Fungal Architectures – an artist's perspective

Irina Petrova Adamatzky

Artist in Residence,

Unconventional Computing Lab

University of the West of England, Bristol

www.fungar.eu

uncomp.uwe.ac.uk

Disclaimer

I’m an artist and a photographer,

so I look at fungal architectures from an artististic perspective.

This presentation contains a lot of photos

of fungi and slime mold made by myself.

I’m not a scientist, so I may not know all the technical details.

TOC

Fungal Architectures

About

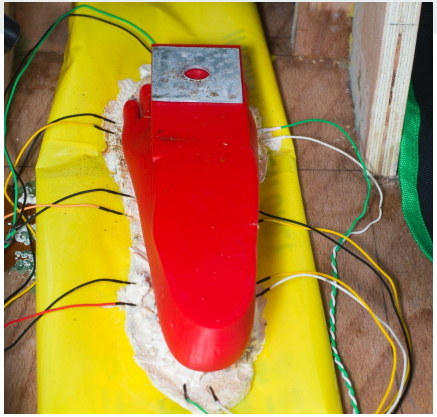
Fungal Architectures is a cross-disciplinary research project aiming to develop an integrated structural and computational living substrate with mycelium for the purpose of growing architecture.

The Consortium includes architects (Centre for Information Technology and Architecture, Copenhagen), computer scientists/biophysicists (University of the West of England, Bristol), mycologists (Utrecht University) and industry (MOGU SME, Italy).

source: https://www.fungar.eu

Targets of this project:

1. growing monolithic structures at metre length scales;
2. functionalizing the mycelium network to act as a computing device.



source: https://www.fungar.eu

source: https://www.irina-petrova.com

Artistic prototype of a one of the potential fungal building by Dr. Nic Roberts.

Background and Motivation

As a primary resource consumer, the building industry faces serious challenges to reduce the environmental impact of current consumption practices.

This applies to both the construction of the built environment and resource consumption during its occupation and use.

source: https://www.fungar.eu

Background and Motivation

source:
https://fungalbiolbiotech.biomedcentral.com/articles/10.1186/s40694-021-00124-5

According to the United Nation's 'Global Status Report for Buildings and Construction' of 2020, the construction sector accounts for 38% of all energy-related CO2 emissions, including emissions from the construction industry.

Where incremental improvements to current practices can be realised, these benefits are overshadowed by the projected scale of demand due to increasing population growth and urbanisation.

source: https://www.fungar.eu

Background and Motivation

Against the backdrop of this grand challenge, it is necessary to explore disruptive approaches in how material is sourced, processed and assembled to address the magnitude of these challenges sustainably.

This also presents an opportunity to seek out new architectural opportunities & objectives and to embody new values.

source: https://www.fungar.eu

Prototype of a fungal building by Dr. Neil Phillips.
Geodesie of a dome is formed by two different sized triangles.

Primary Objectives

Building upon biofabrication approaches, Fungal Architectures develops a living mycelium structural substrate.

The team also proposes to exploit the computational capabilities of this living substrate by doping it with nanoparticles and polymers to make mycelium-based electronics.

source: https://www.fungar.eu

Primary Objectives

This combined structural and computational substrate will implement sensorial fusion and decision making in the fungal electronics to support and steer the growth of monolithic buildings.

Fungal buildings will grow and repair themselves, sense and adapt to the environment, perform resource balancing and connect to ecological systems.

source: https://www.fungar.eu

A photo with mannequins on the exhibition “Fungal Architectures”: Fungal Garment. Mycelium bound hemp, fabric plastic. Credits: Ms. Anna Nikolaidou (UWE), Prof. Andrew Adamatzky (UWE), Dr. Neil Phillips (UWE). Photo by Irina Petrova Adamatzky.

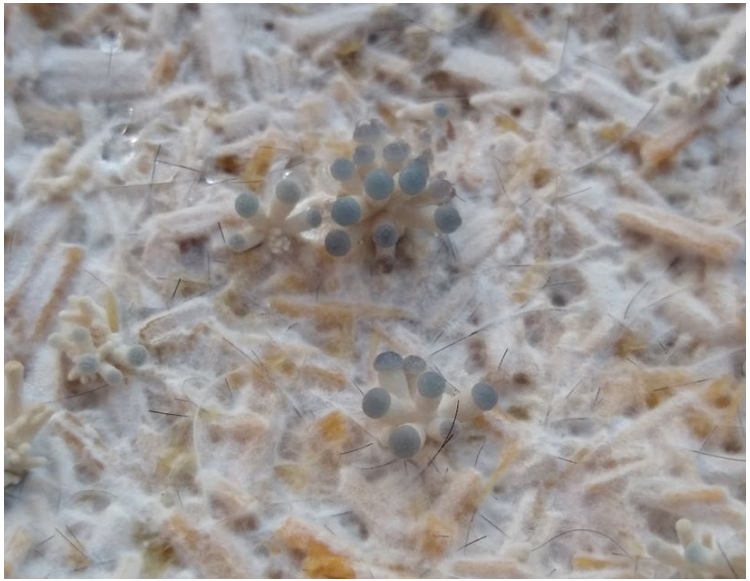
Targeted Breakthrough Innovations:

- Biofabrication - cultivation of metre length scale structures through new growth and cultivation protocols for mycelium networks;

- Functionalization - changing the electrical and mechanical properties of the mycelium network.

source: https://www.fungar.eu

Targeted Breakthrough Innovations:



- Computing - implementation of information processing on mycelial networks

- Designing - development of design rules and construction logics together with the development of architectural tools for designing, living architectures.

source: https://www.fungar.eu

Insulation. Mycelium bound hemp. Faux. Leather

Credits: Ms. Anna Nikolaidou (UWE), Prof. Andrew Adamatzky (UWE), Dr. Neil Phillips (UWE). Photo by Irina Petrova Adamatzky.

Novel Construction Concept

Designing and growing fungal architectures presents challenges to conventional methods of architectural representation and construction, demanding new methods and approaches.

The team is investigating a novel construction concept that integrates mycelium composites with scaffold and reinforcement. This investigation is structured around four objectives:

source: https://www.fungar.eu

Novel Construction Concept

- development of automated production of weave/growth scaffolds using robotics;
- studies of mechanical properties to inform numerical models;

source: https://www.fungar.eu

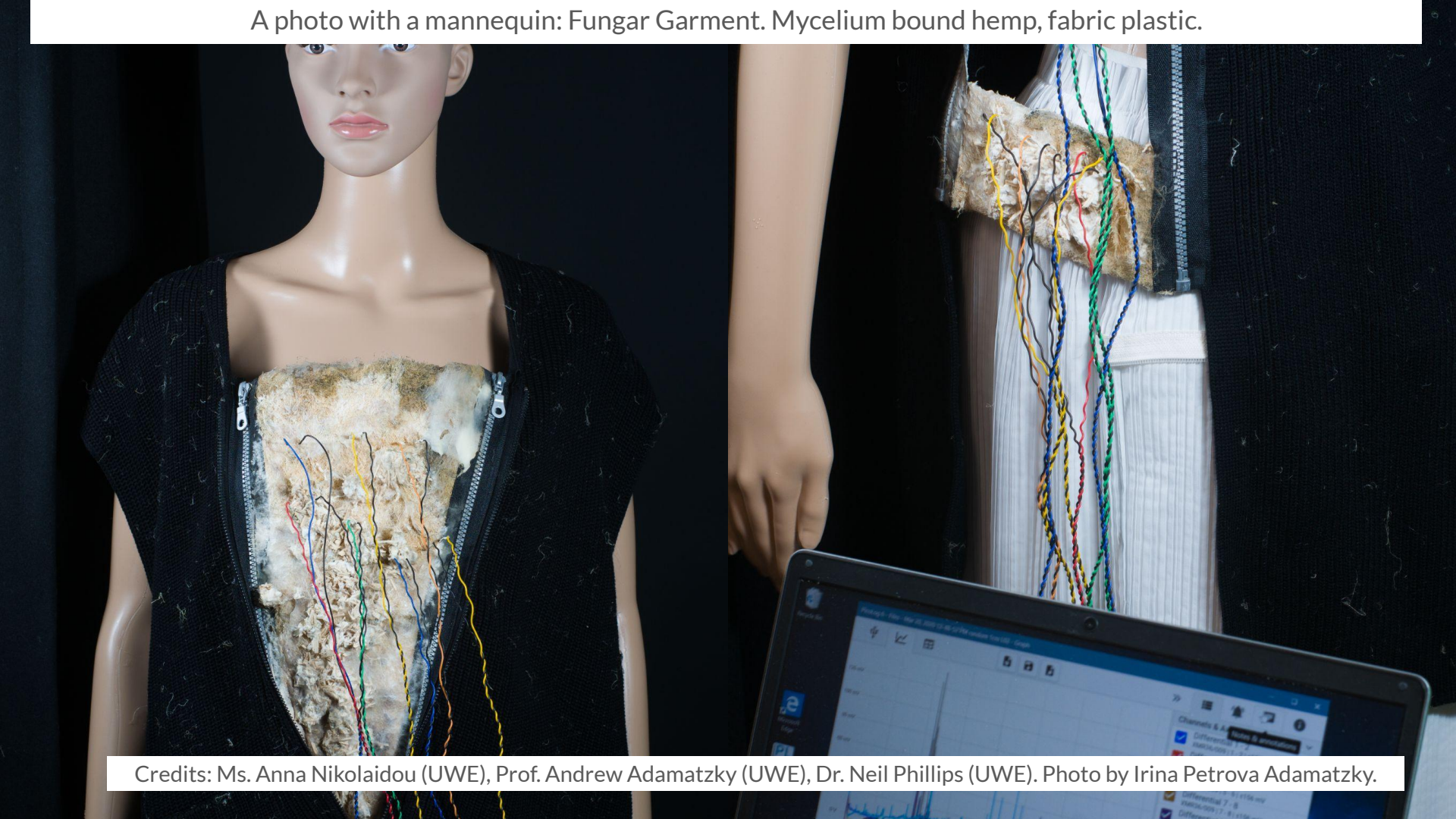
Novel Construction Concept

- defining design rules that integrate spatial, structural and computational properties towards architectural objectives;

- development of a persistent model that couples the living physical artifact with an active design model for steering processes of adaptation towards evolving or changing high-level architectural goals.

source: https://www.fungar.eu

A photo with a mannequin: Fungar Garment. Mycelium bound hemp, fabric plastic.



Credits: Ms. Anna Nikolaidou (UWE), Prof. Andrew Adamatzky (UWE), Dr. Neil Phillips (UWE). Photo by Irina Petrova Adamatzky.

Fungal biomaterials

Fungal biomaterials are becoming incredibly popular in architecture and design, and there has been a significant flourishing of projects over the last years.

Using mycelium as a stabilizing compound for fibers from agricultural waste, new building elements can be produced according to the circular economy model and used in architectural construction to transform the construction industry towards greater environmental and economic sustainability.

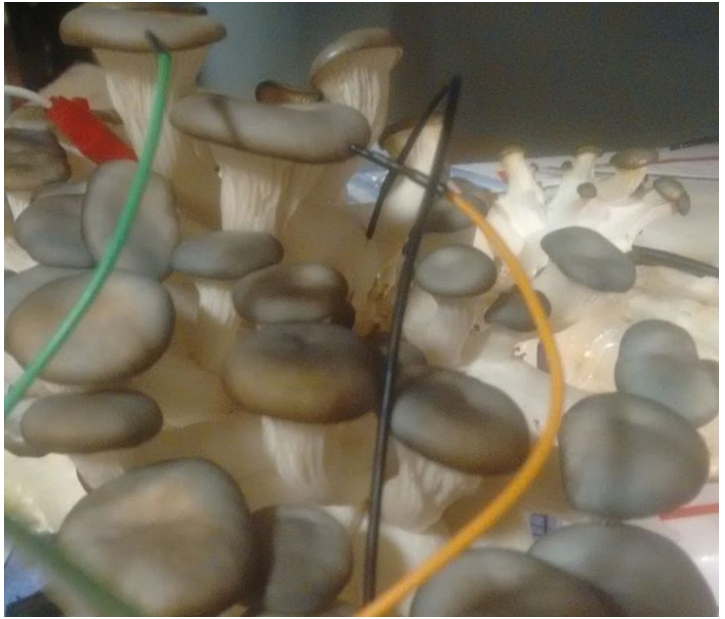
source: https://fungalbiolbiotech.biomedcentral.com/articles/10.1186/s40694-021-00124-5

Fungal biomaterials

At the same time, research on these materials and especially on fungal biocomposites provides knowledge that allows the materials themselves to inspire and transform architectural design.

New research into these materials not only enables their use as building materials, but also inspires and influences the architectural design process by discovering and changing the properties of materials.

Today, a lot of teams are working on this new field to integrate fungal biocomposites into the building industry and bring together science, art and architecture.



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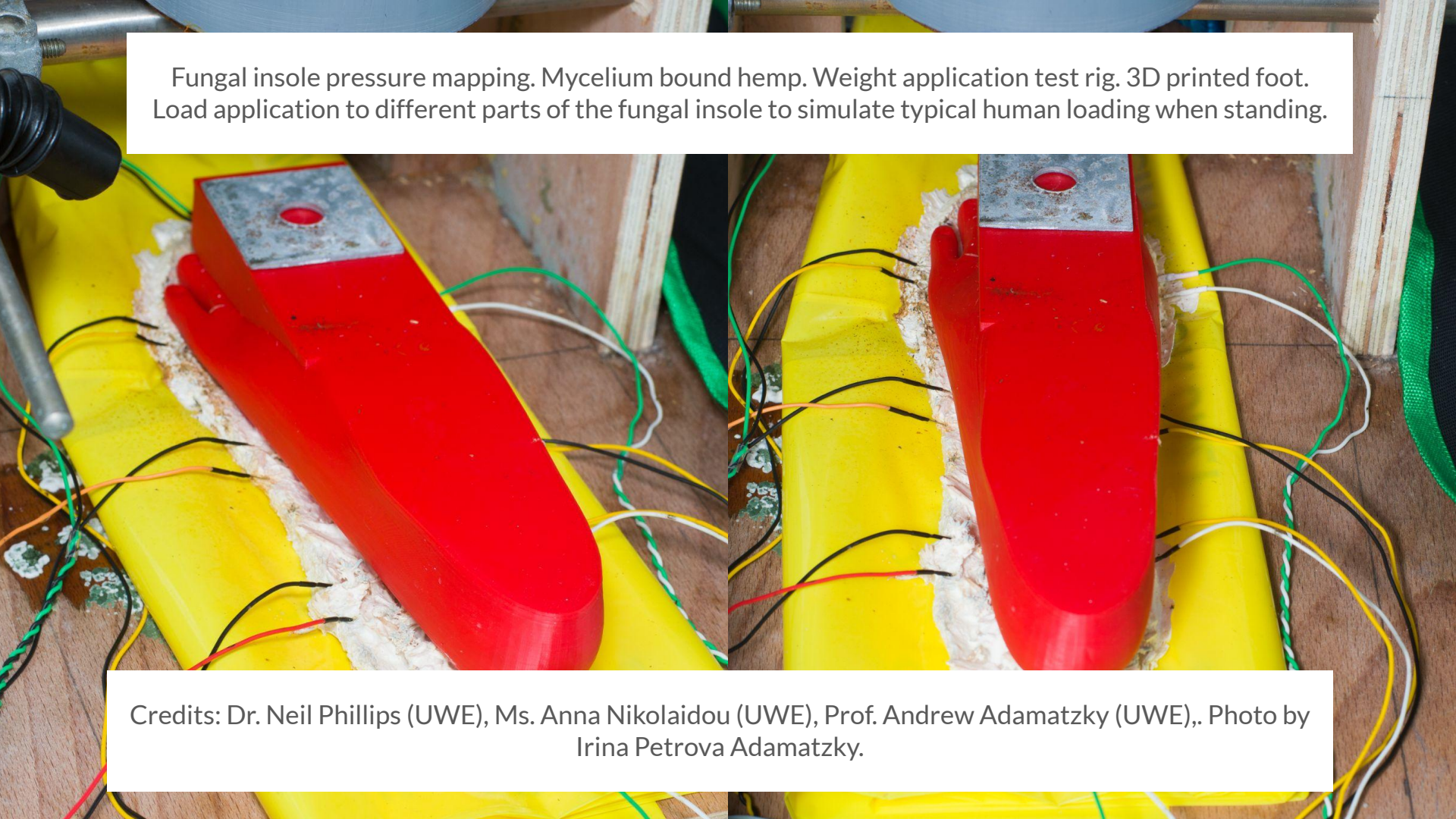


Fungal insole pressure mapping. Mycelium bound hemp. Weight application test rig. 3D printed foot. Load application to different parts of the fungal insole to simulate typical human loading when standing.

Credits: Dr. Neil Phillips (UWE), Ms. Anna Nikolaidou (UWE), Prof. Andrew Adamatzky (UWE),. Photo by Irina Petrova Adamatzky.

Fungal biomaterials

Architecture since 2016 has shown a significant turn towards material technology research for efficient biomaterials produced with a minimal carbon footprint and are non-toxic, biodegradable or compostable.

In particular, during the past 7 years, there has been a lot of interest in the fungal architecture, in order to use the properties of mycelium as the main material, to explore its various characteristics, and to develop original applications for it.

source: https://fungalbiolbiotech.biomedcentral.com/articles/10.1186/s40694-021-00124-5

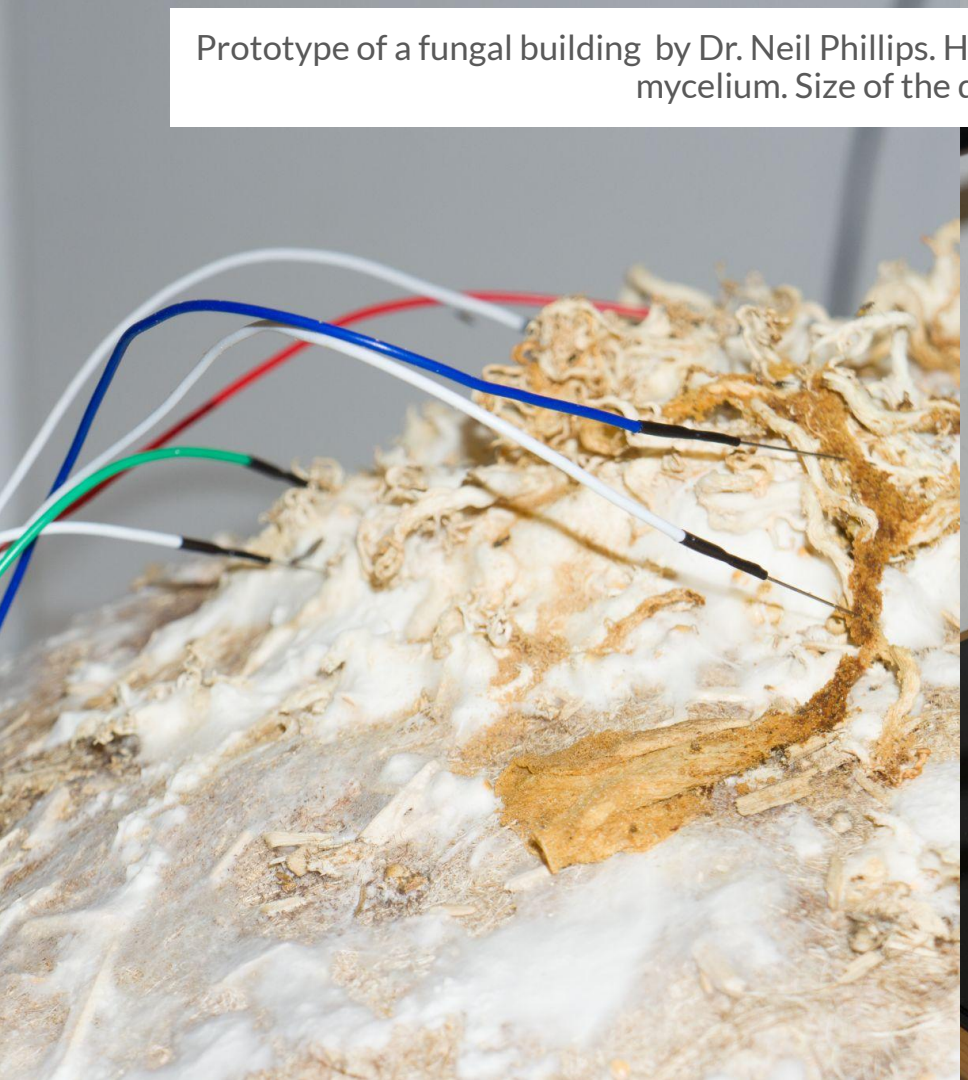
Fungal biomaterials

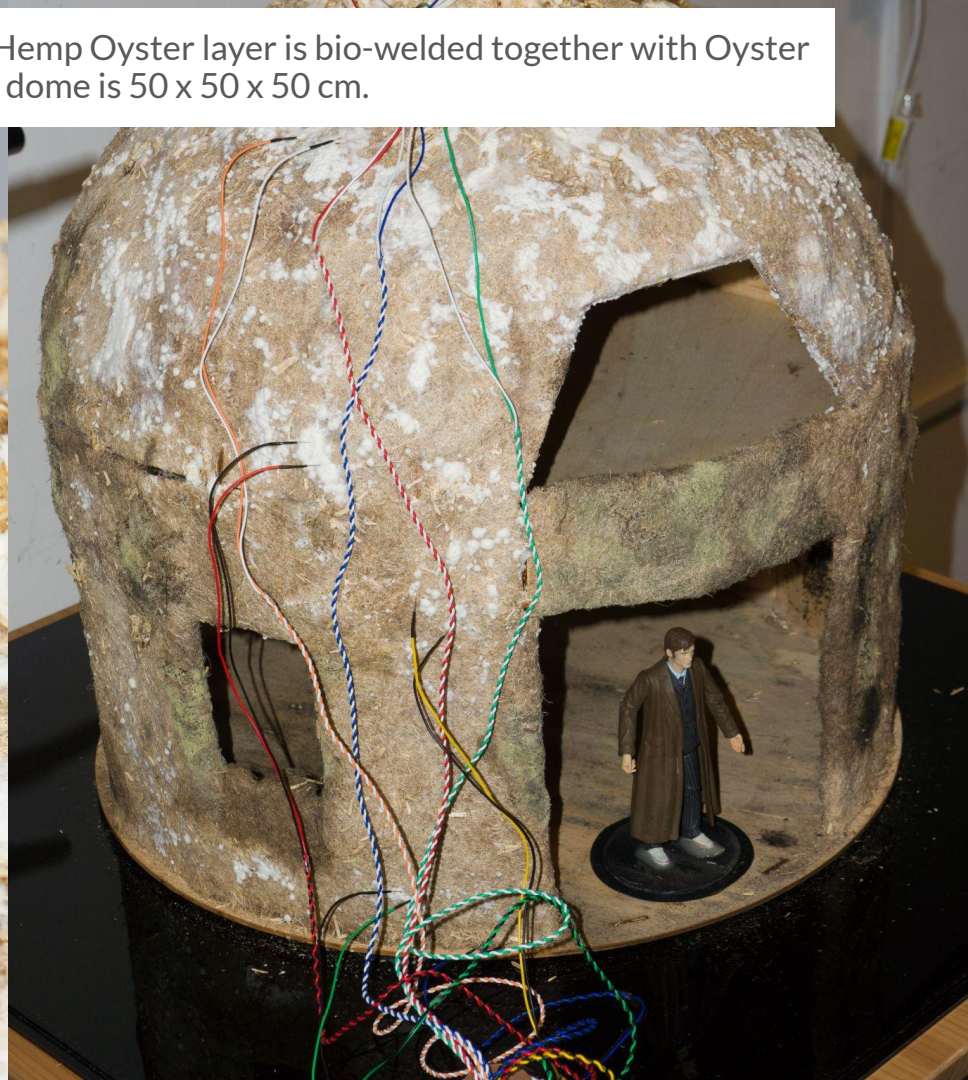
Members of teams working in this new field inform, improve and learn from each other through collaboration.

Their work entails extracting information about the mechanical behavior of fungal materials, analyzing and understanding their aesthetic qualities, and creating concepts for new ways to use them.

source: https://fungalbiolbiotech.biomedcentral.com/articles/10.1186/s40694-021-00124-5

Prototype of a fungal building by Dr. Neil Phillips. Hemp Oyster layer is bio-welded together with Oyster mycelium. Size of the dome is 50 x 50 x 50 cm.





Fungal biomaterials

The morphological and philosophical studies of fungi and their mycelium, combined with a deep understanding of their physical properties, lays the groundwork for architects to visualize an alternative future of the built environment.

It goes beyond the materials and building methods we follow, to the new ways we can perceive our buildings, and the new morphologies and typologies that can emerge from this exciting culmination of fields.

source: https://fungalbiolbiotech.biomedcentral.com/articles/10.1186/s40694-021-00124-5

Fungal biomaterials

Biohm, a biomaterials company that produces mycelium insulation panels, claims production of the project is carbon-negative, "sequestering at least 16 tonnes of carbon per month".

"Mycelium is the way for carbon negative buildings.",

David Cheshire

source: https://fungalbiolbiotech.biomedcentral.com/articles/10.1186/s40694-021-00124-5

Fungal biomaterials

According to sustainability expert David Cheshire, Mycelium could soon be used to insulate and fire-proof buildings while bonding carbon.

"It's naturally fire retardant. It's actually got better insulation properties than most standard insulation and it's actually bonding carbon", he said.

source: https://fungalbiolbiotech.biomedcentral.com/articles/10.1186/s40694-021-00124-5

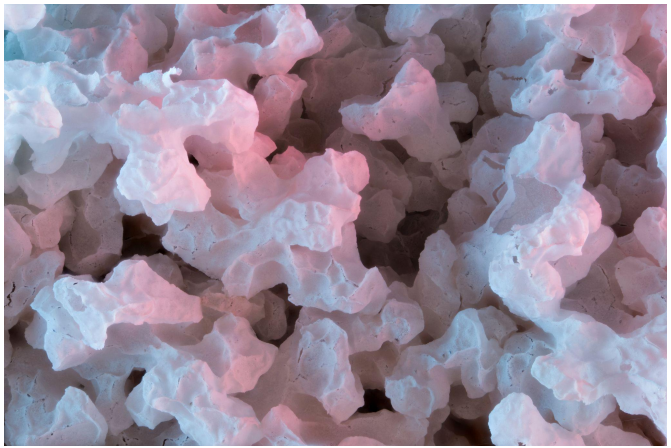
A photo of the exhibition “Fungal Architectures”: A prototype of a fungal dome and fungar Garment. Credits: Ms. Anna Nikolaidou (UWE), Prof. Andrew Adamatzky (UWE), Dr. Nic Roberts (UWE). Photo by Irina Petrova Adamatzky.

Fungal biomaterials

It grows quickly and is cheap to produce in custom bioreactors, where sclerotia can be grown in molds to create usable products such as packaging and lamps.

It can also be recycled to make new materials, including leather goods such as Mylo. These, in turn, can be used to make bags and clothing.

In maintime, a wide range of mycelium composite materials are under development.



source: https://fungalbiolbiotech.biomedcentral.com/articles/10.1186/s40694-021-00124-5

A photo with a mannequin: Fungal Garment. Mycelium bound hemp, fabric plastic.

Credits: Ms. Anna Nikolaidou (UWE), Prof. Andrew Adamatzky (UWE), Dr. Neil Phillips (UWE). Photo by Irina Petrova Adamatzky.

Fungal biomaterials

These can be used to replace "foams, timber and plastics for applications, such as insulation, door cores, panelling, flooring and other furnishings," according to Dezeen.com.

"Mycelium-derived materials have several key advantages over traditional synthetic materials including their low cost, density and energy consumption in addition to their biodegradability and low environmental impact and carbon footprint," said Dezeen.

source: https://fungalbiolbiotech.biomedcentral.com/articles/10.1186/s40694-021-00124-5

Fungal architectures.

A photo with a house made from white mushrooms Agaricus bisporus.

Fungal architectures.

A photo with a house made from white mushrooms Agaricus bisporus.


An artist's
perspective

Affiliated artist

I has become an affiliated artist at the Unconventional Computing Lab (Bristol, UK) in 2020.

It happened because of my project “The X-Files. Ecological Disaster in an Industrial Wonderland”.

I’ve started it in 2017 and it is about the worst aftermath of a climate change and unsustainable future.


The X-Files.
Ecological Disaster
in an Industrial
Wonderland.

Overview

The project “The X-Files. Ecological Disaster in an Industrial Wonderland” is designed to draw attention to the problems of human influence on the environment, such as changing the genome of living organisms in order to obtain certain benefits for humanity, the effect of radiation on the growth of animals and plants, climate change and environmental pollution.


The Industrial Wonderland.
A photo with a death cap (Amanita phalloides).

Overview

It is like the surrealistic world of Alice in Wonderland, which can unfortunately become a reality one day soon. I used 1:64 and 1:87 scale models to recreate the above situations.

I'd like to demonstrate what could happen to our Earth in the future, and what kind of legacy we could leave to our descendants.

They are blessed who are humble, for the whole earth will be theirs...
A photo with oyster mushrooms (Pleurotus ostreatus).

Overview

My world is a universe of living technology, the world where reality and fantasy harmonize and oscillate in unison with my thoughts, where creations of sci-fiction worlds cohabit with samples of the animate world.

Human society faces serious challenges to reduce the environmental impact of current consumption techniques.

After Us.

A photo with bitter false funnel cap (Leucopaxillus gentianeus).

Overview

Where incremental conventional improvements to current styles of living, and, most importantly, styles of thinking, can be realized, the net benefits are often far outstripped by the demands of rapidly increasing population growth and urbanization.


The upside down .
A photo with another side of sunflower eaten by fungi.

Overview

Against the backdrop of this drama, it is imperative to explore alternative, unconventional approaches towards changing human apprehension of the world and creatures populating it, to envision a paradigm shift in how we imagine sourcing, processing and consumption of the products and materials, to shape these in a sustainable way.

My artworks aim to shift the paradigm and the style of thinking, by bringing dreams into reality and the reality into the dreams.


Unknown Planet.
A photo with a dead dragonfly and beetles eaten by fungi.

Mortal aliens.

A photo with panther cap (Ganoderma lucida).


Post-Industrial Era.
A photo with Parasol Mushrooms (Macrolepiota procera).


Memories of the future war. :
A photo with panther cap (Amanita pantherina).


The Unconventional computing.
A photo with dryad's saddle (Polyporus squamosus).


Mycronauts.
A photo with Cordyceps.


Broken angel.
A photo with a dead dragonfly and beetles eaten by fungi.

The Industrial Wonderland.

A photo with a death cap (Amanita phalloides).

My winning photo.

My photo that took the 2nd place in #UKFungusDay 2021 Photo Competition was a part of this project.

I made in the forest near my house in Somerset. It was a very nice sunny day, but anyway I used speedlights and hand made filters for taking this shot.

I used Sony Alpha A7R IV and Laowa 100mm F2.8 lens with Godox X2T-S, Godox V860II and Godox TT600.

Backstage.

Sony Alpha A7R IV and Laowa 100mm F2.8 lens with Godox X2T-S.

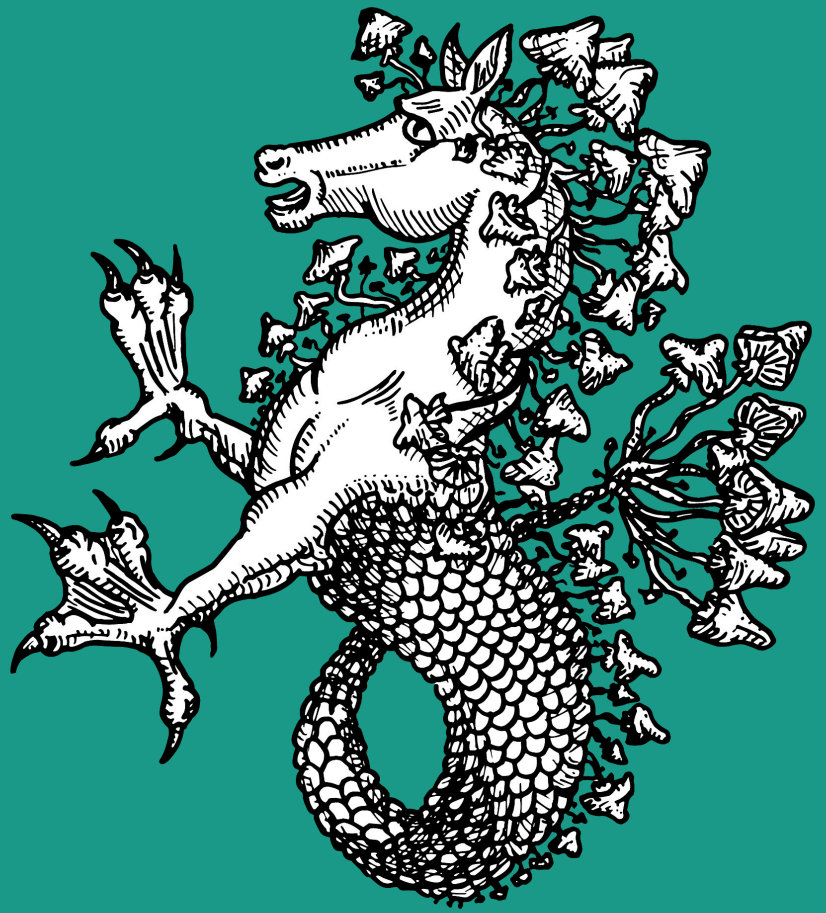

Backstage.

I sent this photo of dryad's saddle mushrooms without any retouching and it took the 2nd place.

But after winning I made a retouched version of my photo for my site, social network accounts and my future exhibition.

Sci-fi fungus photos

Photos based on sci-fi movies, games and etc.



Wonderland.

This photo was chosen as a cover of book “Thoughts on unconventional computing”.

There is no strict definition of unconventional computing. Being an unconventional computist is not a matter of training but thinking and living. Most works on unconventional computing are about implementation of computing in novel substrates (chemical, physical, biological), development of computing schemes and algorithms not fitting into the mainstream framework, or designing of computing architectures inspired by chemical or biological systems. The book gives a snapshot of the unconventional computing field. Articles presented are punchy and well illustrated. The worldleading experts in the field author all articles of the issue. The book will serve well as a lighttouch introduction to unconventional computing for people not familiar with computing and might inspire artists and humanitarians to enter the field.

The book is based on LINKs series
https://links-series.com/

Cover illustration by Irina Petrova
https://www.irina-petrova.com/

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Thoughts on Unconventional Computing

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Editors

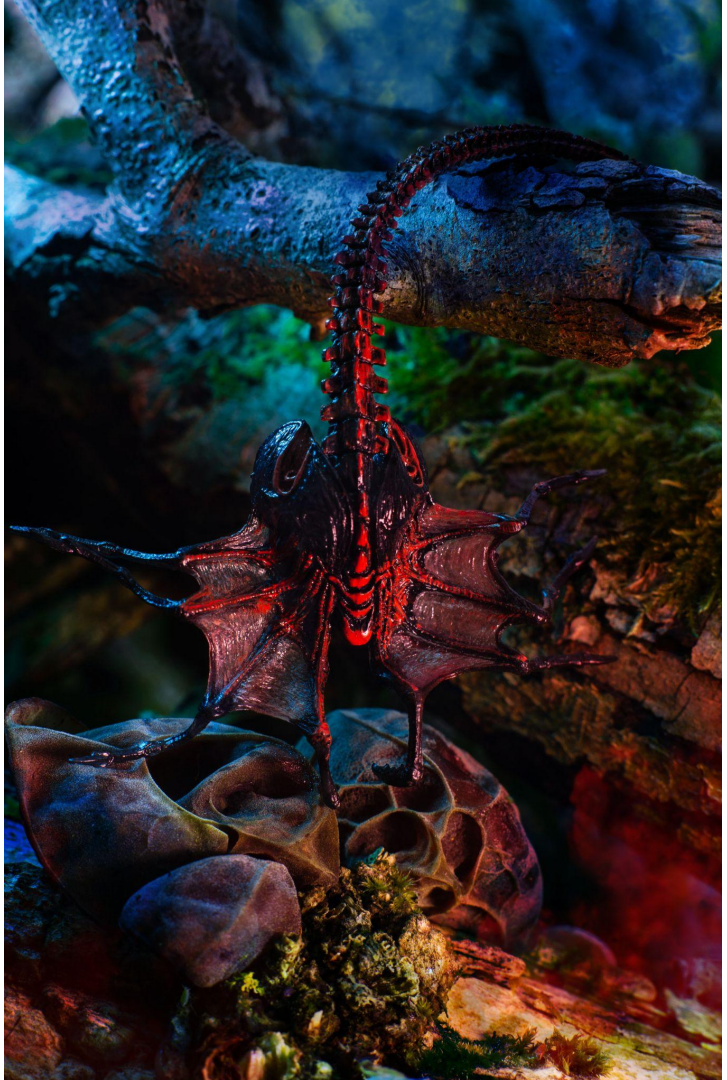
Andrew Adamatzky
Louis-José Lestocart

LUNIVER PRESS


Warhammer.
A photo with mushrooms.

LV426.

A photo series with Auricularia auricula-judae




Warhammer.
A photo with mushrooms.

Deep Down The Rabbit Hole.

A photo with a panther cap Amanita pantherina)

Stormtrooper Alice.
A photo with bitter false funnel cap (Leucopaxillus gentianeus).

Slime mold and fungus photos

Alien eggs.

A photo series with Auricularia auricula-judae

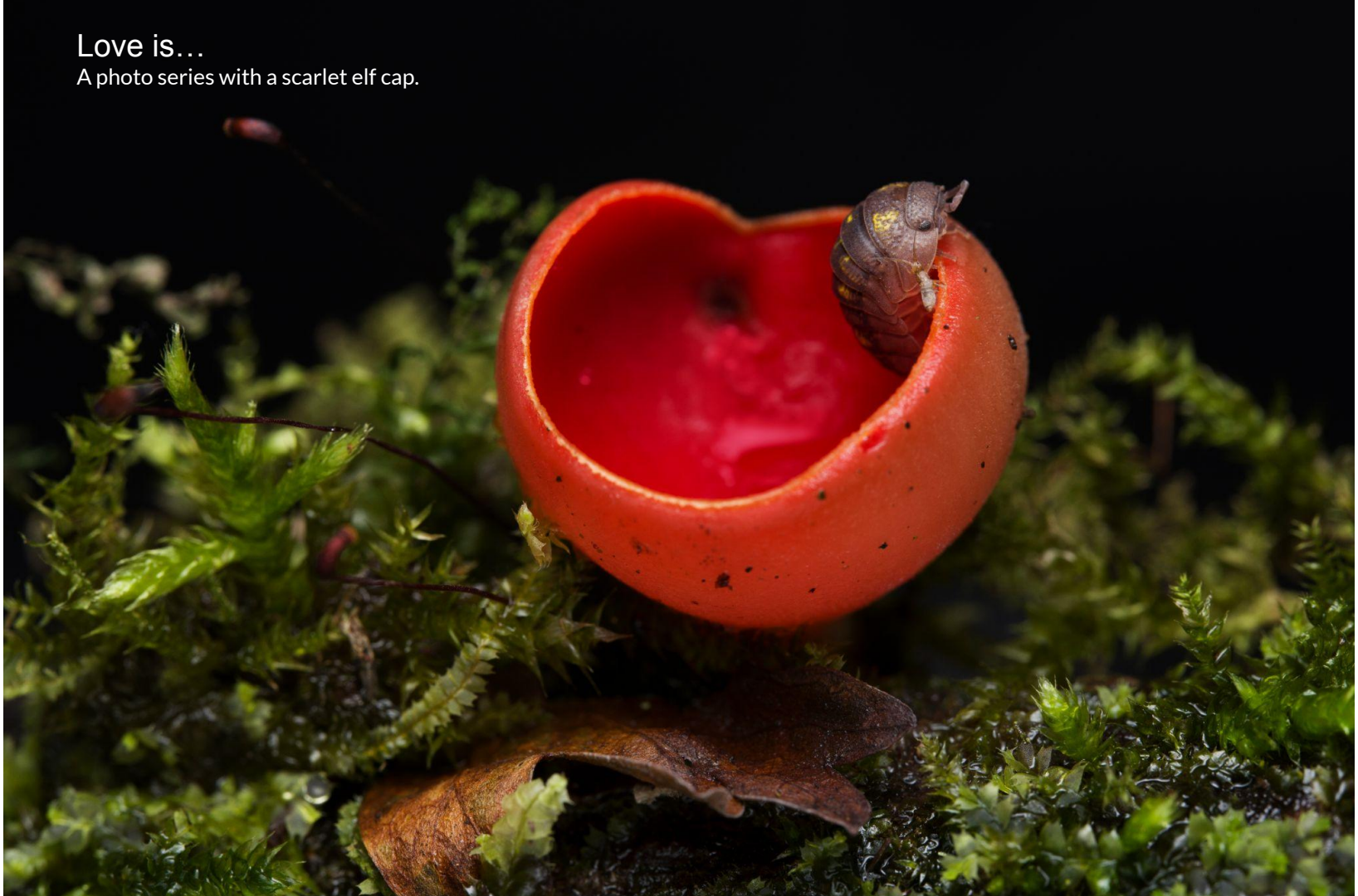

Alien eggs.
A photo series with Auricularia auricula-judae


Tentacles.
A photo series with Cordyceps.


Tentacles.
A photo series with Cordyceps.

Love is…

A photo series with a scarlet elf cap.




On the "ocean" floor.
A photo series with a scarlet elf cap.


Martian landscape
A photo series with Lamproderma sp. slime mold.


Martian landscape
A photo series with Lamproderma sp. slime mold.

A stillborn stick insect on a dying autumn leaf, giving life to a microcosm of its surroundings: fungus feeding on its remains, slime molds and green algae. Each death carries within itself the hope for the birth of a new life, a new beginning.


The stillborn detail.

The stillborn detail.

Thank you!