BiotechLab & Taxonomies Project

Steam, Art, Design and Natural Sciences

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Topics today

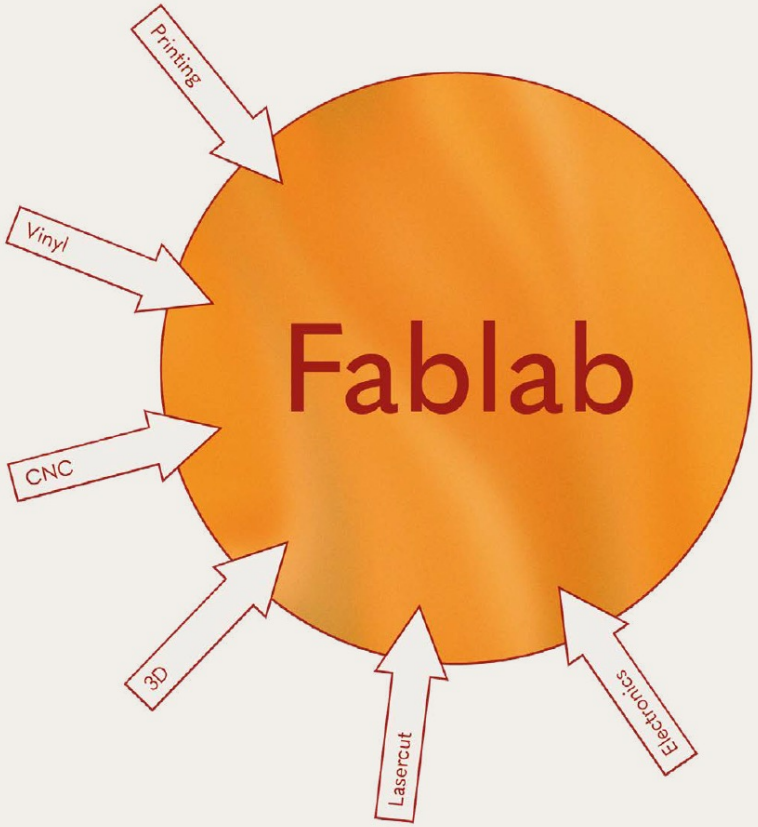
- Spinderihallerne Vejle and the Fablab
- The BioTechLab project
- The ”Taxonomies” project

Spinderihallerne Vejle

- Old industrial building turned innovation environment
- Room for 60 start-ups, artists, studios
- Citizen involvement, design, fablab, entrepreneurship

Fablab

- Citizen involvement, open lab
- Start-up support/ Entrepreneurs
- Education, fablab at school BioTechLab



How to make (almost) anything

Sources:
1.A place to make (almost) anything - the Fab Lab

”Give ordinary people the right tools, and they will design and build the most extraordinary things.” [2]

- Neil Gershenfeld

What is a fab lab?

Fab labs are a global network of local labs, enabling invention by providing access to tools for digital fabrication

What's in a fab lab?

Fab labs share an evolving inventory of core capabilities to make (almost) anything, allowing people and projects to be shared

What does the fab lab network provide?

Operational, educational, technical, financial, and logistical assistance beyond what's available within one lab

Who can use a fab lab?

Fab labs are available as a community resource, offering open access for individuals as well as scheduled access for programs

Peter Dahl
Leader FabLab

Johannes van Roest Dahl
Design Process & Digital Fabrication, Teacher, Instructor & Learning advisor FabLab

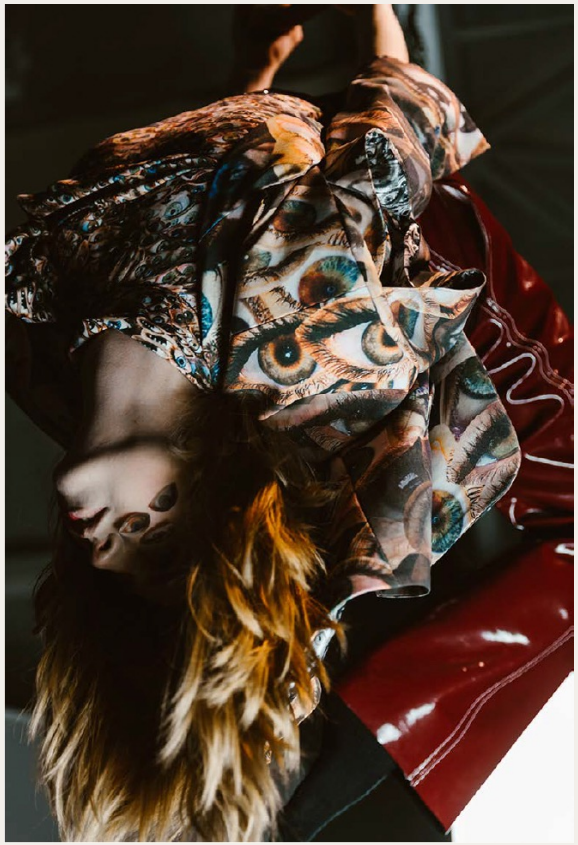
Simon Vibe Grevsen
Design Process & Digital Fabrication, Teacher Instructor & Learning advisor FabLab

Lars Eriksen Høeg
MA Computer Science & Product development
Instructor at FabLab

Shanice Otersen
MA Sustainable De-
sign, Fashion Desigr
Projectleader Biolab

Molly Østergaard
BioTechLab Assistant,
industrial design student
at Designskolen Kolding

Shanice-About/ Background

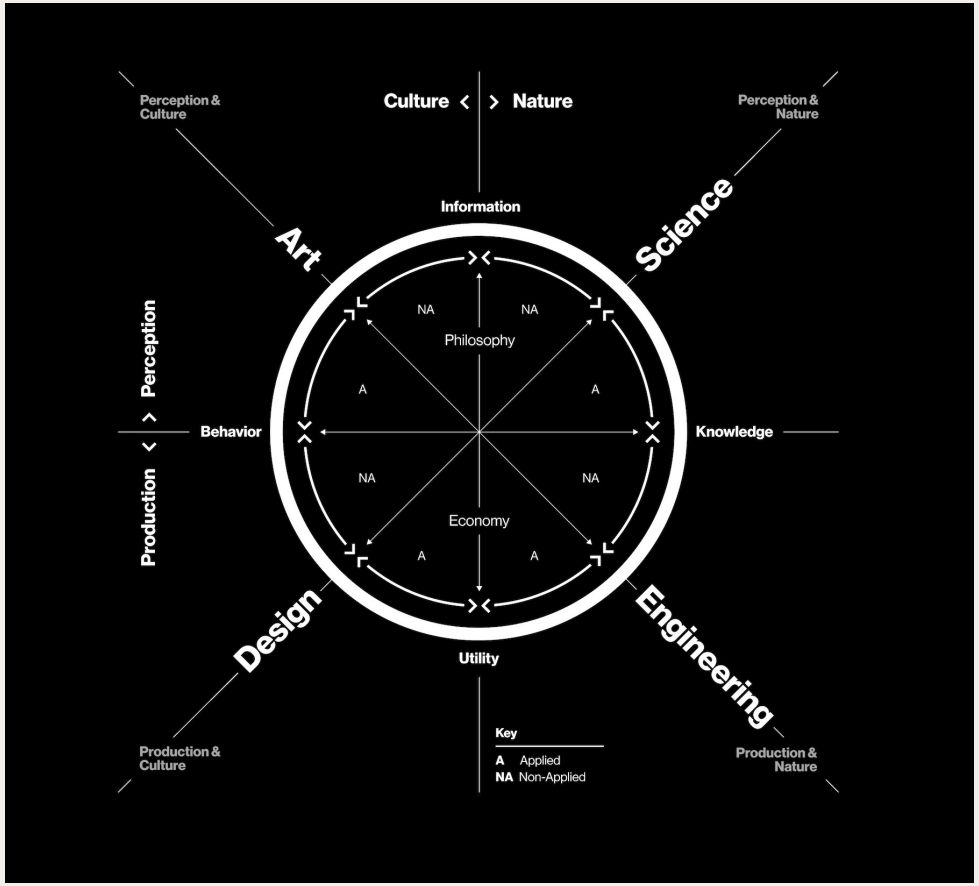


BA: fashion design

MA: sustainable design

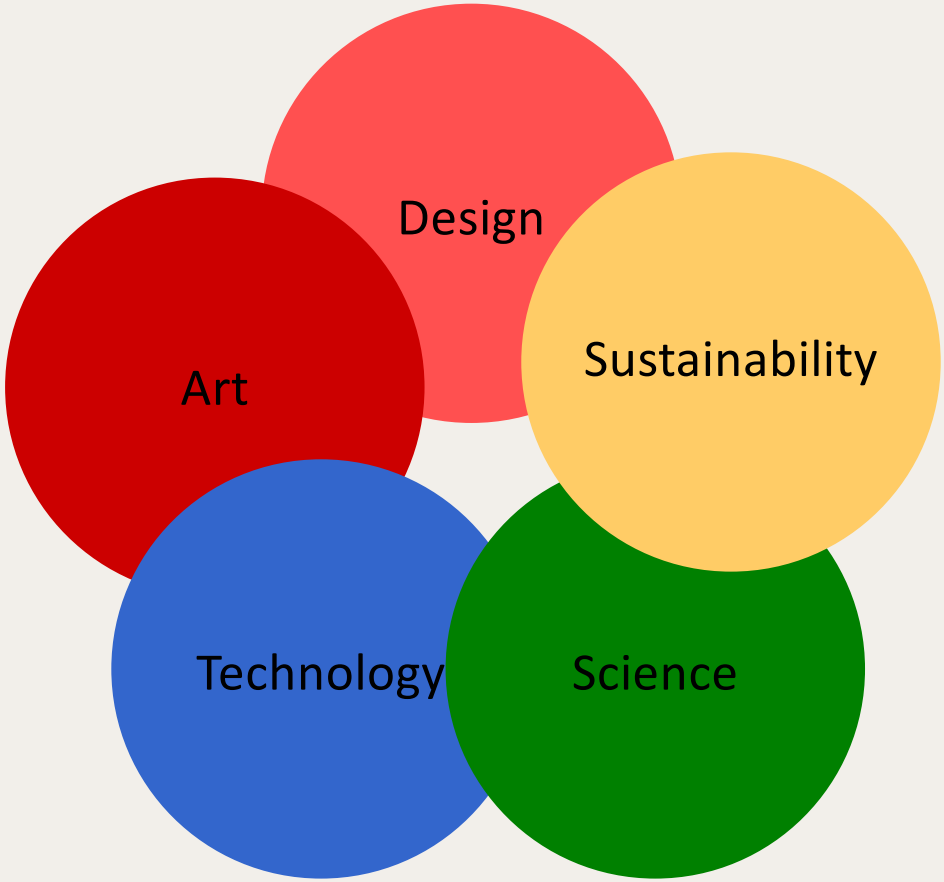
Now: BioTechLab project lead

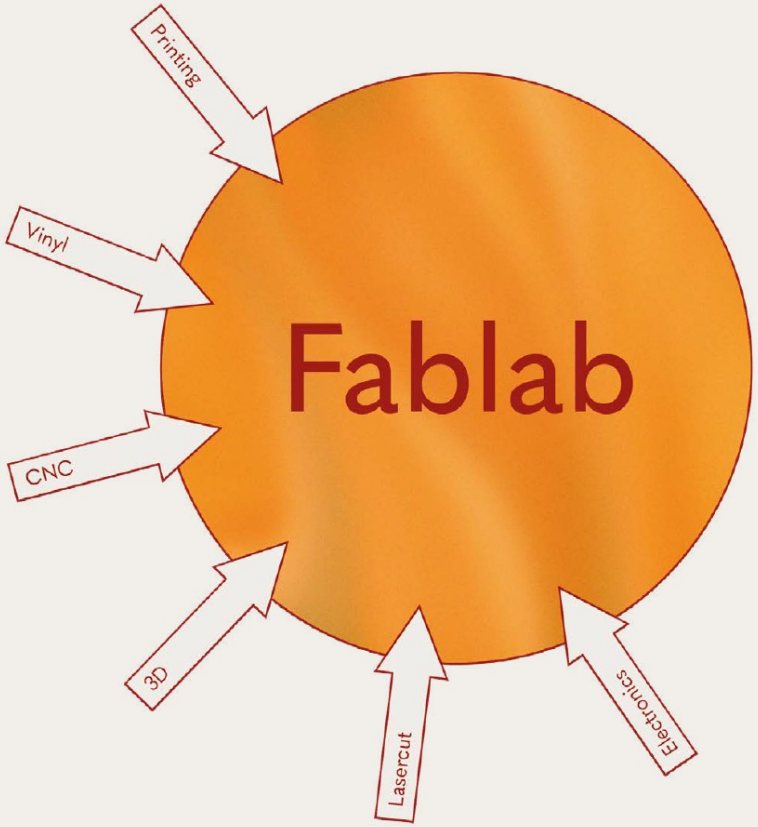
Neri Oxman, Krebs Cycle of Creativity



Source: https://betterworld.mit.edu/spectrum/issues/winter-2017/neri-oxmans-krebs-cycle-of-creativity/

BioTechLab, Design, Art, Science, Technology, Sustainability





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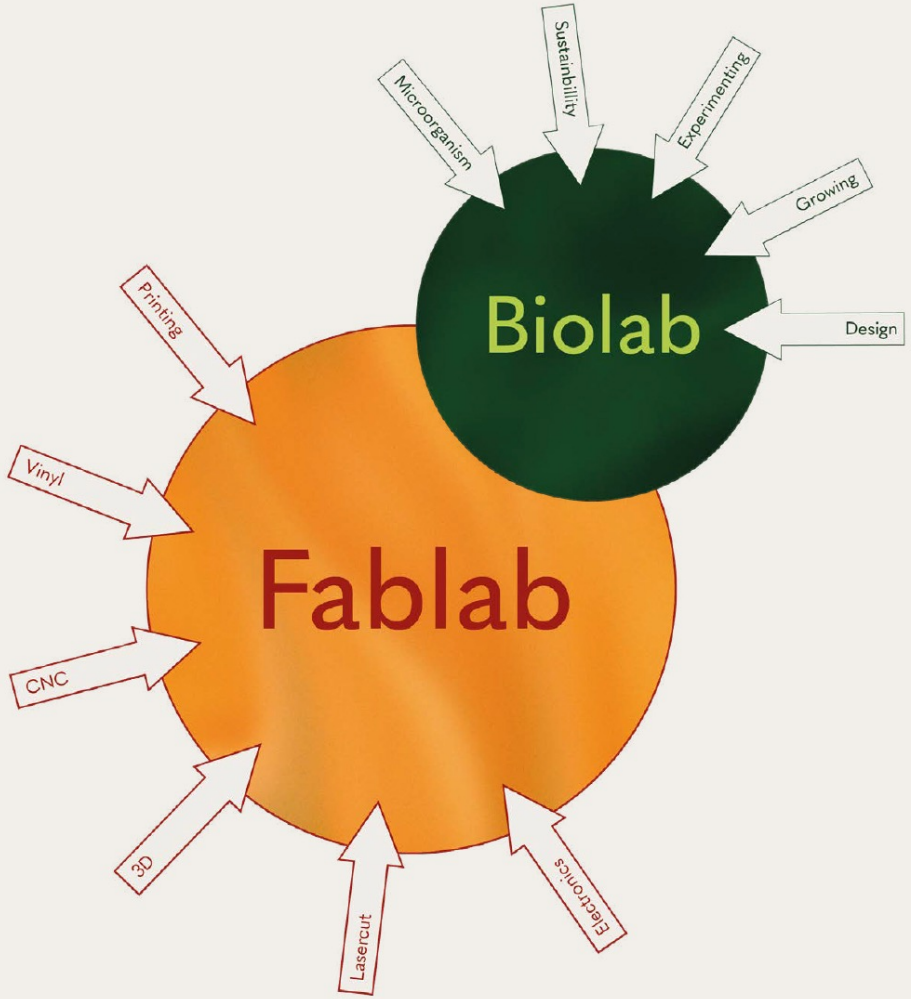


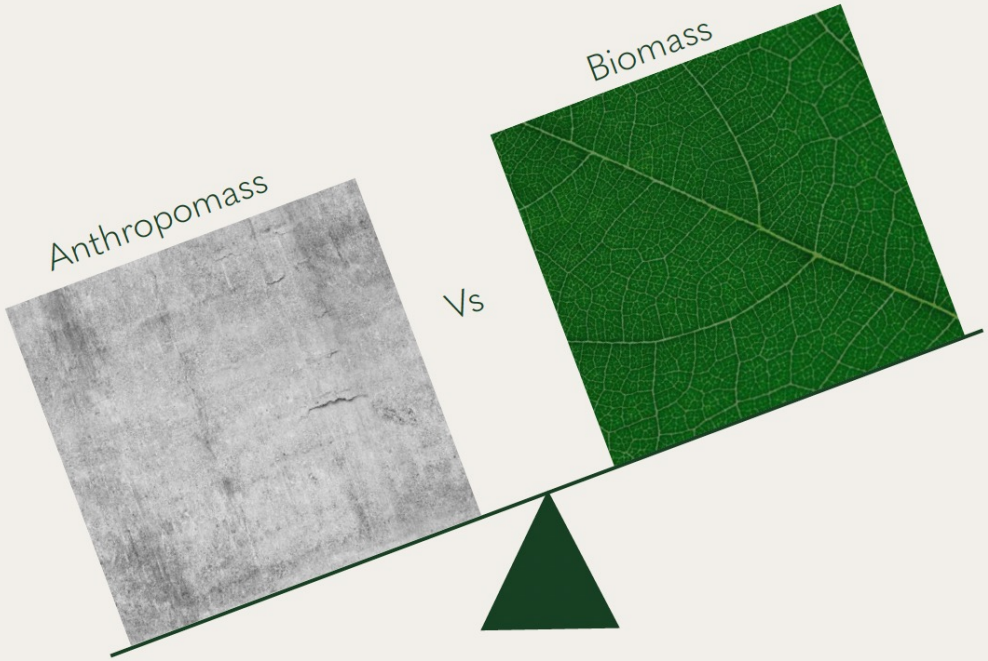
How to grow (almost) anything

What is biodesign?

In contrast to other design approaches that are inspired by biology, like bio-mimicry, Biodesign goes one step further. It incorporates living organsims such as yeasts, fungi and algae and makes them integral components of the design, thereby bringing together the man-made and the natural world.

Sources:

1. Antonelli, Paola/William Myers (2018): Bio Design: Nature + Science + Creativity, Expanded, Revised, The Museum of Modern Art, New York, pp.7-8.

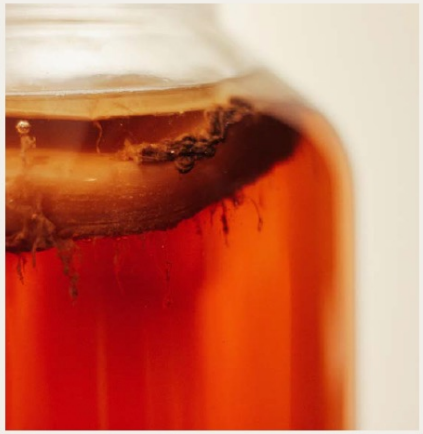


In the year 2020, the Anthropogenic mass has surpassed the earth´s Biomass.[1]

Sources:

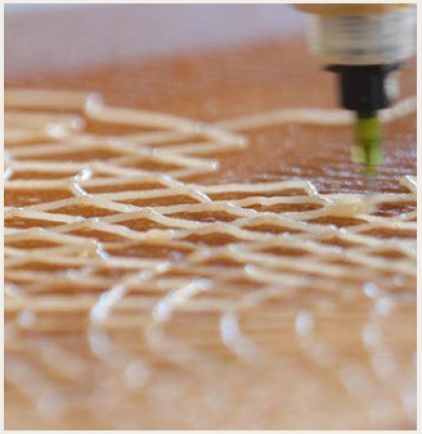
1. Anthropogenic mass: Comparing human-made mass to the living Biomass on earth — Timeline of the Change in balance (n.d.): Anthropogenic Mass: Comparing Human-made Mass to the Living Biomass on Earth, [online] https://anthropomass.org/timeline/ [abgerufen am 19.10.2022]

Ways into biodesign



Kombucha

Bacterial dye



Bio plastic

Mycelium

Kombucha

Bacterial cellulose

INGREDIENTS

			
Black tea	Vinegar	Sugar	Water

CONDITIONS

Fermentation works best when
Kombucha is kept in dark and warm places, needs airflow

PELLICLE

A layer of bacterial cellulose,
can be turned into "leather"

SCOBY

Symbiotic Culture of
Bacteria and Yeasts

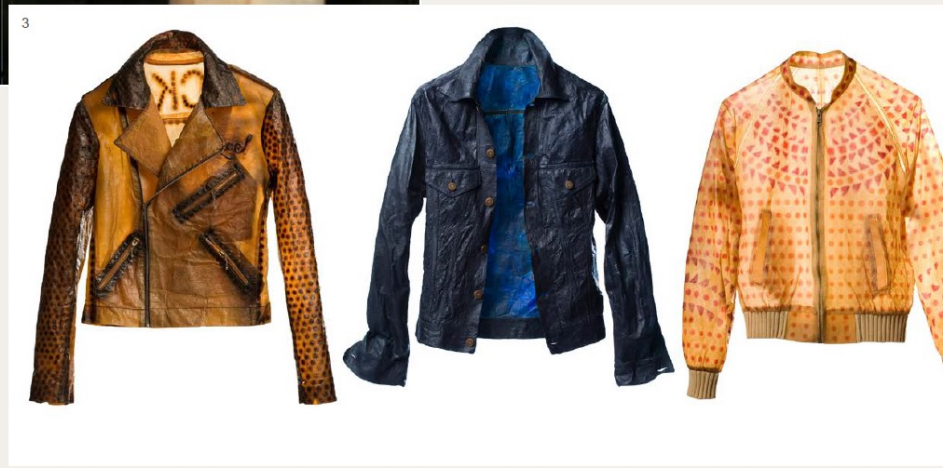
KOMBUCHA

Fermented drink

Sources:
https://en.wikipedia.org/wiki/Kombucha#/media/File:Kombucha_Mature.jpg
https://www.aldi-nord.de/sortiment/kaffee-tee-kakao/tee/schwarzer-tee-3358-0-0.article.html
https://www.nemlig.com/lagereddike-farvet
https://offers.kd2.org/da/dk/lidl/pdJpn/
https://www.cleanwateraction.org/features/whats-your-water

SUZANNE LEE // BIOCOUTURE

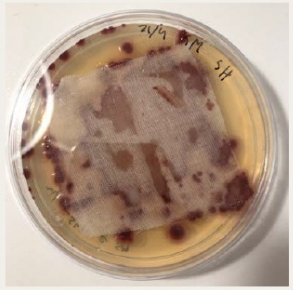
Kombucha Garments made in 2012

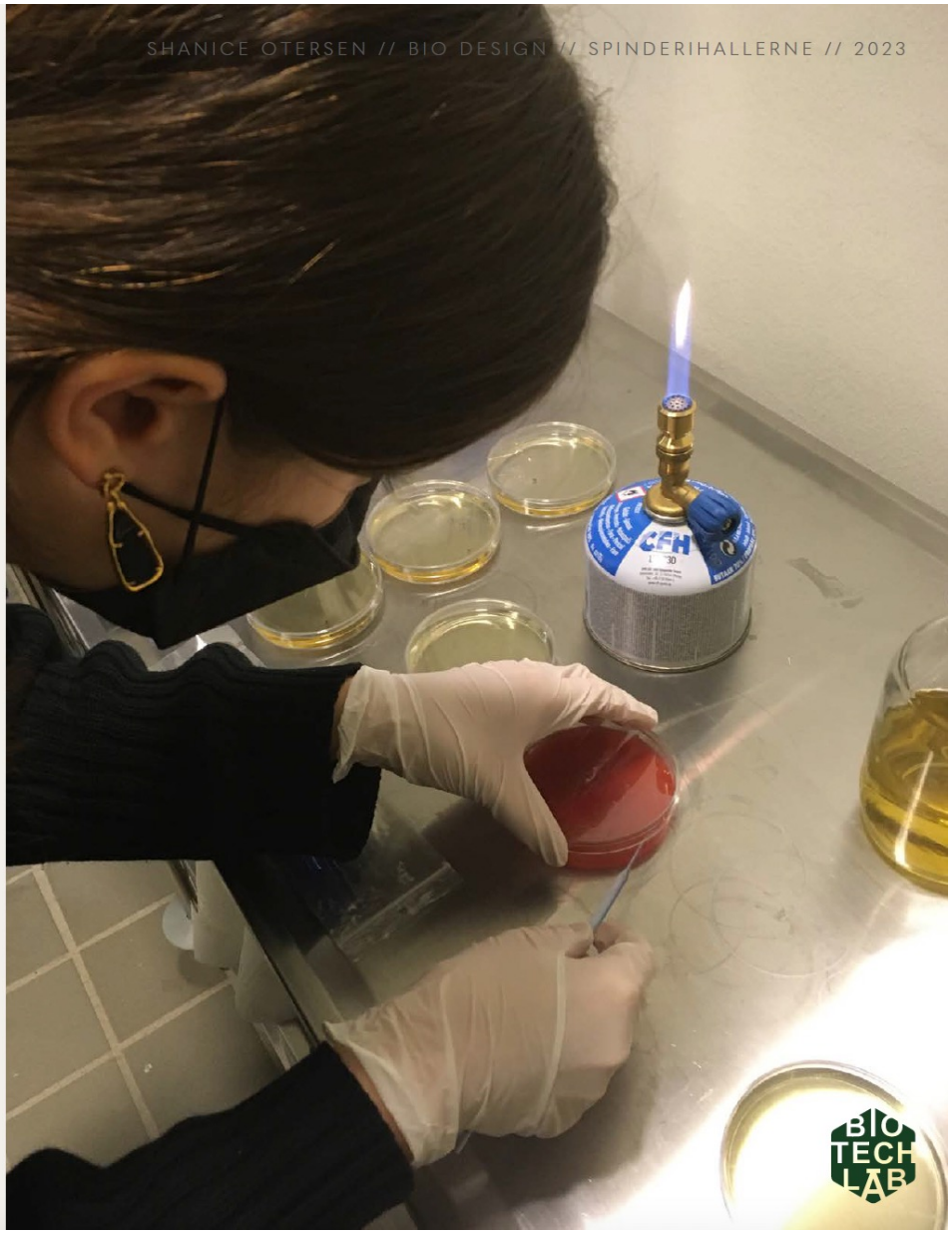


Sources:
1. https://medium.com/the-nomad-magazine/suzanne-lee-revolutionary-of-the-fashion-industry-594bc4d44006
2. https://thekimdavevision.files.wordpress.com/2015/10/bio-film.jpg
3. https://nextnature.net/story/2015/interview-suzanne-lee

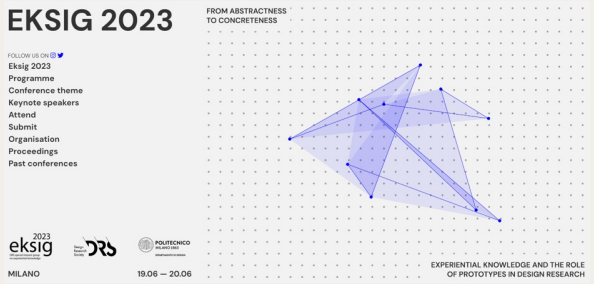
bacterial dye

No chemicals needed!





Bacterial Dye in a designschool setting



[Designers prototyping in the lab]

bioplastic

A bio alternative for plastics!

Biopolymers

Gelatine

Agar Agar

Starch

Cellulose

Chitin

Base for Bioplastic, made by living organisms

Additves

Glycerin (Elasticity)

Fillers (Shrinkage)

Stiffening (Reinforcement)

Expanding (Foaming)

Color (Dyeing)

Changing properties of Bioplastic

Solverns

Water

Dissolves other ingredients, combines them

Sources:
1. https://www.indiamart.com/mridul/animal-bones.html
2. https://blog.modernistpantry.com/advice/agar-vs-the-world/
3. https://www.womenshealthmag.com/food/a31114678/is-corn-a-grain/
4. https://www.indiamart.com/proddetail/raw-cotton-6501937712.html
5. https://wisconsinpollinators.com/BU/BA_ButterflyWings.aspx
6. https://pandhys.com/glycerin-issue/?doing_wp_cron=1667480816.8037459850311279296875
7. https://www.conserve-energy-future.com/can-you-compost-eggshells.php
8. https://www.freepik.com
9. https://www.livescience.com/how-soap-kills-germs
10. https://unsplash.com/s/photos/ink-in-water
11. https://www.cleanwateraction.org/features/whats-your-water

BIO TECH LAB

Mycelium

Nature's glue

Mycelium close up

"Wood Wide Web"

Sources:

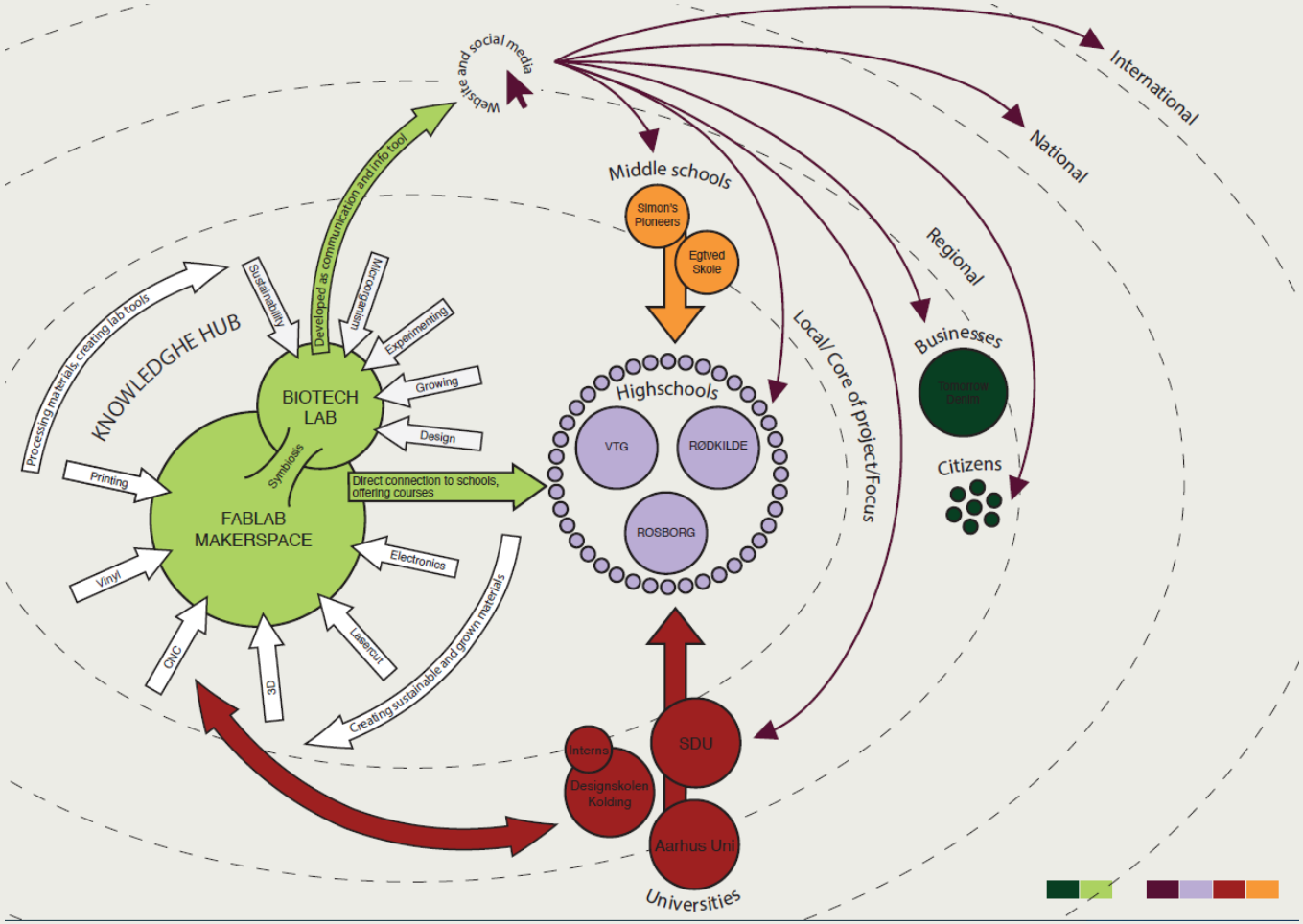
1. https://www.hsph.harvard.edu/nutritionsource/food-features/mushrooms/
2. https://issuu.com/essentialmagazine/docs/essentialmagazine-october2021-digital/s/13576124
3. https://smartvillage.ca/2021/06/24/wood-wide-web/
4. http://junq.info/wp-content/uploads/2018/01/mycelium.jpg

ACOUSTIC PANELS & PACKAGING// MOGU AND ECOVATIVE

Sources:

1. https://mogu.bio/
2. https://www.moekodesign.com/post/mushroom-mycelium-packaging

The BioTechLab: strategic overview



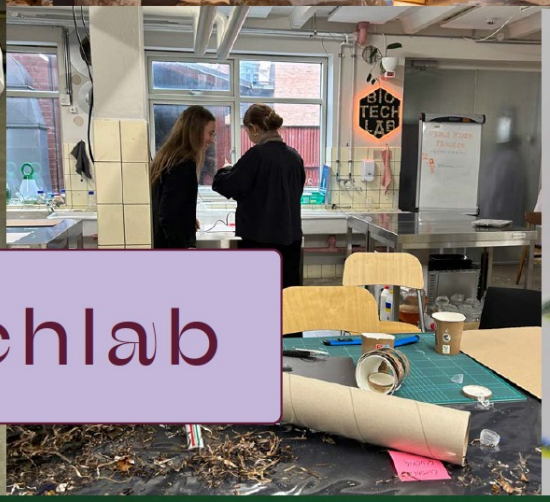
novo nordisk fonden
Benefiting people and society

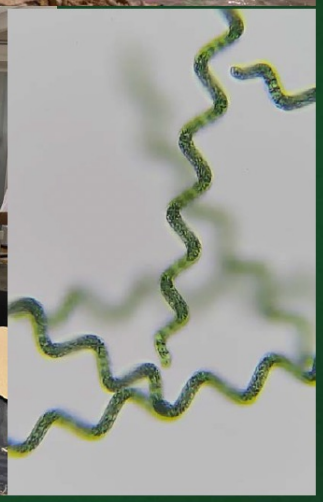
- Main focus: inspiring highschool students to work with science in a creative way
- Main targetgroup: highschool students

BioTechLab, What we do

- Hands-on workshops
- In school presentations
- Open Thursday workshops

SHANICE OTERSEN // BIO DESIGN // SPINDERIHALLERNE // 2023





Join biotechlab

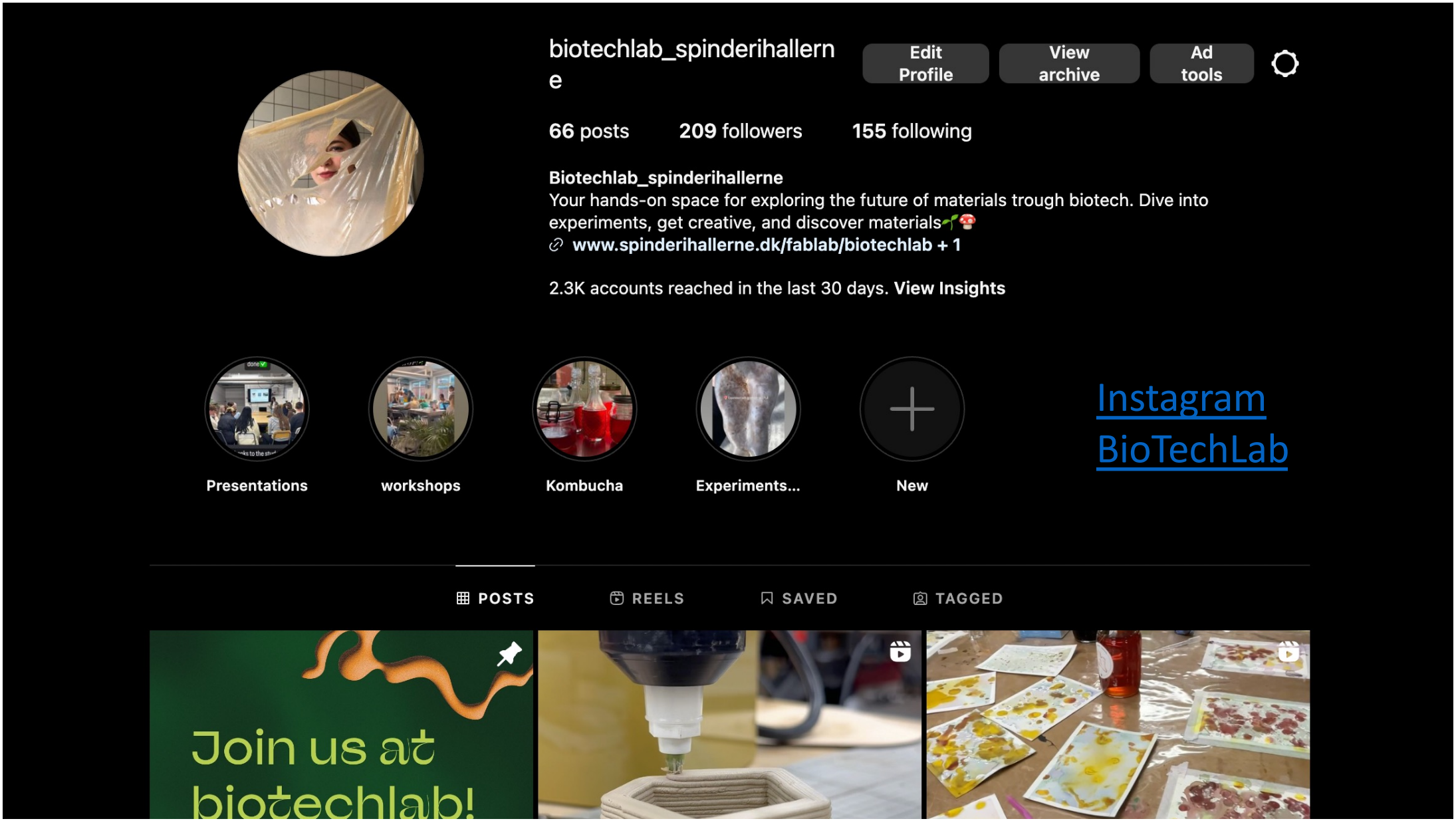
Open lab

EVERY THURSDAY AT
BIOTECHLAB IN
SPINDERIHALLERNE
FROM 3-6pm

Spinderihallerne, Spinderiga-
de 11, 7100 Vejle

email: shmot@vejle.dk

- Alternative material development
- Workshops for citizens


biotechlab_spinderihallern
e
Edit Profile
View archive
Ad tools
66 posts
209 followers
155 following
Biotechlab_spinderihallerne
Your hands-on space for exploring the future of materials trough biotech. Dive into experiments, get creative, and discover materials🌱🍄
www.spinderihallerne.dk/fablab/biotechlab + 1
2.3K accounts reached in the last 30 days. View Insights
Presentations
workshops
Kombucha
Experiments...
New
Instagram
BioTechLab
POSTS
REELS
SAVED
TAGGED
Join us at
biotechlab!

Taxonomies- Concept

Steam – Across: - Shanice, Emanuela, Andrea

- Biology + Chemistry + Art + Computational Thinking
- Come together in 3-part workshop series with highschool art class from Rosborg Gymnasium og HF

Workshop 1
Ink making- Shanice

students learn to make inks from various gathered plant matter.

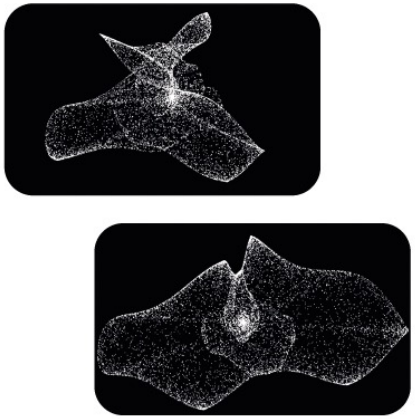
After the workshop the students decide as a group which colors have the best properties and have to pick 3 colors that they want to use further (for color consistency in the later exhibition).

Workshop 2
Botanical drawing- Emanuela

Students use pre-made inks to create watercolor paintings of various plants/mushrooms/etc. with instructions from Emanuela.

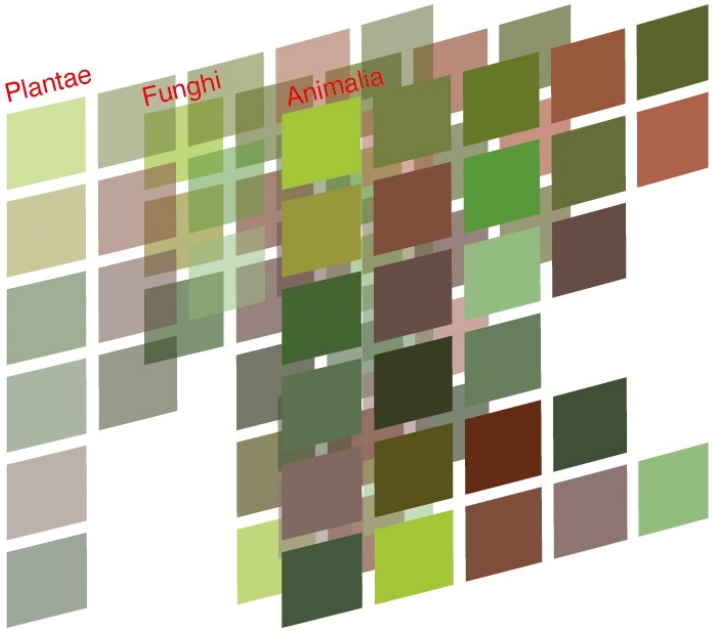
They are each given a live specimen (plant, flower, mushroom etc.) and pieces of watercolor paper of the same size and instructed to draw their specimen from different perspectives/ angles. Finally they need to write their name and the latin name of the species.

Workshop 3
Coding- Andrea

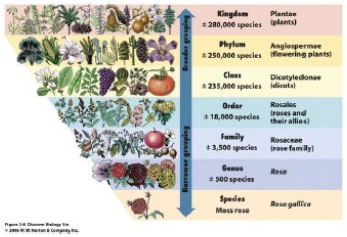


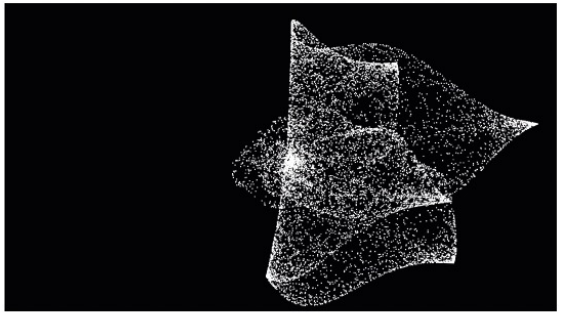
The students get an introduction to visual coding. Their drawings are discussed and scanned in. Each drawing becomes a pixel in an algorithm, the algorithm determines the shape and movement of the pixels, thereby creating new artworks out of the collective pool of artworks.

Each pixel can be selected by the viewer and will display the species and name of the student who made the drawing.



Each square represents a drawing made by a student. They are suspeneded from the ceiling in rows. Each row represents a taxonomy group. Teh more detailed arrangement has to be figured out over time.





A large screen where the visual codes made by the students are displayed. They change and move all the time.

Manuela's artworks are displayed alongside the students, in larger scale as the origin of the project and inspiration.

Learning outcomes:

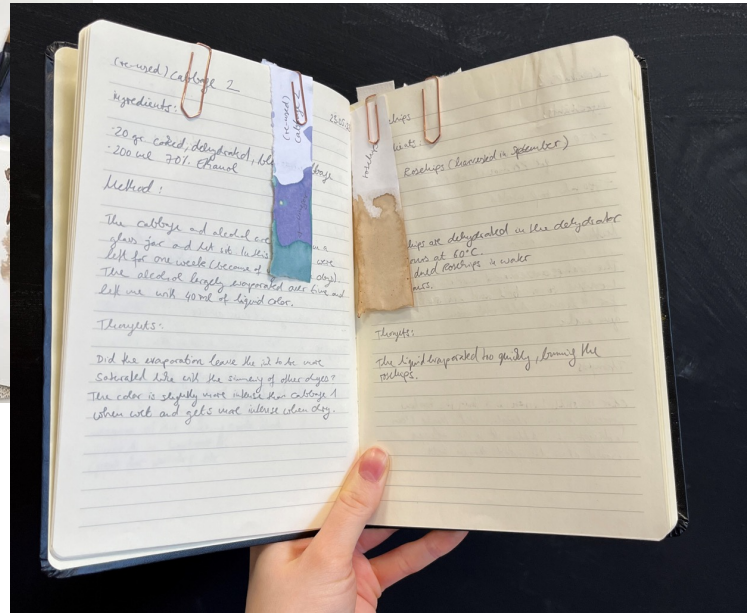
Through this project the students learn how colors are made/ the chemistry of natural colors, how to draw accurate depictions of natural elements, how to observe and depict them and how to create a visual code. Beyond this they learn how to organise artworks in a taxonomy.

The overarching learning goal is how nature, art and science connect and how the synergy of these topics creates interesting, creative outcomes. Furthermore the students get the chance to display their artworks in a public exhibition.

A steam project driven by ART.

Taxonomies –art and chemistry

1. Color making as experimental and hands-on practice
2. Documenting of color ”recipes”, skill for lab practice >which raw material, what date, etc.
3. Which raw materials give us which colors? Why do we see colors the way we see them?



Taxonomies – botanical art

Botanical Art as scientific method

1. Gathering and dissecting plants
2. Drawing as observation and analysis
3. Documenting nature through drawing

- Selective authenticity – Michael Shanks –
  - Zooming in or out,
  - Enhancing details
  - Change of point of view
  - Engage aesthetically with meaning

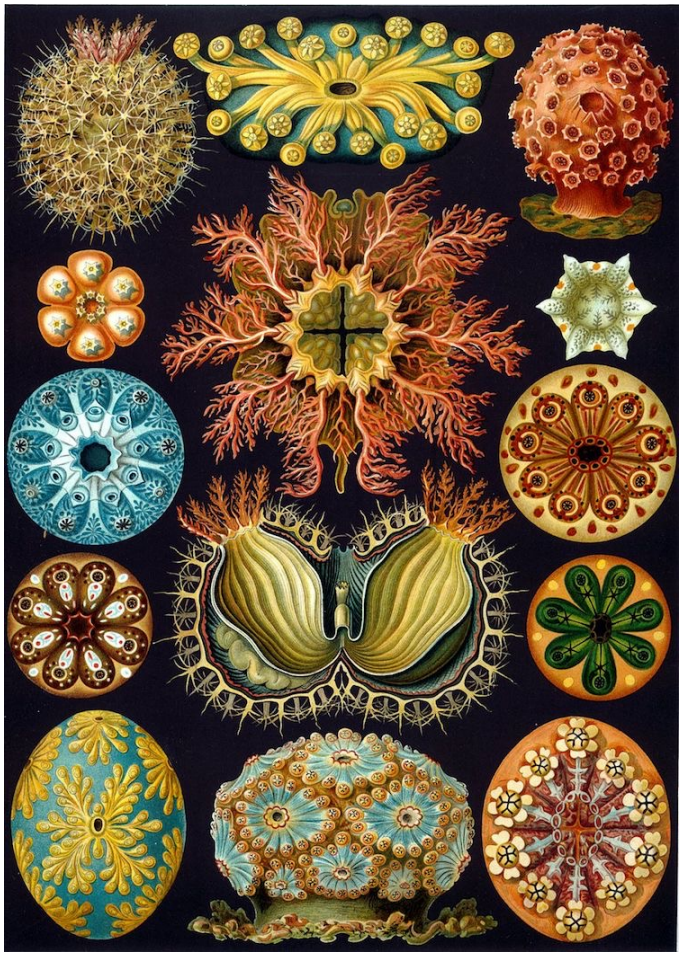
Taxonomies – botanical art

Tradition of drawing as scientific method for analysis and documentation in archaeology and natural sciences

Marchetti 2022 – drawing as ethnographic method

Historical grounding with reference to:

Leonhart Fuchs, Basilus Besler, Marianne North, Ernst Haeckel, Beatrix Potter



Taxonomies – botanical art

Aesthetic observations across species: plants, fungi, algae, human and animals

Capturing how different living end up mirroring each other through their life cycle – paraeidolia - Gestalt

D'Arcy Thompson – On Growth and Form 1917 - Form and Growth of living beings caused by chemical and physical forces = similar forms

Lucretius – De rerum natura

Morphing – deatail of a Bougainvillea

Taxonomies – botanical art

Orchidarium – Orchids as a butterfly collection

Taxonomies – botanical tables

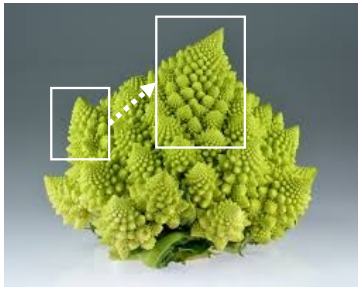
Urban Seeds

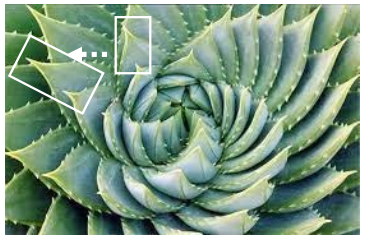
Azalea’s Journey – from blooming til withering

How do plants grow?

- *(and perhaps, can we simulate and draw them with a program?)*
- Plants are often **self-similar:**

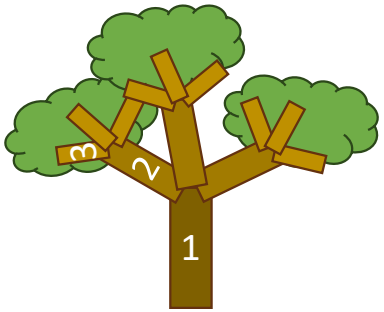
  *e.g. a **fern** is made of **smaller ferns**, …*



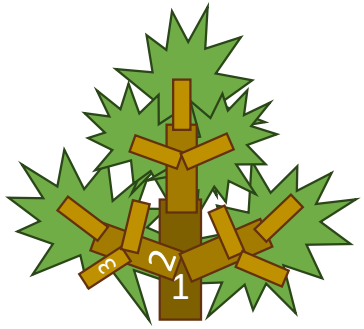


From **plant** to **model**

- We can use self-similarity to “simplify” the structure of a tree or plant:
  - we get a *model*
  - similar trees might have the same simplified model,
  - different trees will have different models



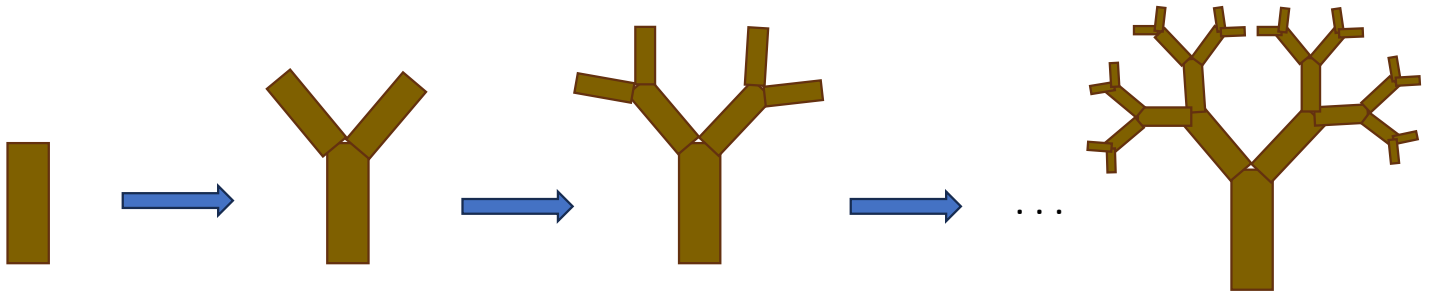
model



model

And what about *time*? Growth?

- We can define a model of a simple plant, and make it grow in steps

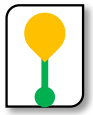


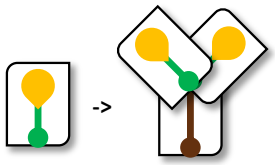
Enter: L-systems

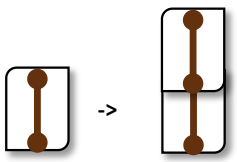
- **Lindenmayer systems (or L-systems)** were conceived as a **mathematical theory of plant development**
  - L-systems were introduced and developed in 1968 by **Aristid Lindenmayer**, a Hungarian theoretical biologist and botanist at the University of Utrecht.
  - Lindenmayer used L-systems to describe the behaviour of plant cells and to model the growth processes of plant development
- L-systems have also been used to model the **morphology** of a variety of organisms and can be used to generate self-similar fractals
  - **Morphology:** the study of the form and structure of organisms and their specific structural features

- Sources:
  - http://algorithmicbotany.org/papers/#abop
  - https://en.wikipedia.org/wiki/L-system
  - https://en.wikipedia.org/wiki/Morphology_(biology)

An L-systems is defined by **symbols** and **rules**

- Imagine that our plan is created by using cards (AKA **symbols**):
  - a **sprout** card  , its symbol could be **X**
  - and a **trunk** card  and its symbol can be **F**
- And some **rules** to replace (AKA rewrite) the cards:
  - start with X
  - X -*becomes*-> F[+X][-X]
  - F -*becomes*-> FF





Rules expresses visually

Description

X

⇓

F[+X][-X]

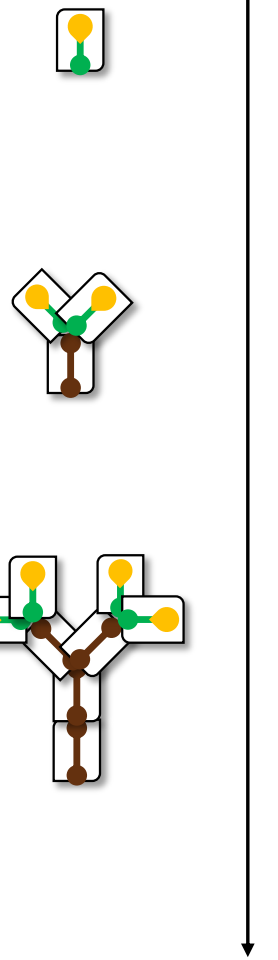
⇓

FF[+F[+X][-X]][-F[+X][-X]]

⇓

... a very long text ...

That's how it looks!



time

L-Systems can generate many kinds of plants

a
n=5, δ=25.7°
F
F → F[+F]F[-F]F

b
n=5, δ=20°
F
F → F[+F]F[-F][F]

c
n=4, δ=22.5°
F
F → FF-[-F+F+F]+
[+F-F-F]

d
n=7, δ=20°
X
X → F[+X]F[-X]+X
F → FF

e
n=7, δ=25.7°
X
X → F[+X][-X]FX
F → FF

f
n=5, δ=22.5°
X
X → F-[[X]+X]+F[+FX]-X
F → FF

Discussion

What do you think is the advantage of interdisciplinary work in schools/ universities? Which parts of STEAM would benefit from this?