# I ART MY SCIENCE

Utrecht University | UMC Utrecht

# I ART MY SCIENCE

## Building Bridges

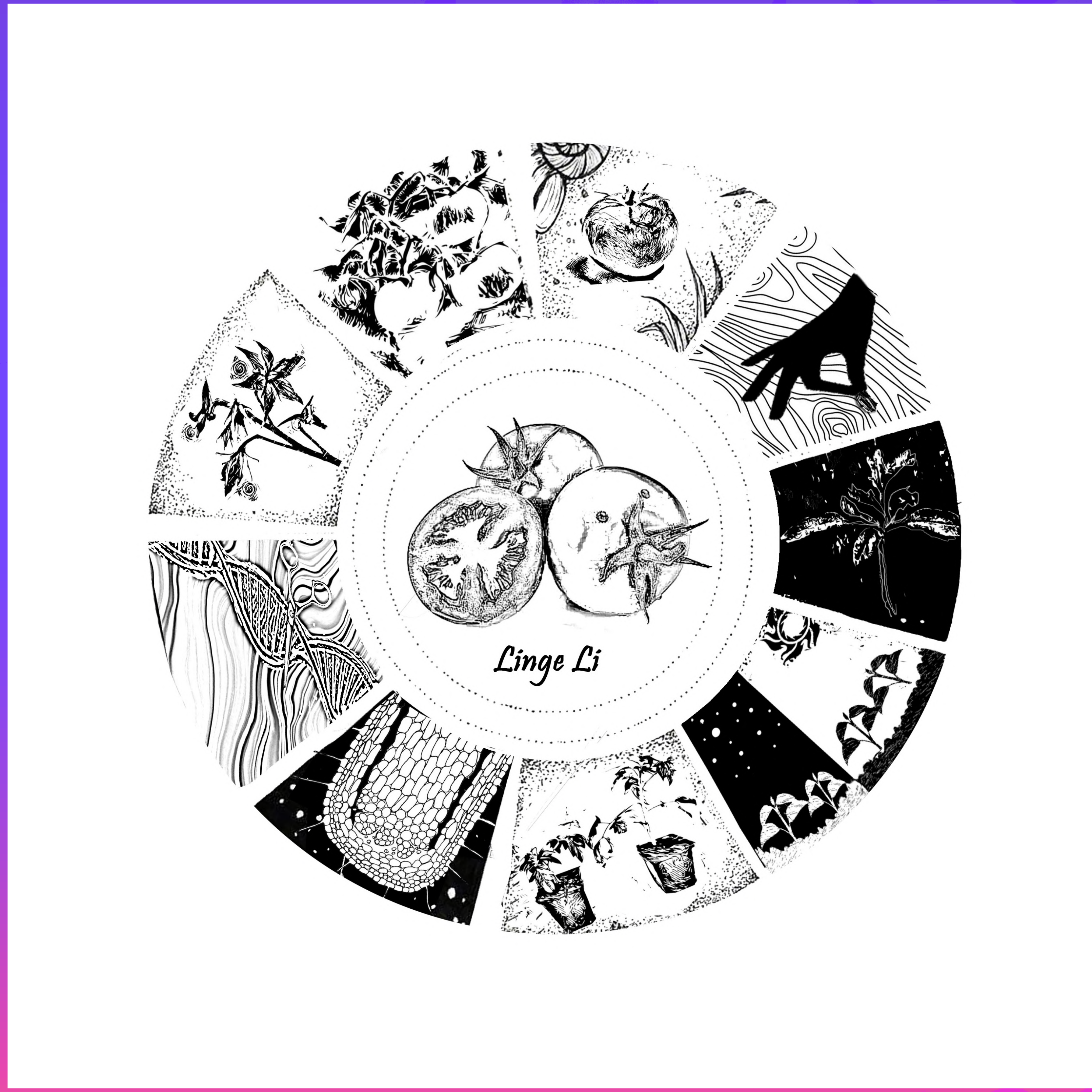
Where do you find beauty and symbolism in your science? Where do you draw inspiration and motivation from? Eleven Master's students, PhDs and postdocs from the Graduate School of Life Sciences (GSLS) of Utrecht University answer these questions from their personal and artistic point of view. With their art, they showcase their research in a surprising new light. They show us how science has more in common with art than one might initially think.

Science is not just precise and systematic. Like art, science is also about creativity, courage and being prepared for the long haul. Insistence and perseverance are crucial qualities for the progression of both. They rely on asking and examining questions about the world around us from a unique point of view. The GSLS wants to use this common ground to build a bridge between art and science, to look at our research from a fresh perspective and to highlight diversity in all its forms.

In an open call, all members of the graduate school were invited to submit works of art that portray aspects of their research, centered around the theme of beauty and symbolism. Fifteen diverse works were selected for the online exhibition 'Building Bridges'. Art that makes you curious or raises deeper questions. The exhibition is divided into four main themes: Cells & Tissues, Bacteria & Fungi, DNA & Molecules and Plants, and celebrates the diversity of the school.

With new and existing works from Ninouk Akkerman, Margherita Duca, Violeta Carmen Angulo Fernández, Alexander Damkær Hansen, Martina Huber, Sophie van der Leij, Linge Li, Emma Sudria Lopez, Bart Lutters, Renee Maas and Stefano Mandija.

## Plants




Title:
How I do my work

Object type:
Digital drawing

Year:
2019-2020

PhD:
Environmental Biology

Field of research:
Plant ecophysiology

## Linge Li

In 'How I do my work', Linge gives us an artful insight into her daily work. Her artwork is a combination of handmade drawing and digital drawing, some based on photographs that she took. 'How I do my work' shows the different stages of tomato growth and the ways Linge intervenes for her research.

Linge's research addresses the issue that tomato plants struggle to compete with their neighbors in order to get sufficient light to grow. To be able to get enough light, they need to grow higher. This adaptation is called 'shade avoidance response'. Linge looks for genetic ways to push tomato plants to be more efficient in this response. Basically, why they grow taller in shade.

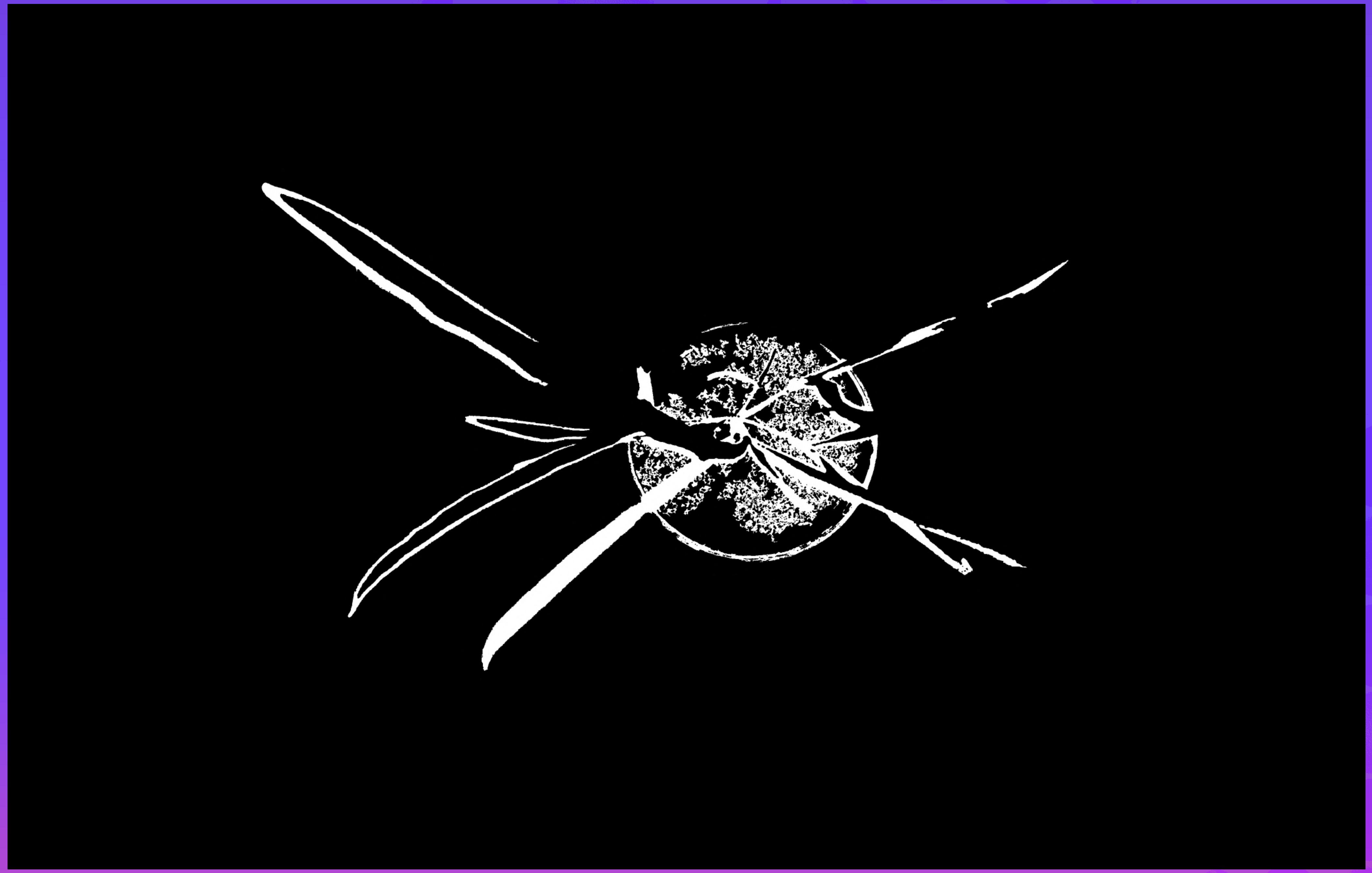
Linge's research is a great representation of how varying the scales of magnitude within one project can be. Tomato seeds are planted and after a short while Linge splits them up. Some go in a spot with lots of sun and some go in the shade. This results in some plants growing higher than others. The process then shifts to a microscopic level, as Linge makes very fine sections (slices) of different parts of the plant and observes them under a microscope.

By looking at how the cellular architecture of the different plant groups have changed, Linge tries to make predictions about which genes have been involved in her plants' shade avoidance response. She will then plant new tomato plants with mutations in those specific genes, and the cycle starts over again. Her aim is to identify the genes that can be manipulated to produce more competitive tomato varieties.

In 'How I do my work' Linge emphasizes the circular nature of her research process. These cycles bring in mind the many beautiful artworks in which the various rounds of trial and error are hidden, before the desired result was achieved.

"I find that the beauty of the tomato is not only in it being a model, but it's also very well structured. Compared to Arabidopsis plants, the tomato plant shows strong effects on the phenotype. Depending on the treatment you can see changes in the color, the leaf shape especially the changes in the fruit it produces are striking."

## Plants



**Title:**
The beauty of plant architecture

**Object type:**
Adapted photograph

**Year:**
2018-2019

**PhD:**
Environmental Biology

**Field of research:**
Plant Ecophysiology: Towards sustainable rice farming

## Martina Huber

How can rice farming become more sustainable?

Martina's research revolves around finding varieties of rice that are more competitive against weeds, reducing the need for herbicide use to eliminate those weeds.

Martina looks for varieties of rice that are "bushy" enough to keep the weeds from overgrowing the fields in the first six weeks after seeding. This period was shown to be a crucial time window, largely determining how much rice a field would ultimately yield. In her experiments Martina took 344 separate rice varieties from all over the world, which were investigated for their competitiveness against weeds. She traveled to the Philippines to grow and screen all the 344 varieties in the greenhouse. She went back a second time to plant a subset of the whole panel in the fields - the ones she predicted to be competitive.

Like starting a new artwork with unfamiliar materials, Martina started her project without prior knowledge. "I had no idea what a rice plant looked like. I knew rice on my plate, that's it. What triggered me is that my research is very applied. I would go in the field and talk to farmers and saw that what I do would have a use for them. Within the first year I started to love my project. That feeling increased over time."

To see how the rice canopy would develop, drone pictures were taken from above the field. An experiment that sadly had to be abandoned prematurely because of the rising COVID-19 pandemic. Two years before in the greenhouse, Martina grew a single rice plant from each variety in individual pots and observed how they developed as a reference. Pictures were taken regularly and fed through computer software that would use a certain script that filtered out the soil and pot, leaving just the green parts of the plant.

In 'The beauty of plant architecture', that script malfunctioned, leaving the outlines of the pot and the soil visible. Martina found appreciation in the result, an abstract picture that leaves room for interpretation. The piece is a reminder that we can find beauty within the imperfections of life. To be able to see through the incomplete or the ugliness.

"I think my project combines science and art in a beautiful way. It taught me to look at this staple food from a completely different perspective. Rice plants are beautiful architected individual plants. I saw how different they are and started recognizing tiny differences. I discovered the beauty and aesthetics of basic plant architecture and I started to value the plants around us more.

## Bacteria & Fungi

Title:
Pacha-mama

Object type:
Mixed media on canvas

Year:
2020

PhD:
Environmental Biology

Field of research:
Bacteria and fungi on soil aggregation under drought

## Violeta Carmen Angulo Fernández

Violeta researches bacteria and fungi on soil aggregation under drought, within the PhD program Environmental Biology. In Bolivia - her home country - drought is a big issue. Violeta states that interaction between bacteria, fungi and other microbes can help to mitigate the climate change and drought - one of the most challenging phenomena for crops in many countries.

Violeta sees her Andean culture as a symbol of the strong alliance between local people, soil, crops, and microbes. This alliance is symbolized in her artwork Pacha-mama by a mix of wool, wood, pastel, dry leaves and paint. Different materials and techniques form one art piece - like all the different microbes form one soil system.

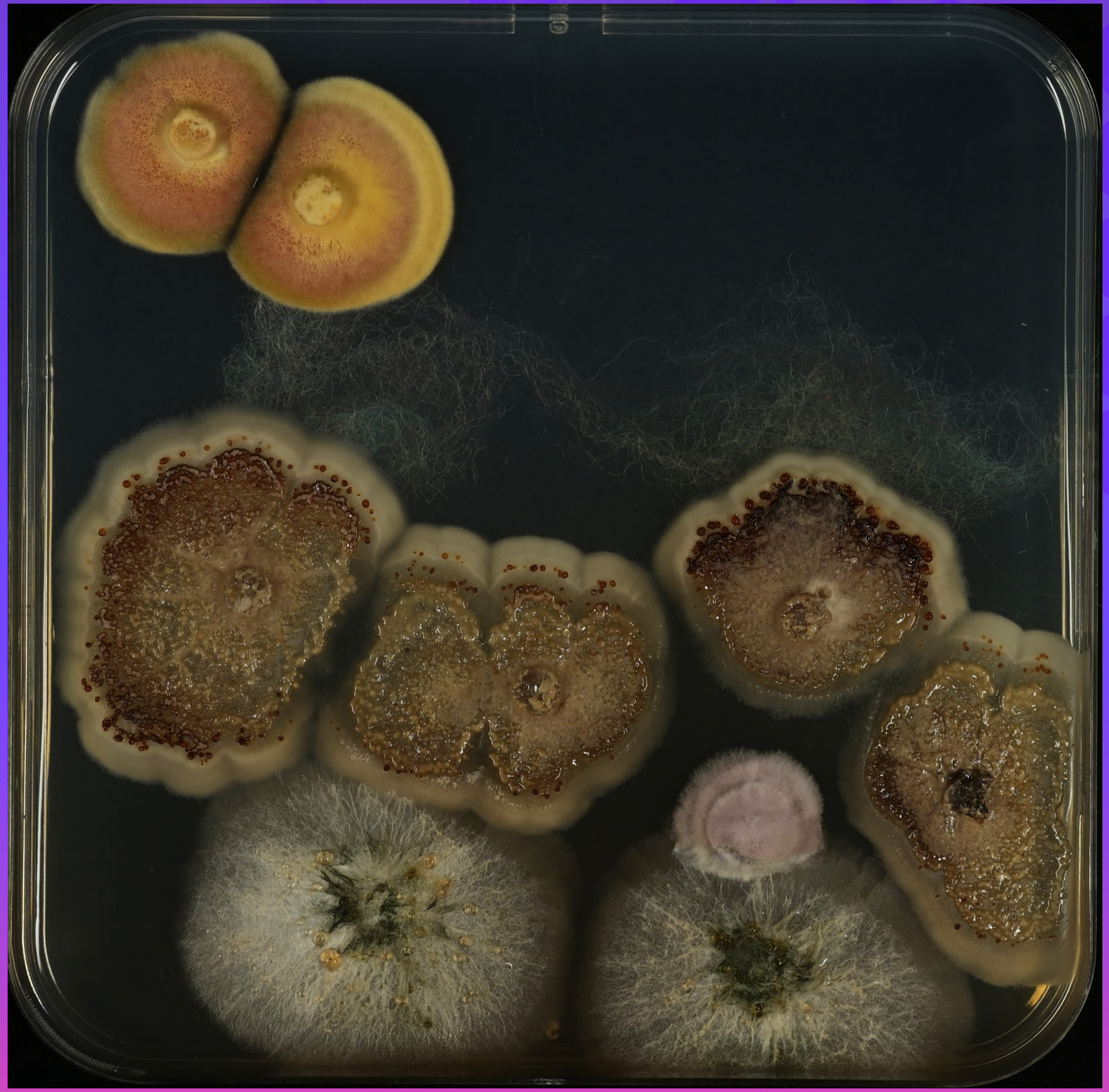
In 'Pacha-mama' a mother represents the earth "Pacha". She symbolizes the wisdom of the soil system which provides us food and health. The child in her arms represents future generations. The mother and child are connected to the abundant microbes which are building the soil the fundamental base for life. Microbes play a key role in the soil's structure and functioning. For millennia, many cultures have lived in equilibrium with these kinds of ecosystems.

"When I was a child, my grandmother was living on a hill in the countryside. She was a hard-working woman. I remember she was wearing traditional clothes from the Andes, a wide dark skirt and her hair in braids. She could climb so well, like a goat. For me she was a symbol of life, of women working with the soil. When I started my research on soil structure, I could imagine the fungi helping my grandmother grow the corn and potatoes. Like a network of life."

The photographs 'Fungal Dawn' and 'Fungal Sunset' represent the beginning and end of a symbolic day for the fungal community in the soil. They have similar necessities like human beings: they need nutrients, water and an optimal physical environment to live most successfully.

Violeta sees symbolism in her photographs. In 'Fungal Dawn' she shows a community of fungi, among which Penicillium sp. and Gliocladium sp. She imagines that they are waking up to greet to the sun. Violeta symbolizes the end of the day in Fungal Sunset. The sun - here represented by Talaromyces sp. - is making its last effort to illuminate the earth, oceans, and living beings. The soil is thankful, and the fungi will have a last talk before they go to sleep.

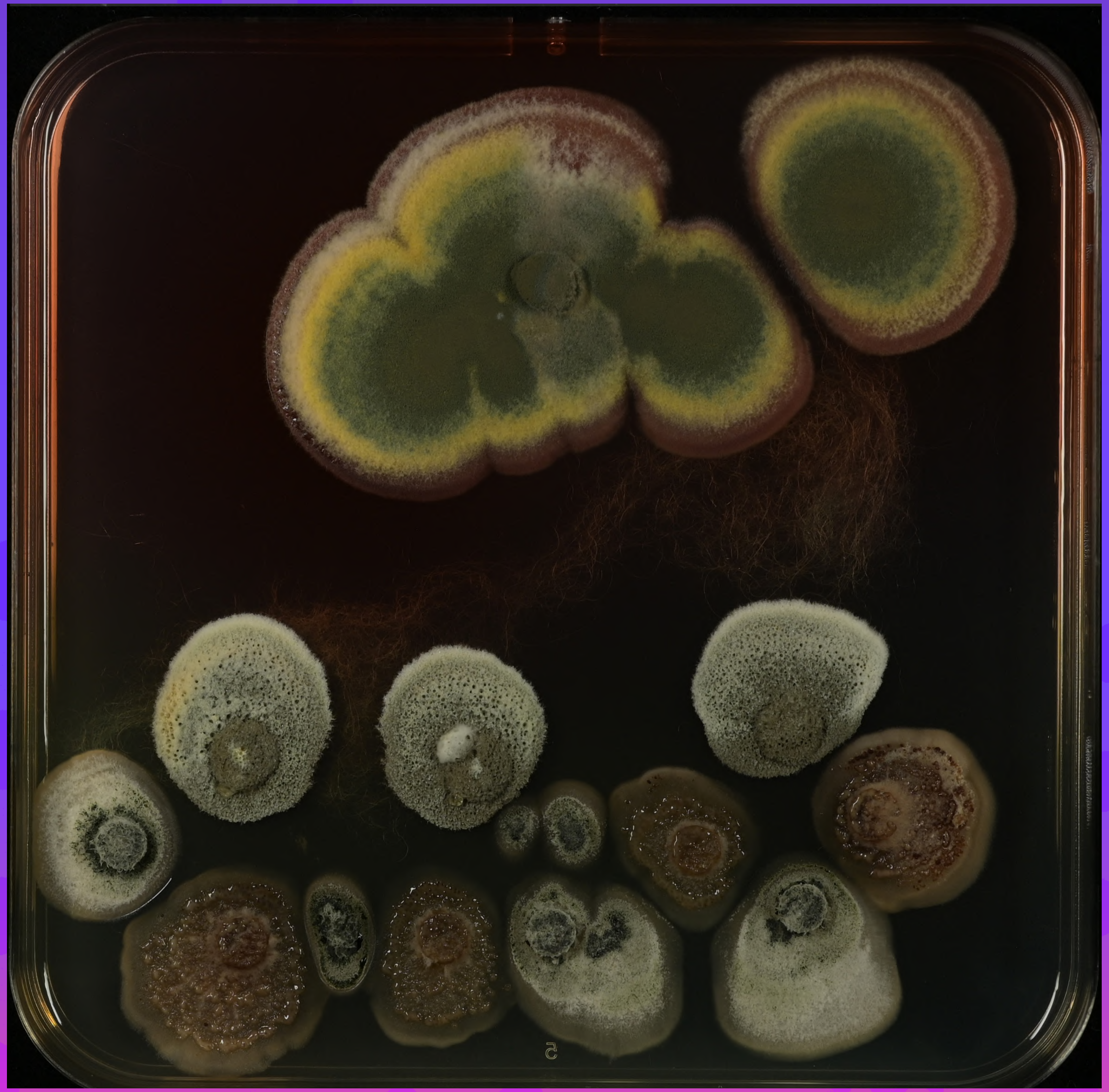
## Bacteria & Fungi



Title:
Fungal dawn

Object type:
Photograph

Year:
2020



Title:
Fungal sunset

Object type:
Photograph

Year:
2020

Title:
The Archive

Object type:
Digital drawing

Year:
2020

Master's:
Cancer, Stem cells and Developmental Biology

Field of research:
Cancer

## Sophie van der Leij

The 'I Art my Science' project inspired Sophie to wonder about a depiction of her research. The result is her artwork 'The Archive' - a symbolic representation of the idea that the human DNA is the historical archive of a cell.

Sophie did her internship in the Van Boxtel lab. Here researchers look at DNA as a historical archive in which they can trace the genomic changes that cells acquired over time, and that led to the formation of tumors. In a tumor, each cell is defined by having a combination of mutations in its DNA. The more cells that have a specific mutation, the longer that mutation has been around. By analyzing how prevalent all the different mutations are, researchers can look back in time and determine the sequence of events that took place on a genomic level.

Sophie refers to the molecular clock depicted as the pocket watch in the lower half of her drawing - a way of inferring cell lineages using mutations as a readout. Like Sophie's research, art can also offer a window in the past. By analyzing paint layers and pigments, statements can be made about a painting's history.

'The Archive' is a dynamic digital drawing made in Photoshop. Sophie based it on a handmade drawing that she made after looking at images of DNA. The bookcase symbolizes the DNA. The snakes that form the backbone of the double helix, refer to the symbol of medicine (the Rod of Asclepius) and Python - the first programming language for biomedical scientists. Sophie put emotion in her drawing by giving the snakes a strong expression.

"I like when I look at a picture and it evokes an emotion in me. For the general feel of the drawing I chose to have an aggressive interaction between the snakes. They make my drawing much more engaging."

The aggressiveness of the snakes can also be associated with the presented archive, composed of mutational records. These mutations can have a negative connotation for causing diseases like cancer. The strangling between the tails of the snakes represents the conflict that comes with disease and makes the drawing more balanced.

DNA &
Molecules

Title:
Transcription

Object type:
Painting

Year:
2020

Master's:
Environmental Biology

Field of research:
Biology

## Alexander Damkær Hansen

How can a scientific diagram be beautiful?

'Transcription' depicts one of the most fundamental steps in the creation of life and in our body's response to being vaccinated against pathogens - the production of proteins. Alexander explores the aesthetics of a scientific diagram that explains the process of transcription. Diagrams like these, generally found in textbooks, can be unimaginative. Alexander questioned how to make them more colorful and artful.

During the process of transcription, certain regions of the DNA that exists in the nucleus of all our cells are 'read' by specialized enzymes and a corresponding RNA molecule is produced. This intermediary RNA molecule, a page out of a cellular cookbook, serves as a recipe for the production of a protein. That protein will support a certain cellular function which will help cells satisfy their needs and adapt to the ever-changing environment.

"DNA is fascinating, it's a recipe for making a human. But how does this recipe actually become a human? That's what you see here."

Alexander is a Master's student in Environmental Biology. He paints in daily life - mostly animals such as people's pets. He made 'Transcription' as a gift for a friend who was studying medical sciences. Alexander used an actual medical diagram from a textbook for reference. He set up his painting in layers which is reminiscent of the process of transcription that also happens in steps.

He started with a broad yellow layer, following reddish and brown strokes and ending with tiny speckles of multi-colored paint. These dabs of paint symbolize all the different elements that are, seemingly randomly, floating around in the cell. The choice for yellow, orange and red is purely aesthetical, although the colors suit the process of burning energy. Transcription is indeed an active process in cells that requires ATP consumption in order to take place. The dark shapes symbolize the enzyme that is reading the DNA. There's a special focus on the incredible length of these strands, suggested by the depth and perspective in the painting.

"DNA and RNA are very long. I'm intrigued by the scale of these things, they're all so tiny. If you would pull DNA out, it would have a total length of two meters, it's insane. It's compacted and folded into every single cell. You could never see it with your own eyes. I'm fascinated with these tiny processes that are constantly happening. Physics and molecules moving around, that's what creates us. Creepy, but beautiful."

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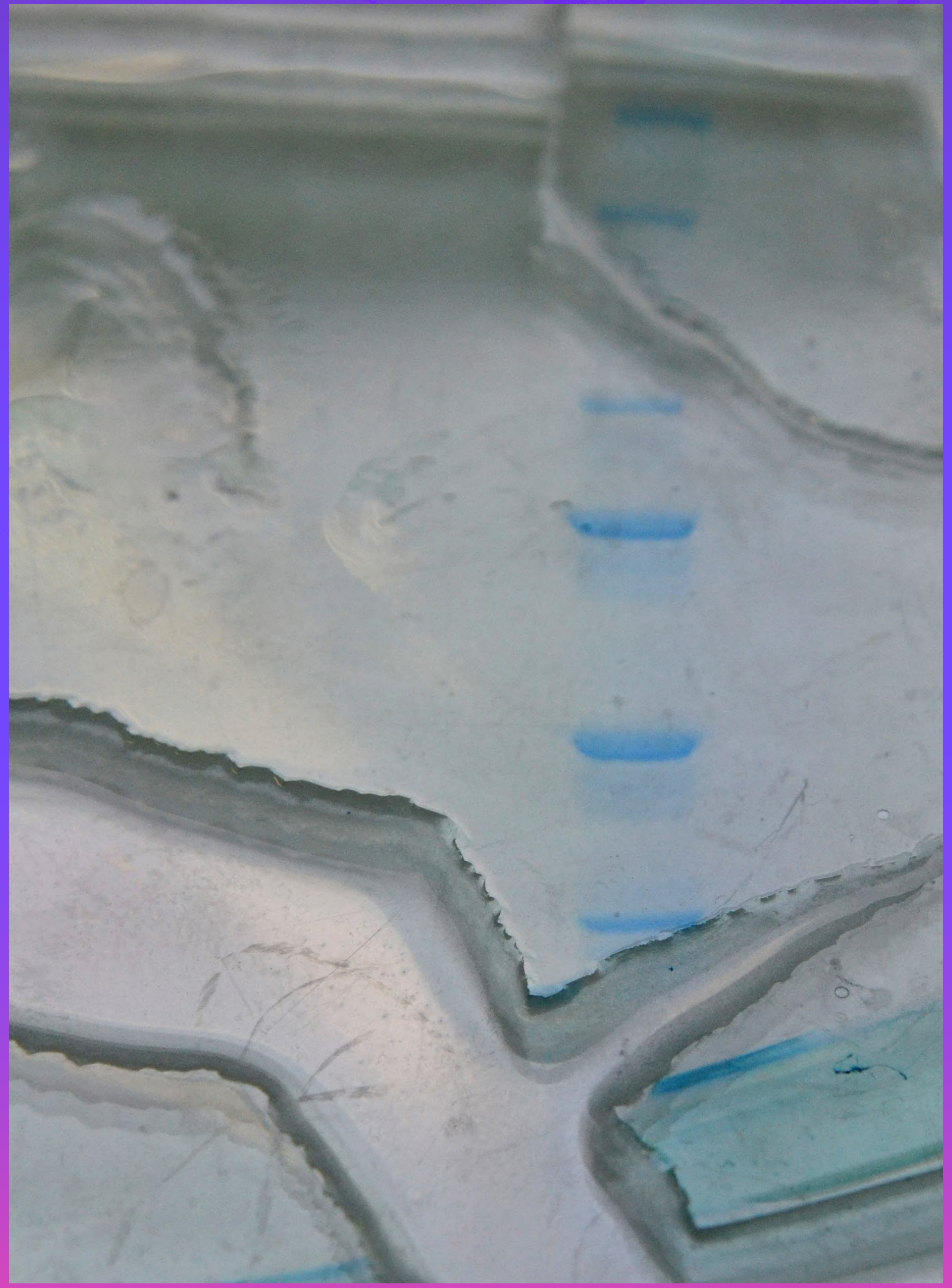
# DNA & Molecules



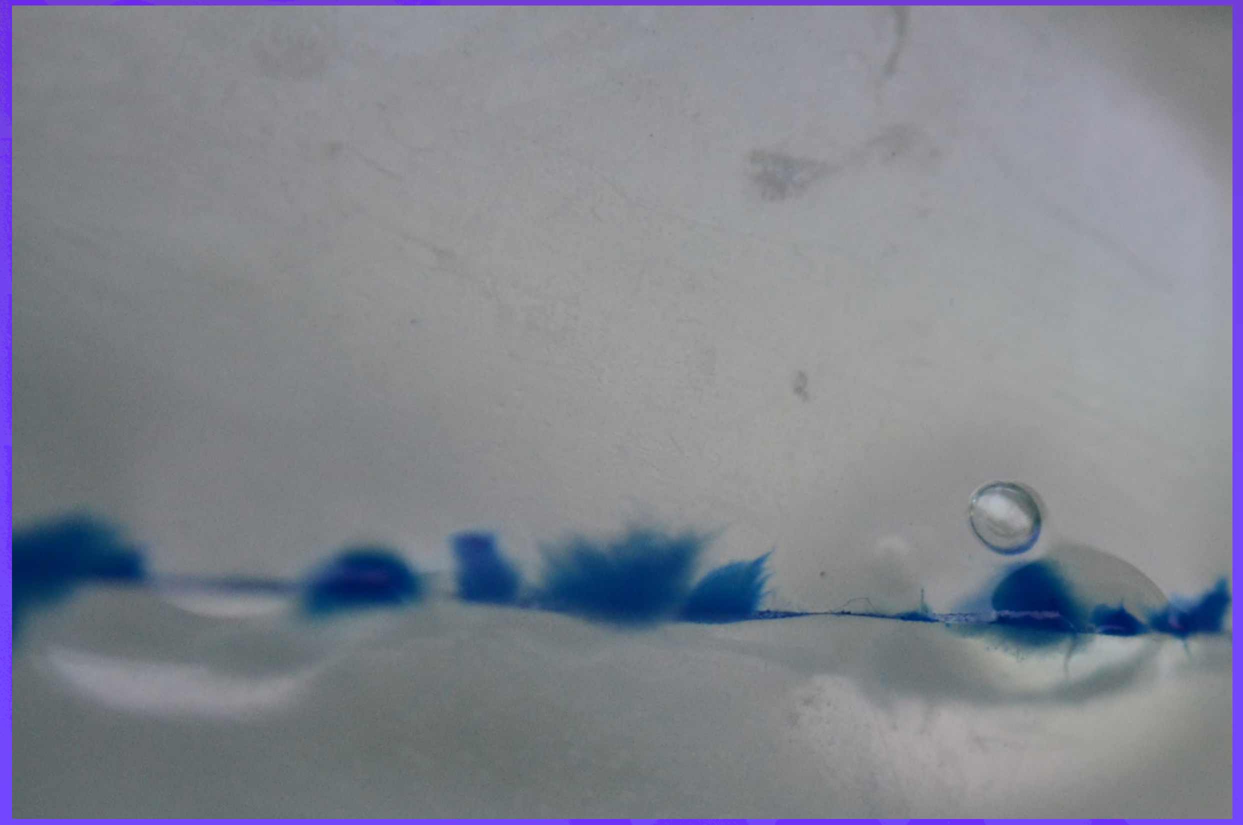
Title:
Icebergs of acrylamide gel in a broken experiment

Object type:
Photograph

Year:
2020

PhD:
Drug Innovation

Field of research:
Medicinal Chemistry



Title:
Puffy adhesion on a forgotten acrylamide gel

Object type:
Photograph

Year:
2020

## Margherita Duca

Margherita feels that artists and scientists have strong common ground. As a scientist, her work can be very creative. "I'm in the chemistry field and I realize that everything I do is creative, because I'm inventing new molecules and I can give them the shape I want. It's about visualization and creation."

Margherita's photographs depict an SDS-PAGE, a common electrophoresis method that allows protein separation by mass. Margherita uses this biochemistry method on a daily basis to check for the expression of the target protein as a readout for the biological activity of lectin inhibitors. Her project aims to develop and use these lectin inhibitors in the treatment of lung infections, thus fighting the current global problem of microbial resistance.

SDS-PAGE is a common electrophoresis technique but comes with a high risk of the gel breaking into pieces at the end of the process. If this happens, the experiment is rendered useless and precious time is wasted. This is exactly what happened to Margherita in these snapshots. 'Icebergs of acrylamide gel in a broken experiment' and 'Puffy adhesion on a forgotten acrylamide gel' depict two of these broken gels.

Instead of letting the failed experiments get her down, Margherita was able to see the beauty in them. For anyone not in the field, the photographs seem abstract and open to interpretation. That's exactly what Margherita was going for. She wants to show us another perspective on her daily work. A spontaneous view, without deliberate setup or reason.

"Every day we run these gels to understand if the proteins that we work with are pure or not. One day I brought my camera to the laboratory. As I was zooming in on my experiment, I saw something different. As if I was looking at an iceberg. The colors gave me the sensation of coldness. I enjoyed playing with the view. To make a gel look like a rocky iceberg. I thought it was interesting to have a different perspective on the same thing I see every day. The object is not beautiful, the beauty is in the balance of the colors and shadows, seen from different angles. The beauty lies within the sensation you get from looking at it."

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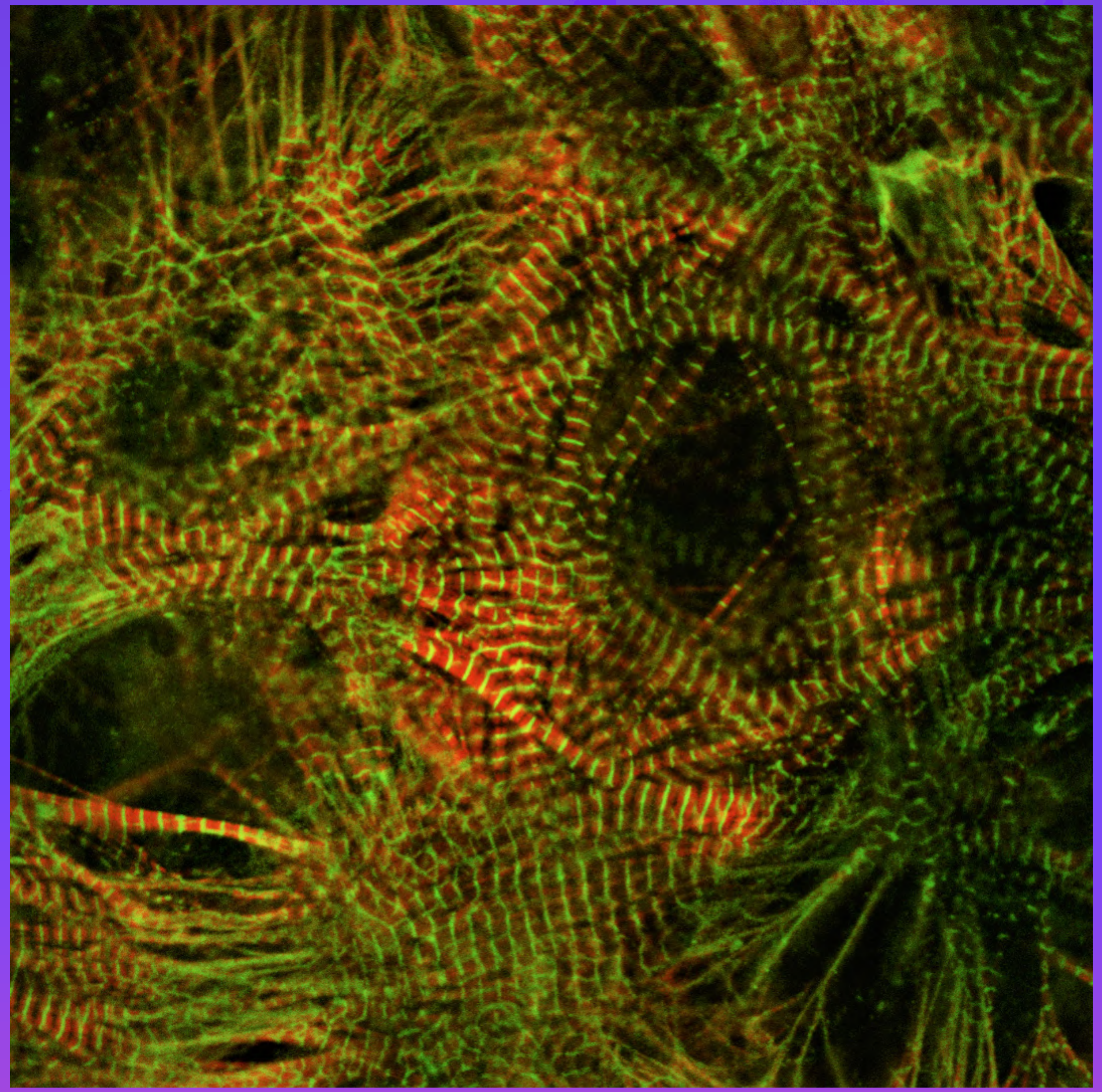
## Cells & Tissues



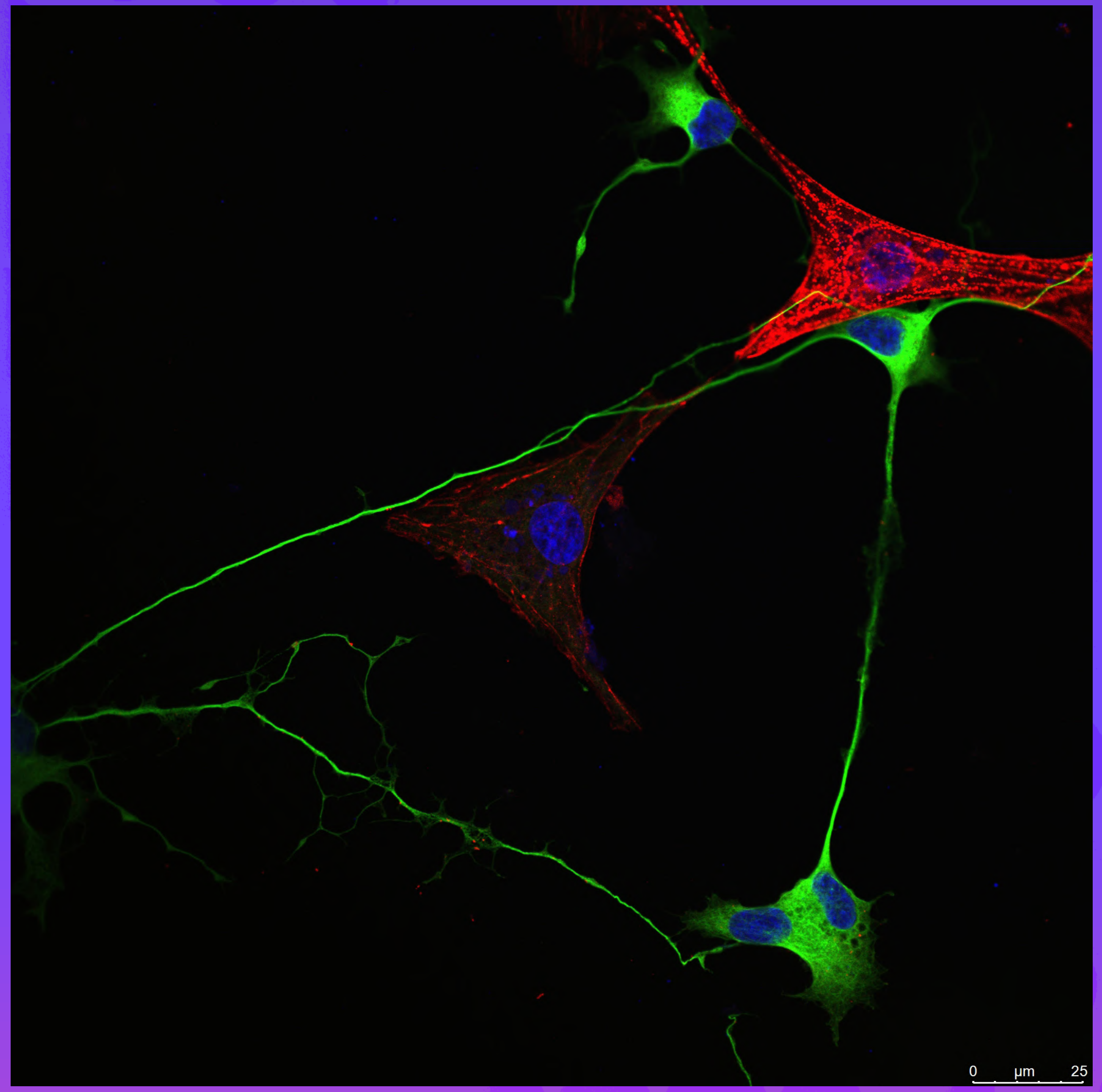
Title:
The Intertwined heart

Object type:
Photograph

Year:
2020

PhD:
Regenerative Medicine

Field of research:
Cardiology, Heart regeneration




Title:
Try-Angle

Object type:
Photograph

Year:
2016

## Renee Maas

Renee uses her photographs to offer people a view into the fascinating features of the heart. Her images depict some of the most important cell types and proteins responsible for the functioning of a healthy heart. She finds beauty in the multiple cell types and cell functions working together to enable performances like physical activities and feeling.

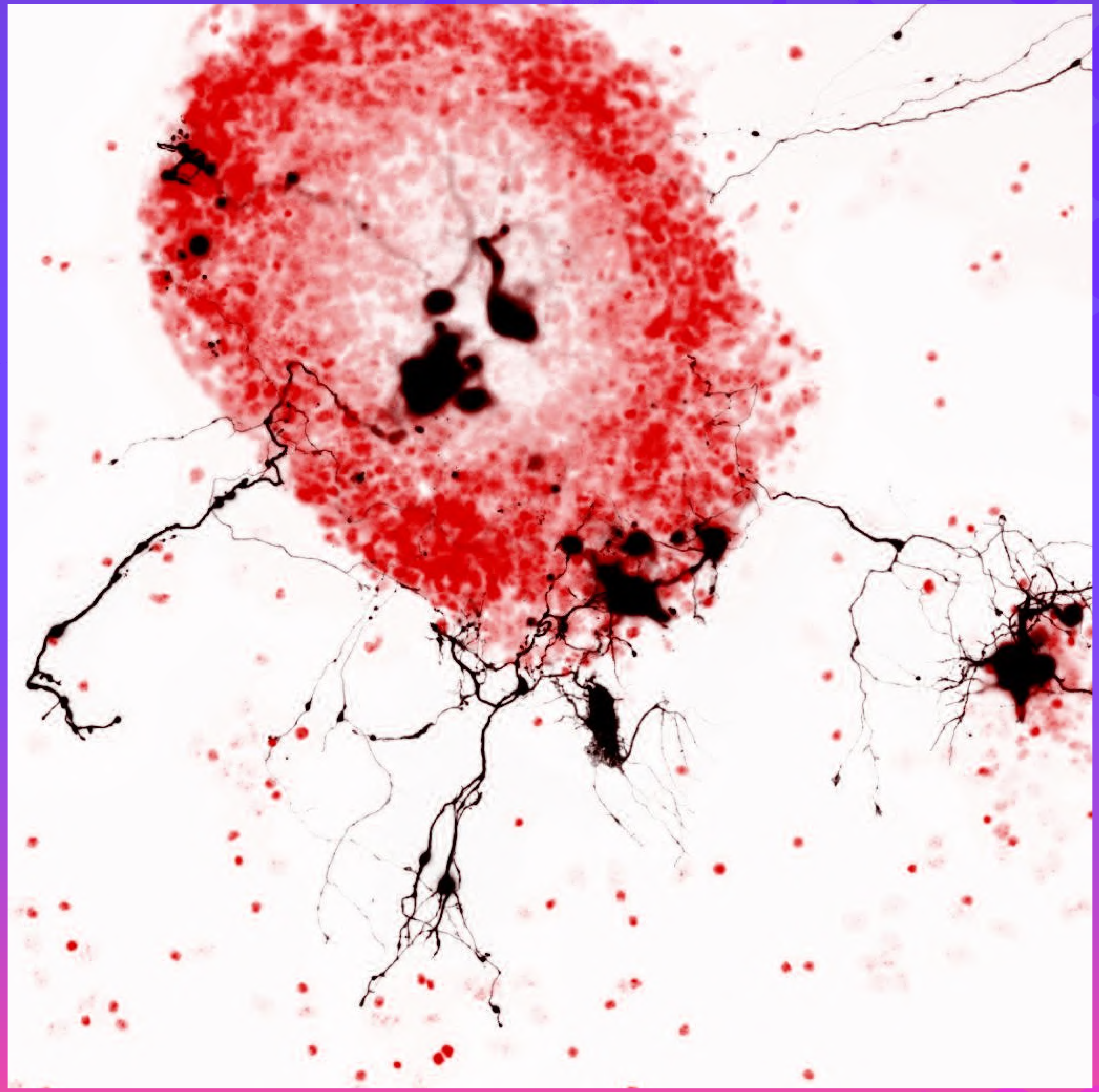
In Renee's research field of cardiology - within the PhD program Regenerative Medicine - candidates study genetic heart diseases. They transform induced stem cells into beating heart cells. These cells start beating within a week, enabling the researchers to study a person's heart in a dish. Their aim is to unravel mechanisms and potential therapies for people with heart diseases.

After having exhibited her pictures before, Renee started looking at them from a new perspective. In 'The Intertwined heart' she recognized the Lego blocks she played with as a child. The different parts of heart cells reminded her of stacking Lego blocks in different colors onto each other.

She saw triangles in her other photograph which explains the title 'Try-Angle' as a play-on-words to suggest the process of trying different approaches within research before improvement can be made. 'Try-Angle' emphasizes the importance of the neurons growing into the heart, a crucial step in development. Early on in the developing heart, the heart cells spontaneously start to beat, but they need the neurons to grow in, to give the heart cells a pulse. This is exactly what Renee shows us. In green, neurons are shown innervating heart cells (red). If this process is unsuccessful, the heart won't grow, and life cannot continue.

"The heart is very limited in regeneration. Most heart cells you are born with, you die with. One single heart cell beats 100.000 times per day, sometimes over 80 years. This means that the "car" (the cell) stays the same, but the "car parts" (proteins) need to be changed during the years."

## Cells
## & Tissues



Title:
Firing together

Object type:
Photograph

Year:
2020

PhD:
Clinical & Experimental Neuroscience

Field of research:
Underlying mechanisms of Motor Neuron Disease

## Emma Sudria Lopez

In her PhD Emma studied the mechanisms that make motor neurons degenerate in Amyotrophic Lateral Sclerosis (ALS). For her research, Emma cultured motor neurons since ALS specifically affects this subset of cells. Her photograph shows a primary culture of neurons - taken directly from mice - observed under the microscope.

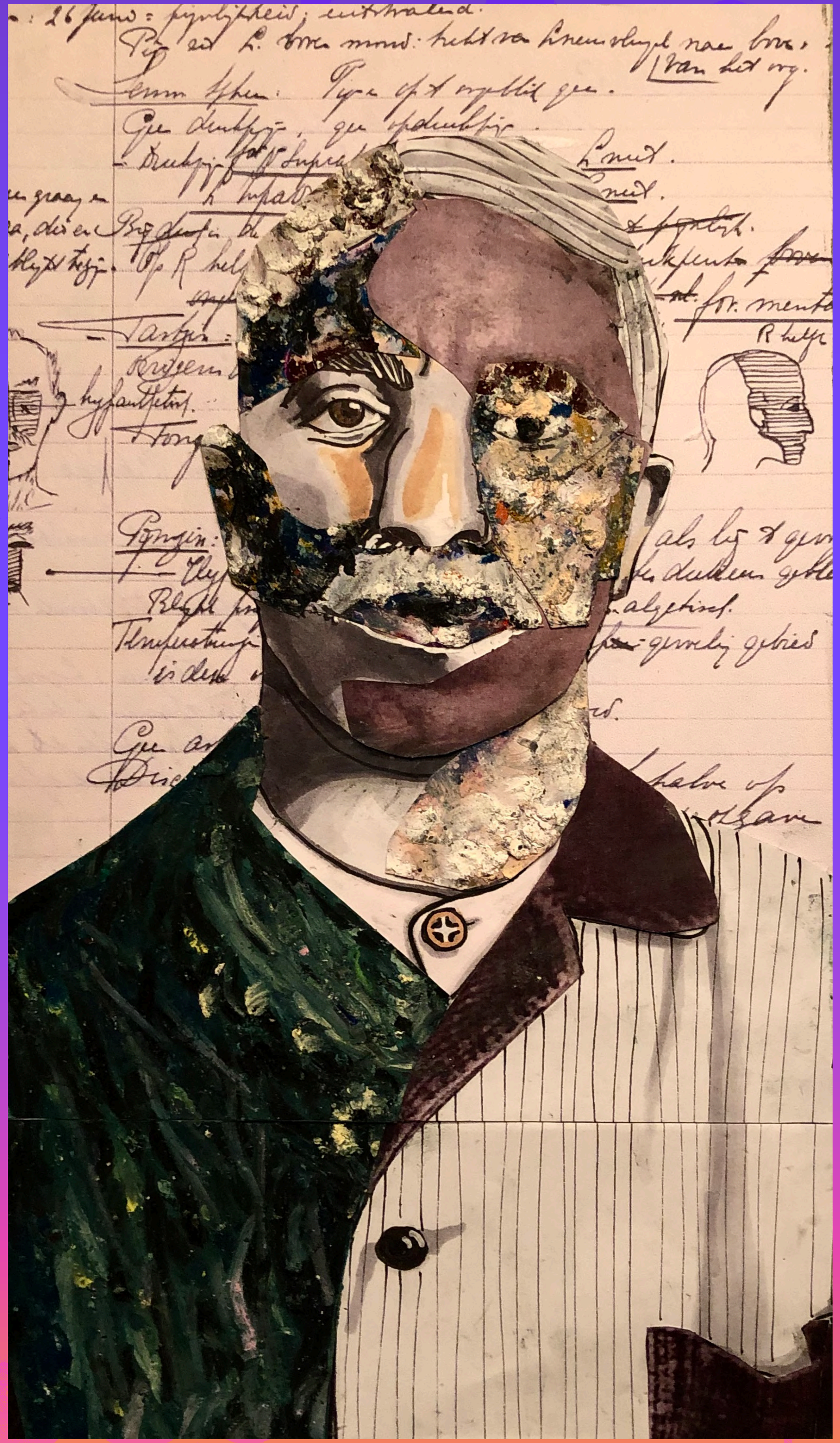
In the photograph five neurons are visible in black. But there are a lot of other cells present too. Emma chose to illustrate this by visualizing all cell nuclei -this is where the DNA is kept- in red, to create a metaphor of an explosion. The result is an abstract expressionist artwork. This specific image is not precisely in focus and didn't provide much data for Emma's research. Like abstract splashes of paint on a canvas, it serves a purely aesthetical purpose.

Still, 'Firing together' emphasizes an important point that Emma wants to make. The culture of motor neurons is not pure at all and depends on the presence of a lot of other cell types in the dish to support neuronal function. This became one of the focuses of Emma's research.

"With this image, I wanted to portray the critical role of other cell types to maintain and support neuronal function. Glial cells - traditionally thought to be just the "glue" of the nervous system - are increasingly recognized as important contributors to neurodegenerative diseases."

'Firing together' is like a lucky bad shot. This is typical for science and art. Something goes wrong, one makes a mistake and it opens up a new direction that leads them to their biggest discoveries.

Cells
& Tissues



Title:
Whispers from the files

Object type:
Collage

Year:
2020

PhD:
History of Medicine

Field of research:
The origin of neurosurgery in the Netherlands

## Bart Lutters

Who are the individuals behind medical records?

Brain changes resulting from neurological conditions can make a person see the world and themselves differently. In 'Whispers from the files' Bart created a portrait of a patient who died of a brain tumor. The scattered and forgotten life of this individual is illustrated by patches of different materials in the patient's face. Bart accomplished this by using the historical patient file and pieces of his drawings in a collage.

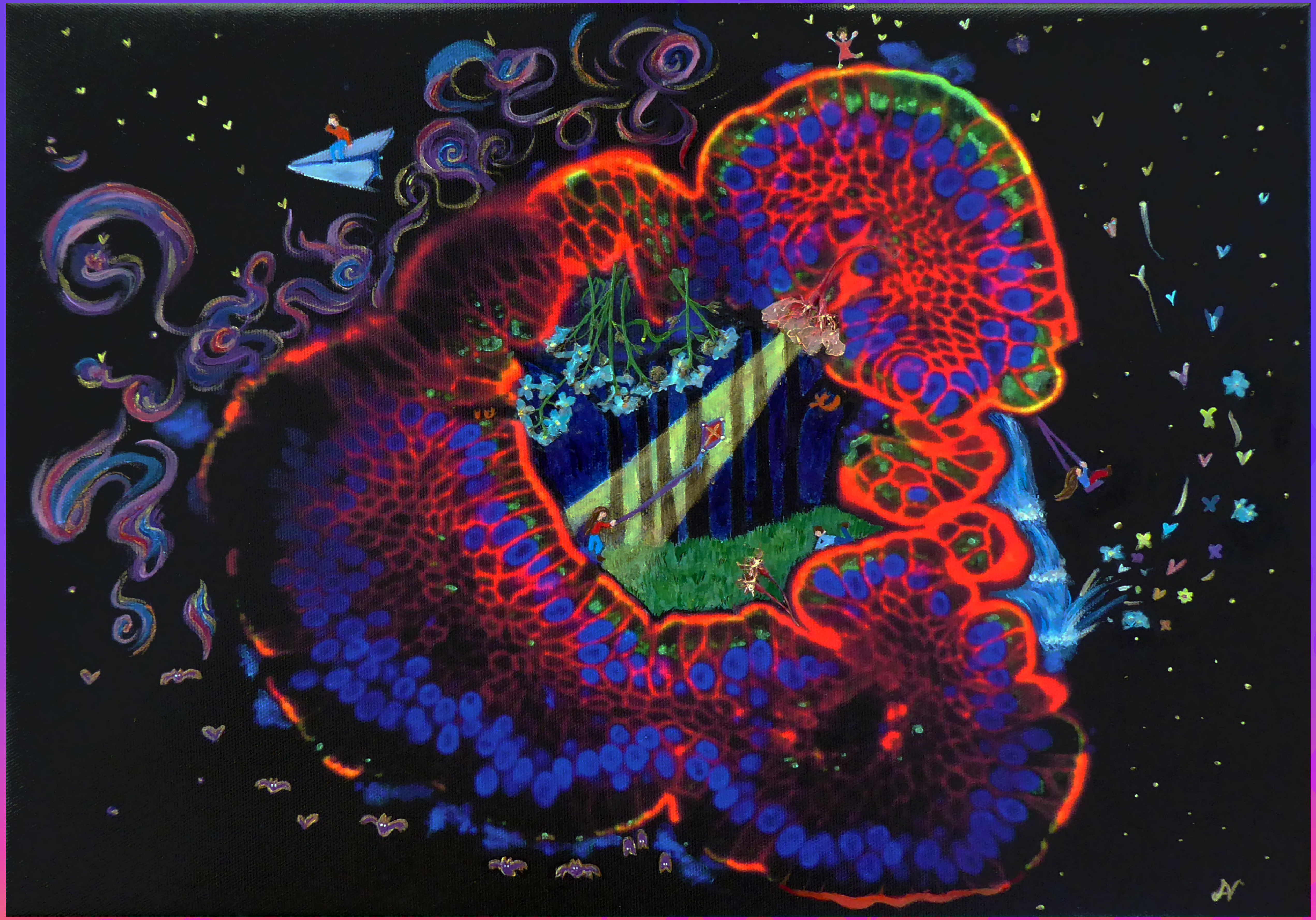
Bart has a degree from medical school (SUMMA) and worked for a year at the neurosurgery department. In clinical practice, he missed a focus on reflection, which motivated him to start his PhD in the history of Medicine - specifically on the origin of neurosurgery in the Netherlands. In his research, he explores how the field of neurosurgery took shape in the late nineteenth and early twentieth century. His sources include old patient files from medical archives.

"When you open the files, you encounter pictures of patients - taking photographs before and after was part of the diagnostic process. History may sometimes appear quite abstract, almost like fiction. When you see a picture of someone and you read the file, you realize all these lives that were there - all hidden in the files. It's touching."

'Whispers from the files' is built up from four layers. A portrait picture from the medical file, a marker and fine liner drawing, and an oil pastel painting, all cut up and superimposed on a page of the actual patient record. Like the different views from scientists on the same patient, Bart uses different materials and techniques to form the portrait of the same person. In the background of the portrait, descriptions of tests are written that are still done today, like testing the function of the tongue. Bart has a fascination for the human aspect of science and medicine. "It makes my research come to life. It addresses the human aspect of the work that I do."

Bart's research allows him to have an open mind and look at the bigger picture. "An important lesson from the history of medicine for medical and science students is that what we consider true today, might change over time. It's important to remain flexible when that happens."

Cells
& Tissues



Title:
In Vitro Phantasia

Object type:
Mixed media on canvas

Year:
2020

Master's:
Regenerative Medicine & Technology

Field of research:
Host-microbiota interactions in organoids

## Ninouk Akkerman

"If an organoid could dream of the world beyond the well, what would it dream of?"

In her painting 'In Vitro Phantasia', Ninouk imagined the childlike dreamworld of a 'sleeping' organoid. She composed it in great detail. Starting on canvas with a printed photograph of her experiment and completing it with paint and preserved flowers such as cherry blossoms and forget-me-nots, the result is a spontaneous, intuitive work.

Ninouk's research examines interactions between cells and their microenvironment using organoids as a model system. In her painting a cross-section of a single organoid is shown, a three-dimensional structure grown from a single cell. By using different molecular dyes, various characteristics of the cells that are present in the organoid come into the spotlight. The blue color, present in all cell types, corresponds to the nuclei of the cells. The red color visualizes where the borders of neighboring cells are. The green dye highlights a protein which is only present in a subset of specialized cells within the organoid, setting them apart from the rest.

'In Vitro Phantasia' symbolizes the new world Ninouk discovers through the microscope. It represents all the possible things that may be happening in and around her sleeping organoids, while they wait for her to observe them. No matter how sensible her hypotheses, chances are that what she sees is completely unexpected. This makes her research - like her art - filled with spontaneity.

"Visualizing what cannot be seen with the naked eye, is something that intrigues me. That is why I love doing microscopy. When you look at things under the microscope, a brand-new world opens up. My last immunofluorescence staining before the lockdown showed me the wonderful complexity of differentiated organoids. The cells had arranged themselves in mind-boggling structures, in twists and turns, yet remained connected. Whether I find my way or get lost, I never get bored wandering these strange new worlds."

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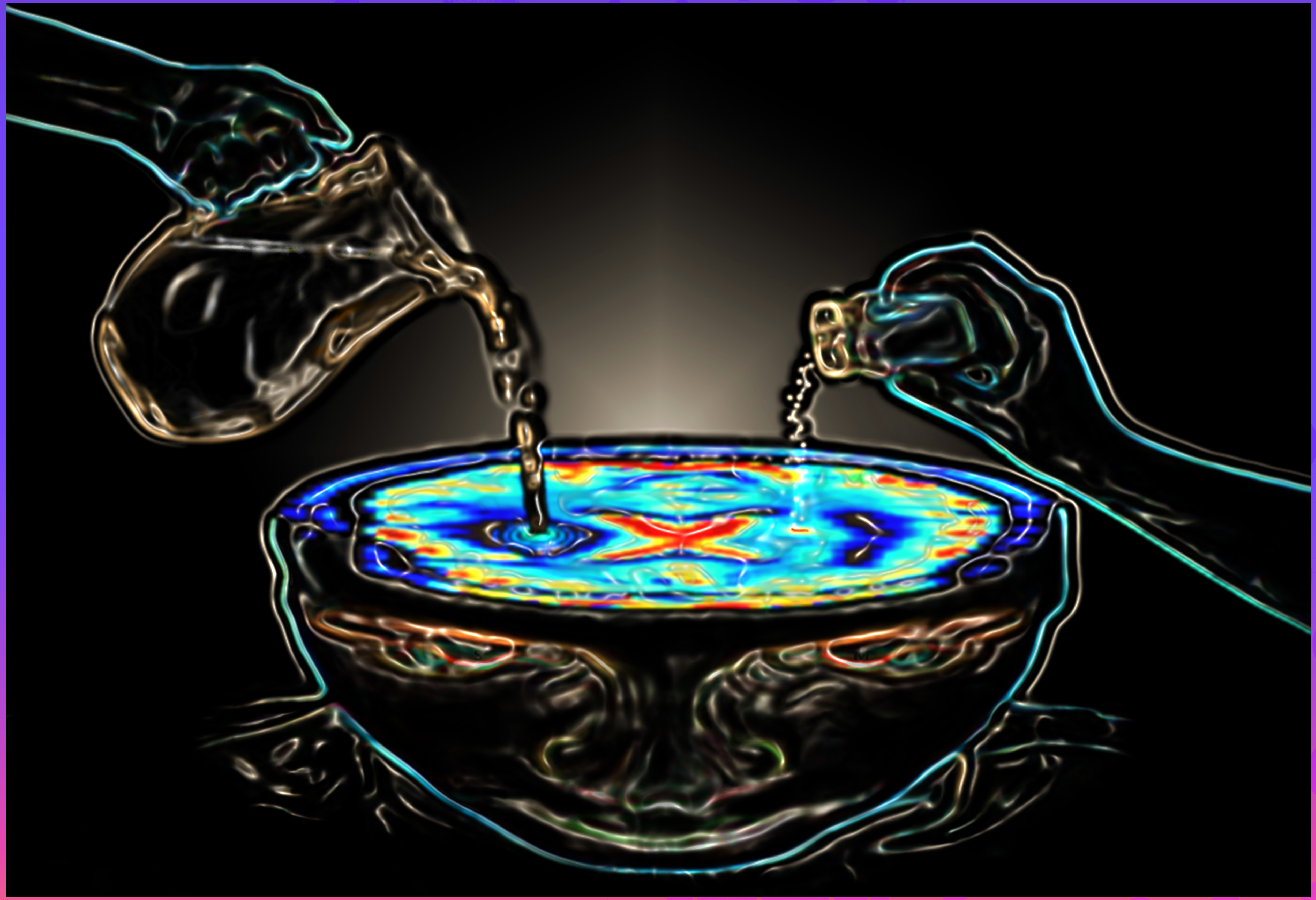

Title:
Cooking ingredients of brain conductivity

Object type:
Digital image

Year:
2018

Postdoc

Field of research:
MRI biomarkers for diagnostics and therapy in oncology

## Stefano Mandija

With his research Stefano aims to establish brain conductivity measurements in Magnetic Resonance Imaging (MRI) as a biomarker for cancer. In this digital self-portrait - a cross-section of his own head - he reveals a brain electrical conductivity map, measured with MRI. The conductivity of brain tissue is characterized by the mixture of two ingredients: water and salt. Two basic ingredients that our lives depend on. Stefano is inspired by the way the body regulates these ingredients perfectly. His digital artwork emphasizes the importance of the balance between water and salt for our well-being.

In his work, 'Cooking ingredients of brain conductivity', Stefano's two passions meet: food and science. In the kitchen he enjoys cooking Italian food. He compares a healthy balanced body to a perfect dish. In a perfect dish all the ingredients are present in a delicate equilibrium just like a perfect body maintains an intricate balance between all its tissue components. In Stefano's self-portrait, two arms pour water and salt in his head to prepare the dish that inspires his artwork: Italian pasta.

"Like an altered concentration of ingredients would lead to an unbalanced taste in a dish, an excessive presence of salt in tissues would indicate the presence of pathologies, e.g. tumors. In my artwork it's carefully depicted by a red spot where the grains of salt meet the brain, indicating high conductivity as observed in tumors."

During oncological treatment it is possible to measure alterations in the salt concentration in the brain. Mapping these alterations provides information about the status of the cancer. This can be used to monitor the treatment. The hope and expectation during treatment is that the tumors become smaller. The light in the background of the artwork eludes to the horizon and brighter future that he hopes lie ahead - curing cancer.

# I ART MY SCIENCE


## Colophon

### Participants

Ninouk Akkerman
Margherita Duca
Violeta Carmen Angulo Fernández
Alexander Damkær Hansen
Martina Huber
Sophie van der Leij
Linge Li
Emma Sudria Lopez
Bart Lutters
Renee Maas
Stefano Mandija

### Project concept

The Graduate School of Life Sciences
Dimitra Mousa
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Tania Morán Luengo

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Linda Eversteijn

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Michiel Langbroek

### Publication and promotional design

Haendehoch.nl

### Text writing/editing

Linda Eversteijn
Spiros Pachis
Tania Morán Luengo
Robert-Jan Eckhardt

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UMC Utrecht

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