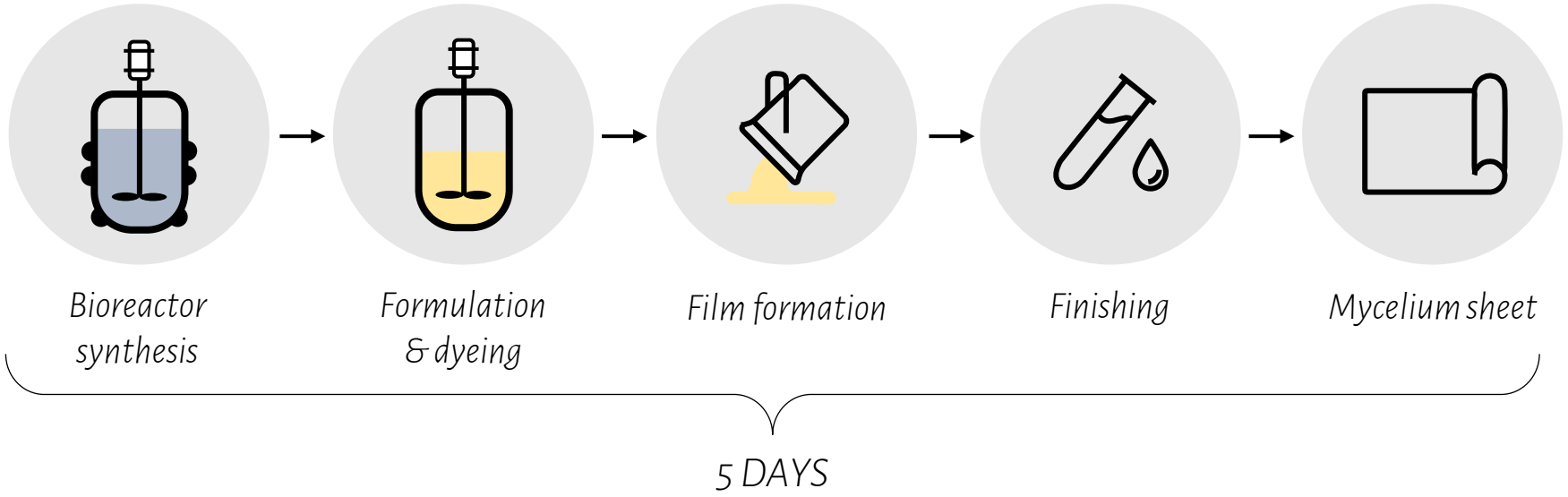


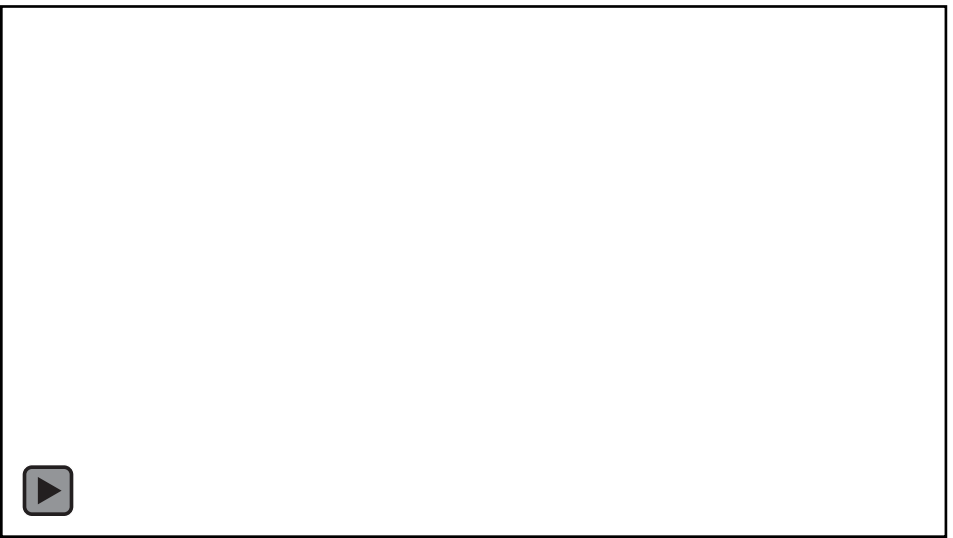
SUBMERGED LIQUID FERMENTATION

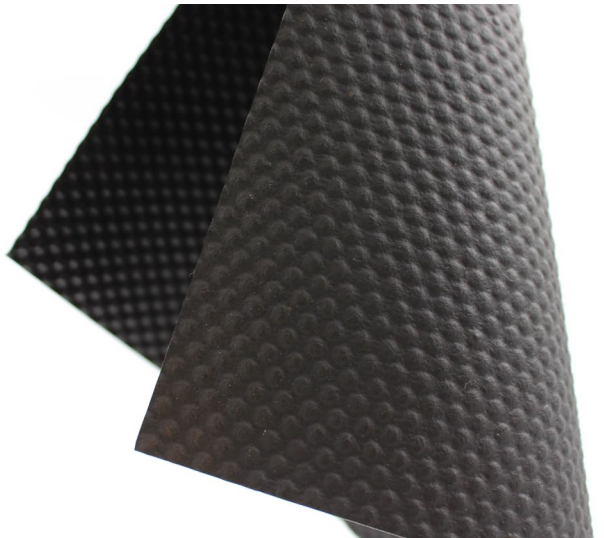
(E.g. flexible materials)

SUBMERGED LIQUID FERMENTATION

VTT'S MYCELIUM TECHNOLOGY



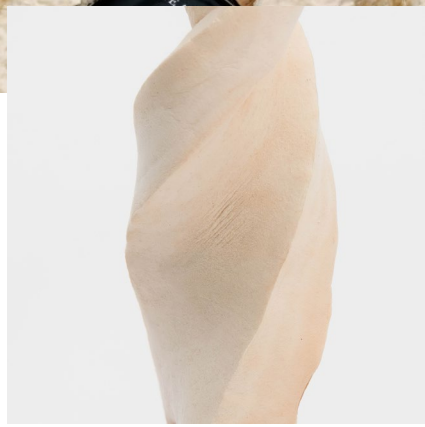




Phill Ross (Mycoworks)

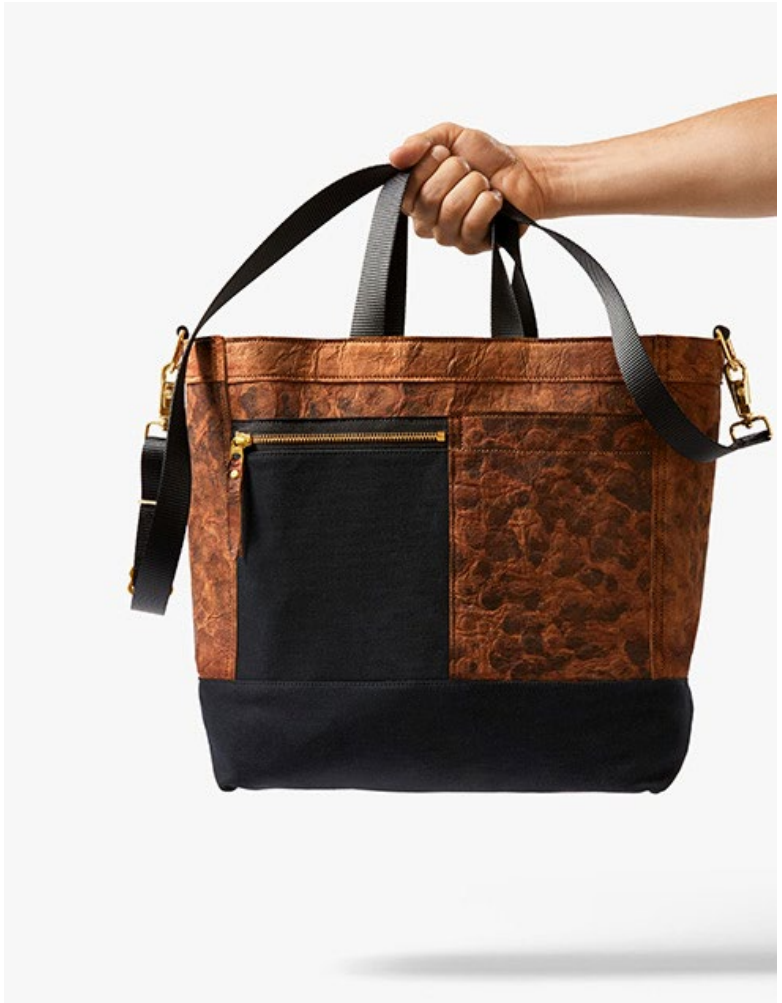
Pascal Leboucq (Company New Heroes).

Ecovative



Ephea (Collaboration with Balenciaga)

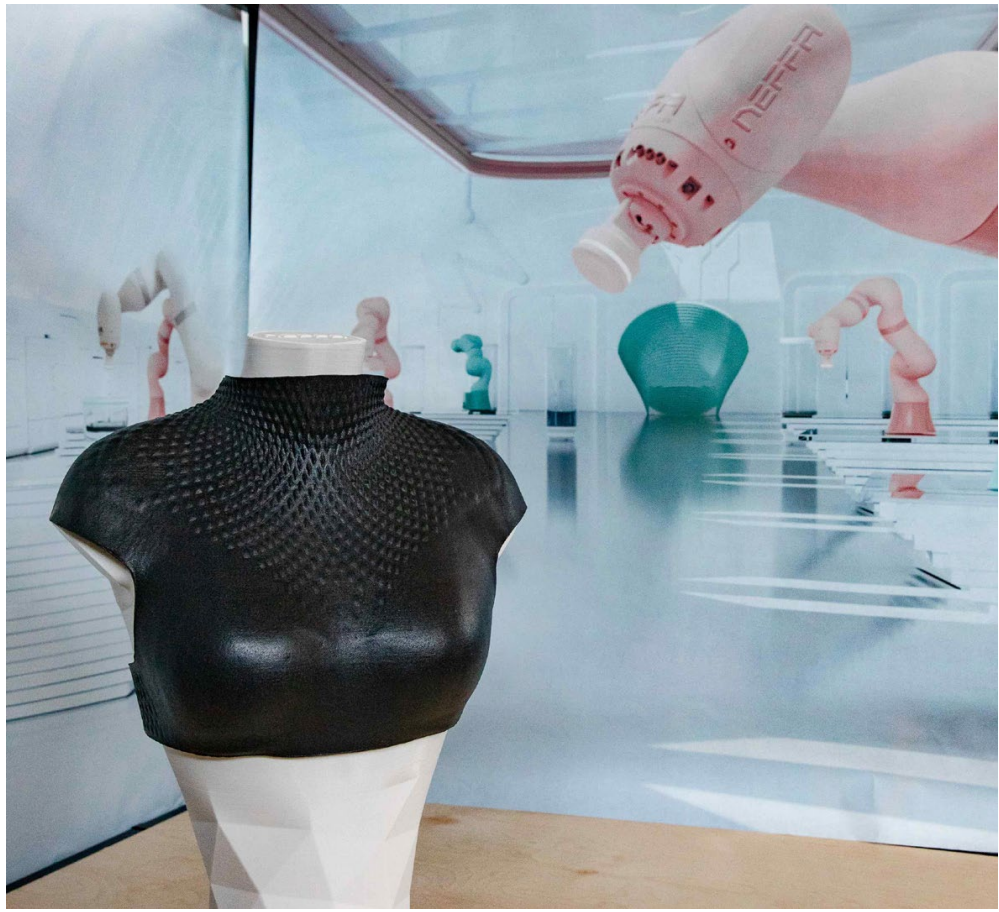
Mylo by Bolt Threads (Collaboration with StellaMcCartney



MYCELIUM

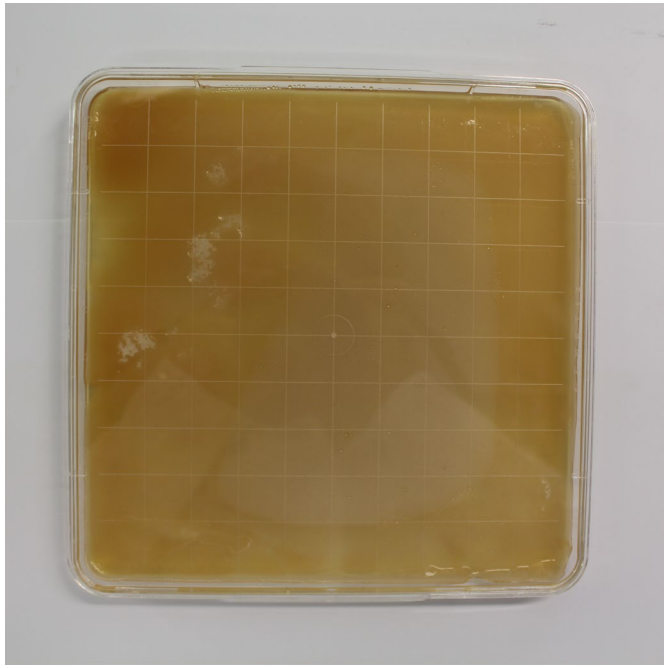
Reishi by Mycoworks
(Collaboration with Hermès)

Mylium



Mycotex

WORKSHOP



STANDING LIQUID FERMENTATION

Spores → Media + Dyes (if needed) → Cultivation Period → Drying

VALUES & ETHICS

designwanted

DESIGN

Mylo's mushroom-based leather is the next in fashion

A sustainable alternative to traditional leather, the luxury fabric is carbon-neutral and can be grown to order.

QUESTION EVERYTHING THAT YOU SEE AND READ

Material composition (What is the material really made out of? Is it fully biobased?)

Patents (Why are they important? Are they helping or blocking innovation?)

Design (How to make products more circular? Am I taking sustainability into account in my own work? Am I really solving or creating new problems? - e.g. recyclability challenges for the future)

Terminology (Am I using the right terms?)

Claims and press releases (Am I reading from reliable sources? Do they really understand the topic? Is the material truly sustainable?)

Genetic modified organisms (What are the existing regulations for GMO? What type of new regulations need to exist? How will materials containing GMO be disposed?)

FUTURE LANDSCAPE

Art Residency at Bolt Threads

FUTURE LANDSCAPE

Grant applications
(solo or group projects)

Residencies at companies or institutions

Research (e.g. Doctoral studies)

Companies with R&D departments
(still limited)

THANKS!

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