pHen

One pHen, infinite hues.

Colors are all around us. They are the first thing we recognize when we enter a space, look at an object, or choose our clothing. Colors catch the eye and represent our personal style, but they also have the power to influence our mood. The clothes we wear, the art we surround ourselves with, the spaces we live in... colors in any way play a vital role in our daily lives. Given the environmental impact of traditional pens, there is a pressing need for sustainable alternatives that are both functional and engaging. pHen uses natural ink derived from vegetable juices or bacteria, offering a safe and eco-friendly solution. But that's not all—it also has a unique feature: it alters color in response to pH level changes by adding acid or alkaline. This color-changing capability not only makes the pen fun to use but also educational for users of all ages, sparking curiosity and creativity. Imagine writing or drawing with a pen that shifts hues, providing a dynamic and interactive experience. It's not just a tool; it's a conversation starter, a learning aid, and a creative companion.

Our team

Budapest, Hungary

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media design

Nóra Gulya
textile design

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graphic design

Colors

Colors have always played a significant role in our culture, history, creativity, and everyday life.

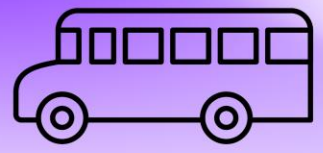
We use them all the time, but do we know exactly what is the cost of colors?

Problem

1. *Waste*

10 billion
plastic pens

=

1467X 

Problem

2. *Harmful*

produced behavioral abnormalities

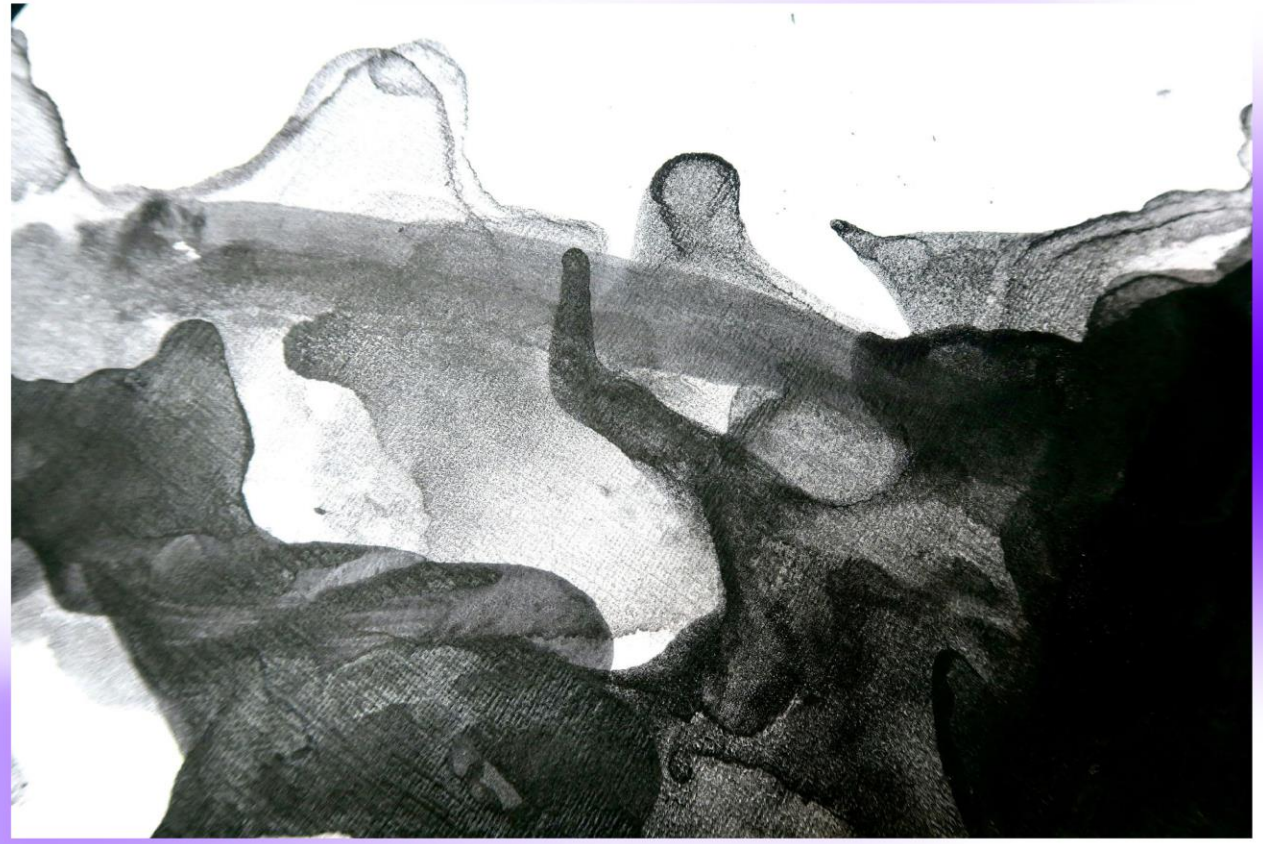
heavy metals

volatile organic compounds (VOCs)

solvents

chemicals

improper disposal of waste



Goal

How can we create a sustainable colorant alternative that is fun and engaging, so people will actually use it?

Research

1. *pH*

pH is a scale that measures how acidic or basic a substance is, ranging from 0 (most acidic) to 14 (most basic), with 7 being neutral

Research

2. *Level1.*

Veggies

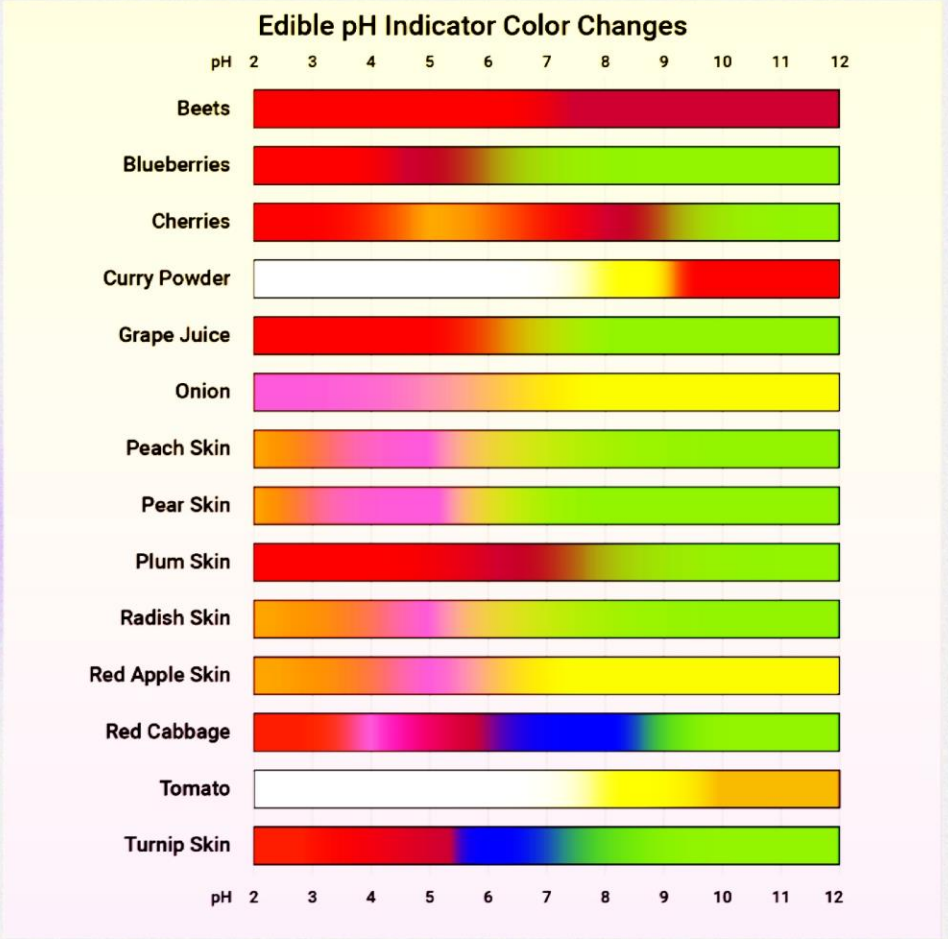
Pigments:

anthocyanin-> widest range of colours

betalain

curcumin

polyphenol



https://sciencenotes.org/edible-ph-indicators-from-your-kitchen-and-garden/

Research

3. *Level2.*

J. Lividum

Janthinobacterium lividum

Pigment: Violacein

Found: soil/amphids skin

What else do we have?

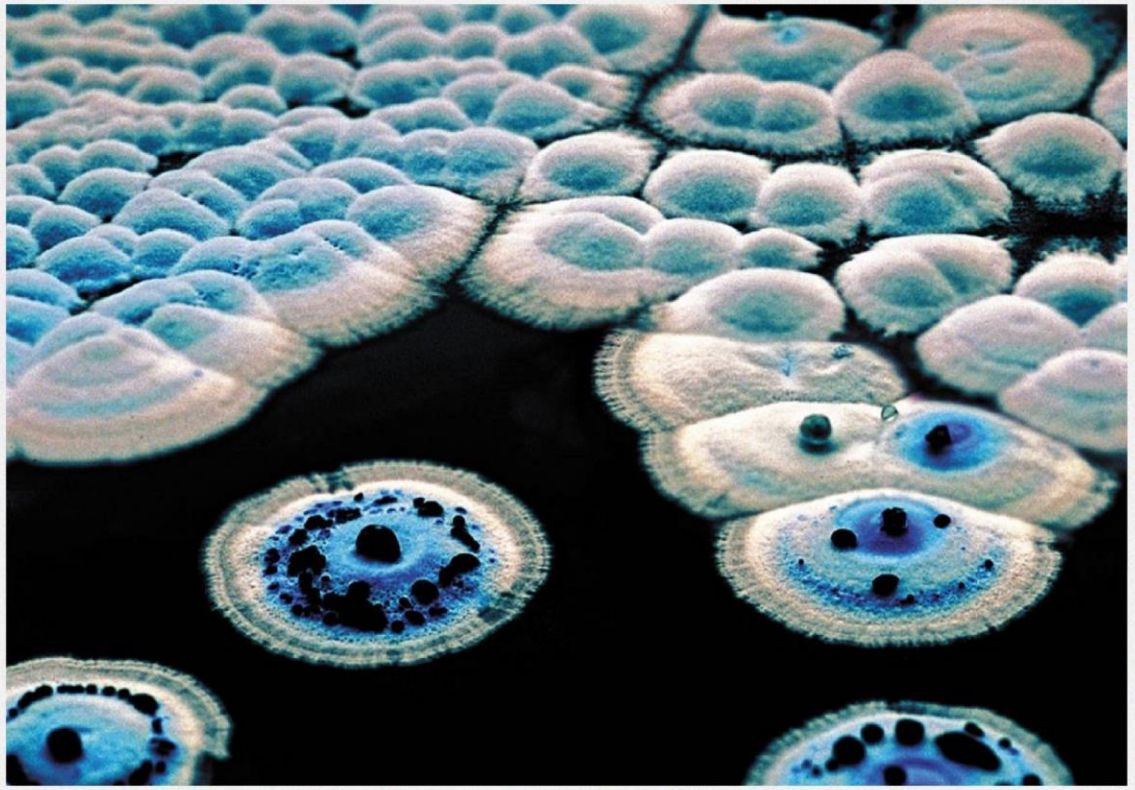
living pigments reacting to change in ph

Streptomyces coelicolor:

is the choice for future experiments

Pigment: Actinorhodin

Color Change: blue-red



Genetically modified bacteria

4. *Level 3.*

genetically modified with anthocyanin:

Escherichia coli

Saccharomyces cerevisiae

Corynebacterium glutamicum

Lactococcus lactis

Target group

B2C

Designers

Educational

Phen as a *solution*

Different colors using a single source.

Create an engaging, fun, easly usable pen.

Rethinking creative process

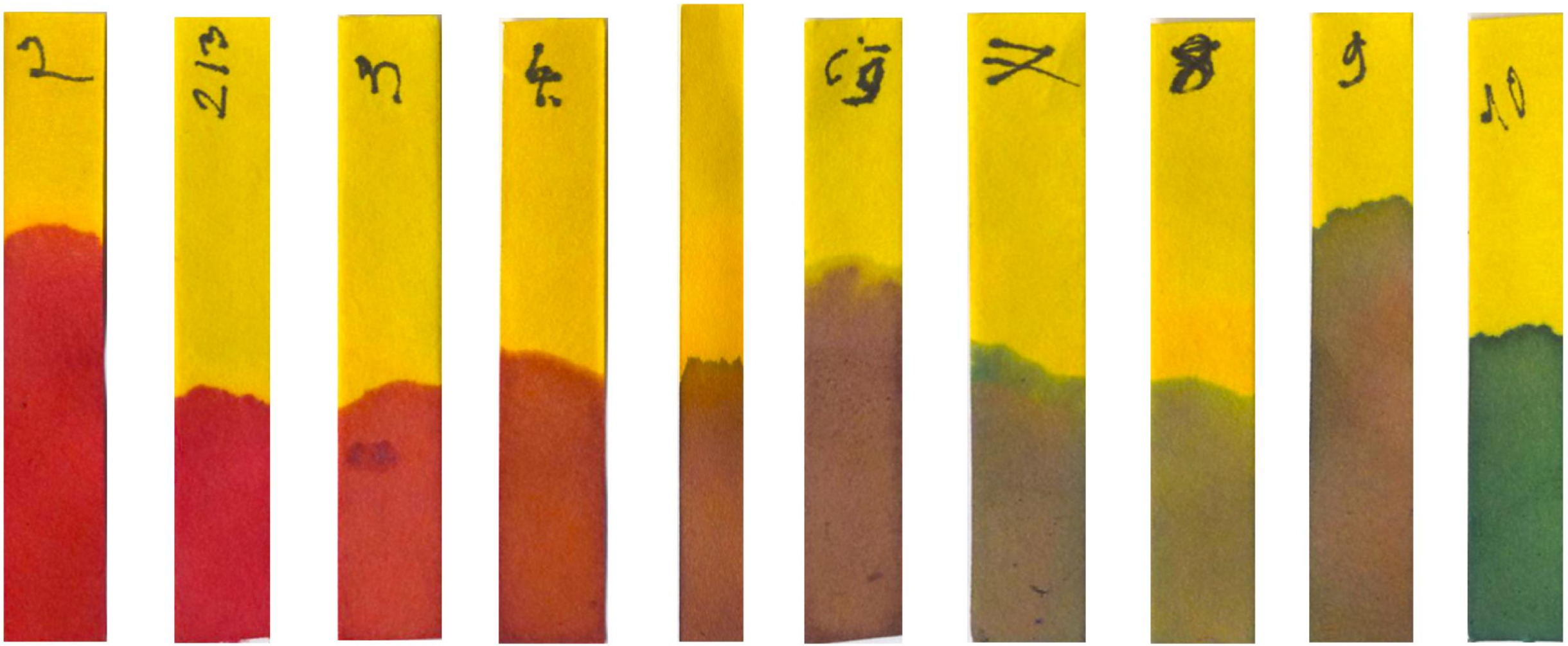
Making use of the natural phenomena of PH changing color

Create your own solution (open source , diy)

-> household items

PH change

Cabbage



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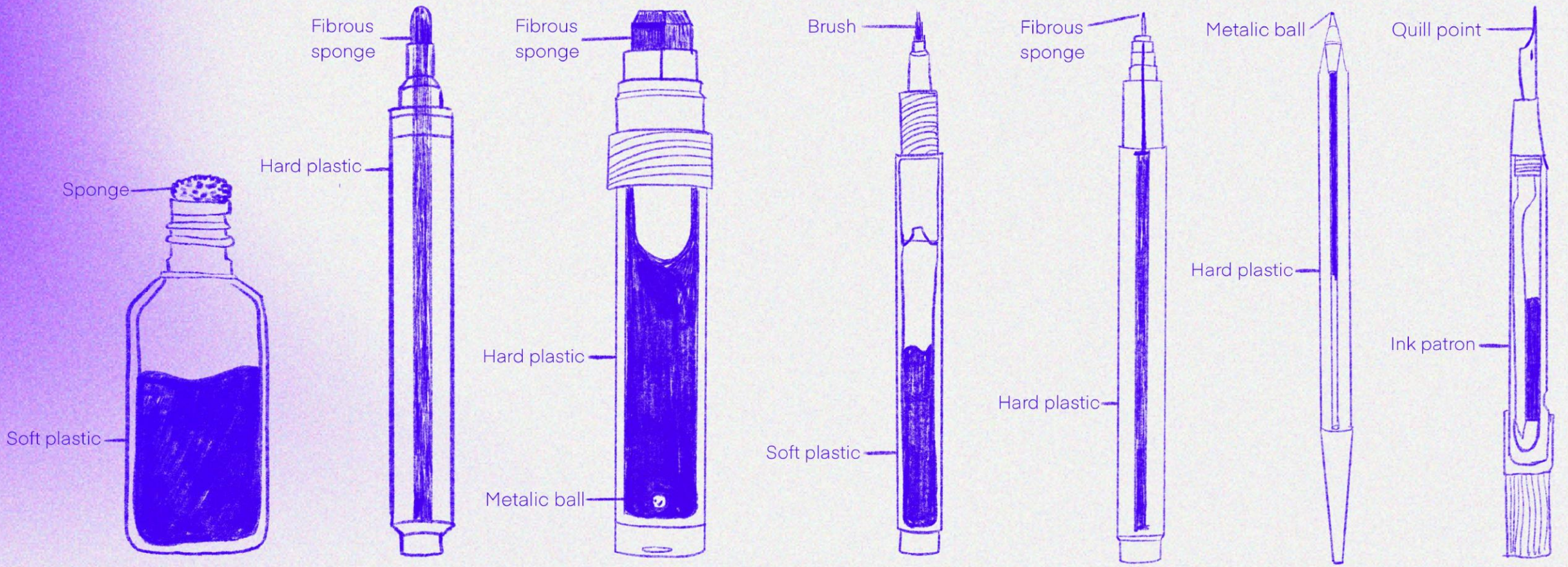
2024

Research

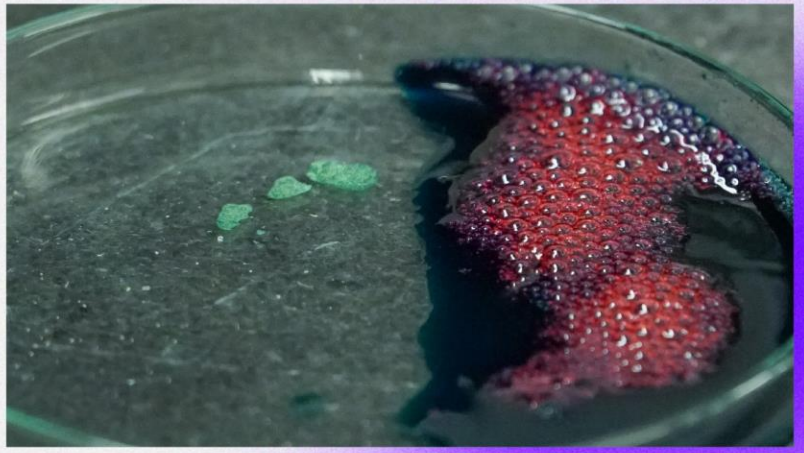
3. *Pens, markers*

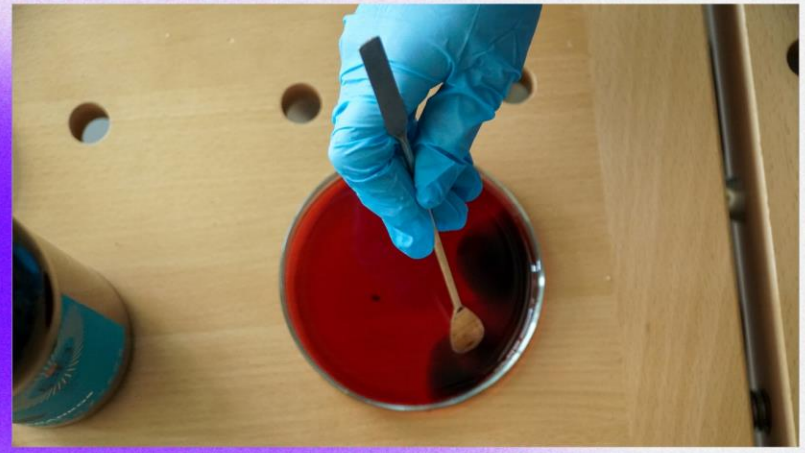


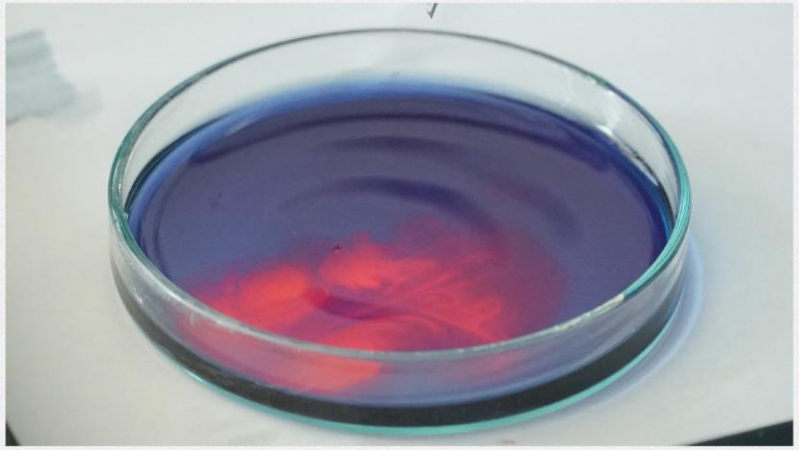
Veggie experiments

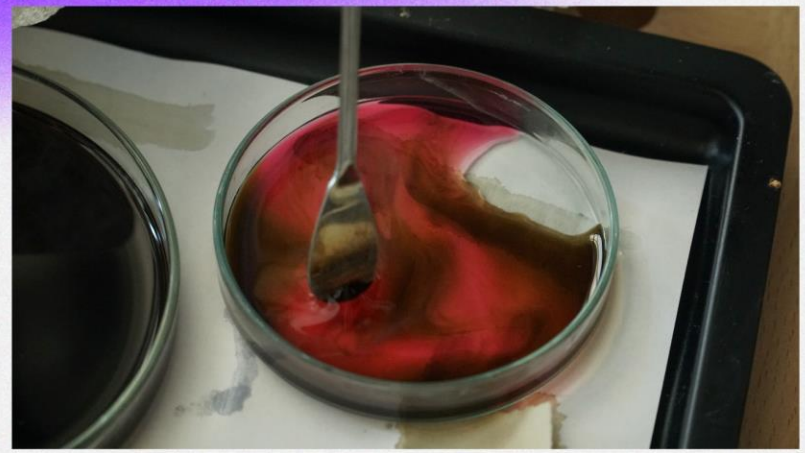
Different kind of materials react to pH value changes by changing their colorhigh pigmentation

You can do it home or grow your own color part of the ink









Bacteria experiments

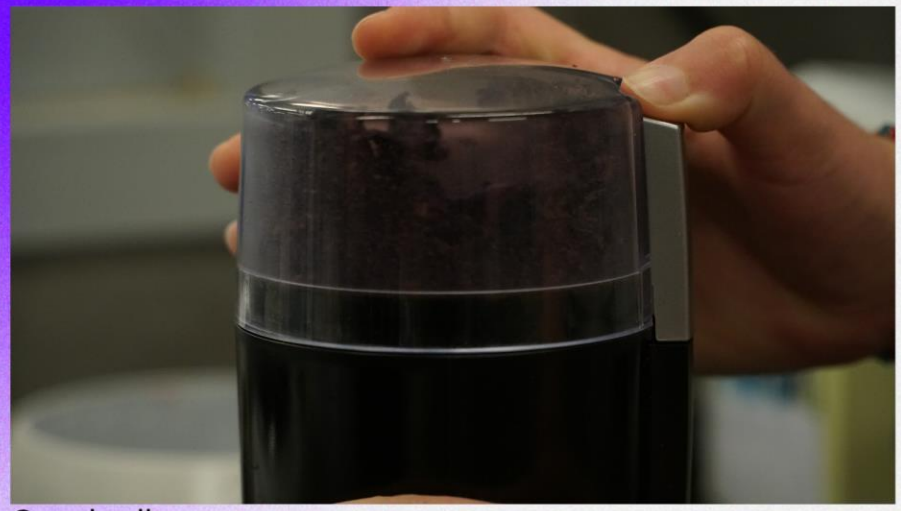
J. Lividum

Goal: make the pigment more purifyied:

1. Growing a paste
2. Extracting with alcohol
3. Gowing a liquid culture
4. Evapurating the water content

Method

1. dryig



2. grinding

3. sifting

4. squeeze

Conclusion

bacteria vs. cabbage

Pro's of Bacteria dye

Self-regenerative (no Agricultural land needed)

Useable on synthetic material

Con's:

It can dye and then you wont be able to grow it

slower process

Pro's of Cabbage dye

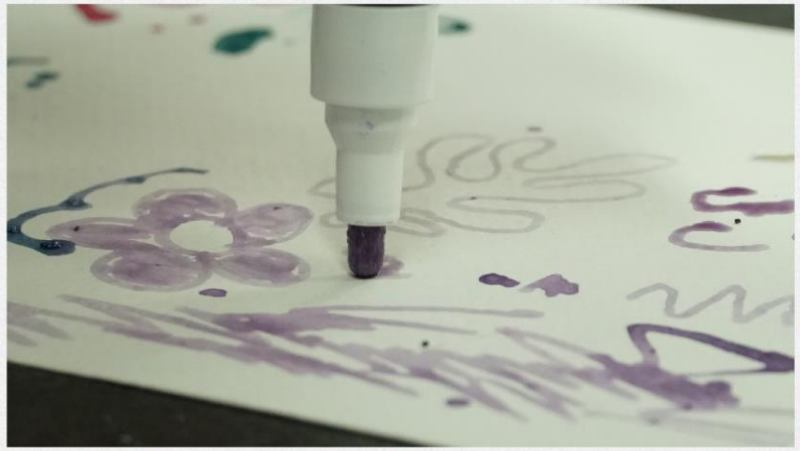
High pigmentation

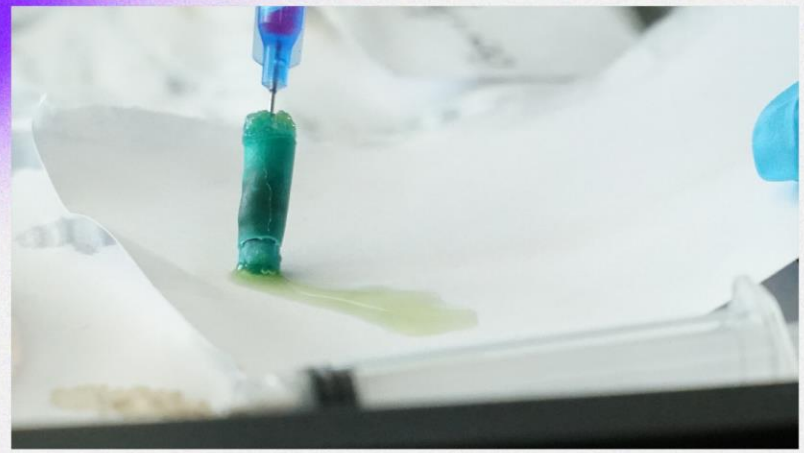
Good chemistry with acid and alcalye

Con's:

Smell

Prototype experiments

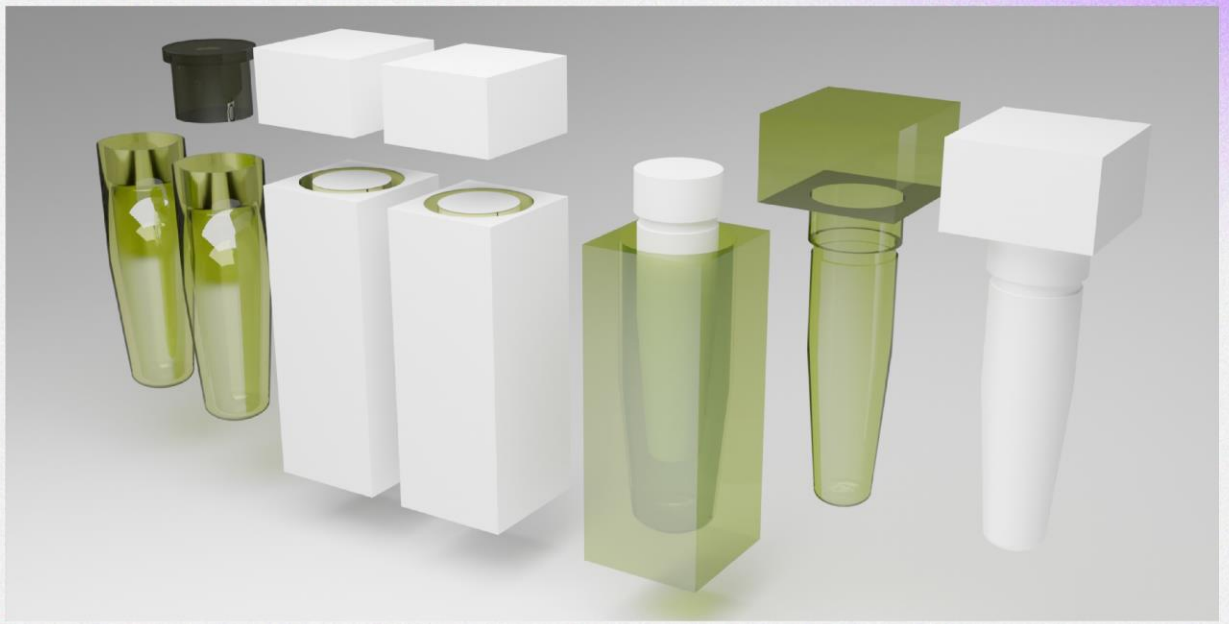


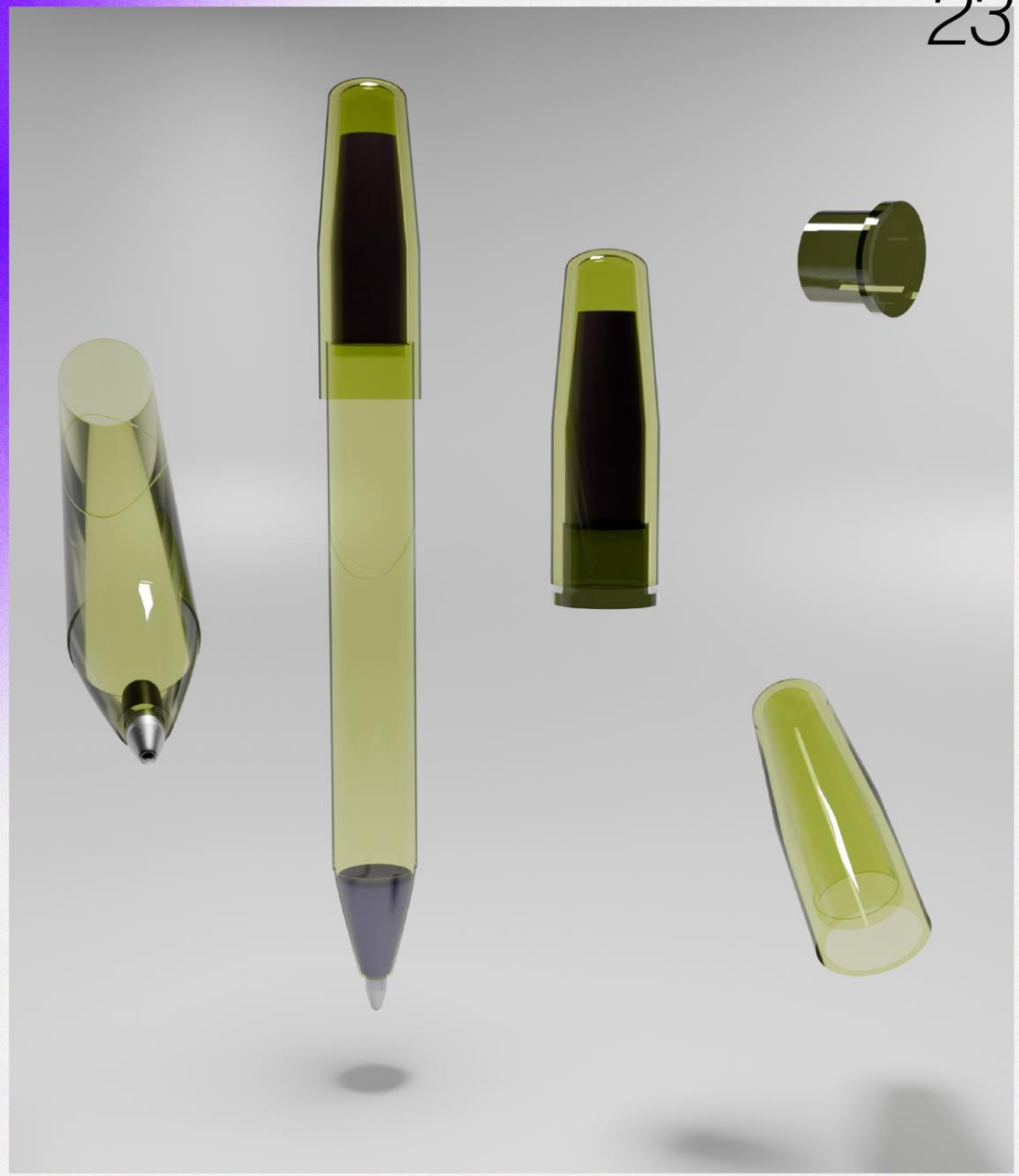


Pen prototype

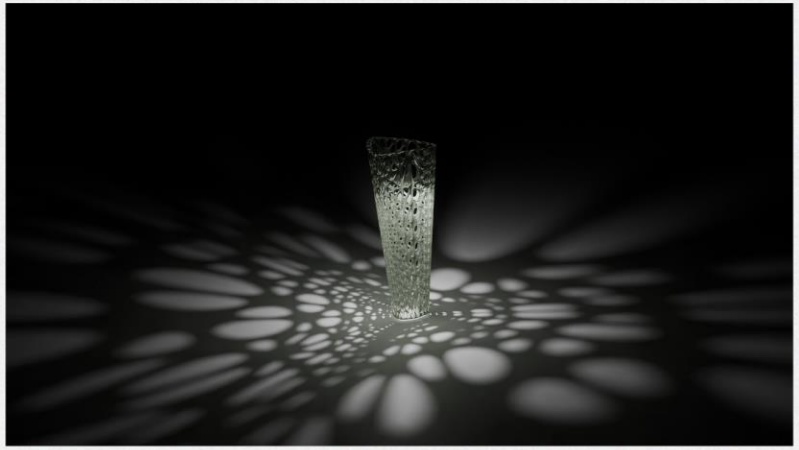
No. 1

bacteria as a source of pigment





Final prototype

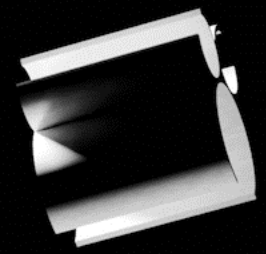


Hybrid solution

pH-reactive pigments

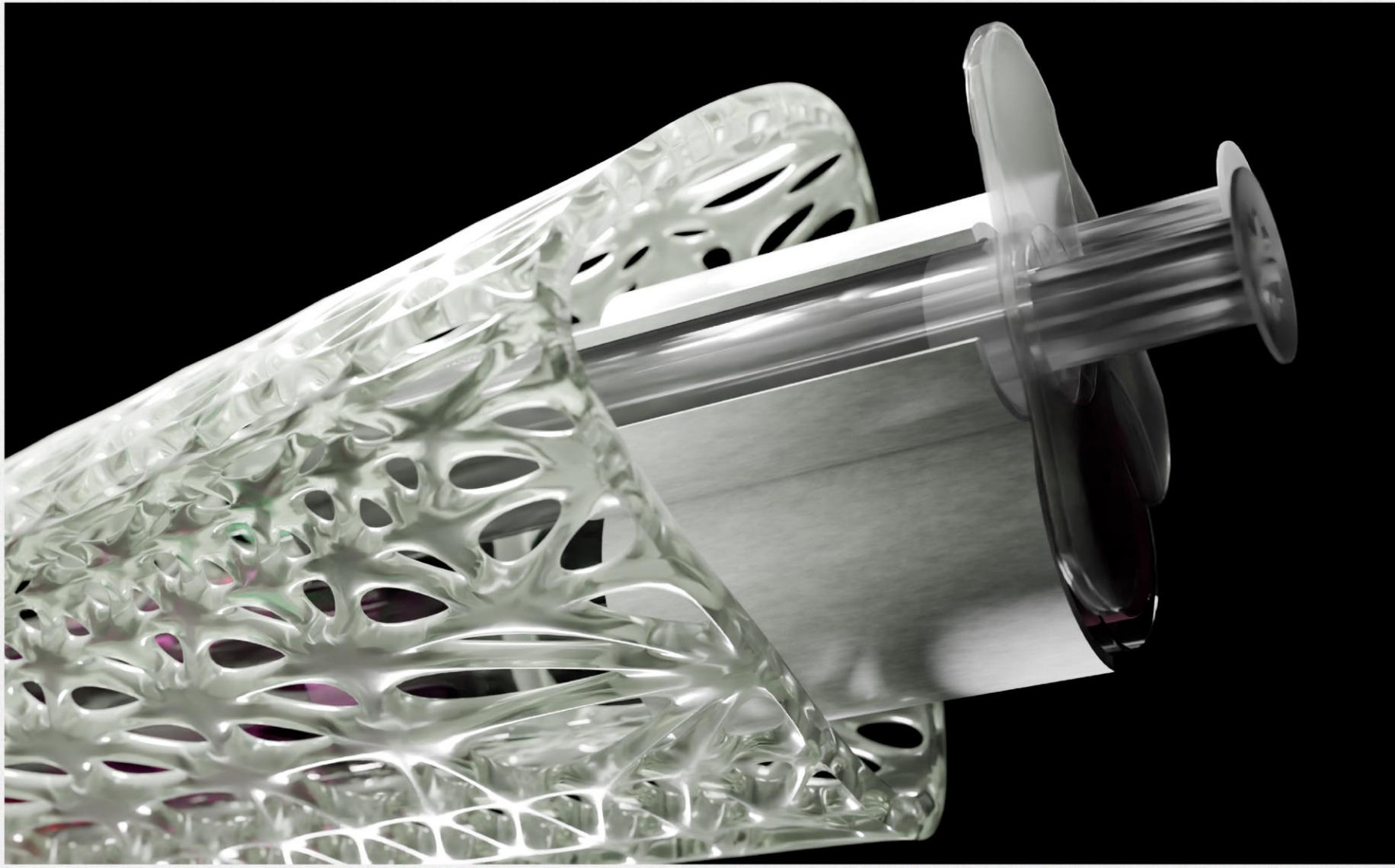
Household and off-the-shelf items

Bent needles



Phen

1. *details*



Phen

2. *Open source*

Manual:

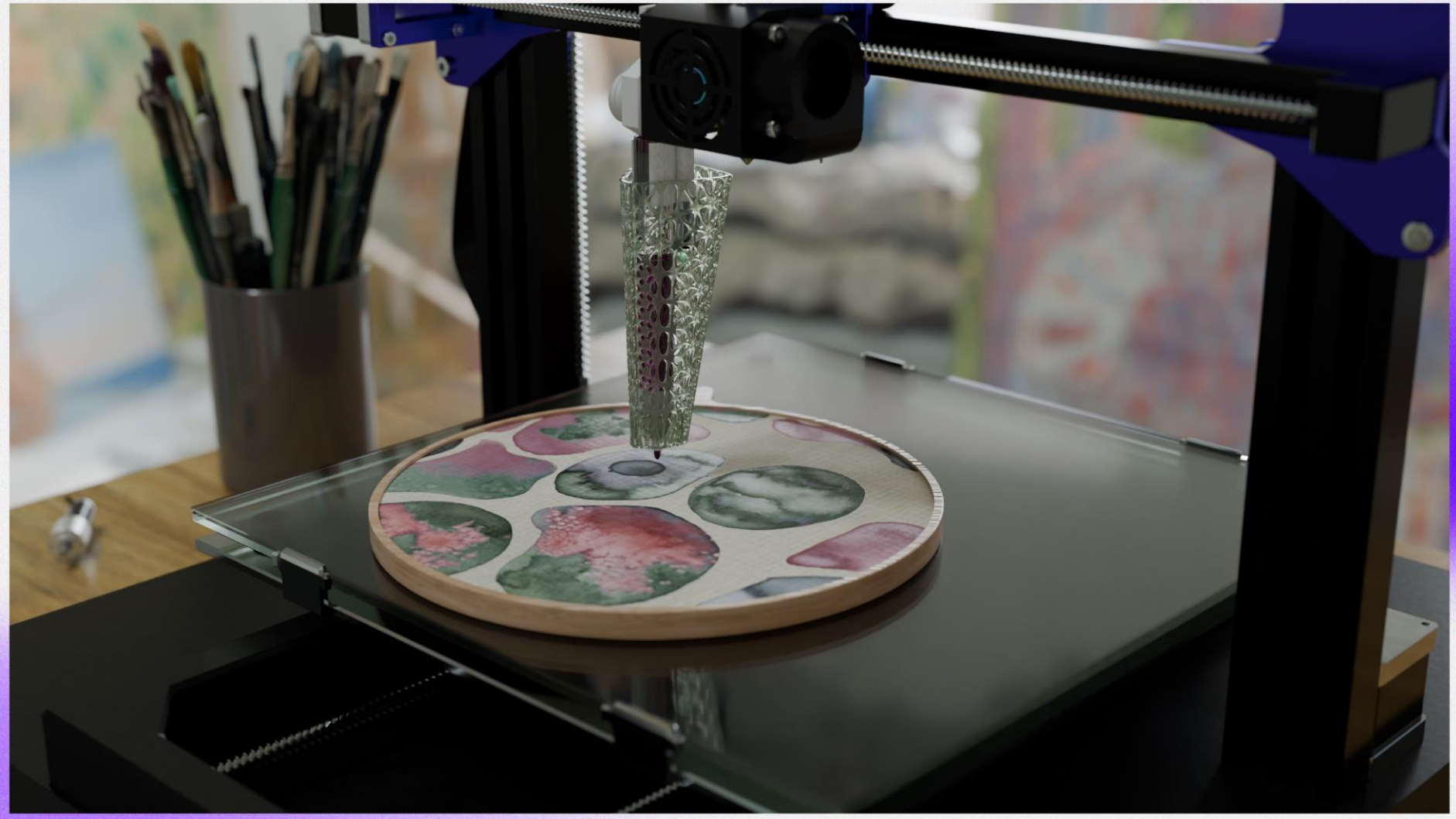
Scan me

In practice

Painting

Left: watercolor like
Right: ink pen like

Future application



3D printer adapter

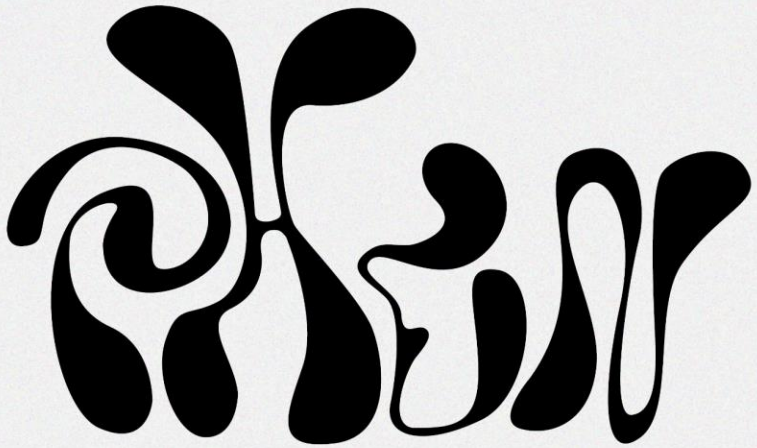
Special thanks to:

Juni Sun Neyenhuys

Ferenc Kovács-Nagy

Malu Lücking

Go
Try it out
Start building your own Phen today!



Questions