



NOTES FROM THE SUBSURFACE

DR CHARLIE TWEED
DR TOM WILLIAMS

EARTH ART GALLERY
ARTIST FELLOWSHIP JOURNAL
SCHOOL OF EARTH SCIENCES
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BIOGRAPHY
CHARLIE TWEED

Charlie Tweed is an artist and academic based in Bristol. His video, text and performance based works interrogate the affective qualities of digital technologies and their use in the control and management of populations and environments. He employs strategies of re-appropriation and speculative fiction, often taking on personas of anonymous collectives and hybrid machines, to outline subversive plans for enhancing and escaping control mechanisms and renegotiating relations between human and non human.

His films have been screened internationally at venues including: ICA, London; CCA, Glasgow; Whitechapel Gallery, London; Forum Des Images, Paris; HKW Berlin; Watershed, Bristol; Plymouth Arts Centre; CAFA, Beijing; Quad, Derby; Eastside Projects, Birmingham; Castlefield, Manchester.

Recent commissions include a Wellcome Trust Large Arts Award for the production of a new film work in collaboration with a biomedical scientist that considers the future of genetic sequencing technologies. He is also the curator of the Digital Ecologies symposia series at Bath Spa University which considers new approaches within contemporary art practice that interrogate themes including the digital anthropocene, digital materialities, fiction machines and post-truth conditions.

He has a PhD in art practice (Kingston University) and an MFA in art practice (Goldsmiths College, London).

Exhibitions

Solo Exhibitions

2020 *Notes from the subsurface*, Earth Art Gallery, Earth Sciences, Bristol University. Find out more here: www.earthart.org.uk/Charlie-Tweed
2017 *Soon we will become output*, Stanley Picker Gallery, London
2013 *I am Algorithm*, Aspex, Portsmouth
2013 *I am Algorithm*, Exeter Phoenix, Exeter
2011 *Notes I,II & III*, Alma Enterprises, London
2010 *Notes I,II & III*, Spike Island, Bristol

Selected Group Exhibitions, screenings and performances

2020 Visions in the Nunnery, Nunnery Gallery, London
2020 Strangelove Film Festival, (Official Selection)
2020 Labocine Magazine Spotlight: *Humans, nature and control*
2020 Emotional Interfaces screening and performance event, La Machine Du Moulin Rouge, Paris.
2019 Rencontres Internationale Paris/Berlin, Pompidou Centre, Paris and HKW Berlin (official selection)
2019 Emotional Interfaces online exhibition, Wrong Media Art Biennale (official selection)
2019 Black Box, Biomedicine West Wing Foyer, Times Square, Newcastle
2019 0.1%, Navel Gallery, Los Angeles, USA (sci/art group exhibition)
2019 Aesthetica Short Film Festival, UK (official selection)
2018 Visions in the Nunnery, Nunnery Gallery, London
2018 TBCTV, Somerset House, London
2018 Altered States, Crypt, London
2017 WRO Media Art Biennale, WRO Center, Poland
2017 VAEFF, Tribeca Film Centre, NYC
2016 NeON Digital Arts Festival, Dundee
2016 Selected 6 (curated by Videoclub), touring to Whitechapel Gallery, Watershed, Plymouth Arts Centre, CCA Glasgow)
2016 Both Sides Now 3: Screenings in East Asia
2016 Silent Signal, Wellcome Trust Commission produced by Animate Projects touring to: Quad, Derby; Vivid, Birmingham; Lifespace, Dundee; Oberhausen Short Film Festival
2015 We are publication – film screening, ICA, London
2015 The Signal and the rock, Performance Lecture, CAFA, Beijing
2014 'Art in the city talks: Charlie Tweed', Arnolfini, Bristol (screening and talk)
2012 The London Open, Whitechapel Gallery, London
2011 Grizedale Arts Residency Programme and performance event, Cumbria

INTRODUCTION

'Notes from the subsurface' is a new film produced by Charlie Tweed as a result of his Earth Art fellowship at the University of Bristol in 2019. Exploring lifeforms and ecosystems within the earth's deep subsurface, the film has been built from ongoing discussions and collaborations, drawing out the research from the Schools of Earth and Biological Sciences within the university.

The work delves into deep subsurface environments and the extremophiles that live within them to consider how these lifeforms can function at extreme depths and pressure within challenging conditions such as highly acidic, high temperature, high radiation, low oxygen and methane heavy environments. The film references the zonation of lifeforms and their ability to live over vast timescales and with varying metabolisms that are far removed from those of humans. The work also considers notions of deep time and non-human temporalities, including lifeforms that exist, and geological processes that take place over hundreds, thousands and millions of years.

Characteristically, Tweed's work employs strategies of re-appropriation and speculative fiction – often taking on personas of anonymous collectives and hybrid machines – to outline subversive plans for enhancing and escaping control mechanisms and renegotiating relations between human and non human. To achieve this, Tweed uses archive footage by remix and bricolage methods throughout his films.

Through sci-fi narratives, the twelve minute film (1) exposes non-human and multi-species perspectives, hidden networks and unheard voices. Beginning with bird-eye view footage of the Burgess Shale in the Canadian

Rockies, the film's initial documentary approach comments on the soft bodied organisms fossilised in the sediment that was once below our feet.
(2)

The machinic narrator gives factual information about the ecosystems and lifeforms that it encounters, enlisting modified ambient noise tomography as a way to anthropomorphise these lifeforms - voicing their perspectives. As a result, we hear from Nematodes, in an old gold mine, discussing their dauer stage and their ability to go into a form of cryogenic suspension when resources are scarce. We also encounter the Methanogens who disclose their 'love' for carbon as well as the anonymous CPR Bacteria, of which huge colonies exist in the subsurface with very little known by scientists. Here, the film draws attention to the alien world of the subsurface whereby lifeforms have given hope to researchers exploring extraterrestrial life.

The second part of the film takes a science fictional approach; as the narrators firstly develop proposals for adapting humans to live in these extreme conditions, utilising a 'Vision Space' to adapt their perspectives and then employing designs for hybrid future lifeforms capable of living within these environments. With designs generated using an AI neural network app (creating images from text), it references discussions around genetically modifying lifeforms for extraterrestrial exploration. The film closes with new lifeforms brought to life through an evolved form of bio printing, leaving us thinking about whether these will function as the future of human life on earth.

With reference to historical literature and current research papers, the exhibition space gives opportunity to explore reading of Donna Haraway, Timothy Morton, Bruno Latour and John Law's work on Actor Network Theory (ANT) and Guattari in *The Three Ecologies*.

¹ Watch the film 'Notes From the Subsurface' here: www.earthart.org.uk/Charlie-Tweed.php or on vimeo here: vimeo.com/379758583

² soft bodied organisms fossilised - these fossils are over 500 million years old and part of the Cambrian explosion, a moment when many new forms of life appeared on the earth. There are a number of Burgess Shale fossils in the Earth Sciences collection, some of which are displayed in the exhibition.

LECTURE

NOTES FROM THE SUBSURFACE

So the film and related materials are the result of my discussions with researchers Dr Tom Williams and Dr Heather Buss, who will be speaking after me about their research and expanding on some of the content of the film.

I'd like to begin by thanking the department for the fellowship opportunity which has proved very productive and I'd like to thank Tom and Heather for their invaluable input. And also like to thank Claudia Hildebrant for all of her help, taking me through the collections and providing me with many excellent insights and of course organising the exhibition of the work. And also Georgia Hall for her work on the interpretation materials and text.

I wanted to begin by providing some context to my practice, and the sorts of methods that I have used during the fellowship.

My video, text and performance works have often considered the human relation with technologies, interrogating their material and affective qualities and their use in the control and management of populations and environment. In the work I employ strategies of re-appropriation of still and moving images and text, as well as fictional writing. In the work I often take on the personas of anonymous collectives and hybrid machines: devising subversive proposals and manifestos for enhancing and escaping control mechanisms and for developing new relations with non humans. In relation to this project, the exploration of the underground as a place for alternative ways of living and thinking has been an ongoing theme within my practice.

Here is an early work which utilised a fictional alter-ego the MFB - to

make a subversive proposal for a safer life underground for the Citizens of Bern, Switzerland as part of the show dragged down into lowercase.

From the early alter ego works, my practice has developed into taking on the voice of anonymous collectives and power forces sometimes human and sometimes non human.

In *Notes I,II &III* at Spike Island I constructed a series of eight short propaganda films which addressed human control desires and their related belief systems. The works acted as anonymous calls to action, voicing proposals for new ways of living, new relations between technology and ecology, new visions of human and non-human agency.

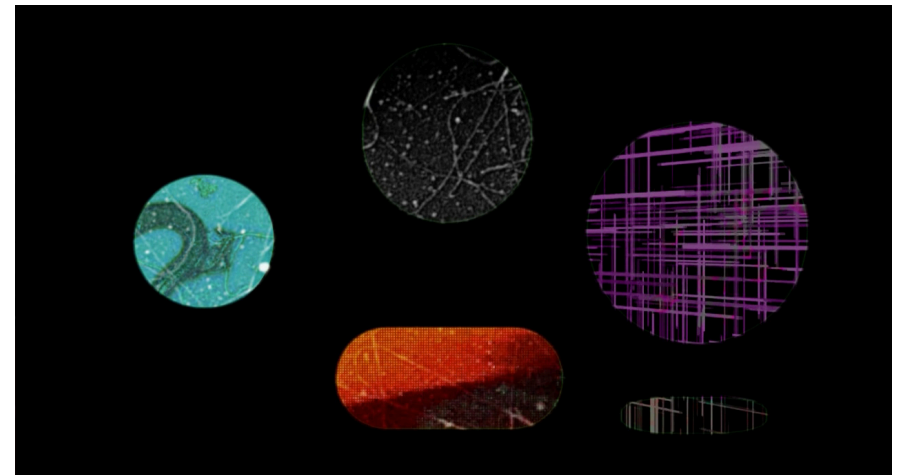
Another project that has contributed to my approach is *The Signal and the noise*, a Wellcome Trust funded sci/art project that was produced by Animate Projects London and part of the larger project *Silent Signal*.

In this film I collaborated with a biomedical scientist Dr. Darren Logan at the Sanger genome campus in Cambridge. Here I made a work that exposed some of his research and looked to the future, considering the parallels between computer coding and genetic coding in humans and animals. The work's narrators consider ways of editing and improving their code using actual genetic technologies such as CRISPR and OPTOGENETICS to do this.

Whilst the work appeared to be a piece of science fiction, all of the technologies and ideas discussed were based on actual advances and research, and visions of how things might materialise in the future. So these are some of the projects that led me towards the concept for the film made during the Earth Art fellowship and they have all informed the approach taken in particular ways. The focus on the subsurface began for me as an interest in its alien qualities, as a space below the human world that is still largely undiscovered and contains many questions about the lifeforms, metabolisms, temporalities and ecosystems that exist there.

A space where extremophiles are able to operate within challenging conditions such as high temperature and high pressure environments. The Fellowship provided me with a vital opportunity to begin to understand these communities and to connect with the dynamic research taking place in earth sciences and life sciences.

I wanted to generate work that was able to bring some of this research into view, whilst also employing my fictional methods to draw out some critical proposals for the future of the human. For me it was important that the scientific and art research became an assemblage of interactions and potentials and these also play out in the display cases in the gallery. In order to talk about this in more detail, I wanted to now present a semi-fictional piece of text that aims to take some of these ideas a little further and expose some of the thinking behind the final video work and the focus of the Fellowship.



FICTIONAL MANIFESTO

I use these words to make myself into other species, machines and objects.

I becomes WE, becomes a sensor, or a future specialist technology seeking out new directions, a translation mechanism, an anonymous powerforce, a collective of potentials.

WE, want to unravel non human perspectives, and move away from a singular voice. We want to harness the functionality of algorithmic governmentality, in order to take another path.

THEREFORE, We have developed the subsurface laboratory, a vast space, stretching 5000 metres down.

It can be accessed from just below your feet, descending through the basement of the Wills Memorial Building, into the deep tunnels that connect to the Redcliffe Caves before the final descent. It is a research site embedded within the earth and its layerings, that stretches its tentacles out for thousands of miles in every direction.

Despite extreme heat, minuscule nutrition and intense pressure, we know that the subterranean biosphere is teeming with many tonnes of microorganisms, hundreds of times the combined weight of every human.

Our technologies and sensors are observing and monitoring their metabolisms and behaviour.

The diversity of these underworld species bears comparison to the Amazon or the Galápagos Islands, but unlike those places the environment is still largely pristine.

Therefore, We feel that, it, is a place of possibility.

It is also a good place for collaboration between scientists, artists, writers, non humans, machines, fossils and AI. It is a good place for co-creation, a good place for collective thinking.

It is also a good place for discovering new patterns for living, and for seeking out generative joy and terror.

Our technologies allow us to monitor and learn from the subsurface lifeforms, using our translation mechanisms and our fictional writing approach to 'listen' to them.

Our exploration machines build on the super computers that were used by HUMANS for oil exploration, they demand enormous computational power and enable massive data management.

They are able to do 4,000 trillion calculations per second.

In our work, we value improvisation, jump cuts/

And randomiser algorithms... encouraging participants to perform as other species, to relocate their consciousness.

We are encouraging them to work together in order to design new futures.

Many say that 'the human' has little to be proud of these days.

That the human induced anthropocene is all about shooting itself in the foot, with its narrow vision of the planet, and of other species, as it fracks them to pieces and emits its effluent.

We feel, that the social body is in paralysis, unable to come to terms with the calculation for the probabilities of their own future. The future that their data economy does not wish to see.

Whilst the possibility of rethinking conditions deteriorates, the only decisions they make become filtered through their technical apparatus.

Whilst the surface burns they view it through their screens, AND their hand gestures, their TAPS, CLICKS, SWIPES, LIKES and pinched in ZOOMS. These become the RESPONSE.

As Stiegler notes, these screens drive entropy in their users, they anticipate and outstrip their thought processes, their words, their decision making.

Meanwhile, we make plans for further extraction.

In the Subsurface Laboratory, we are focused on bringing a new visibility. Opening up perspectives, by turning OUR vision toward the ground. Towards the pristine layerings that lie beneath our feet.

We want to bring the subsurface lifeforms and ecosystems into view, and understand non human temporalities, and functionalities.

OUR approach connects with Donna Haraway, who calls for the use of fiction to develop multi-species perspectives using stories 'that are just big enough to gather up the complexities and keep the edges open' (Haraway, 2016, p.82).

Following Haraway, we want to make kin with rocks, fossils, machines, archaea, methanogens, nematodes, CPR bacteria and rethink ourselves as a species. As a new type of 'collaborator'.

In the writing of Ursula Le Guin, and Octavia E. Butler, fictional social

experiments are used in order to outline models which rethink our engagement with other living worlds, both interplanetary and terrestrial.

Le Guin outlines the notion of "dispossession" as a "change of mentality," in which statelessness and being without property is the precondition for genuine freedom.

In Parable of the Sower (1993) Butler proposes a politics of hyperempathy, a notion of interplanetary cooperation and interplanetary guesting.

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Meanwhile, Simon O'Sullivan notes that fiction can be used not as a matter of 'make believe' but rather in a Ranciere sense of forging the real to better approximate historical and contemporary experience (O'Sullivan, 2017: 6).

SO in our work, we harness fictioning to develop our proposals for future relations between the human, the non human, the ecological and the machine.

Using fictioning as a tool and a weapon that infiltrates and actively pursues alternatives.

WE EXPOSE the functionality of long extinct fossils. Building them into our thinking.

We are thinking about how temporality is spatially embedded, in sedimentations and condensations, which have the potential to form a kind of object that operates as what Deleuze would call a radioactive fossil: objects that through their own charge and materiality make transversal cuts through time.

Such objects can act as portals to collapse temporal moments together.' THUS, We consider the Burgess Shale lifeforms and connect them with our present and our future.

When we see a rock, we don't see stasis, but movement, temporalities that flow over centuries and millennia, and when we look around at humans and non humans we cannot distinguish them, we see the tangled web of relations, complex meshes and trees of life.

Timothy Morton calls for humans to become more aware of their entanglement with other species, and he defines the notion of the hyperobject, an object so vast and distributed that it is beyond human vision, the subsurface and its vast scale and set of ecosystems could also be labelled as a form of hyperobject.

In Morton's terms, the words on this paper are contingent on a complex mesh, that includes dependency on trees and sunlight.

...

We are feeding all of our research data into a vast set of neural networks to produce designs for hybrid future lifeforms, capable of living within the deep subsurface. For us, it makes sense to position the future of the human species in the hands of AI technology, feed them to their machines we say.

OUR strategy for future human life functions as a form of montage of different lifeforms, research and data, an assemblage of quotes and ideas.

We see value in reappropriation, and re-assemblage.

This approach drives our hyperempathy, enables new imaginative models for more-than-human comradeship across coexisting scales of time and space.

We also build here on discussions around genetically modifying lifeforms for extraterrestrial exploration.

We connect with Guattari, who in *The Three Ecologies* calls for the creation of new experimental living species via a constantly mutating socius, an environment in the process of being reinvented.

Species with self regenerating circuitry, that are future proofed. Reformatting and escaping the limitations of HUMAN code.

Lifeforms that harness the functionality of the Altiarchaeles, the Methanogens, the Nematodes, the CPR bacteria, the Magnetic bacteria. Capable of living under extreme pressure, in high temperatures and toxic conditions, lifeforms that enjoy highly acidic, high radiation, low oxygen and methane heavy environments, lifeforms capable of living with minimal nutrition, with very slow metabolism.

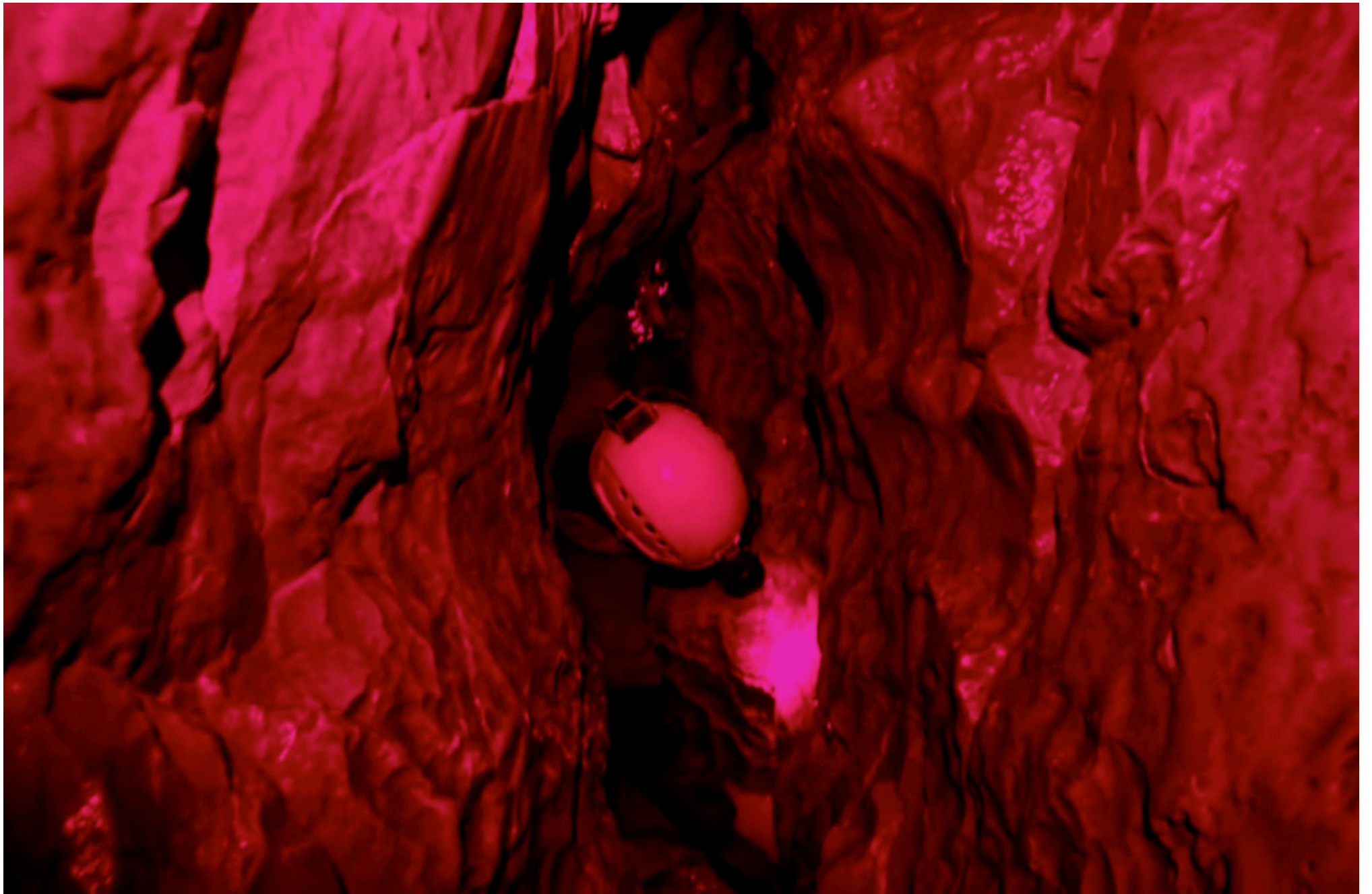
Lifeforms capable of feeding happily on rocks or carbon or lying dormant for vast timescales over centuries and millennia.

For us, the future can taken only one direction,

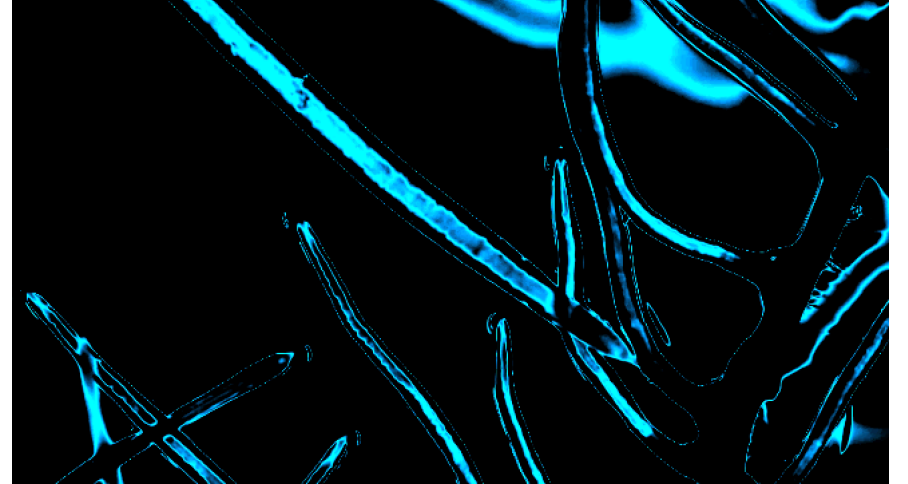
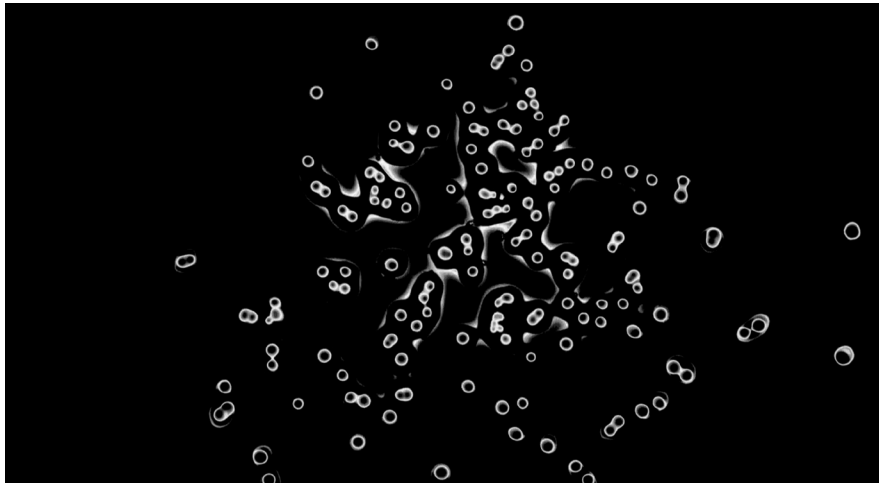
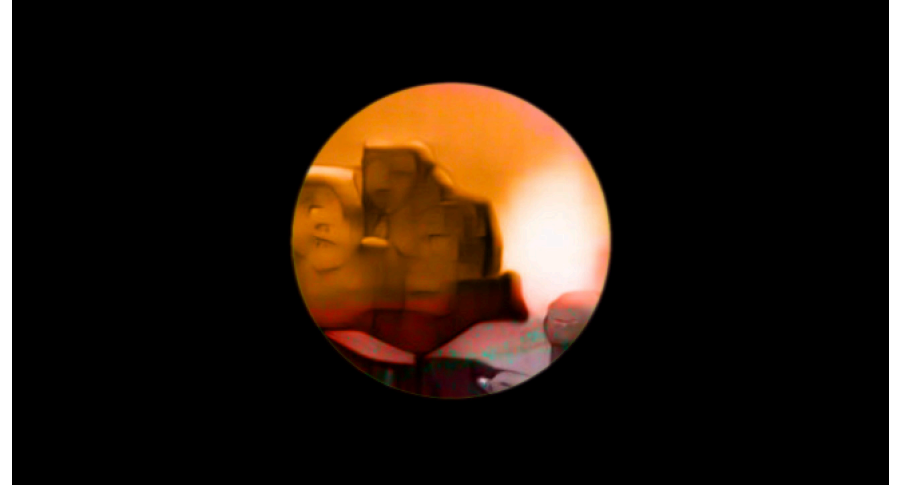
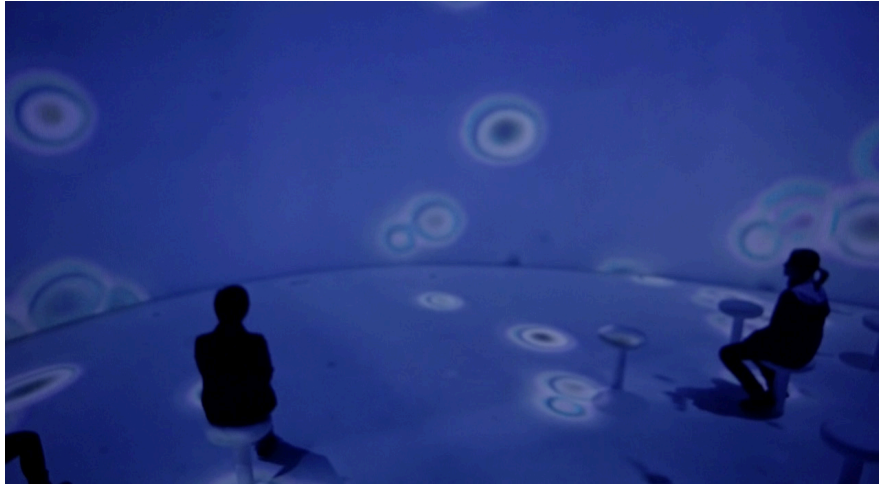
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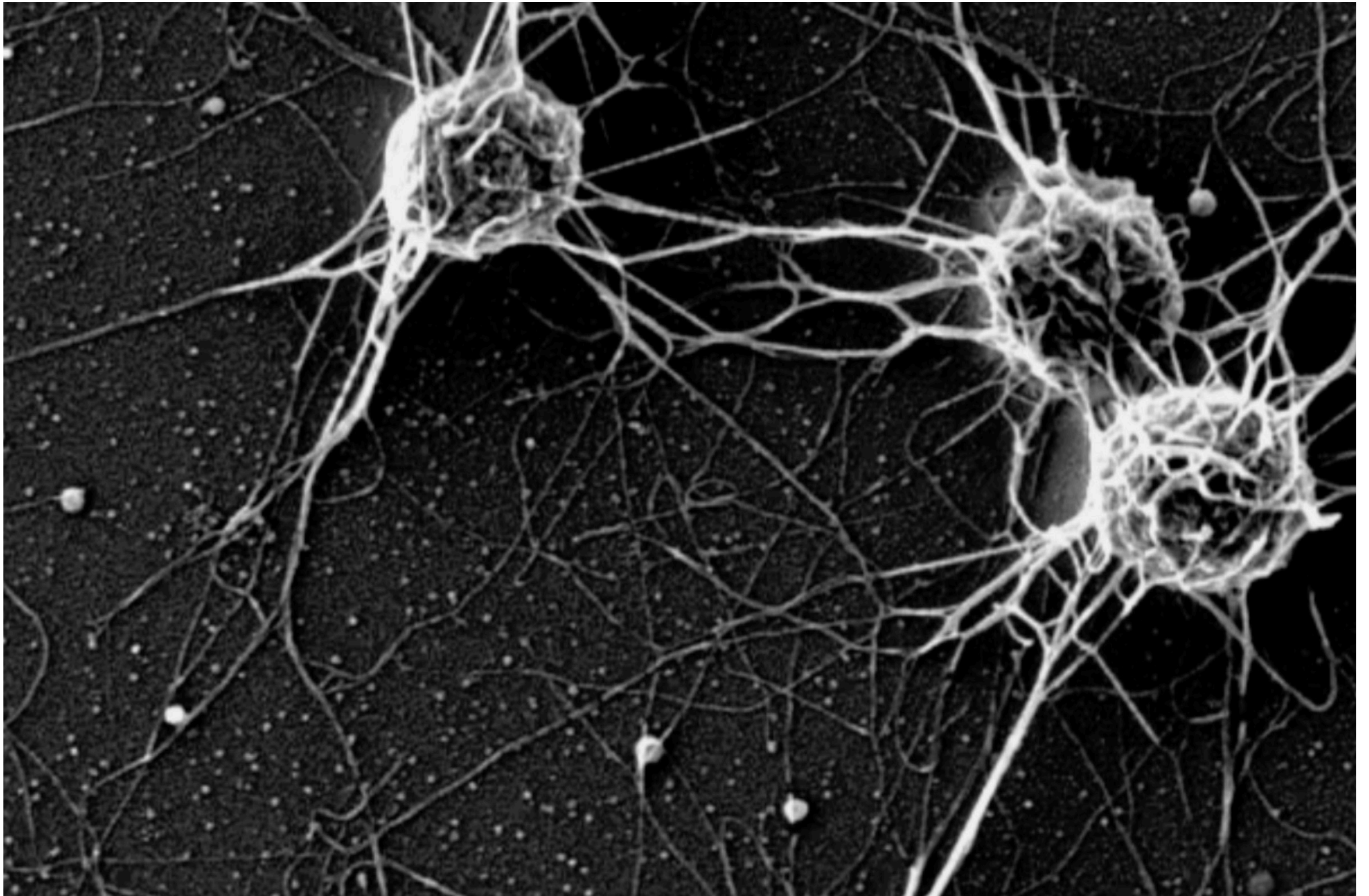
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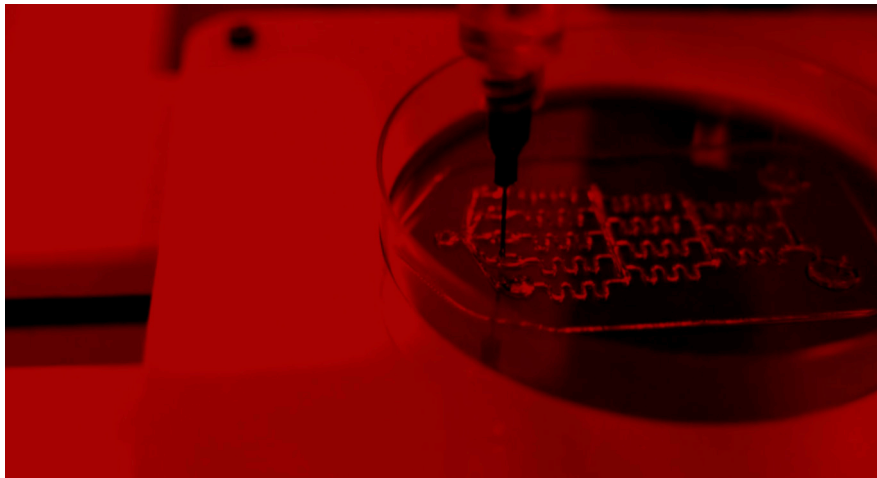
the only way is down.











*INTERVIEW WITH
PHYLOGENETICIST DR TOM WILLIAMS
BY ARTIST DR CHARLIE TWEED*

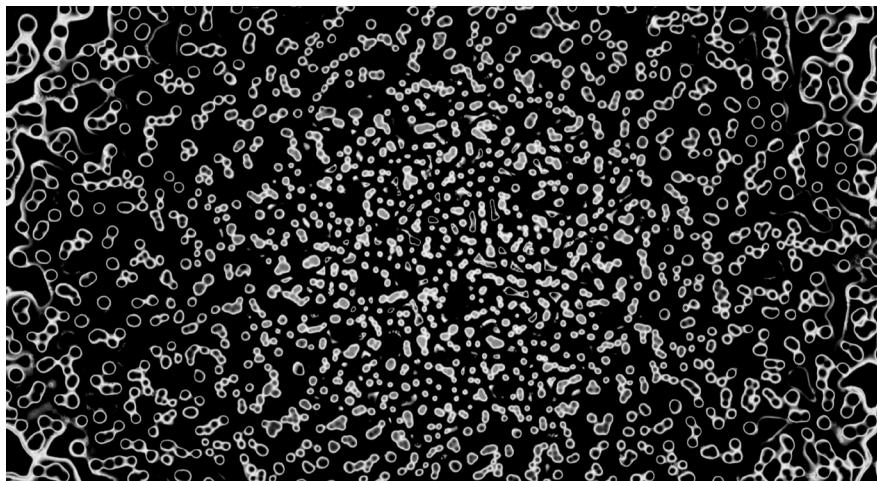
Dr Charlie Tweed (CT): Tom, to begin, could you summarise your current research areas?

Dr Tom Williams (TW): I'm a phylogeneticist interested in trying to build or reconstruct the tree of life. To do that, I take genome sequences from modern organisms, mostly microbes, and use statistical models to work out what the most likely relationships are among all of the modern groups of life that we see, based on some understanding of how the evolutionary process works.

The idea is to use those models to understand the processes of evolution and how it has played out on earth. I'm interested in whether the biodiversity we see around us can be generated by simple models that we can understand and even approximate on the computer. We also see big gaps in the diversity of life and I am interested in how this diversity arises and how it is maintained by evolutionary processes which include subsurface life.

CT: How important is technology in the kind of models that you are talking about in your research?

TW: It's fundamentally important, because when we have faster computers or better algorithms we are able to analyse a larger amount of data more effectively. Technology also allows us to sequence organisms directly from the environment. Until very recently, the only way to study an organism was by looking at its genome sequence and then growing it in the lab so we could then sequence it. In the last 10-15 years, sequencing technologies have been developed that allow us to sequence environmental samples. For example, we can now sequence a sample of mud or pond water to directly



see the genomes of the organisms in that sample. This is important for understanding biodiversity because it's estimated that over 99% of the organisms alive today cannot be lab-grown. After all, they have complex living conditions, such as being involved in symbiosis with other organisms. Therefore, better computers, algorithms and technologies for sequencing underpin a lot of what I do.

CT: Is there a point in the future where you could lab-grow more complex organisms?

TW: I work on a computer for my research and I am not directly involved in that kind of work due to the different skills it requires. However, many researchers are interested in this idea; if we manage to sequence the genome of something, can we analyse the genome and work out what it needs, such as a particular food or condition, and then use that information to grow new things in the lab. Therefore, it could be possible, but we don't have the resources to do it for everything. We know that if we want to reconstruct evolutionary trees, for example, we need the best sampling of biodiversity possible and we know that sampling from the environment already tells us a lot about evolutionary history.

Also, some of the organisms that you cover in the film 'Notes From the Subsurface' are things that we only know about from environmental sequencing subsurface sites. For example, the very difficult environmental conditions of Altiarchaeales require these technologies to sequence things.

CT: How do you sequence a very deep subsurface site?

TW: It's useful to define what we mean by a subsurface environment as it is quite a broad term, for example, just a few centimetres below the ground can be defined as a subsurface environment. Sampling happens in various ways; either directly at shallow depths or by drilling into an underground site and extracting material that can be sequenced. It is also possible to take samples from existing sites located deeper in the subsurface, including caves and old mines.

Also, one connection between the organisms in the film and my research is that when you look at where these subsurface organisms fit in the tree of life, they sometimes appear in quite interesting places. So, the Altiarchaeales branch deeply and they seem to be distantly related to most of the other members of that group of life. Therefore, without sampling those subsurface environments, we wouldn't know about those very distantly related branches of the tree, yet knowing about them allows us to

come up with new inferences around the evolution of early life. This is the primary reason I'm interested in those sorts of environments in my own research.

CT: Could you talk more about Altiarchaeales; where they live and how they function? They inspired many ideas in my film, being interested in their alien qualities and their relation to the tree of life.

TW: When we talk about early life, it's important to realise what we're seeing when we sample something from the subsurface; we're not sampling something from billions of years ago, we're finding a modern thing that is very distantly related to everything else.

In our research, we can make inferences such as predicting the common ancestor of the Altiarchaeales as a particular type of Archaeon that might have lived around three billion years ago or more. Therefore, we get information about reconstructing the past. Specifically, Altiarchaeales are anaerobic, living without using oxygen as an electron acceptor, and that makes sense because their living environment is underground where there isn't much oxygen. We don't know much about their fundamental biology. The most remarkable thing about them - a rather alien-type of thing - is they produce this grappling hook-structure out of the surface layer of the cell, which they can then use to hook onto other cells in the same community. This was first noticed when Altiarchaeales were washed out of subsurface environments by underground flows of water. On the surface, they used these hooks to interact with aerobic bacteria, for example, living in surface streams. So, the initial electron microscopy images of them were in that context.

However, we don't fully understand what precisely they use these hooks for in their natural subsurface habitat. Presumably, it's for sticking to surfaces and other cells, and maybe maintaining a community in a harsh environment by crowding together. Maybe the cells in the centre of an aggregate are protected from difficult conditions, whereas the cells on the surface are more exposed. However, there are many things in basic biology that we don't yet fully understand.

CT: Thanks, that's really interesting, so it feels like there are quite a lot of unknowns within subsurface environments and therefore opportunities for speculating. I also wanted to ask you how your research connects to the artworks that were produced during the fellowship.

TW: Well as you said, there's a lot that's unknown about these subsurface life forms and they're very interesting in their own right, but they also raise questions or provide data that we can use, reference points we can use

to study the deep ancient past on earth. This is where my research interests aligned with the project. The weird biology of all of these organisms is really fascinating and it's probably a biology that should be publicised more widely. My impression is that not that many people, apart from Archaea geeks, know about a lot of these organisms. One reason for that is because it's very hard to do anything visually engaging such as filming these organisms, as they're very small, difficult to film and aren't very colourful. So natural history programmes don't cover them, even though they'd be able to talk about all kinds of interesting aspects of evolutionary biology. Using them as a jumping-off point in art, as an exploration of some of these concepts of alien life or weird biology, is an effective way of communicating about biology. When you study an organism about which very little is known, the artistic license provides an interesting opportunity to explore different perspectives.

CT: This was a useful departure point, allowing me to use a fictional approach for the film and exhibition, thinking about scenarios for future life as well as exposing some of the research around the subsurface. I was interested in some of the research you discussed where these different life forms and extremophiles can function in really challenging conditions. In my art practice, I can jump ahead proposing future scenarios for life and bringing lots of ideas together.

TW: Yes, we don't know anything about the inner life of methanogens or Archaea, it's a blank space where you can start to think - oh, it's probably quite claustrophobic and quite terrifying living like this, being trapped in the subsurface. You then have the opportunity to add in speculative ideas. It interested me how the project was a way of bringing these organisms to life and exploring something through them.

The film also treats microbes seriously, making comparisons between possible futures for human society and the way that Altiaarchaeales and methanogens live. This is a nice thing to do, elevating microbiology to a level that it's not normally discussed at. I guess most people's view of microbiology is to do with diseases, with even evolutionary biologists sometimes having prejudices about microbiology. Whereas microbiology is much more about fundamental evolution, how life works and how environments under the surface can be studied. Therefore, any way of bringing this to life is fascinating to me.

CT: Absolutely, that's really interesting because I had a key interest in looking at non-human life with a kind of equal standing as humans. Later in the film, I make a satirical proposal for future human life in the subsurface, again, playing around with lots of discussions around ecocide,

climate change and the human impact on the Earth, thinking about the limitations of a human-centred field of vision.

Would you like to say a little more about the final film and exhibition, was there anything that surprised you?

TW: Yes, the sense of creepiness, the horror mood, for example, life coming up from under the subsurface resonated with several Horror films, at some kind of emotional level. The film isn't a horror film, but any time that you explore these kind of unknowns with slightly creepy music and so on, those sorts of references come up.

It manages to succeed as a piece of art in its own right rather than some kind of popularisation of science, rather than as a form of purely scientific engagement, this surprised me about the work in a positive way. This is because in general, any kind of interaction or explanation of microbiology is often focused on popularising it. The film you produced moves beyond this in a really successful way and this was a great achievement. I also think that the satirical element of the film was strong, with the underlying message that maybe we shouldn't be so quick to destroy this rather nice habitat that we're living in right now, and that concept is often done in a very didactic way. It surprised me how the film made those points subtly and humorously; those elements of the film that I didn't anticipate but thought worked very well.

CT: That's great to hear because it was an aim of mine to move the work beyond the focus of science communication to have its own voice, being able to do something with our interactions and produce something that was evolved further with its own message and critiques. I'm pleased that you got those responses to the work. How did you find the launch event, Tom? I really enjoyed the launch with you and Heather's presentations alongside mine. It was really rich and layered, revealing lots of connections, a nice culmination of everything. How did you find it?

TW: I would agree with that. I think that the audience enjoyed watching the film and were surprised by it or found it really cool. There were a mix of different sorts of people, scientists and non-scientists. It was nice to see people engaging with it.

CT: Yes, the audience was an interesting mix of scientists, the public, other researchers, artists, a whole mesh of different people who had some interesting responses. I wanted to ask one final question, which is where you're going with your research now and whether you'd maybe do another collaboration with an artist in the future?

TW: Yes, in terms of working with artists, I'd be very happy to do more. The general approach was fascinating, and what was nice about the impact of this film at the launch event, was that people found it thought-provoking.

It felt like it was effective at making microbiology relevant to people, in a way that wasn't just by curing a disease but was stimulating ideas about human society and non-human behaviour. It was a really rewarding project to be part of, and it had the most cultural impact or relevance that any of my work is likely to have.

In terms of my own work and research, I'm currently exploring the deepest branches of the tree of life. We're trying to work out the last universal common ancestor of all modern life forms, and subsurface organisms are important for this research. We're working on developing some new methods to try to map genes and metabolic capabilities back from modern organisms to the roots of the tree. One of the interesting things is the last universal common ancestor is an ancestor of all modern life forms and was already a very complex organism.

So if we can get a good idea of what this ancestor was like, it gives us a starting point for trying to look back further and have some evidence-based views of how the first metabolisms were put together by evolution, and we then have to consider how the environments for that could have happened.

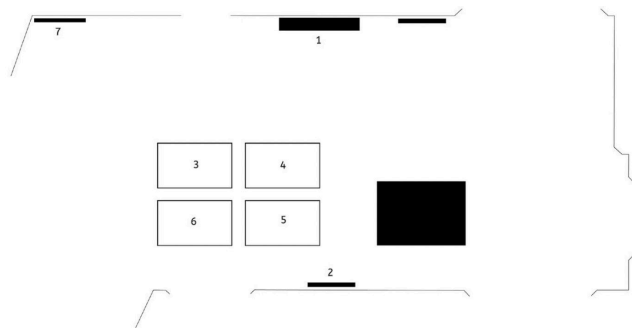
Biodiversity on the planet today relates to how biodiversity is distributed among all of these different environments including the subsurface. You could imagine if there was a subsurface on the early earth and the earth's surface was very inhospitable, being bombarded with meteorites or whatever, then maybe there would have been a refuge in these deep subsurface environments where things could happen.

BIOGRAPHY

DR TOM WILLIAMS

Dr. Tom Williams is an Associate Professor in Molecular Evolution at the University of Bristol.

Work in his lab focuses on using computational methods to reconstruct and understand the early history of life, the evolutionary relationships among life forms, and the processes by which molecules, genomes and organisms evolve.



1. *Notes from the subsurface*, 2019, Film
2. AI designs of future lifeforms, 2019, photographic print

Reference material:

3. Burgess Shale specimens and drawings
4. Material from the research of Dr Heather Buss
5. Science Fiction texts related to the film
6. Images and text related to the film
7. Reading area

IMAGE CREDITS

Cover:

Notes from the Subsurface, composited film still, Charlie Tweed

Pages 9 and 16- 24:

Notes from the Subsurface, composited film still, Charlie Tweed

Page 32 (opposite):

Top - Gallery plan, extract from printed exhibiton guide

Bottom - Exhibition display at Earth Sciences department, University of Bristol, 2018



EARTH ART INITIATIVE

Founded in 2015, Earth Art is a series of collaborations between contemporary artists and scientists from the School of Earth Sciences at the University of Bristol. Each collaboration consists of a six-month artist Fellowship followed by an exhibition in the Earth Art Gallery in the Wills Memorial Building.

'Earth Sciences encompasses not just rocks and fossils but increasingly climate change, oceanography, natural hazards, evolution and extraterrestrial life. There is a lot of material for artists to explore and we thought this was a great chance to bring artists into the School to meet with scientists and the wider academic community through a six-month duration Fellowship'. Jon Blundy, Professor of Petrology and Earth Art Gallery Co-Founder

'The idea of developing the Fellowship and Earth Art Gallery at the University of Bristol following my Leverhulme Trust residency was to address two things; firstly, to deepen the dialogue and investigation between artists and Earth scientists, generating new ways of visualising research, and secondly, to create a Gallery to share this work with a wider public'. Rodney Harris, artist and Earth Art Gallery Co-Founder

This journal is an opportunity to reflect, share and document the fellowship and exhibition of artist Charlie Tweed in collaboration with the School of Earth Sciences at the University of Bristol.



All photographs and film stills courtesy of the artist.

Many thanks to the artist Charlie Tweed and the scientists and academics from School of Earth Sciences at the University of Bristol, UK.

With special thanks to Dr Tom Williams and Dr Heather Buss.

Many thanks to the Earth Art founders and Council members: Prof. Jon Blundy, Prof. Kathy Cashman, Claudia Hildebrandt, Jo Lathwood, Rodney Harris, Georgia Hall, and Helena Moretti and gallery volunteers of the School of Earth Sciences.

Journal research and design by curator Georgia Hall.

