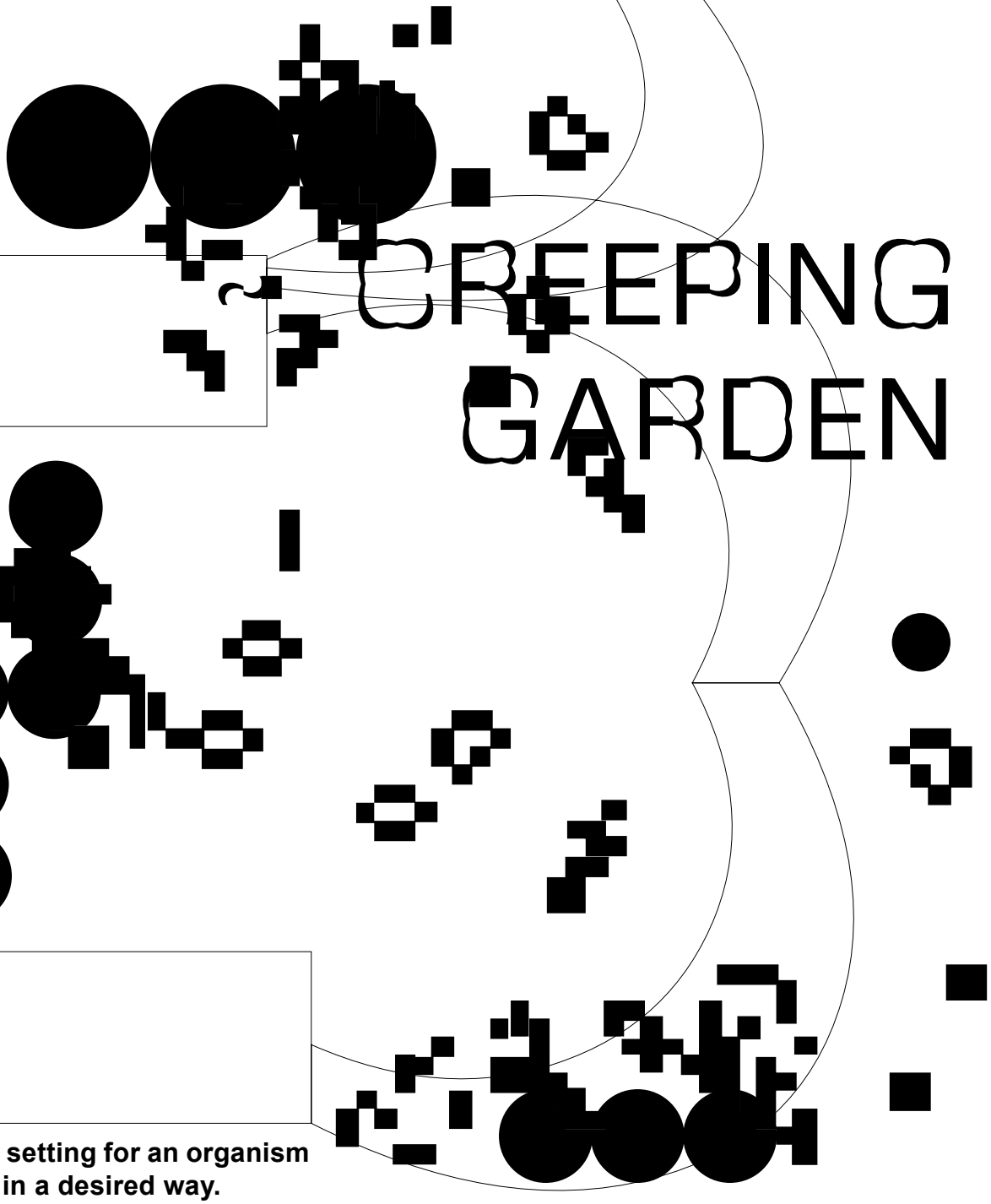
BODY HABITAT



CREEPING GARDEN

An artistic setting for an organism to behave in a desired way.

Body Habitat ~ creeping garden

The reader to a living sculpture

Body Habitat

The 'Body Habitat' project, as a media-artistic-scientific examination of non-human forms of life, explores and translates the artistic work with a vital organism and its habitat into a living sculpture.

The organic starting point of the project is the genus of the slime mold (Mycetozoa), specifically: Physarum polycephalum. The defining design and artistic element of the sculpture is the visual similarity between the natural appearance of this organism as part of a tree structure and the human body. With this visual analogy, the scientific-ontological relationship between humans and other species is questioned. The intrinsic connection between nature and humans is shown as a complex relationship, consisting of explorative approach, admiration, care and also incomprehension through an experimental practice.

The common (scientific) examination of the slime mold organism has so far been determined by terms such as ‚complex social behaviour', ‚memory' or even ‚intelligence', while the media communication has frequently been more reminiscent of science fiction. It is important to question these and other such assessments and to lead the viewer back to the direct confrontation with nature.

Introduction

Goal and Approach

The overall goal of the project is to create a visceral connection between the viewer and a completely different form of life - the slime mold -, whose habitat and abilities for survival are a central theme in order to vividly question human interaction with nature.

The creative work process is characterised by the numerous difficulties in controlling an organism according to the human will. By combining techniques of classical art and the Bioart approach with living matter, the contrast between an alien organism and humans is creatively implemented, reflected in its properties and ultimately the resulting relationship is re-evaluated.

Based on the breeding, cultivation, care and various design experiments with the biological organism in the ‚home-studio' (of the DIY Biolab), an artificial habitat in the form of a time-based sculpture was designed. In parallel, field research in the form of the direct collection of a carrier structure (tree branch) from nature was conducted and subsequently artistically translated by wax casting with a silicone mold.

In the end, the question of how living matter relates to the characteristics of form is posed: Will the slime mold Physarum polycephalum behave in a desired way in this new setting?

Introduction

Concept

The designed hybrid sculptural habitat for a living organism connects the slime mold's* natural habitat - the woods - with the life it has been habituated to lead in sterilised, monitored and controlled human captivity - the petri-dish.

To this end, these two ‚habitats' are translated into a sculptural setting, by visually comparing the surface structure of trees to the human body in a 'form-study'. This study of shapes and forms revealed numerous textural similarities, directly connecting the two. As a result, the final sculpture - cast from an actual tree - implies a corporeal impression, in which the human body represents an analogy for our human-centred perception of nature and at the same time questions, how we encounter other species around us. It also speaks on the irony, of how humanity both draws knowledge from the natural world and increasingly rejects all spirituality and magical thinking connected to the individual appreciation of nature in favour of digital quantifiability.

In the temporarily living sculpture, the slime mold acts as an agent of nature as it grows, moves and covers the defenceless (tree/body) limb. What appears to be a body-like member, exposes our vulnerability. It hypothesises, how - by exceedingly cutting ourselves off from natural forms and personal interactions with other lifeforms - we grow exposed and vulnerable in time.

The struggle for control over an organism to behave in a desired way, is an additional underlying theme. Ultimately, *the slime mold* determines the outcome in response to the conditions of the provided habitat. This includes its possible return to a more natural life cycle beyond the vital, plasmodial stage of growth into the development of spores (a form of reproduction), hibernation or death.

*specifics see page 37- 39

Introduction

Core and Relevance

People are increasingly replacing the relationship to other living beings and forms of life with the digital world. This is precisely, why it is important to continually reflect on how we approach our natural resources, the environment and sustainable living.

The sculpture as an a-typical combination of Bioart and classical art intends to emphasise the connection between humans and nature as the most original source of knowledge and innovation. Through the reduction to an interplay between (living) matter and form, the question: ‚How do we encounter nature?‘ echoes the current, intense sustainability and environmental debate.

Prior texts can be found in German translation in the endnotes

Pages

Project scheme

lab context

the two existing, opposing habitats of the slime mold

polarities which emerged during the creative process

Aesthetics

Sculptural aesthetics

The imperative was to begin as close to the natural habitat of the slime mold as possible. Therefore, in a first step, I went into the woods (Weimar, Germany) to inspect and collect tree branches and trunks from the forest floor.

The tree, in the end, serves as a figurative meeting point between the natural habitat and the human interaction, influence and perspective onto the organism. A foreign yet familiar form, which itself has life pulsing and oscillating through its vein-like network.

The field-research in the woods resulted in a study of shape and form similarities between human and tree. From these observations evolved the search for specific traits on tree trunks or branches, that connect both the human and non-human forms. Direct visual similarities to the human body include features like creases, folds, scars, structures of muscle or bone, stretch marks, a collarbone, an elbow.*

In a further step to bring forth the body-like characteristics of these wooden features, the shape of the selected branch was emulated by a silicone mould. From this mould, a second branch was cast from hard wax in a faint skin-tone colour.

This wax branch, an impression taken directly from nature, becomes something between tree branch and severed (corporal) limb: An oversized elbow with stretch marks that hint at muscular veins just below the surface; stretch marks as a signifier of both human and non-human life and growth; scars and cuts on the outer most protective layer that hint at vulnerability underneath.

Thus, a new terrain for the vein like slime mold to live on was artifically created: 86cm in length with a radius of 3cm. An interplay of surface, texture, colour, structure and patterns emerges.

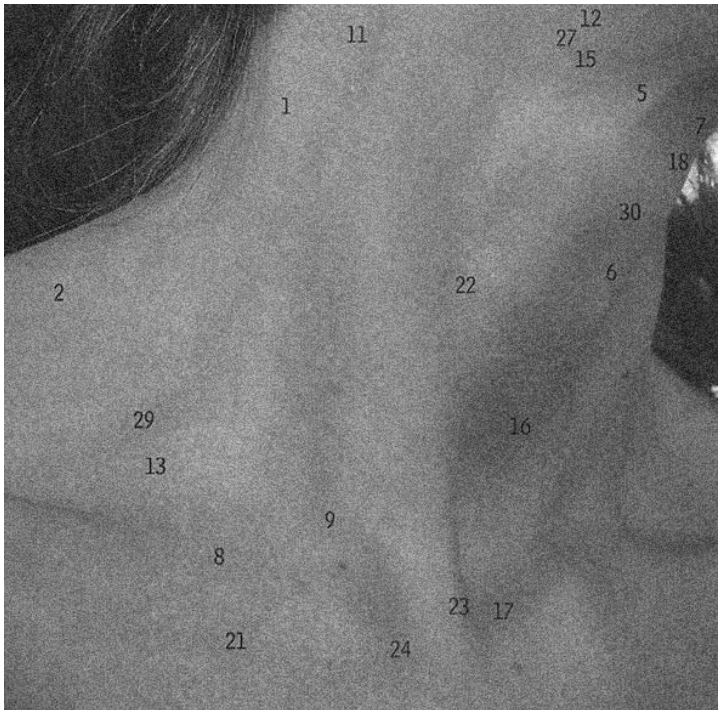
Can Physarum polychefalum survive, live and grow on this altered habitat?
Or will it quickly retreat, reproduce or hibernate?

**The branch selected was freshly logged and had multiple body-like features. In addition it became evident that the already decaying trunks and branches on the forest floor give us an impression of death and decay, different from the freshly cut branches of still vital and growing trees. Vitality proved another key feature to serve the form-analogy between tree and human body.*

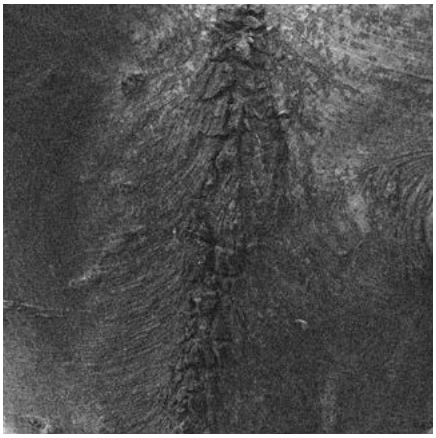
See page 127

tree structure 01

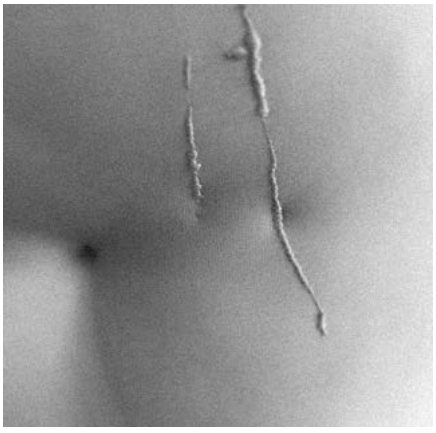
Analogy of the living
vol. 1



body structure 01



tree structure 02

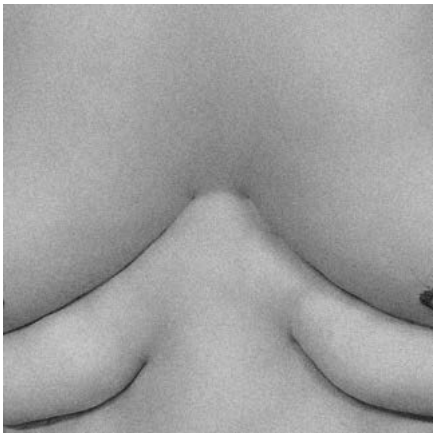


body structure 02

tree structure 03

body structure 03

tree structure 04



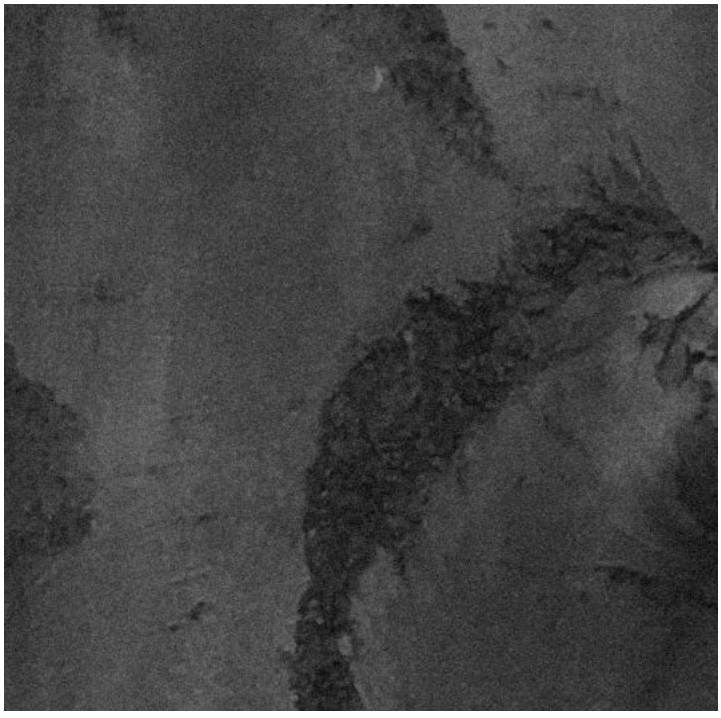
body structure 04

tree structure 05

body structure 05

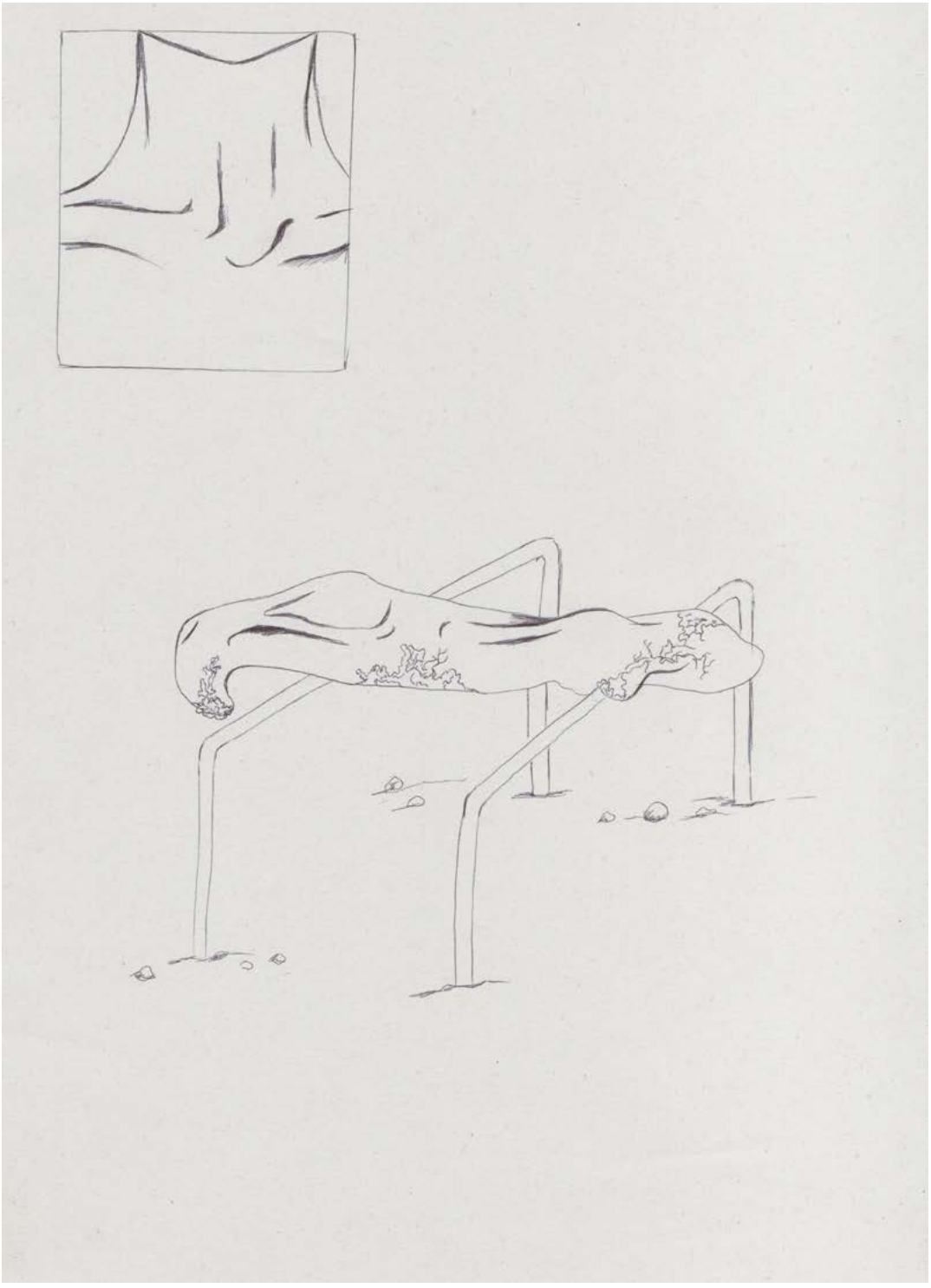
tree structure 06

body structure 06



tree structure 07

body structure 07



early sketch of wax sculpture 01

early sketch of wax sculpture 02

Additional sketches in endnotes

Scientific / Technical

An interspecies interaction

An interspecies, in-between habitat, quasi-scientific approach to working with unicellular slime mold was chosen.

This project revolves around the attempt to shape other life to an artistic will and the unspoken interspecies-negotiations that took shape through trial and error experimentation, which was required to effectively integrate the slime mold - Physarum polycephalum - as living component into the final sculptural artwork.

The dialogue with the slime mold was from the beginning not an equal one. Instead, it was determined by a sculptural vision*. Hence, the desired outcome: a visual showcase of the structures, colours and unpredictable growth movements of the slime mold in a new environment was set.

A quasi-scientific artistic practice

Both, the organism and the sculpture posed their own, conflictive needs.

Because the chosen approach was not ‚open' for entirely unexpected or undesired outcomes of the experiments, the process could be deemed ‚non-scientific', as it is the imperative of real scientific research to test hypothesis without prejudice.

However, as the aesthetic vision of this project asks the slime mold to look and behave in a specific environment and way, the process towards bringing the artistic vision and the realities of the organism together, became a quasi-scientific artistic practice. This process included at-home experiments, which lead to new hypotheses, personal insights and philosophical thoughts. As a result, the restrictions posed by the sculpture allowed invisible and unexpected parameters** to emerge, which might otherwise have stayed unnoticed.

see sketches page 28-29
***invisible parameters: airflow, oxygen, humidity, temperature, aerosol - see endnotes*

Research question

‚What happens in the area of tension between laboratory and nature?‘
This overarching theme is composed of the practical inquiry into:

(1) ‚Which parameters need to be closer to a lab context‘ vs. ‚Which can more closely resemble the natural environment to tend to the needs of the living organism‘ while realising the sculptural vision?

(2) How does my human influence manifest on a controlled, repeatable visual level? Can I control the slime mold‘s appearance (color, size, network structure, movement)?

A unicellular, plasmodial organism

Physarum polycephalum is a unique ‚unicellular' or ‚single-celled' organism. This means that every cell carries the entire genome information as nucleus and as such the slime mold can be endlessly divided, with each part retaining all essential information to live on, on its own.

The most commonly observed form of the slime mold is the ‚plasmodium'. In this main vegetative phase, the slime mold is bright yellow and grows to be one large mass of multiple nuclei in one large joined structure, the ‚cytoplasm'.

Through its own means of survival, it actively migrates while ‚searching' for optimal living conditions, including new food sources. Under disadvantageous conditions of starvation or desiccation/dryness, the plasmodium enters into one of two stages: ‚hiberation' or ‚reproduction':

The first, is a dormant stage - called ‚sclerotia' - from which it can be resurrected/revitalised even years later, simply by providing moisture and an appropriate food source (e.g. oat flakes).

The alternate stage, Physarum polycephalum can transition into under especially disadvantageous conditions, is the building of spores or ‚sporangia'. What then appears as small black clumps, contains packaged inside ‚haploid nuclei', ready to be carried away through the forest landscape and eager to open and release the spores in environments that again have the proper levels of moisture, nutrients, temperature and light.

Habitats

The first space: the natural habitat

A state in which the parameters that shape the conditions for life of the organism occur so naturally, that they often appear invisible to the human eye.

The second space: the lab context

A man-made, engineered, contained and controlled environment that best simulates the living conditions to grow and synthetically keep the organism in its plasmodial stage for scientific observation and research.

The third space: the arts

An artistic engagement with the organism, developed in the process of isolating single parameters* of the slime mold's living condition and re-configuring the supply to the organism, resulting in a ‚negotiation' between the first and second space.

**moisture, food source, space, light, temperature, care - see design experiments starting page 45*

Technicalities

The conducted at-home experiments were designed to habituate the unicellular organism out of the petri-dish into a hybrid situation, inspired by its natural condition. To promote the slime mold's dynamic growth and oscillating state on top of the body-tree structure, the parameters that make up the organism's living condition need to be pinpointed, controlled and artistically developed, starting from the standardised petri-dish of the lab context.

At-home design experiments

All experiments and outcomes are in principal ‚quasi-scientific', because they are designed and executed with a desired specific, artificial outcome in mind. These ‚design-experiments' are primarily oriented on visual aesthetics, that aim to show an unobstructed close-up view of Physarum polycephalum in the designed environment.

Moreover, these experiments are not repeated often enough under completely consistent conditions for real scientific hypotheses or insights to be concluded.

The aim of the experiments was to first test and observe the slime mold's behaviour inside the petri-dish, in order to later sustainably transplant it to the final sculpture.

(1) Moisture

lab context: Agar

The Biolab standard is a 100ml distilled water x 2g ‚Agar agar' (Agartine - plant based gelatine) solution.

vs.

natural habitat: Residual moisture and humidity

The natural condition for the slime mold is residual moisture - hidden to the naked human eye - inside fallen logs, tree branches, piles of leaves and soil.*

**Because of this, the slime mold is more commonly found in wet areas and during the rainier fall months.*

Design experiment (1)

simulating rain

Point of reference: The natural condition of how the organism receives moisture, is from wet, decaying biomass.

How: Provide moisture by simulating rain and spraying the organism with (distilled) water.

Overall time frame: **Inoculated*:** 2 July 2020
First spores: 18 July 2020
Plasmodial stage: 16 days

Times sprayed per day: 1-2 times; irregularly

Observations: The structure is more pronounced and vein-like, indicating that the conditions are not ideal but sufficient for plasmodial survival.

Aim: To replace Agar as means to supply moisture, because it is a breading ground for other, unwanted bacteria and mold to grow.

Outcome: Slime mold survived for 16 days, similar to plasmodial survival in a petri-dish with Agar base.

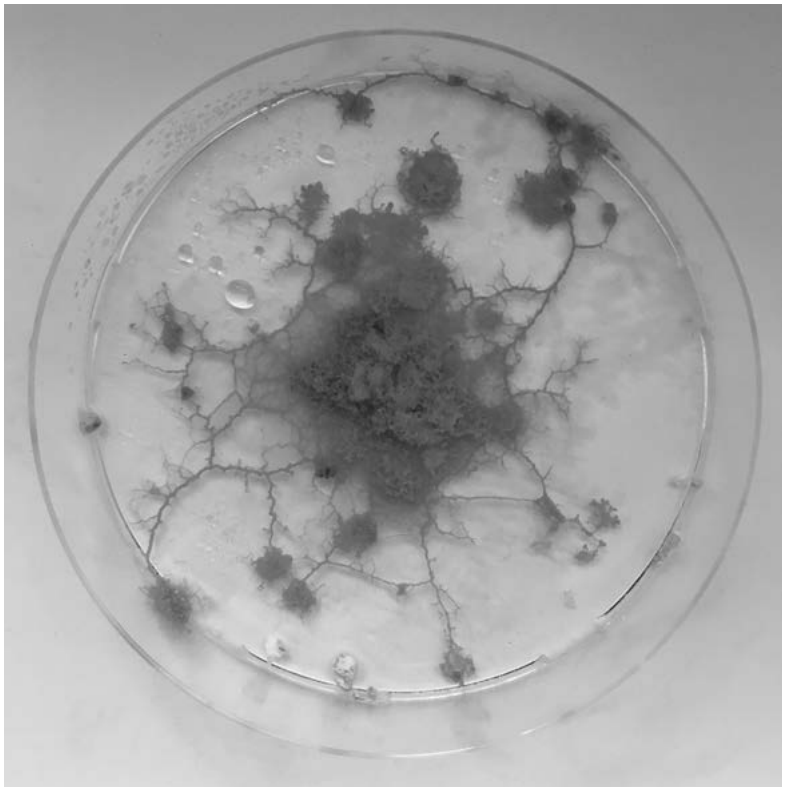
Hypothesis: When regularly sprayed/kept moist, the slime mold can survive without Agar base.

Implication for sculpture: Moisture can be supplied by keeping the environment wet through spray ‚rain' simulation.

petri-dish day: 1

**Inoculation: The method of transferring the organism to a new petri-dish, see page 85*

distilled water



petri-dish day: 6

Design experiment (2)
moisture pods

How: Sculpt an uneven surface with holes/pods to pour Agar into as ‚moisture pods' for the slime mold to draw needed moisture from.

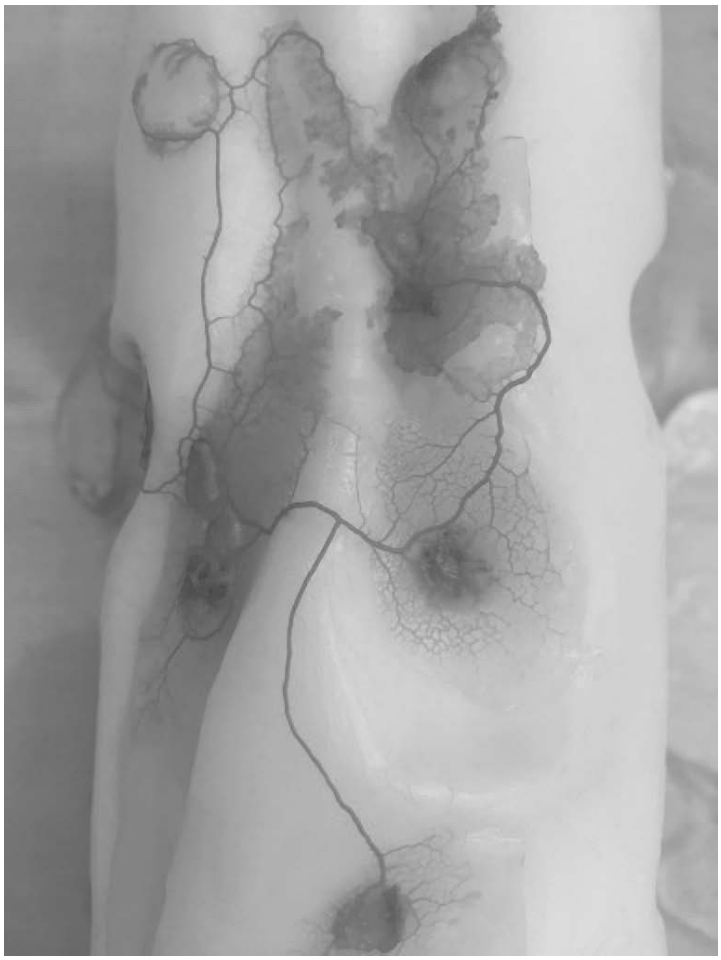
Aim: To see if Physarum polycefalum looks or behaves differently in spots with or without the Agar, and find out how the Agar base can be configured.

Overall time frame: 7 days

Observations: Physarum polycefalum does not appear to favour the Agar pods, neither does it appear to draw moisture exclusively from these areas.

Hypothesis: Instead of being dependant on growing directly on top of Agar, the slime mold is hydrated by the evaporating Agar, which supplies humidity to the entire space through the air.

Implication for sculpture: A permanent Agar base is not an absolute necessity to keep the organism hydrated.



vein network on wax object with Agar-pods

**Because of unfavourable, high summer heat, the experiment had to take place at around 27°C, which gave the following interesting implication on the slime mold's behaviour: Even in this heat it did not exclusively cling to the moisture pods.*

(2) ‚Food'

lab context: Oat flakes*

The Biolab standard are oat flakes, from which the slime mold ‚eats' only the bacteria and yeasts on the flakes.

vs.

natural habitat: Microorganisms, bacteria, fungi, yeasts

The natural ‚food-source' of the slime mold are bacteria, yeasts, and fungi responsible for decomposition, found on decaying tree logs/wood and rotting leafs.

**Oat flakes used: Alnatura Hafer Flocke, Feinblatt 500g*

Design experiment (1)
retreating food

Point of reference: In the natural habitat, Physarum polycephalum migrates when areas do not provide optimal food resources anymore.

How: No longer ‚feeding' the slime mold with oat flakes*.

Aim: To question to what extent oat flakes are an absolute necessity and to retreat the human influence/direct human care.

Overall time frame: up to 20 days, repeated many times over the course of 5 months.

Observations: The slime mold migrates out of the dish to new terrain. Even when the petri-dish grows other mold, sometimes small patches of Physarum polycephalum remain active in the plasmodial stage.

Hypothesis: Physarum polycephalum is a very resilient organism. After a starting base of oat flakes has been supplied it can sustain itself, if necessary escaping the petri-dish to new ground.

Implications for sculpture: Transfer onto the sculpture should start off with a healthy, strong base of Agar and oat flakes, after which the slime mold can do without oat flakes for at least several days.

By stopping the continued intensive care of the organism, the control over its life cycle is released back towards a more natural unpredictability.

nature habitat vs. lab petri-dish

no more oat flakes after day: 12

**Physarum polycefallum only ‚eats' the invisible bacteria on the flake's surface and leaves a pile of damp mush of oats behind.*

Design experiment (2)
no food at all

How: Never ‚feeding' the slime mold with oat flakes.

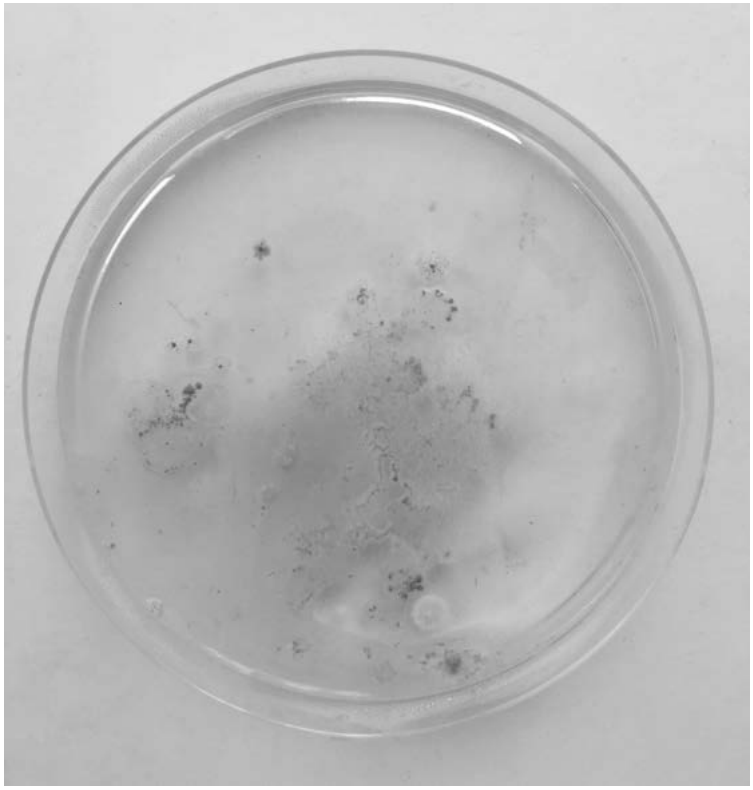
Aim: To test, to what extent the direct supply of ‚food' can be fully omitted from the outset, primarily for visual purposes of the sculpture.

Overall time frame: 6 days

Observations: In 3 cases of using different stages of plasmodium (from fresh to aged), the slime mold was not able to thrive without a food source. It was also not strong enough to forage or move out of the petri-dish.

Hypothesis: When freshly inoculated into a new dish, the slime mold needs atleast some initial source of ‚food' to grow.

Implications for sculpture: The slime mold either needs oat flakes supplied on the sculpture or a transfer starting from a nutrient-rich oat flake + Agar base.



no oat flakes after day: 4

Design experiment (3)
other food sources

Point of reference: The natural decaying wood habitat of the slime mold.

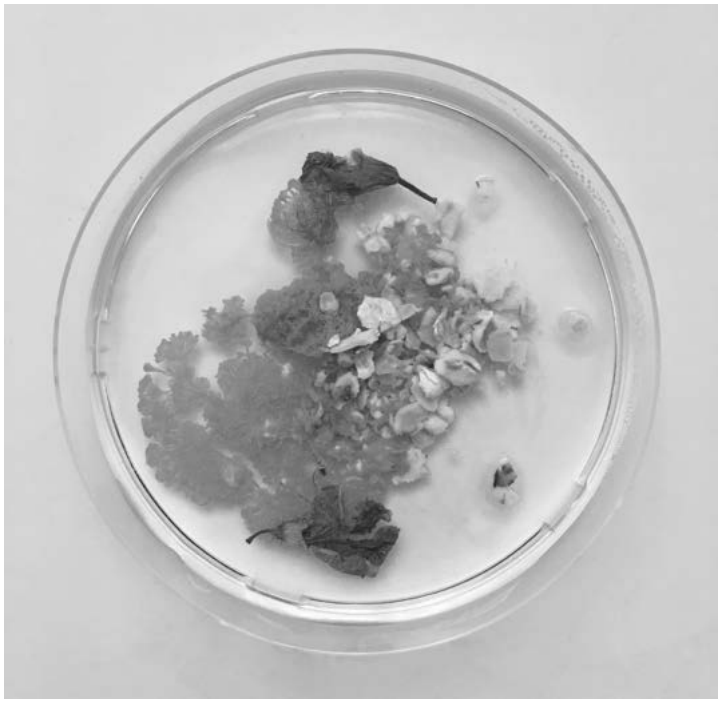
Aim: See, how the slime mold reacts to other natural (food) objects and the microbial palettes attached to them.

Overall time frame: 6 days

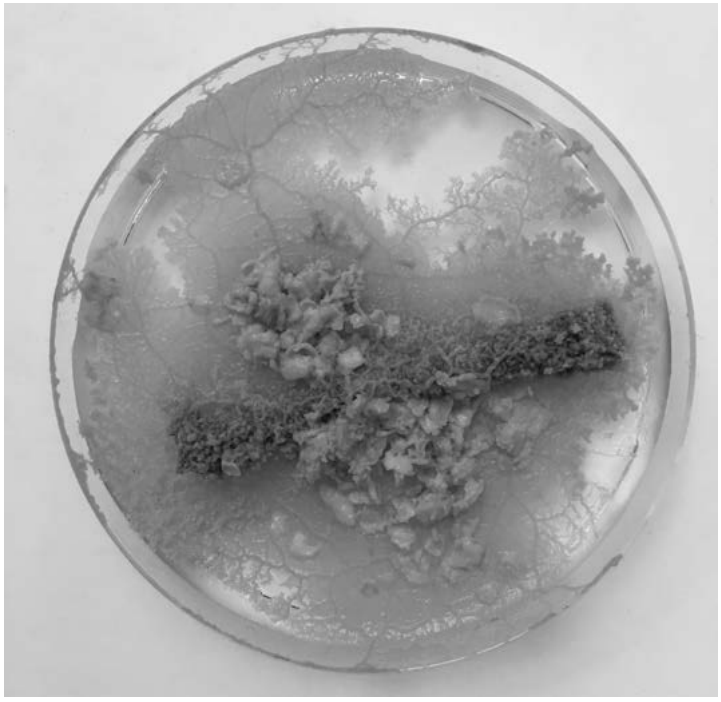
Observations: The organism quickly devours the natural objects.

Hypothesis: Physarum polycephalum is highly drawn to natural matter.

Implications for sculpture: A natural assortment of microbes and bacteria found on natural matter like branches or flowers is an alternative means to coerce the organism.



flowers after day: 1



twig after day: 2

Design experiment (4)
bacterial transfer

Point of reference: Previous experiment on ‚foreign matter' and the natural microbial wood habitat of the slime mold.

How: Test the hypothesis, that microorganisms and bacteria can transfer to a wax object when the latter is placed in the exact same wooded environment a slime mold would naturally grow.

Aim: Supply the bacteria/food source invisibly on the artificial wax structure, when ‚transitionally charged' from the actual, original habitat.

Timeline: **Time frame in woods:** 5 days (19 - 23 August)
Time in terrarium: 2 days
Overall time frame: 7 days; *(The transfer phase was cut short/discontinued due to Corona/travel reasons.)*

Observations: The transfer was significantly slower than with the previously tested natural objects. No difference between ‚charged' and ‚non-charged' wax objects. No catalyst effect was detected. No indication for bacterial transfer given.

Hypothesis: A short ‚charging' period in the woods is not sufficient for the outdoor transfer of local microbes and bacteria onto the wax object.

Implications for sculpture: No bacterial transfer by leaving the wax-branch out in the woods.

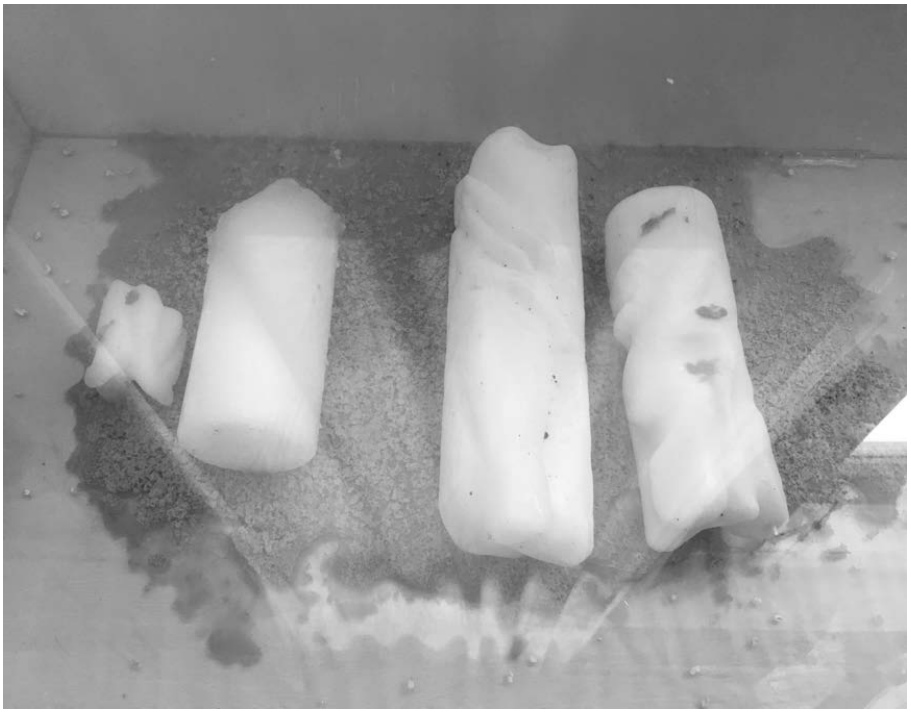
Implications for possible future renditions (as extension into ecological art):
Results might differ when exposed over an extended period of several months or even years.

presumed natural habitat: macro view

presumed habitat: intermediate view

presumed habitat: close-up view

top view: ‚charged' wax objects



close-up view: far left: object without outdoor transfer but direct inoculation onto object
left: object without outdoor transfer and no inoculation onto object

far right: object with outdoor transfer but direct inoculation onto object
right: object with outdoor transfer and no inoculation onto object

(3) Space + Surface

lab context:

The petri-dish has a contained circular, flat plane. It is small, isolated, homogeneous and stripped of everything that is nonessential to sustain the organism's plasmodial growth and life. Therefore, the parameters as simulated by humans, are clearly visible.

vs.

natural habitat:

The open tree-habitat of decaying woods is characterised by uneven surfaces, cracks, bumps and elevations. The surface is an organic ‚obstacle course' over which the organism sustains its life.

Design experiment (1)

open space

Point of reference: The natural, non-restrictive woodland habitat of the slime mold.

How: Allow Physarum polycephalum to live in a 67x37x25cm terrarium with lid, lifting the restrictive spatial boundaries of the petri-dish and thus, allowing for more natural movement patterns to emerge.

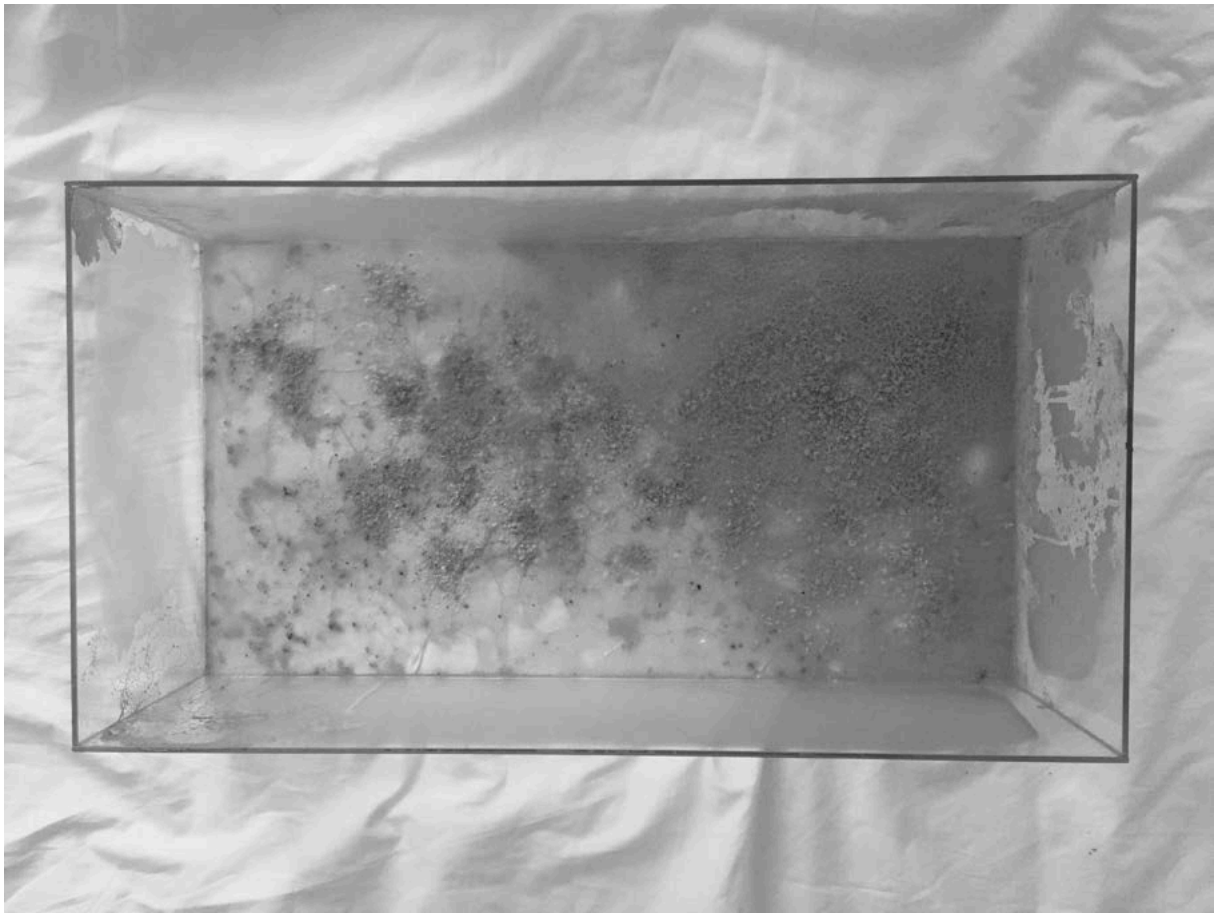
Overall time frame: Up to approx. 15 days; in 4 separate sessions*

Observations: Physarum polycephalum is different from other comparable organisms, because it is not firmly bound to its origin. It can move freely and (when not overfeed) climb up the walls of the glass box, leaving translucent trails and traces behind. When supplied with sufficient oat flakes, it grows to cover the entire base of the glass structure.

Hypothesis: Physarum polycephalum can grow very large according to space- and food-ration. Less oat flakes even provoke the organism to move around the space and forage more.

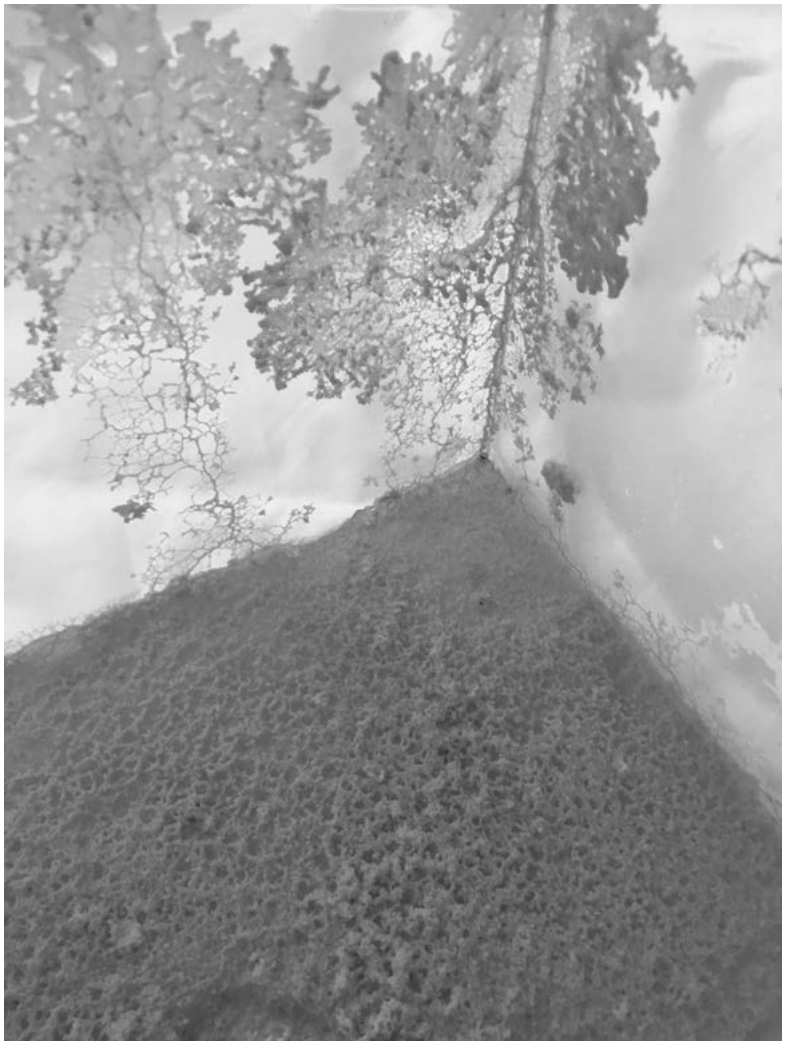
Implications for sculpture: A larger surface will better show the movement and dimensions, the unicellular organism can grow to.

nature habitat vs. lab petri-dish

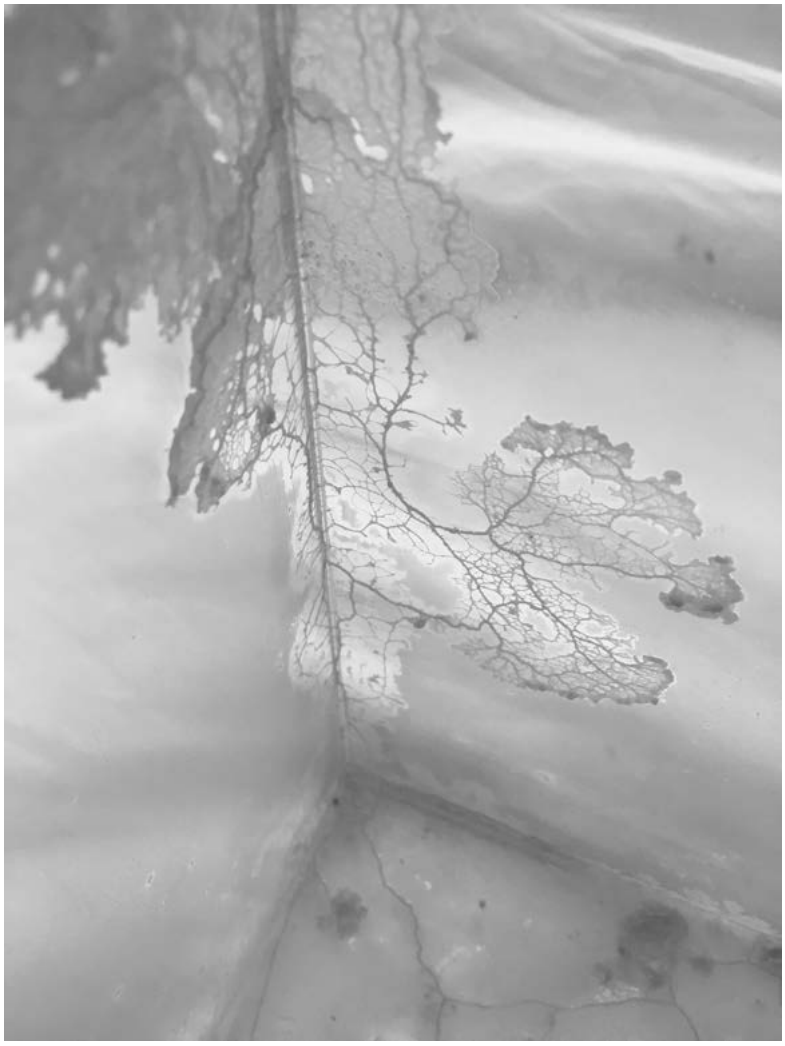


terrarium after day: 8

*See page 72



terrarium after day: 11



terrarium after day: 11

Session 1

Terrarium fully covered: **8 days**
Time frame for coverage: **26 June - 4 July**
Spores: **10th July**
Total: **15 days**

Session 2

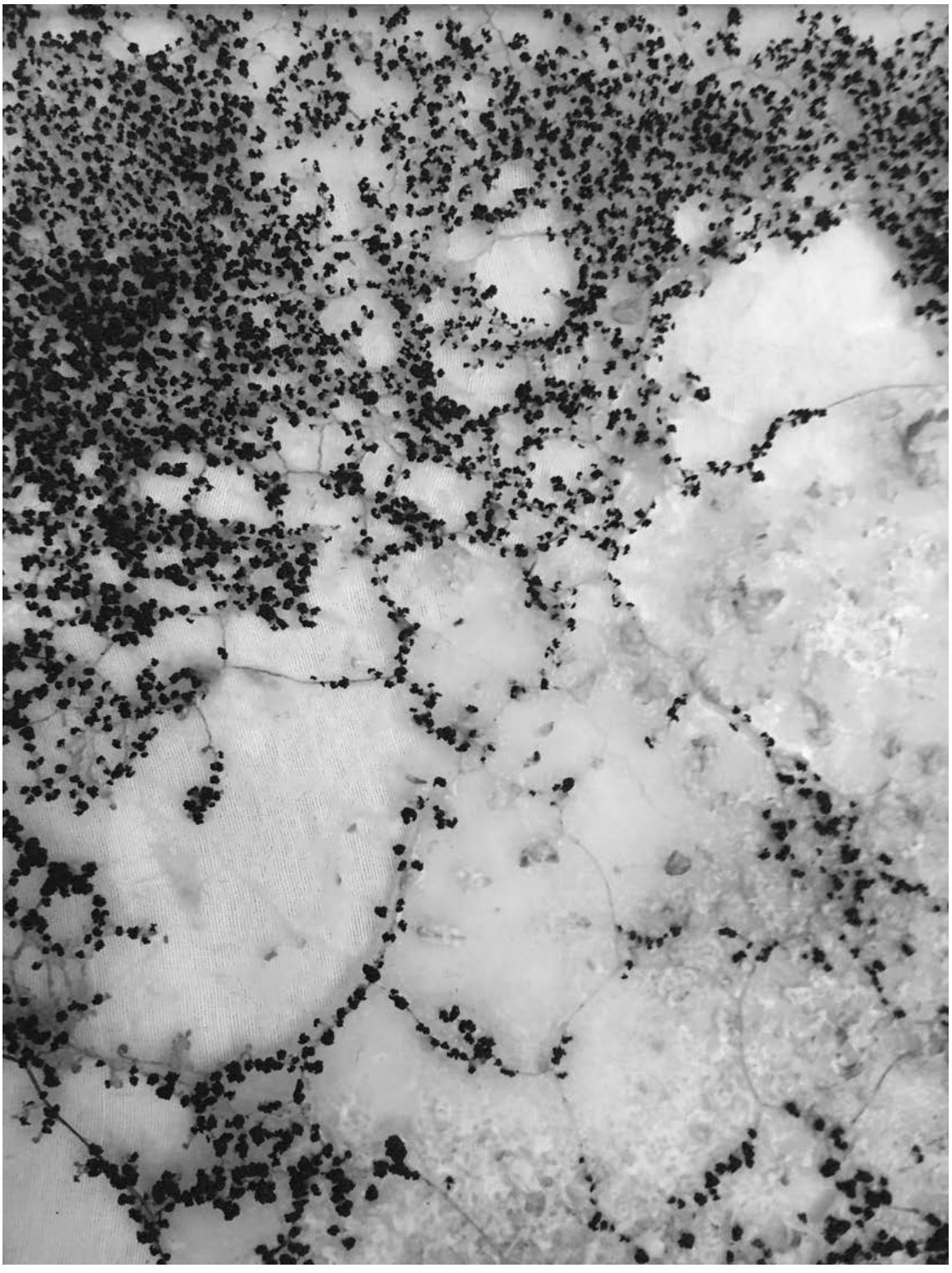
Terrarium fully covered: **6 days**
Time frame for coverage: **20 July - 26th July**
Spores: **30th July**
Total: **10 days**

Session 3

Terrarium fully covered: **4 days**
Time frame for coverage: **19 August - 23rd August**
(additional mold problems due to high temperatures up to 27°C)
Spores: **30th July**
Total: **11 days**

Session 4

Terrarium fully covered: **10 days**
Time frame for coverage: **7 October - 17 October**
(initially colder: 18-19°C, then warmer: 22°C)
Spores: **21st October**
Total: **14 days**



Physarum polycephalum built spores on day: 15

Design experiment (2)
On wax

Point of reference: The vision for the sculpture requires the slime mold to live and build networks on a wax surface.

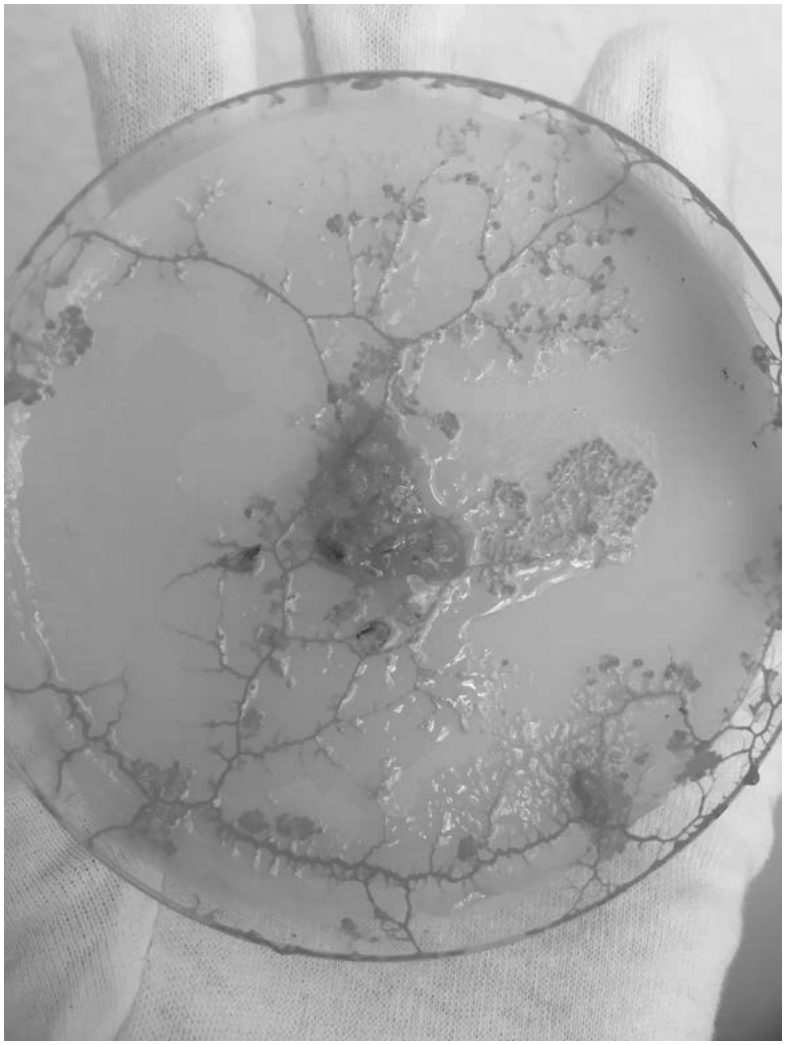
How: Wax was poured into the petri-dish as Agar replacement. Additionally, moisture was supplied by sprayed distilled water.

Overall time frame: 5 days

Observations: The traces that are usually visible like veins on the Agar become more like a transparent, wet-looking slime substance on top of the wax.
The slime mold spreads across the petri-dish similar to when on Agar base.
The organism is more likely to dry out, with a very high occurrence of spores being formed. Without Agar, less probability for molds or bacterial infections.

Hypothesis: The transparent slime traces build a second layer on top of the wax. After ‚living' on wax, the slime mold is more likely to build spores.

Implications for sculpture: It is presumed, that Physarum polycephalum will be able to thrive on a wax object/terrain.



Physarum polycephalum on wax in petri-dish day: 2

Design experiment (3)
open airflow

Point of reference: In the natural habitat, the slime mold lives in unrestricted airflow.

How: Remove the prepared and covered twig from the terrarium.

Overall time frame: 3 hours

Observations: Within 2 hours, the plasmodium begins to recede, until it is entirely evaporated 3 hours after being removed from the terrarium.

Hypothesis: Heavy, unrestricted airflow is not supportive to the slime mold. Instead, the humidity which builds up due to contained airflow is crucial for the plasmodium to sustain itself.

Implications for sculpture: The slime mold can only grow inside a contained area, in which consistent low airflow can be controlled and humidity provided.

twig covered in plasmodium

receding plasmodium after 2 1/2 hours in fresh air

(4) temperature and light

lab context: It is presumed, that slime molds passed on in captivity, are all continually kept at room temperature over extended periods*, during which they experience a range of temperatures from approx. 16°C up to 30°C. During this time they are also frequently exposed to light and not kept in complete darkness.

vs.

natural habitat: The organism grows in the lower levels of shaded woodland on top of logs, where no direct sunlight disturbs its growth and it is generally dark(er).

**For this project alone the slime mold was continuously kept in its plasmodial stage for 5 months, during which temperatures changed from 18°C - 29°C*

Observations
temperature

Observed ranges:
Summer months: 20.8°C - 26.7°C
Fall months: 17.4°C - 20.9°C

Overall time frame: 2-3 weeks in summer; 2-3 weeks during fall

Observations: Temperatures above 24°C invite too many other molds and bacteria. Inoculations below 19°C are more unsuccessful; the slime mold does not grow or branch out.

Humdity inside the terrarium ranged from 93% to 99% humidity.

Hypothesis: Over time, the slime mold has been unintentionally and slowly habituated away from its natural condition to now need warmer temperatures than it did in the natural environment.

Implications for sculpture: Supply a temperature of 20°C - 21°C for the slime mold.

unusually low temperature and humidity measurements

Design experiment (1)
light exposures

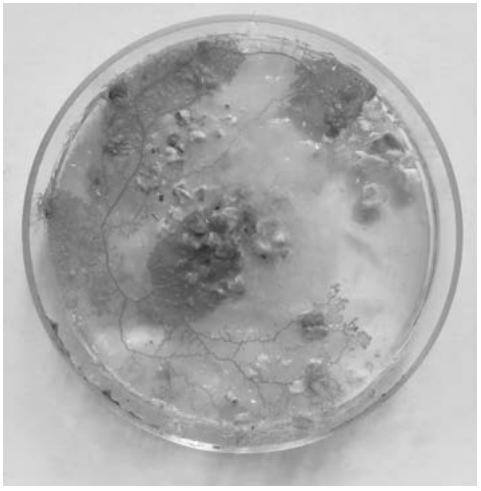
How: 3 petri-dishes are inoculated simultaneously and kept in 3 different light exposures, ranging from (1) in direct sunlight, (2) shaded by box covered with cloth and (3) complete darkness in drawer.

Overall time frame: 7 days

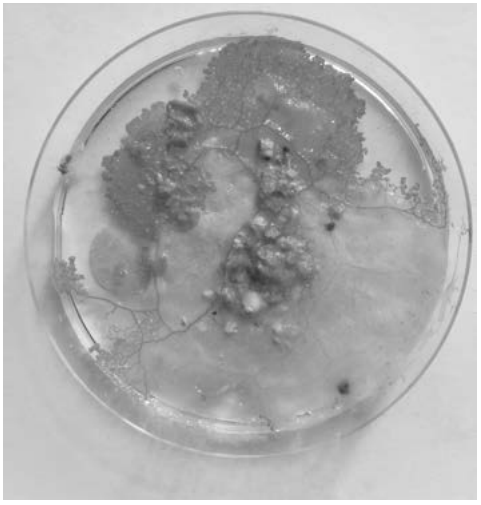
Observations: Between the (3) completely dark and (2) shaded petri-dishes, no difference in structure or colouration could be detected. The petri-dish exposed to direct sunlight (1) exhibited a discolouration of the yellow, turning to a faded and grey-ish tone.

Hypothesis: It is not necessary for this specific slime mold to be kept in darkness, possibly because it has been habituated towards elevated light exposure.

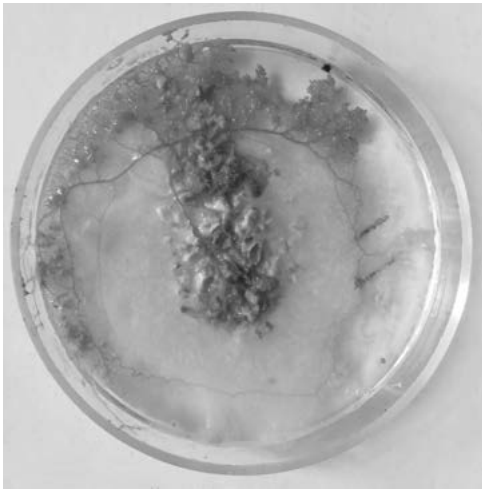
Implications for sculpture: Try to avoid direct sunlight with as little light as possible. But it is not detrimental, if the slime mold is exposed to some light, i.e. the space does not need to be kept especially dark.



kept in complete darkness for 7 days



kept in medium shade for 7 days



kept in sun for 7 days

(5) Care

In the lab context of the petri-dish, the organism is kept isolated, protected and under surveillance. ‚Care‘* is given by transferring fresh parts of the plasmodium to new petri-dishes, a method called: inoculation. The exact procedure of inoculation can influence the appearance of Physarum polychefalum.

The following is an investigation into the different structures, network-patterns and colourations of the plasmodial stage. It is an inquiry into the question, to what degree the human-care influence can manifest on a visual level.

**Care or control? is an additional parameter for the degree of human interaction with the organism and thus fundamentally necessary for the transfer of the slime mold to the hybrid, sculptural habitat.*

Incolulation method (1)

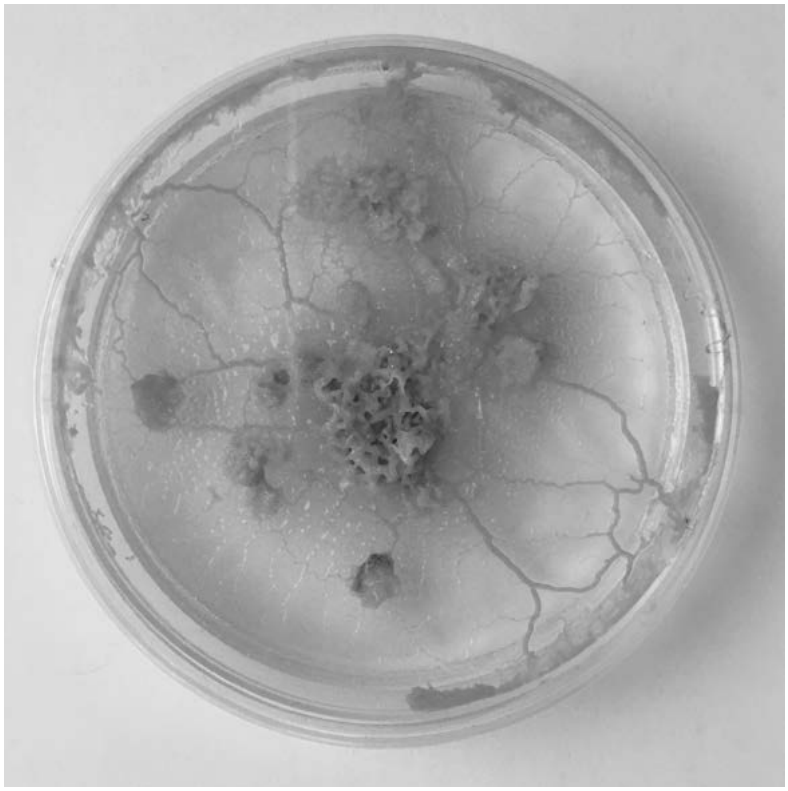
Slime mold with oat flakes

How: Inoculate ‚fresh' plasmodium with a chunk of the old oat flakes from previous petri-dish.

Observation: Initially, the organism spreads fast and stays ‚strong'. The old oat flakes continue to deteriorate, hereby leaving less fresh space.

Outcome: The old oat flakes increasingly obstruct a clear view of the slime mold structure and make the petri-dish less presentable.

Implications for sculpture: Least preferred inoculation method.



after inoculation day: 3

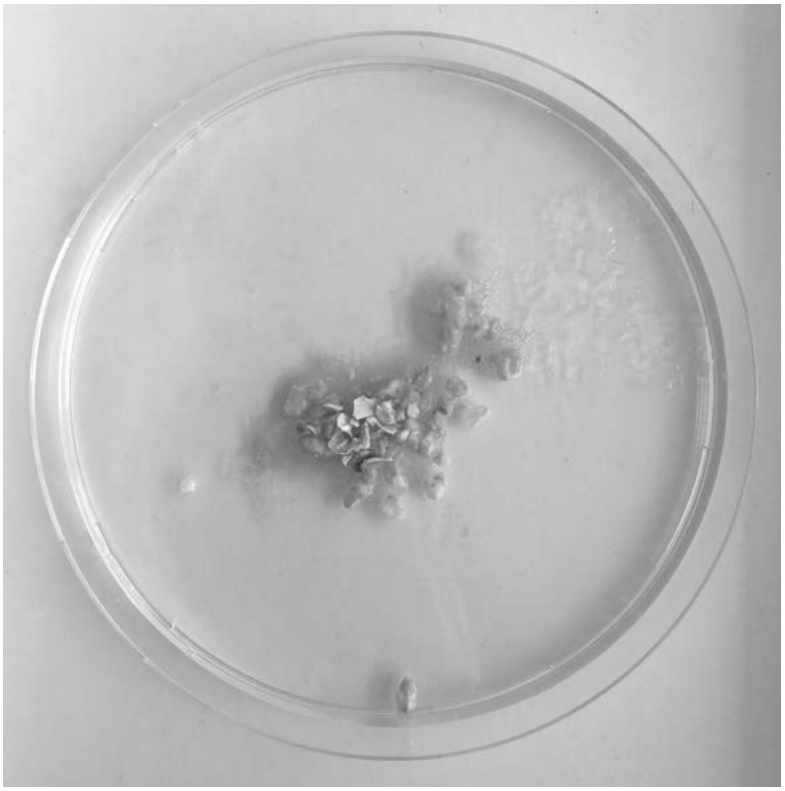
Incolulation method (2)
‚fresh' slime mold

How: Inoculate ‚fresh' plasmodium by scraping from the top of the organism growing on top of oats in an aged petri-dish.

Observation: Smaller quantities of Physarum polycephalum can be gathered, which make successful inoculation in new dish less probable.

Outcome: The slime mold seems ‚weaker': it grows slower and seems more vulnerable to bacterial infections.

Implications for sculpture: Non-preferred inoculation method, because it is too difficult to get sufficient quantity scraped together and uncertain, if it will grow well in the new dish.



after inoculation day: 1

Incolulation method (3)

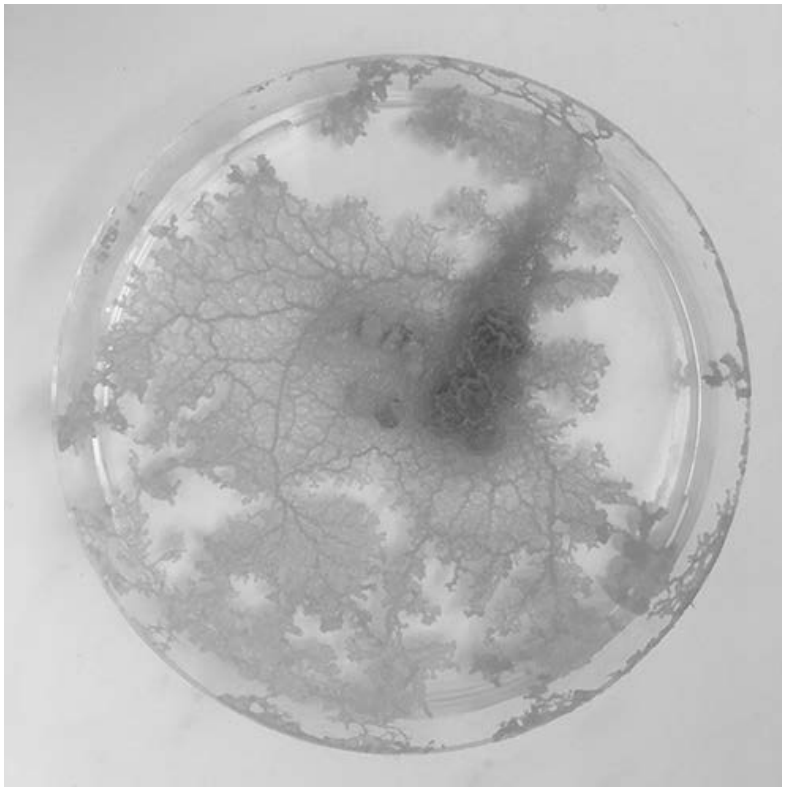
‚medium fresh' slime mold

How: Inoculate ‚medium fresh' plasmodium by scraping the veins that are on the Agar (not the oat flakes) or taking the plasmodium from the outer walls of the petri-dish.

Observation: The plasmodium takes to the fresh petri-dish and continues to grow there.

Outcome: Most frequently/consistently used method of inoculation over the months.

Implications for sculpture: Solid method of inoculation.



ready to be inoculated from

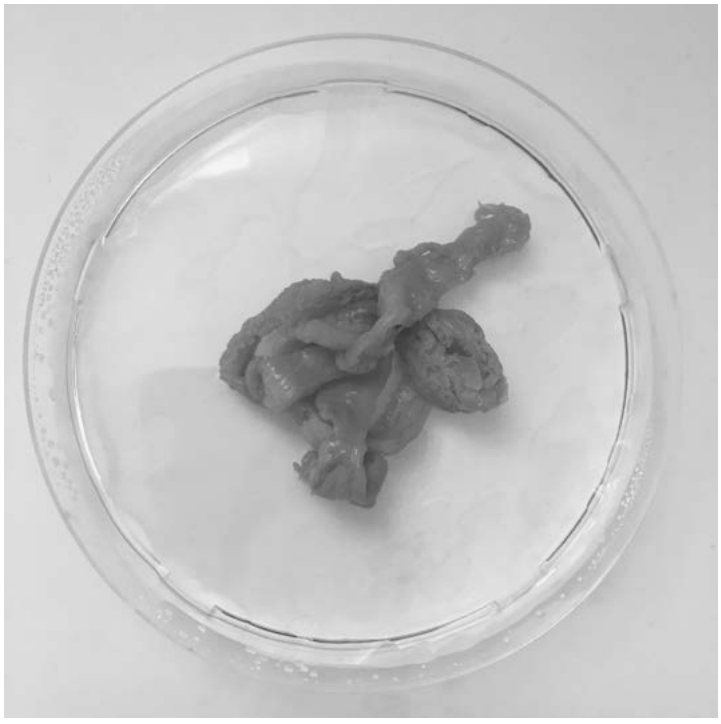
Incolulation method (4)
‚old' slime mold

How: Inoculate ‚old/aged' slime mold by using the already orange parts, that have grown out of the dish and become a blob-like mass.

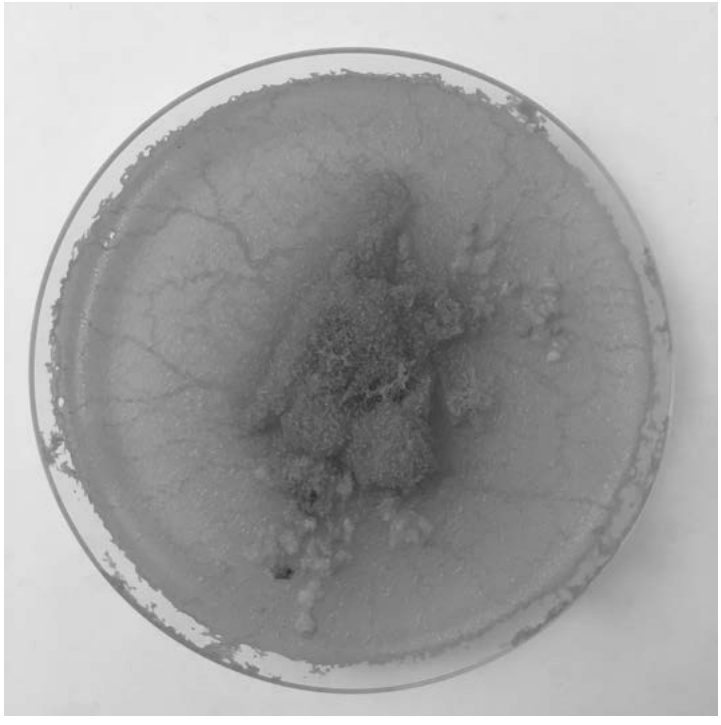
Observation: In a period of 2 weeks this created highly interesting results, as the blob-like structures of ‚old' slime mold would retain their shape inside the fresh petri-dish and fresh plasmodium would grow over and around it.

Outcome: This created especially interesting structures and even colouration (dark brown/black), but could not consistently be recreated later.

Implications for sculpture: Possible method of inoculation with uncertain results.



freshly inoculated



after inoculation day: 1

Incolulation + transfer method (5)
transfer directly onto wax

How: Fresh Physarum polycephalum is transplanted onto the wax object in several spots, while, additionally the entire base of terrarium was already fully covered with slime mold.

Days until vein/network structure takes shape: 2 days
Overall time frame: 6 days
Times repeated: 3

Observation: Physarum polycephalum only reluctantly spreads across the object in a thin vein-network. Even when supportively supplied with oat flakes on top of the wax object, the slime mold grows weak quickly and cannot ‚survive' after several days.

Outcome: The naturally occurring structures are tainted by blob-like inoculation spots that cause an uneven spreading of the slime mold. It is difficult to attain a wide-spread covering of the object through this method.

Implications for sculpture: If a direct transfer/inoculation of the slime mold onto the wax branch takes place, those spots will remain visible as origins of an only thin vein-network. However, this method could be additionally used to speed up ‚the voluntary process' *(see next page)*.

after inoculation day: 2

Incolulation + transfer method (6)
voluntary transfer

How: Inoculate Physarum polycephalum inside terrarium (67x37x25cm) and allow ‚free'/voluntary transfer onto wax object.

Overall time frame:
Time of initial migration to: 1 day, if Agar base is no longer fresh
Time of initial migration to: 3 days, if Agar base is medium fresh

Observation: No transfer onto the wax object takes place as long as Agar base is fresh. No migration to wax object as long as there is still some untouched space on the terrarium base. Observations verified in 4 separate trials.

Outcome: Once the organism has migrated onto the wax object, it remains vital and covers the object quickly. Subsequently it creates interesting vein structures, that cover the whole surface and can sustain itself for approx. 4 days before building spores.

Hypothesis: Physarum polycephalum only goes onto the wax surface, once all other migrating options have grown increasingly inhospitable. The organism seems to be more repelled by its own trace* than the untouched wax surface.

Implications for sculpture: Because this voluntary/naturally occurring method creates naturally appearing, wide spread growth patterns, it is the preferred method of transferring the organism to the wax object.

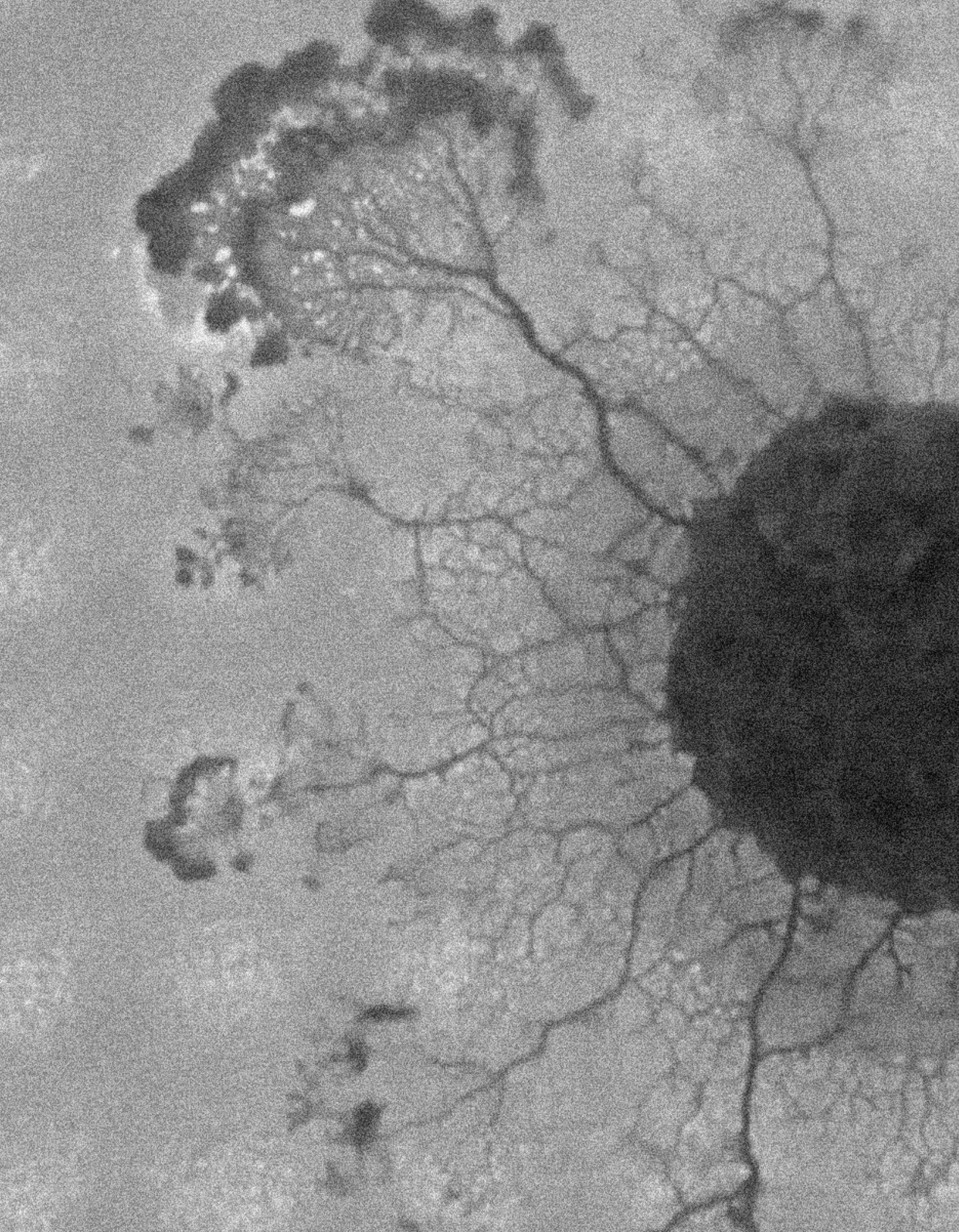
voluntary transfer day: 2

**Physarum polycephalum leaves a trace of excretions on the surfaces it has been on, comparable to a snail's slime trace. Exact interdependencies - namely the full nature of the trace-substance - are not yet fully scientifically understood.*

personal philosophical

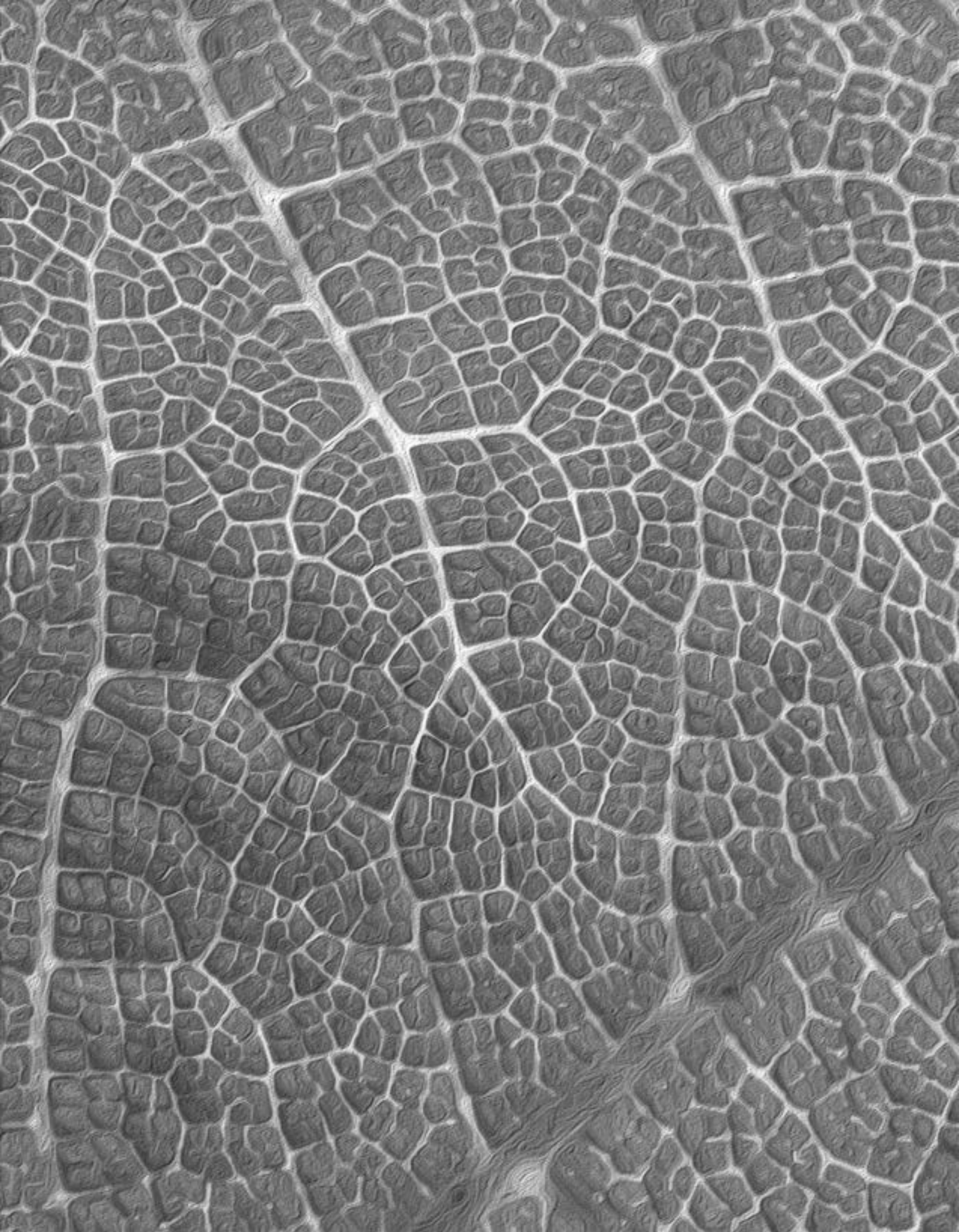
Analogy of the living vol. 2

The slime mold Physarum polycephalum under a lab microscope



Mature sea fan coral in Caribbean Sea

Vein-like structures of a leaf

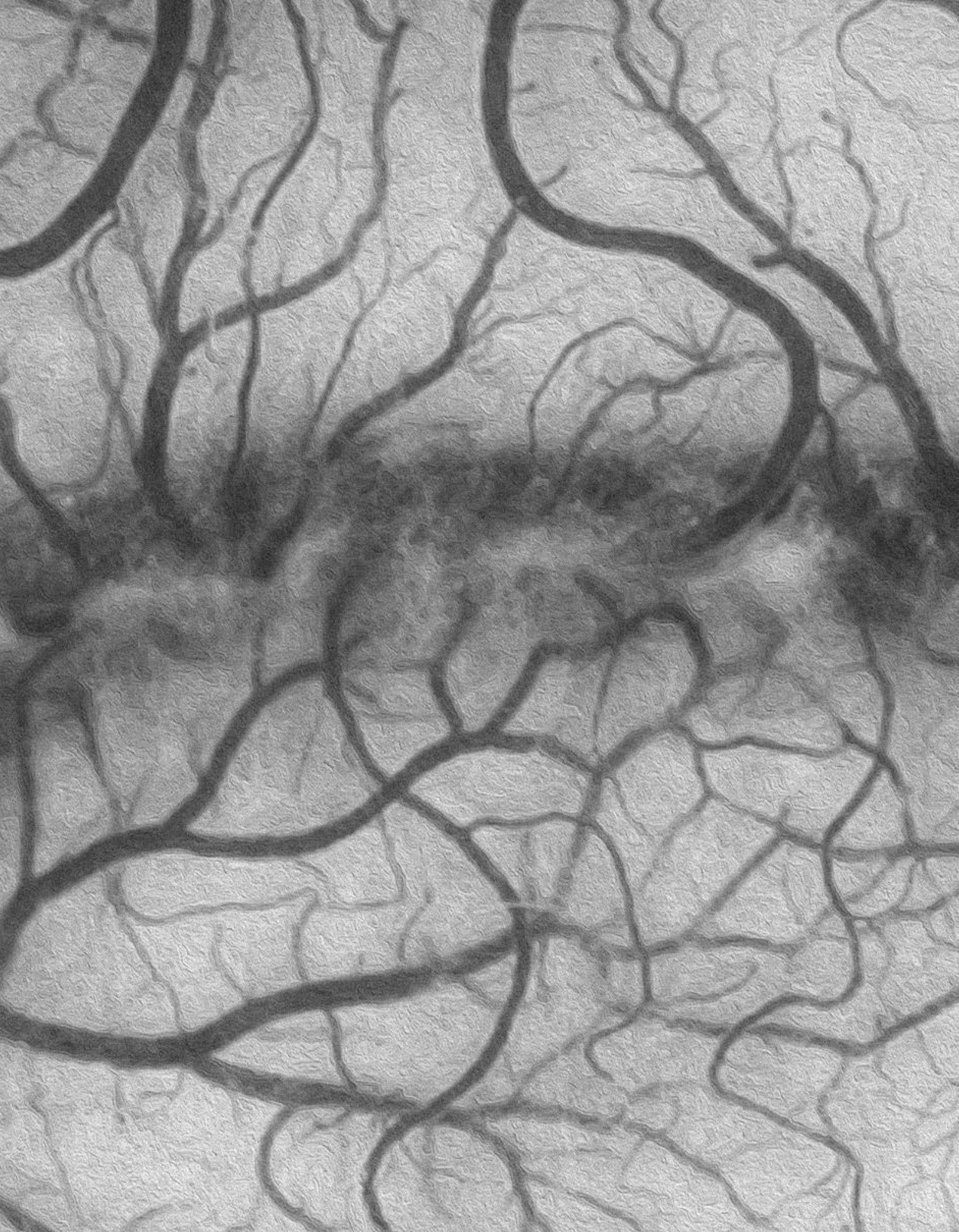


Fern vegetation

Tree roots in European forest

Aerial photograph of wetlands of Celestial, Galbar

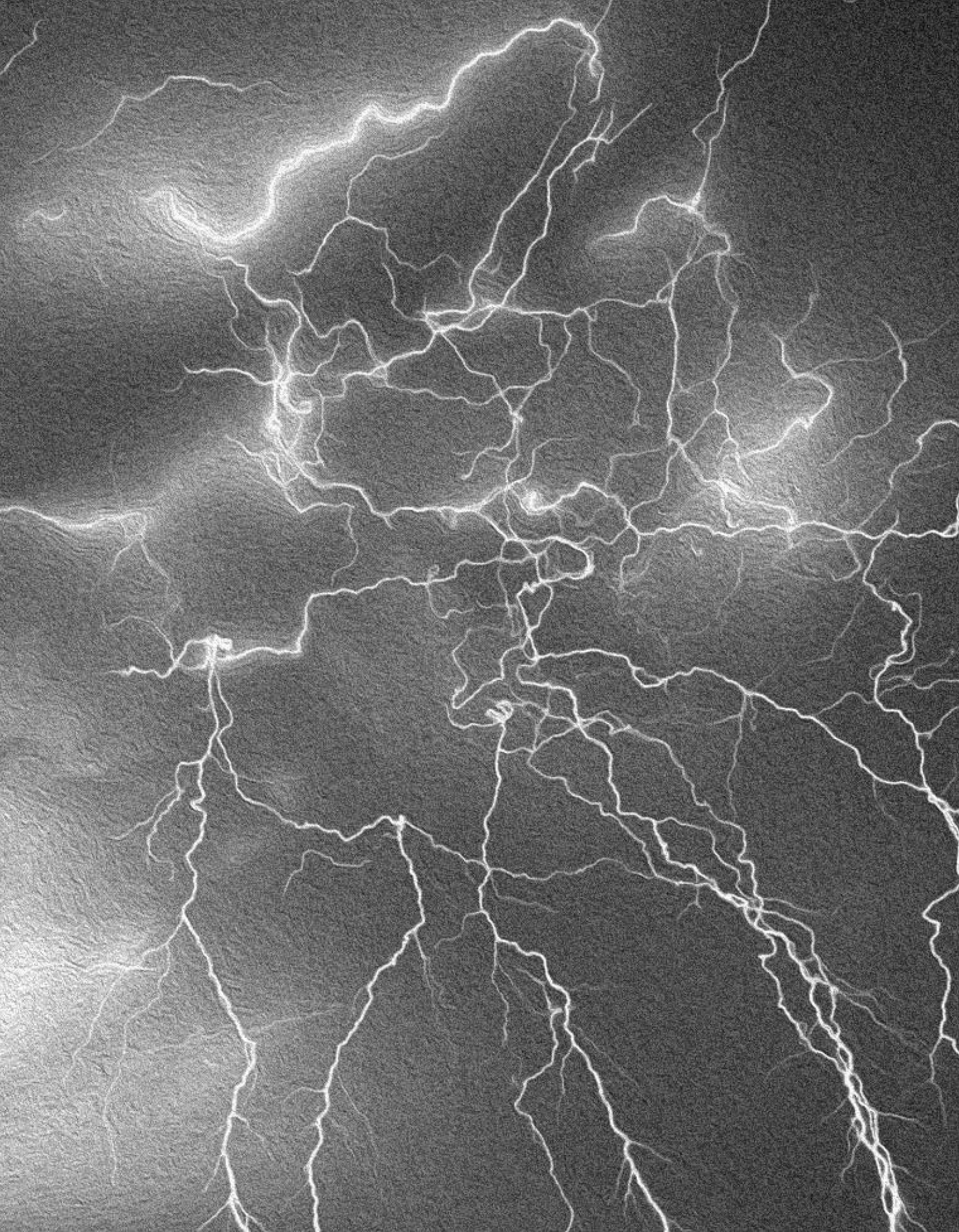
Human blood vessels



Veins on grandmother's hand

Visualisation of a neural network

Lighting striking in Weston, Missouri



End Reflections

How do we encounter the physical world as humans?

On a small scale, the artistic engagement with another living species mirrors how we, as humans, approach other life around us. Constantly, we seek to understand, to categorise, to humanise and wherever possible to control.

The presented sculpture should serve as a catalyst to being vividly reminded of one's own corporeality and to allow for a more immediate and even intimate encounter with another, alien organism. In the end, the sculpture is a self-organising artwork, in which human control has to be relinquished to a certain degree and unpredictable changes of ‚becoming and decay' occur over time.

In this artistic ‚negotiation' between the natural habitat and lab context it becomes clear that for a living organism to behave in a desired way, even the smallest and invisible components of the setting have to be controlled. Therefore, the deployed processes and technologies - needed to sustain the organism - do become highly visible. As a result, the human perspective inevitably completely engulf the smaller organism.

The striking insight however is that things that seem to work so effortlessly in nature must become highly engineered when transferred to the human world. It is absolutely fascinating that the slime mold can adaptively oscillate between these two worlds.

Such insights and artistic analogies pose the final question: Can (Bio-) Art offer a vivid form of acknowledgement, deeper appreciation and reconciliation between human and nature?

Endnotes

Potential additional parameters*

Connected to parameter (1) Moisture

air humidity

Connected to parameter (3) Space

oxygen

aerosole

altitude

PH- value

pollutants

**Additional parameters are more intangible and therefore much harder to control and track in a (DIY) home lab context and have therefore only been part of this project to a certain extent.*

Central hypotheses and insights

(1)
Physarum polycephalum not only draws moisture from the surface it covers, but effectively also via the humidity surrounding it.

(2)
If presented with the choice between fresh space or fresh food (oats), the slime mold favours fresh space.

(3)
The Physarum polycephalum used in this setting did not not exhibit any distinguishable difference in structure and growth patterns depending on light exposure. It might have been habituated towards this behaviour over time.

(4)
In colder temperatures (below 20°C) Physarum polycephalum needs more food (oats).

(5)
The method of inoculation influences the appearance of Physarum polychefalum, i.e. the human interaction can manifest on a visual level.

(6)
The slime mold used during this project would no longer survive outdoors, because life in captivity has habituated it towards warmer temperatures and airflow insensitivity.

Artwork timeline / guideline

This guideline reflects the observation in the home-studio, to be followed for the exhibition of the sculpture.

Temperature: between 20-22°C

Light: no direct sunlight; covered under sheets when not on view. (Note: Some of the literature reports Physarum polycephalum to be highly light sensitive.)

Procedure:

Day 1: Inoculate plasmodial Physarum polycephalum onto Agar base (here: 100cm x 40cm) with oat flakes* as 'incubator' stadium

Day 3/4: Allow min. 3 days for the slime mold to cover entire ‚incubator' base

Approx. day 3 or 4: Place wax branch inside ‚incubator and allow up to 2 days for 'voluntary' transfer** onto wax branch to begin

Depending on the degree of the vein-like network, allow more time

Aprox. day 7: Remove wax branch from 'incubator' after sufficient initial inoculation

Day 7-8: Projected plasmodial ‚survival stage' on wax branch is 2-3 days

Projected end of plasmodial stage and transition into sporangia (building spores) after approx. 4 days

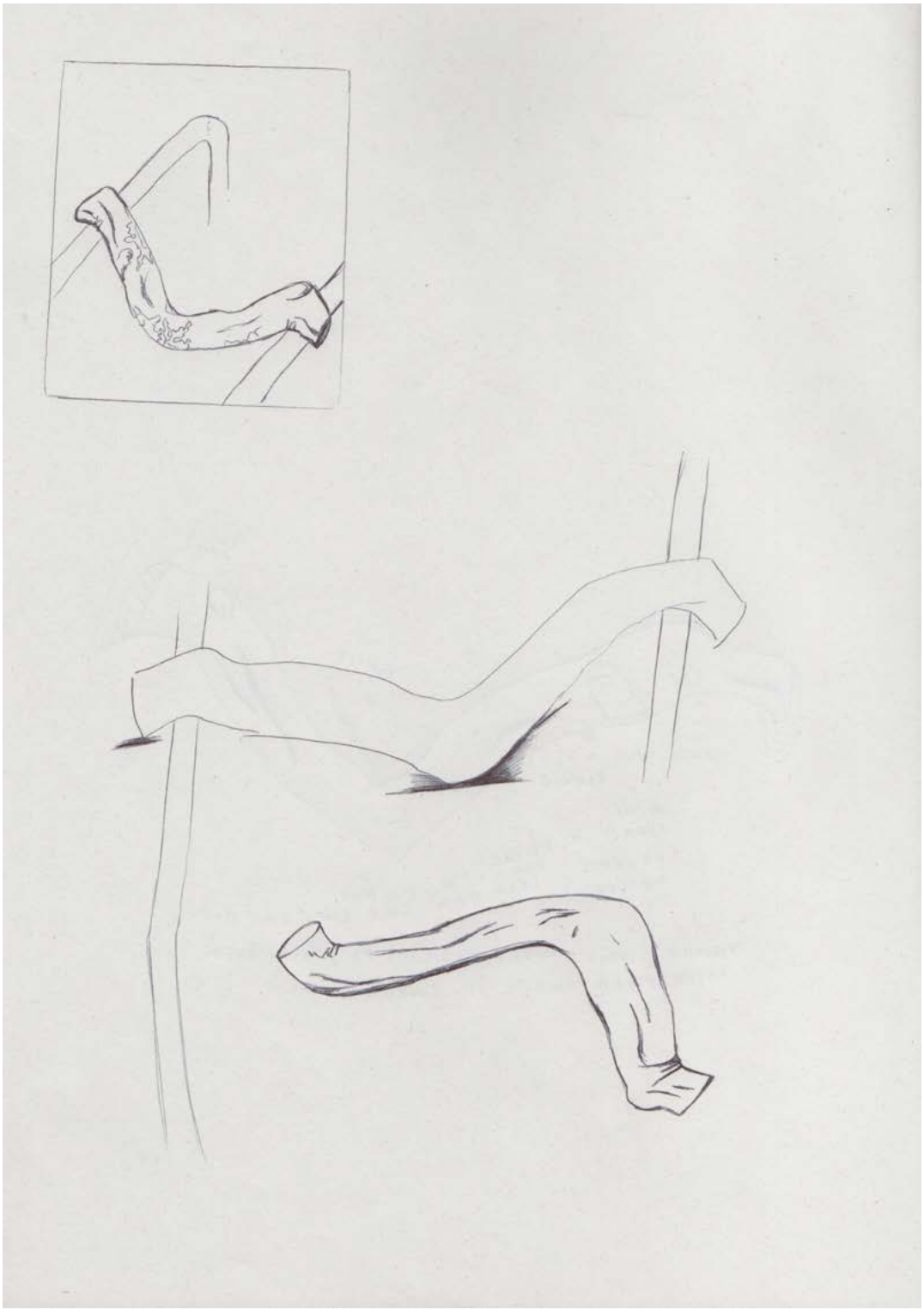
Used oat flakes: Alnatura Hafer Flocken, Feinblatt 500g; Used Agar: RUF Agartine
**Option: Potential acceleration of process by inoculating directly onto the wax branch.*

selected branch view: left

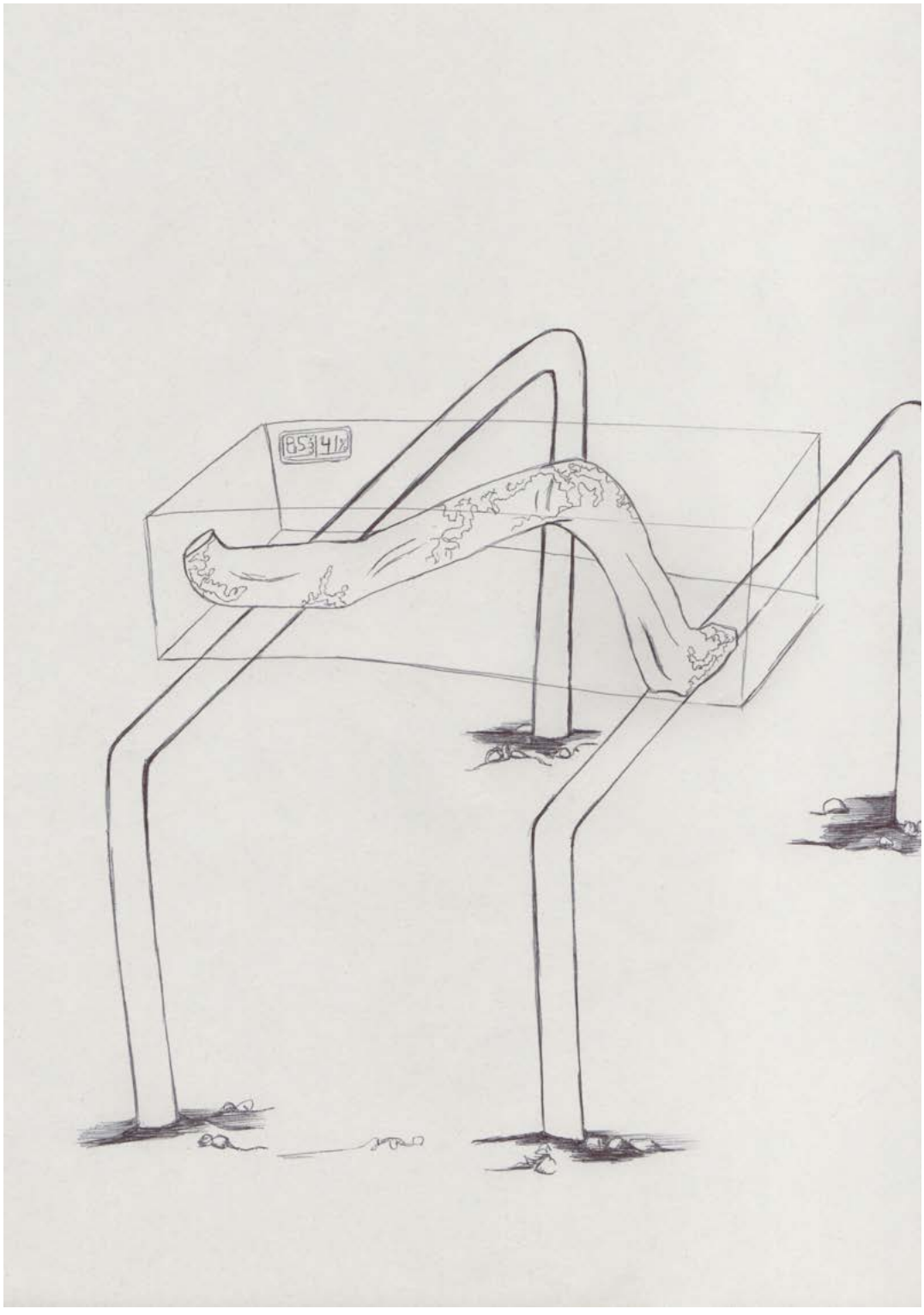
selected branch view: right

selected branch view: top

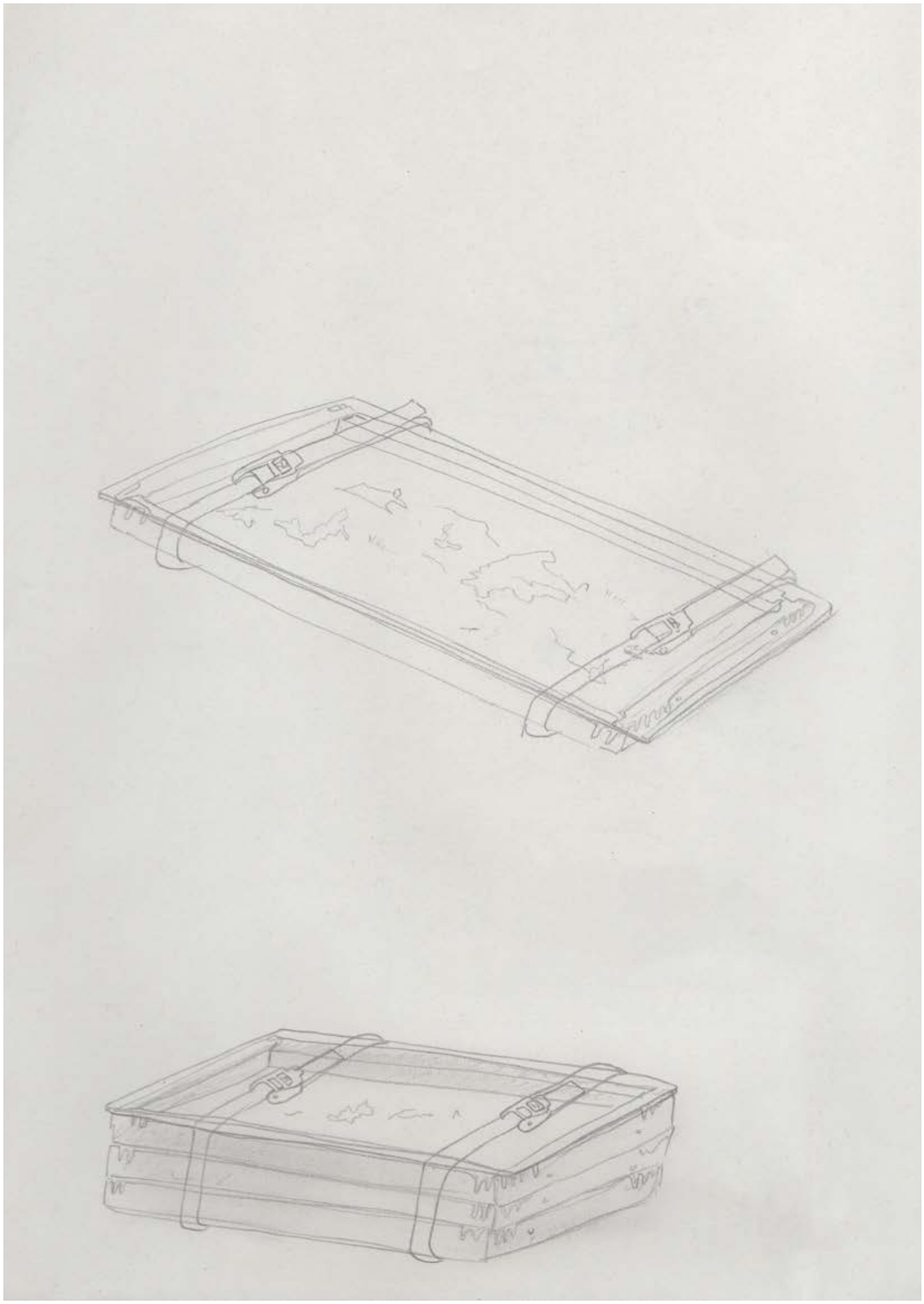
Organic shape with uneven surface and varying micro-textures



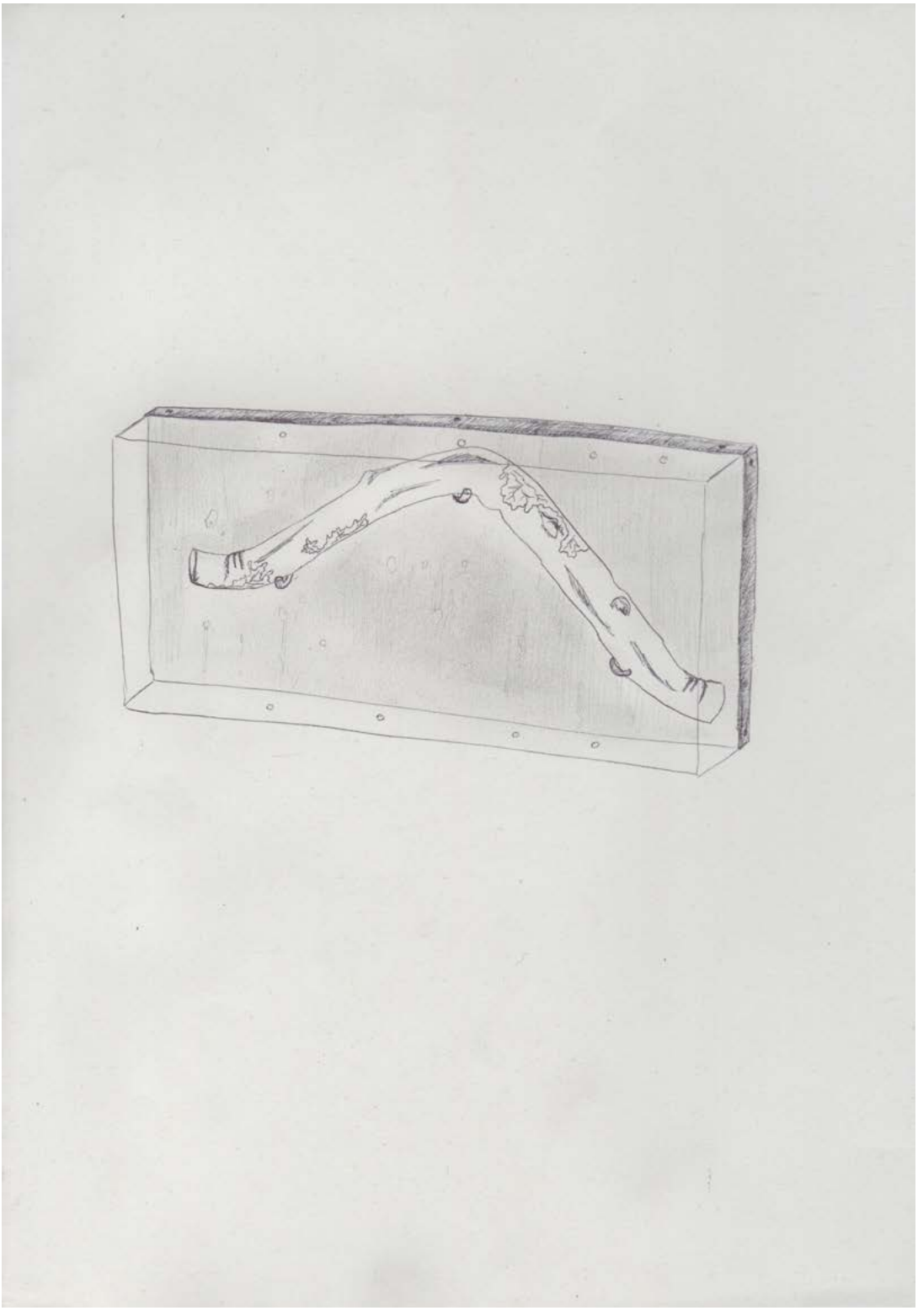
process sketch



sculpture variation - outdoor exhibition



‚incubation station' - Agar and oat flake base for slime mold



final sculpture sketch

Body Habitat

deutsche Fassung

Das Projekt 'Body Habitat' entsteht an der Schnittstelle von Bioart als medienkünstlerisch-wissenschaftlicher Auseinandersetzung mit andersartigen Lebensformen und der bildenden Kunst/Bildhauerei. Der Fokus liegt auf einer zwischenfachlichen Konzeption von Medialer Gestaltung, Naturwissenschaft und bildender Kunst. Techniken der Bioart, die Arbeit mit lebenden Organismen und deren Habitat werden in eine Skulptur übersetzt.

Den biologischen Ausgangspunkt des Projekts bildet die Gattung der Schleimpilze (Mycetozoa), konkret: Physarum polycephalum. Als bestimmendes gestalterisches und künstlerisches Element dient die visuelle Formähnlichkeit zwischen der natürlichen Erscheinungsform dieses Organismus als Baumgebilde und dem menschlichen Körper. Auf diese Weise wird die wissenschaftlich-ontologische Beziehung zwischen Mensch und dieser anderen Species künstlerisch hinterfragt. Zudem wird die inhärente Verbindung zwischen Natur und Mensch als komplexes Verhältnis von Annäherung und Abstoßung, Bewunderung und Ekel, Fürsorge und Unverständnis durch das künstlerische Experiment aufgezeigt.

Die bisherige (wissenschaftliche) Auseinandersetzung mit dem Organismus ist vor allem durch Begriffe wie 'komplexes Sozialverhalten', 'Erinnerung' oder gar 'Intelligenz' bestimmt; die mediale Vermittlung erinnert bislang oft eher an Science-Fiction. Es gilt diese und andere solche Einschätzungen zu hinterfragen und den Betrachter auf die unmittelbare Auseinandersetzung mit der Natur zurückzuführen.

Ziel und Herangehensweise

deutsche Fassung

Übergeordnetes Ziel des Projekts ist es, eine ‚viszerale' Verbindung zwischen dem Betrachter und einer gänzlich andersartigen Lebensform zu schaffen, deren Habitat und Lebensfähigkeit zu thematisieren, um zugleich die menschliche Interaktion mit der Natur zu hinterfragen.

Dies geschieht zum einen durch Einblicke in den kreativen Arbeitsprozess mit seinen zahlreichen Schwierigkeiten, einen fremden Organismus gemäß dem menschlichen Willen fremd zu bestimmen. Gleichzeitig wird durch die Verbindung von klassischer plastischer Kunst und der neu-medialen Vorgehensweise in der Bioart der Gegensatz zwischen einem fremdartigen Organismus und dem Menschen gestalterisch umgesetzt, in seinen Eigenschaften reflektiert und diese Verhältnis letztlich einer Neuevaluierung zugeführt.

Konkret wurde ausgehend von der Züchtung, Kultivierung, Fürsorge und diverser 'Design-Experimente' mit dem biologischen Organismus im 'home-studio' (des DIY Biolabs) ein künstliches Habitat in Form einer vergänglichen Skulptur entworfen und anschließend künstlerisch auf Basis einer Feldrecherche (in Form des direkten Sammelns von Trägerstrukturen aus Baumholz) durch Waxguss mit Silikonabformung umgesetzt.

Am Ende steht die Frage, wie verhält sich lebende Materie zu den Eigenschaften der künstlichen Form: Ist der Schleimpilz, Physarum polycephalum, befähigt in dieser neuen Umgebung zu überleben?

Kern und Relevanz

deutsche Fassung

Der Mensch ersetzt zunehmend den Bezug zu anderen Lebewesen und Lebensformen mit der digitalen Welt. Gerade darum ist es wichtig, den reflektierten Zugang zu unseren natürlichen Ressourcen, der Umwelt und nachhaltigem Leben aufrechterhält.

Die Skulptur als untypische Kombination von Bioart und klassischer Kunst soll durch die Reduzierung auf (lebende) Materie und Form die Verbindung des Menschen zur Natur als ursprünglichste Wissens- und Innovation-quelle betonen, welche im Zuge der aktuellen Nachhaltigkeits- und Umwelt-Debatte starken Anklang in der Gesellschaft findet.

Additional considerations on immortality

Physarum polycephalum is a shapeshifter, altering with the many stages of its lifecycle. Both scientists and artists, primarily focus on the vital plasmodial stage of the organism's life, hereby, zeroing-in on only a small fraction of its varied transitions and forms.

The plasmodial life form is typically kept ‚alive forever' through continued intense human care inside laboratories. If - as part of this artwork - the slime mold pauses its own life by receding into the phases of sporangia or dormant sclerotium, it will remain patiently waiting for the day to be resurrected in friendlier terrains.

Could this be a daring analogy to our human life and (fear of) death? Could we similarly only be in one of many stages of our own life cycle?

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Tree structure 02-07: artists's own field research
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Body structures 02-04, 06 : Sally Hewett - @sally_hewett instagram account
Body structure 05: https://www.shutterstock.com/image-photo/nervous-man-screams-into-camera-muscles-1508567996
Body structure 07: Juditch Dorothea Gerke -@judithdorotheagerke instagram account

Special Thanks:

The project was developed under artistic guidance of Prof.Ursula Damm and Mindaugas Gapševičius as part of the courses ‚Artists Lab IV' and ‚If the organism will not come to me, I will come to the organism'.

Many thanks to the DIY Biolab, Antje Danz and Kreativfonds ‚Föderlinie Nachwuchs' Bauhaus-Universität Weimar.

And above all the unicellular slime mold ‚Physarum polycephalum'.

The project was developed by Kristin Jakubek in Sommersemester 2020.

Bauhaus-Universität Weimar

Kreativfonds

BODY HABITAT

~ CREEPING GARDEN

An artistic setting for an organism to behave in a desired way.