THE DECOLONIZED MARS

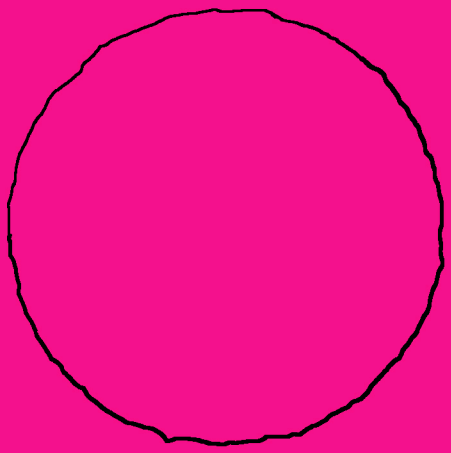

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TABLE OF CONTENTS

ABSTRACT

The decolonized Mars is a photographic science-fiction story based on the ongoing debate about the term “Anthropocene” suggested by Paul Crutzen and Eugene F. Stoermer in 2000. (Stoermer/Crutzen 2000: 17) In my thesis I am going to digitally visualize a version of one future’s nature. Is there such a thing as nature now and in a future and is it detached from culture and technology?

Story:

The story begins on earth, somewhere in one of the near futures. Plant species that were found to be possible candidates to live on Mars, are genetically engineered to withstand the harsh environmental conditions on Mars. DNA taken from multiple species like jellyfish or potatoes is mixed and matched and set on Martian soil. The role of these plants is to build an oxygen atmosphere for humans to be able to breathe in the future. Unexpectedly there is an undocumented bacterium on Mars, which starts transforming the plants as soon as alien DNA appears on Martian soil. Similar to Wolbachia bacteria, the Mars bacteria is able to transform the hosts DNA. Instead of terraforming Mars for human purposes, a new life form starts changing and transforming the Martian landscape unexpectedly and without control. As soon as human beings touched Martian soil, their DNA would also get transformed into something not categorizable. Changing and transforming its appearance and life form undisturbed and continually, the new organism, exchanges DNA but also thoughts, dreams, memories and knowledge. It is one big organism (referring to Gaia Hypothesis, Holobiont by Dr.Lynn Margulis).

Photographic practice:

Part one: are genetically engineered plants, which are represented by a photographed image. Each plant is built of different plant and animal pieces, consisting of one scientifically relevant plant and one historically relevant plant. With each fictive plant I refer to the roots of science and colonialism.

Part two: The Erythro bacteria, which lived on Mars undetected by human technology, is shown alongside an AI generated text about the fictive bacteria.

Part three: A transformation of Mars and its organism, represented by several images (also GIFs and sequences of motions or interpolations) generated by a GAN (generative adversarial network) programmed by Dr. Markus Goldgruber. The GAN is the metaphor for the bacteria on Mars, echoing the loss of control or relinquishing of control by humans.

INTRODUCTION

The debate about the term “Anthropocene” suggested by Paul Crutzen and Eugene F. Stoermer in 2000 is a debate about the perception of humans and or culture in nature. (Stoermer/Crutzen 2000: 17) It is a debate about the future of the concept of nature and the roots of the consequences we as humanity are facing now concerning environmental damage. And it is a debate about the relation of human, nature, culture and technology, which cannot be separated in my opinion.

In my thesis I question the term Anthropocene as the correct expression for the current geological epoch and want to find out who is acting as the more effective terraformer. Is it humans who shape nature or is it nature that forms human? Do humans have so much influence on the environment that they could transform a hostile planet like Mars into a flourishing environment for human purposes? Or could a pandemic like we are currently living through, or a tiny organism like Cyanobacteria, shape the future of humanity even more powerfully?

There is no doubt, certain human activity does have an impact on earth, and it does harm the ecosystems on earth and is causing climate change. (Stoermer/Crutzen 2000: 17) But this visibility of the human impact on earth’s climate leads to the belief that humanity has power over climate, because humanity did change it. For some humans this means that if they can change the climate on earth – no matter if for good or for bad – they can change the climate wherever they want. As if humanity (as an undifferentiated whole) were a superior force, completely detached from its location, taking control of earth and space.

If we consider visions of colonizing Mars and terraforming it to humanity’s (western-centric concept of) advantage, there is no indication of a shift of

western perception of nature and culture and a reattachment of the two, although climate change does get more and more attention finally. Western-centric societies consider themselves as the terraformers of earth and even of neighboring planets like Mars. Considering that bacteria have terraformed planet earth for the last billion years and are still doing a great job, (Harraway 2016: 99) it is also remarkable how much bacteria the human being itself contains. Not only do we share this earth with other creatures, organisms and tiniest living entities, we share our body as well. We are one another. Divided we do not survive. Together we recompose (Harraway 2016: 101) matter and energy continuously.

Just like in the science fiction story I am going to tell. It is a story about composting rather than about a post-humanist dystopia or utopia. (Harraway 2016: 101). It is about a never-ending transformation, relations and a symbiosis of living and non-living entities.

MOTIVATION

My reason for creating a photographic science-fiction story is my deep interest in natural sciences and science fiction. What fascinates me the most is the design and the ideas of how a future could look. Aside from the very colonial and sexist representations of characters, I was always wondering why in most science fiction movies or literature, humanity had to escape from earth in order to survive. It was usually not shown what exactly happened to mother earth, what we saw was just the glorious triumph of technology to save humanity and how we set off to new worlds.

When I first thought about a diploma topic, I was deeply fascinated by the bioengineering tool called CRISPR (Doudna 2018:86) and its possibilities – good or bad. I talked to the founder of CRISPR Therapeutics Rodger Novak who worked closely together with Marie Charpentier who was awarded the Nobel Prize in Chemistry 2020 for the development of a method for genome editing together with Jennifer Doudna. We talked about CRISPR's possibilities and its dangers, if it gets in wrong hands, but then again that's the case with almost every scientific achievement in history. While I was in San Francisco, doing research for my diploma, I reached out to Josiah Zayner, a so-called Biohacker. Him and many other like-minded people are practicing CRISPR without being part of the science elite or even using standardized laboratories. Josia Zayner is using his garage in Oakland. After working with NASA Ames Space Synthetic Biology Research Center, he decided to make CRISPR accessible to more people than just the elite. His idea was to let people without university background, experiment with DNA editing. (josiahzayner 2020) You can acquire a CRISPR-beginner set and sign up for his online classes for a small fee. Although I struggle with the idea that humanity should just bio hack nature, I liked the idea of facilitating scientific research for people from diverse backgrounds. I believe

that it is as much of relevance who is doing research as of who is using the achievements in what way.

At stochastic labs in Berkeley I met Alexander Reben. His work “probes the inherently human nature of the artificial. Using tools such as artificial philosophy, synthetic psychology, perceptual manipulation and technological magic, he brings to light our inseparable evolutionary entanglement to invention which has unarguably shaped our way of being. This is done to not only help understand who we are, but to consider who we will become in our continued codevelopment with our artificial creations.“ (Reben, n.d.) It was through him that I learned about the magic behind generative adversarial network generated images. GANs could be seen as an artificial version of parts of our brain. (Crespo, n.d.).

I was wondering if plants could be engineered, in order to be diligent oxygen producers on Mars. In fact, I found out that there was already some research happening in this field. Though I was imagining a romanticized thriving Mars flora, I imagined mars inhabited by humans, doing the same thing all over again, what was done to earth. Dreams of colonizing Mars are the dreams of billionaires like Elon Musk. It is important who is imagining futures. His vision of a future is the vision of a white, privileged, cis man, a very conservative image of a future. There is not much innovation in his imagination of Mars. So, I am going to show another alternative, while being aware of the fact that I am privileged too as a white European woman.

I couldn’t make up my mind about how to feel about categories like human, nature, culture or technology. What I experienced in San Francisco was an immersive tech-hype in Silicon Valley. Technology as the savior of humanity, but on the other hand a giant backlash against technology and its dramatic consequences for the environment. But there is not only good or bad, black or white, utopia or dystopia. My diploma is about the relations and shades in-between. Human is nature, technology is human, I believe.

So, I started spinning a yarn about one of many futures' nature. A science fiction story where my problem of separated categories vanishes.

The Anthropocene, a binary concept of nature

The Anthropocene, a term suggested by Paul Crutzen and Eugene F. Stoermer in 2000 is a broadly debated term. It was proposed for describing for a new geological epoch to ‘mark the profound ways in which humans have altered the planet.’ (Subramanian, 2019). The actual start date of the proposed Anthropocene is still under debate, but between the Agricultural Revolution 15000 years ago and the first atomic-bomb blasts which littered the globe with radioactive debris that became embedded in sediments and glacial ice (Subramanian, 2019), researchers favor the first atomic blast as starting point (Monastersky, 2015).

What the term Anthropocene wants to point out is the impact humanity had and has on the atmosphere and the ecosystem, but what it doesn’t explain is, who created this system of destruction and exploitation. Jason Moore suggests therefore the term “Capitalocene”.

‘For the Capitalocene—“Age of Capital”—is not an argument about replacing one word with another.’ (Moore 2016: 81) In his opinion the Capitalocene argument is able to express the history of cheap nature and the relations of capital, power and nature. I agree that the impact certain humans had on climate and the atmosphere cannot only be reduced to the industrial revolution. Moore’s argument points out that the Capitalocene is rooted in colonial appropriations of land and its nature. (Moore 2016: 81)

The concept of human (or culture) and nature as a binary concept has the result that everyone excluded from society is considered as natural, and everything natural is considered a resource and handled as such (Moore 2016: 81). For this reason, Indigenous people, Africans, women, Jews or

Irish were not part of the Eurocentric concept of humanity and never had and still do not have the exact same rights than a cis white male does. Social categories are based on decisions made by someone. Alienating others from whoever has more power.

'The symbolic, material, and bodily violence of this audacious separation—Humanity and Nature—performed a special kind of "work" for the modern world. Backed by imperial power and capitalist rationality, it mobilized the unpaid work and energy of humans— especially women, especially the enslaved—in service to transforming landscapes with a singular purpose: the endless accumulation of capital.' (Moore 2016: 79)

Colonial invasion changes the landscape, instead of only inheriting landscape. Changing and producing new landscape for dominion over place, people and plants also means capital accumulation and gain of power (Mastnak et al. 2014).

Under settler colonialism emerged the concept of "*gardening of eden"* , gardening the perfect landscape, reminding the settlers of their home, uprooting plants from the settlers original home, planting them in the colonized regions and destroying healthy ecosystems while "cultivating" the newly discovered plants, again to show dominance over nature and indigenous people. Playing god.

This is what the Anthropocene argument is missing. The term implies a binary concept of humanity as an undifferentiated unit versus the unit of nature. Which parts of humanity had the most influence and where it came from is not further explained.

The duality in nature and culture could be compared with our understanding of past and future. There is no future without past and no past without

present and yet we think of them as divided categories. Images of a future contain a past and a present.

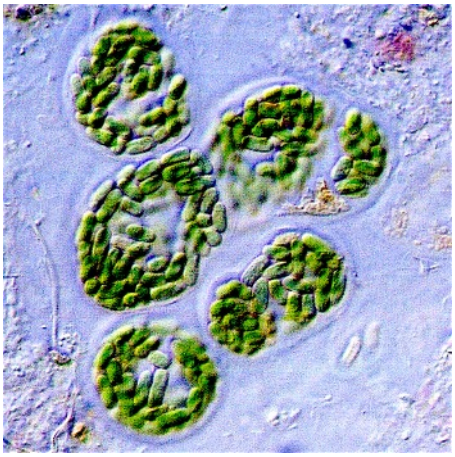
'Social change will be viewed as a push-pull process in which a Society is at once pulled forward by its own magnetic images of an idealized future and pushed from behind by its realized past. Poised on the dividing line between past and future is man, the unique bearer and transformer of culture. All of man's thinking involves a conscious process of dividing his perceptions, feelings, and responses, and sorting them into categories on the time-continuum. His mental capacity to categorize and reorder reality within the self (present reality) and in relation to perceptions of the not-self (the Other) enable him to be a citizen of two worlds: the present and the imagined. Out of this antithesis the future is born. Man's dualism is thus the indispensable prerequisite to the movement of events in time, and to the dynamics of historical change.' (Polak 1973: 1)

What this argument misses, is the relation of future and past. The imagined contains a past as much as the present does. Pushing time into divided categories does make it less tangible. The future becomes an object of conquest and control. I argue that the image of the future is in control of our present. The anthropocentric argument does include the present but doesn't really explain the future or the past. It doesn't communicate the complexity of an epoch in which humanity but also a wealth of further forms of life have an impact on earth and its future.

Bacterial life in the Universe

‘Not only did life originate on earth very early in its history as a planet, but for the first two billion years, Earth was inhabited solely by bacteria.’

(Margulis 1997: 29)



(Fig.1: Unicellular bacteria)

Bacteria are one of the oldest inhabitants of earth. Studies show that even a nuclear disaster could not destroy all lifeforms of earth, which is good news. It also means that humanity (emphasizing western-centric perception) does not have complete power over earth and life even with its most powerful weapon so far. Humans will most likely destroy themselves in case of a nuclear war, but life will continue without them. Of course, I would wish for a future including humanity, but I believe that this scenario is only possible if the whole of humanity starts acknowledging the importance of every lifeform living on earth and with earth. We are not alone. We don’t know for sure about the universe yet, but we do know about earth and even our bodies. ‘Diverse forms of life are running wild beyond the limits of human ethics, hopes, dreams, and schemes. Microbes are constantly moving, hesitating, vibrating, spawning possibilities within a spectrum of fuzzy values (Serres, 2007: 161) (Kirksey 2018: 199)

Roughly calculated, an average human body lives with two kilograms of bacteria. This is more than our brain weighs. They act as protector against harmful germs. Our body offers them a homely accommodation in return. There are also bacteria living with and in us – the so-called commensals – which we do not necessarily need, but which do not harm us as well. (Schierle 2011)
Bacteria stay with us longer than most of our partners, family members and friends do. Studies show that strains of bacteria colonize a body in the first two years of life and stay there for the decades to come. Not until a few days after death, they depart from our bodies. They live with us but also outlive us.

"Pushing beyond anthropocentric concerns, into the world of this microbe, also offers an opportunity to imagine the possibilities of life without us. Even if Anthropos destroys itself, and other creatures we love, perhaps it is possible to embrace post-human futures with compersion. Learning how to love and care for invertebrates, and their microbial companions, in an era of extinction could open up lively post-human possibilities." (Kirksey 2018: 201)

In "Queer Love, Gender Bending Bacteria, and Life after the Anthropocene" Eben Kirksey suggests a term for the current geological epoch instead of the human-centered Anthropocene, the Wolbachiacene. (Kirksey 2018: 209)

Learning about the Wolbachia bacteria I started understanding the power of bacterial life and stepping out of the human-centered point of view we usually learn from western society. Bacterial life happens next to us, in us and in earth, in soil. The Wolbachia bacterium is especially interesting as it is able to transform DNA. It changes life not only over a huge period of time, but as well in a very tangible short one.

‘Wolbachia are promiscuous parasites that are subtly transforming the known world.’ (Kirksey 2018: 203)

Wolbachia bacteria transform male DNA into female DNA in their hosts like flies and fruits. They use different techniques to do so: Killing male hosts by infecting them during larval development (Hurst et al. 1999: 735), feminizing their hosts during larval development so they are born as females or similar. (Fujii et al. 2001: 855) and reproduction of female hosts without the need for male hosts (Parthenogenesis) and stopping male hosts from reproducing with uninfected females. (Breeuwer/Werren 1990: 346)

Other bacteria like Cyanobacteria (Kirksey 2018: 203) did not transform DNA but planetary life as a whole. The first microbes to produce oxygen on earth were forces of life and destruction at the same time, as they helped built an atmosphere, we could live in but also were responsible for a mass-extinction 2.3 billion years ago. “The cyanobacteria producing the oxygen caused the event, which enabled the subsequent development of multicellular life forms.” (University of Zurich 2013). To generate a biosphere on Mars suitable for humans to live, it is again Cyanobacteria which could be used to transform a planet.

“However, resources needed to grow specific cyanobacteria are available on Mars due to their photosynthetic abilities, nitrogen-fixing activities and lithotrophic lifestyles. They could be used directly for various applications, including the production of food, fuel and oxygen, but also indirectly: products from their culture could support the growth of other organisms, opening the way to a wide range of life-support biological processes based on Martian resources.“ (Verseux 2016: 65)

Plants grown on Mars, within an artificial biosphere or without, would need cyanobacteria as their companion.

“The human microbiome, the flora and fauna of our gut, contains a multitude of symbiotic companion species” (Haraway, 2008; Wilson, 2015; Helmreich, 2016). As Lynn Margulis points out in her concept of the holobiont, a human and its microbiome form an ecological unit together. (Margulis/Fester 1991)

In a way, when James Lovelock and Lynn Margulis developed the Gaia paradigm, they explained the same operation just on a larger scale. Like the microbiomes of humans, living organisms like humans interact with their environment (earth), existing as a self-regulating system of life. (Lovelock 1972: 579) When we go further and look at Buckminster Fuller’s Spaceship Earth in the context of the solar system, we see it is a self-regulating organism interacting with other planets and the sun, which builds yet another synergy in the universe.

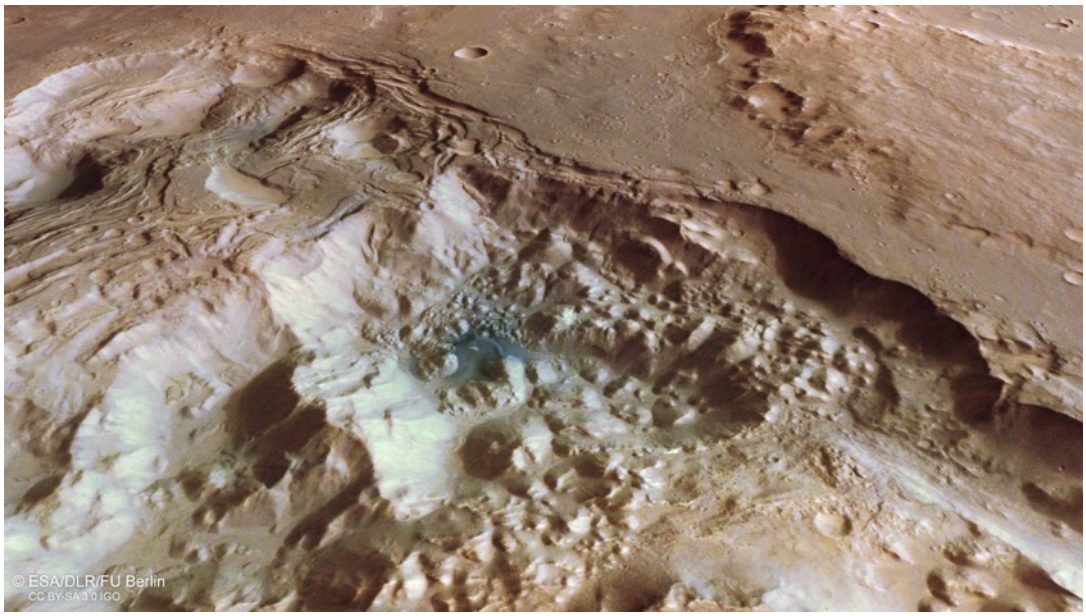
In my story, after technologically advanced attempts to conquer Mars, a synergy of technology, nature and human with Mars is born. A life form representing Buckminster Fuller’s “Ephemeralization”, where the sum is greater than its parts, but every part in itself houses the same importance. The Mars organism gets close to the “ability of doing more and more with less and less, achieving almost everything with nothing.” (Fuller 1938: 252)

Images and science: There is more to a picture than meets the eye

Images and data in science are abstractions of nature pushed into categories. For a long time, the atom was believed to be the smallest division of matter. The atom, the abstraction of the component everything we know so far is made of. Abstractions help to understand the unknown, but an atom in isolation does not explain its essence, neither does a quark or a Higgs-boson. It needs relation. (Whitehead 2015: 111)

Through observing nature artistically or scientifically (which were not always separate forms of observation), it was possible to discern certain patterns. With those patterns, one could find similarities in different celestial bodies for example. Patterns in the movement of the moon and the stars would show that the earth might not be the center of the universe. But all the images science approaches are only abstractions of a universe or a culture or a nature we are able to see. Technological progress is just the extension of our senses and our minds.

‘Astronomy has always been an observational science. Images therefore play an important role in it, starting with drawings made during observation by eye or since the 17th century by telescope, to photography, which has been used in astronomy since the 19th century, to today's » Data images «, which are produced from data that are transmitted to earth by high-resolution cameras, or the simulation images that are based on theoretical assumptions and highly complex calculations.’ (Adelmann 2009: 14).



(Fig.2: Perspective view of Pyrrhae Regio, Mars)

Dr. Markus Goldgruber, who helped me with my work by coding the Generative Adversarial Network, the algorithms generating the Mars organisms of my story, creates those simulation images based on theoretical assumptions and complex calculations for a living. He works with simulations, gathering information from these images and doing calculations based on other data images. He tells me he needs to see his calculations as images, otherwise at some point the data itself reaches its limits of usefulness or he reaches his limits of understanding just raw data. We both work with images. Him as an engineer and me as a photographer. Our images do not of course contain the same information and they reach very different people. But we both need images to express the ideas and information we gather. Even images generated by a GAN also somehow express what it learned from the database I fed it with.

“The computer is an imitation human brain. There is nothing new about it, but its capacity, speed of operation, and tirelessness, as well as its ability to operate under environmental conditions intolerable to the human anatomy, make it far more effective in performing special tasks than is the skull and tissue encased human brain, minus the computer.” (Fuller 1969: 118).

Images, in science or elsewhere, are able to show, to illustrate or exemplify the invisible and the visible. But even databased images which we can find in scientific magazines or books are images shown after a long chain of human decisions, technical manipulations and human interpretations (Adelmann 2009: 16). Like Adelmann, Frercks, Hessler and Henning say in "Datenbilder" "The process of making the image is part of the image itself." (Adelmann 2009: 13) or who is generating the image is part of the image, whether in science or in art.

"Technically, the digital image itself is an artifact, literally, a thing that is contrived, devised, fashioned, or made by a human. Remember this whenever you interpret CCD images: The image is not reality. It is an artifact. And it is full of artifacts. Do not mistake an artifact for reality." (Berry/Burnell 2000: 505) (Adelmann 2009: 16)
This doesn't mean that those images are fiction, but it means that they are a product of humans. Even through the eye of technology, they will never be objective enough to be the truth, only a truth of a human consensus or a truth we are able to understand with a human mind. (Adelmann 2009: 16)

In my series „About the Universe" from 2018, I create scientifically inspired images, but there is nothing scientifically relevant about them. The series is a visualization of a thinking process about abstract theories. What the documentary part of the series does show is my interpretation of the scientists' everyday work life, of their work environment, but also of their inherent playful approach of abstract thinking and imagination. The image "Solar plasma" apparently shows a solar eclipse. But in fact, it shows a piece of perforated black fabric with a circular hole in it, through which flashlight is radiating. A black disc made of paper in front of the hole creates the impression of a celestial body in front of a sun. Steam coming from an iron provides the solar plasma look around the celestial body. This image could have been created in so many different ways, never with the exact same outcome, but mostly with the same impression.

In the last part of my current work, my thesis, Generative adversarial networks (from now on called GANs) generate images of fictitious organisms living on and with Mars. The images are the output of various images the GAN was fed with. I do not have control over the outcome, neither can I manage how the GAN is learning, but still, it is always dependent on what data I feed it with. For the GAN, every image is an accumulation of pixel data. It analyzes pixel by pixel, row by row, column by column. Then it looks for similarities or patterns in these accumulations of pixel data. What it creates in the end I could be called “Datenbild”. A term Ralf Adelmann, Jan Frercks, Martina Heßler and Jochen Hennig suggest in their book “Datenbilder” for images based on data. (Adelmann 2009: 16,122)

In my series I play with the aesthetics of the scientific image, while there is no scientific relevance to the images themselves. But their structure itself invites us to rethink scientific practices.

Images in science and art do have a similarity in their function. They enable an intuitive comprehension of a certain topic or knowledge. They are an illustration of the invisible and work as a communicator. (Adelmann 2009: 128)

PRACTICE

Words shape futures, just as images do. But who is creating this language and imagery has an impact on those futures.

The emphasis in my science fiction story is on the relations between organisms and the power of the tiniest amongst us. Hence the main characters are plants, bacteria and unknown organisms transforming the landscape, instead of oppressing humans doing so.

My work contains 3 visual parts in three differentiated imageries:

1.) The genetically engineered plants

2.) Erythro bacteria

3.) Mars organism or the perpetual transforming and morphing living thing

Part 1: The genetically engineered plants

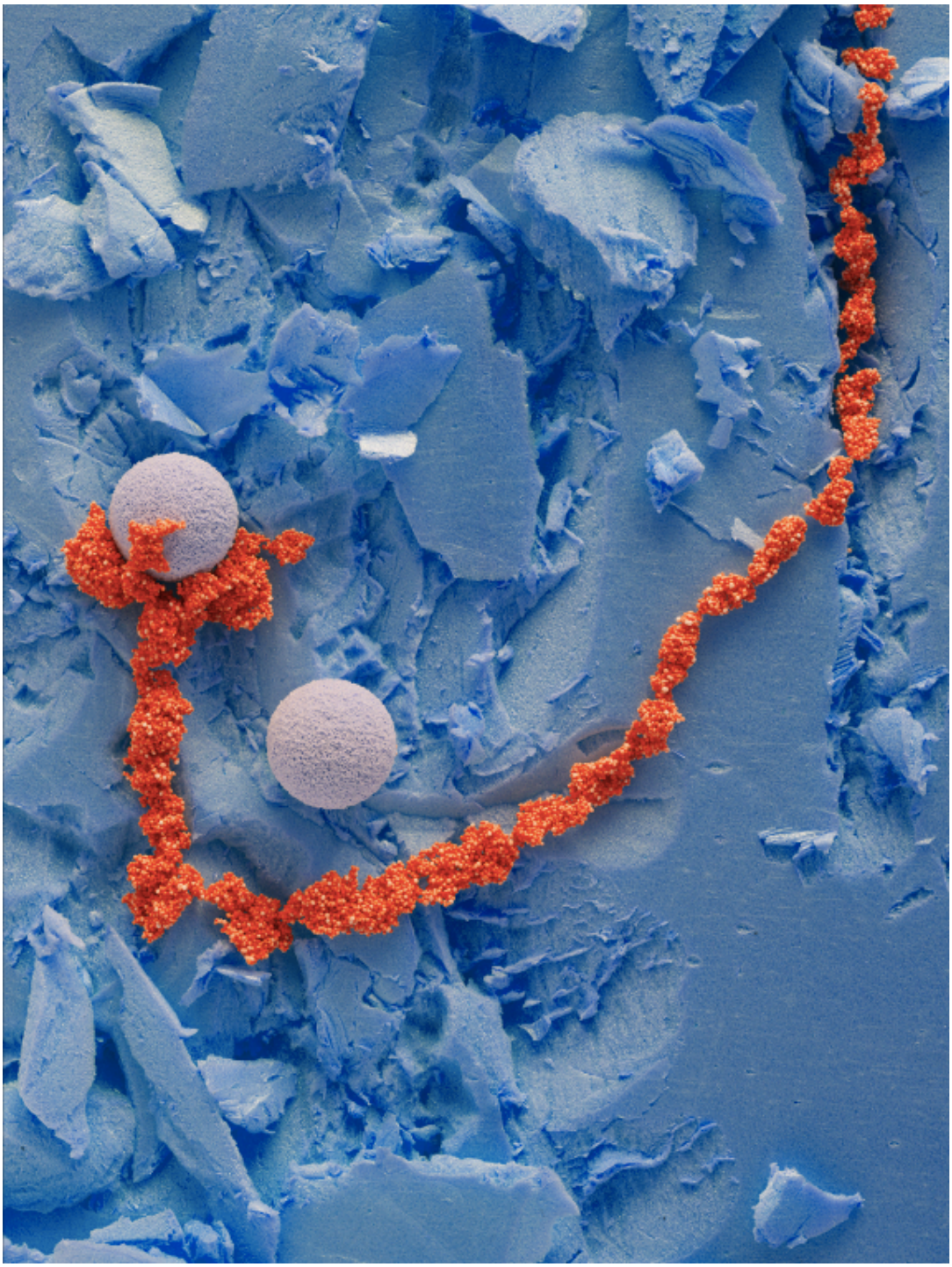
(Fig.3: Solanum melongena X Mnium hornum X Catalpa X Peperomia caperata)

The genetically engineered plants contain a part of a plant which was imported during colonialization of the Americas or other continents by the Europeans. For example, the pineapple, which was taken by Christopher Columbus as one of the first “exotic” fruits to be brought to Europe. Further the images contain a part of a plant on which research was done to examine whether they are possible candidates to be grown on Mars.

Through the Columbian exchange or European colonization, plants, humans, animals, microorganisms, technology and ideas were transplanted between the continents. Today certain humans dream of colonizing Mars and do so by the same old pattern. Transplanting first plants, microorganisms and technology, then humans.

I chose the aesthetics of a herbarium in my images, because it combines the scientific approach of examining plants and uprooting them from their environment and the capitalist approach of classifying them to make them accessible for trade. The western-centric scientific approach paves the way for the capitalistic exploitation of resources and lacks a broader vision in which a future without humanity's control over nature is possible. This is why in my story the undetected Erythro bacteria becomes the most powerful entity. It doesn't control Mars either, but it creates and lives with Mars and builds a Martian version of Gaia.

Part 2: The Erythro bacteria



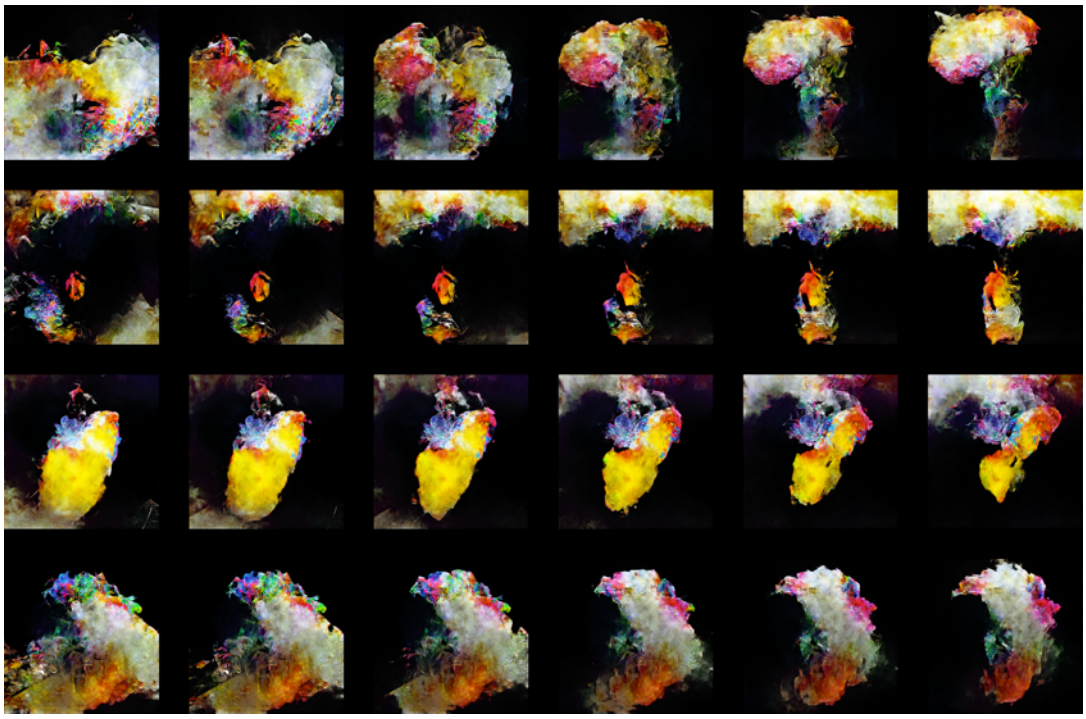
(Fig.4: Erythro bacteria III)

The Erythro (comes from the Greek erythrós for red) bacteria which is made up by me refers to the terraforming stars of earth: the Cyano bacteria as

well as the DNA-transforming bacteria, Wolbachia. Erythro bacteria is the true main character in my story, although shown just randomly and small sized in a magazine page torn out. The text on the magazine' page is an AI generated text about the made-up bacteria. The text generator was fed with three sentences ripped out of context about scientific approaches and the fictive Erythro bacteria. I chose the format of a ripped-out magazine page to create the impression of the scientific inspiration of my work, but also to put in context how little attention the smallest entities get when it comes to the naming of a new geological epoch.

Part 3: Mars organism or the perpetual transforming and morphing living thing

The perpetual transforming and morphing living thing is the answer to my question about the dominance of humanity over nature. In my story there is no separation of human/culture and nature/technology on Mars anymore. Oppressing humans have no control over Mars. Humans landing on Mars and touching the bacteria will be transformed into a part of the perpetual transforming and morphing living thing. Which doesn't mean humans' death. The human now will be an inseparable part of a living planet.



(Fig.5: Mars Organism III)

The formal realization of the images is carried out by Generative Adversarial Networks coded by my husband, as a metaphor for the DNA being transformed and the infinite number of variations and mutations generated by the bacteria or the GAN, respectively. The GAN is fed with the images of the genetically engineered plants from the first part of my work.

SUMMARY

In my thesis, though I am inspired by science in my fiction, I want to inspire science by creating images of one future which breaks with the current mindset of overwhelming power over nature wielded by humanity or science and technology.

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LIST OF FIGURES

APPENDIX

(Fig.6: Curcuma longa X Dryopteris erythrosora X Bryophyta)

(Fig.7: Zingiber officinale X Lentinula edodes X Lagenaria siceraria)

(Fig.8: Ananas comosus X Lentinula edodes X Polyporaceae)

(Fig.9: Solanum lycopersicum X Polyporaceae X Phaseolus)

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