Biodesign

From Inspiration to Integration

80 | Nature Lab

RISD CO-WORKS

RHODE ISLAND SCHOOL OF DESIGN: 1877: RISD

Biodesign

From Inspiration to Integration

Catalogue created on the occasion of *Biodesign: From Inspiration to Integration* (August 24 to September 27, 2018), an exhibition organized as part of RISD Nature Lab's 80th anniversary celebrations at the Woods-Gerry Gallery, Providence, Rhode Island.

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Designed by Angela Torchio

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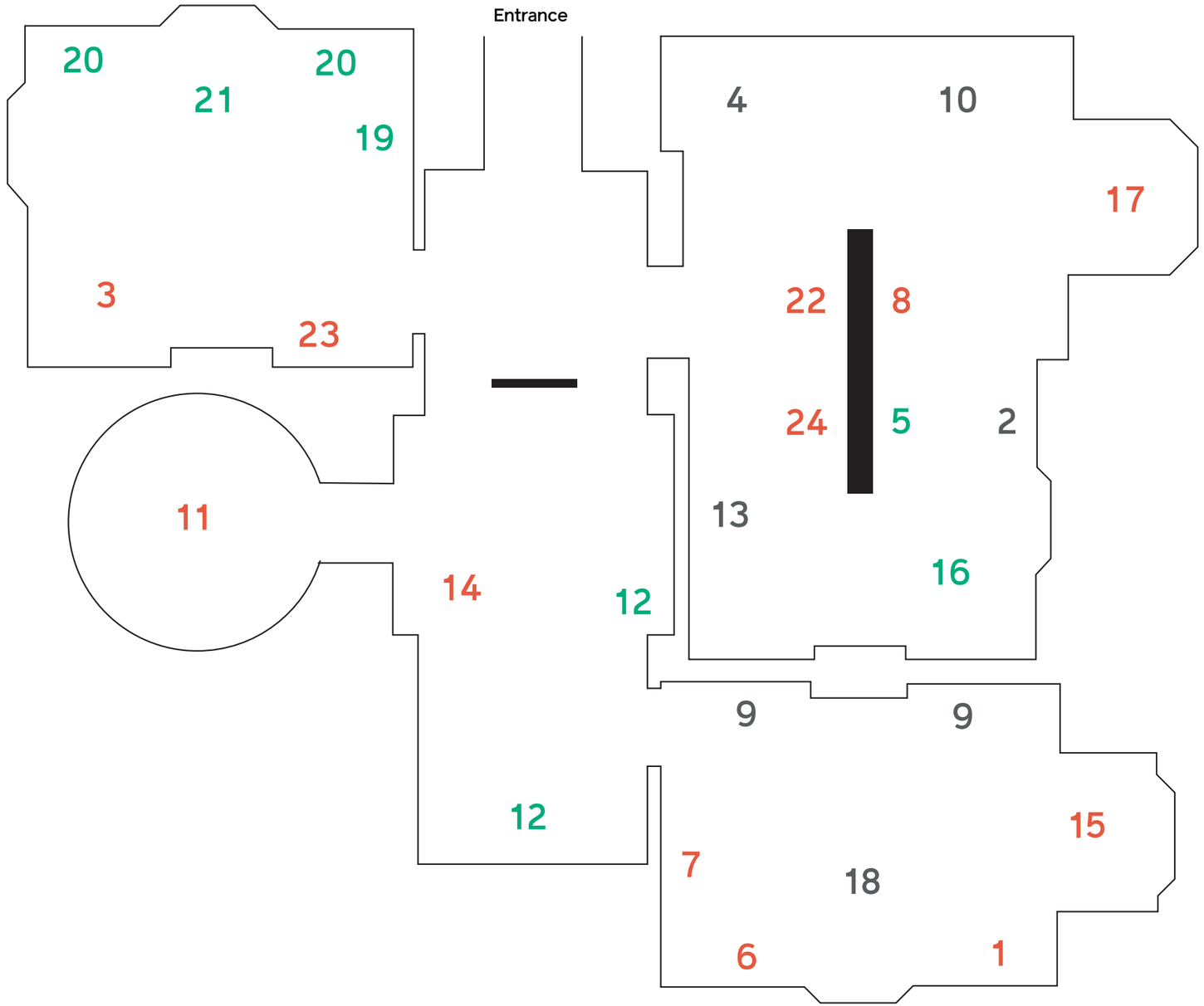


Rancho El Barril, Baja California Mexico

Introduction

Neal Overstrom, Director, Nature Lab

Years ago I visited a region of Baja California in Mexico where generations of early human inhabitants left evidence of their connection with nature. Along the Gulf of California coast, rock faces and inland caves held images of sea turtles and tortoises, fishes, mammals and even the people themselves, painted by ancestors of indigenous Cochimi Indians. Such artwork, dating as far back as 7,500 years, provides a glimpse into these hunter, fisher and gatherer societies and, though their definitive meaning is unclear, marks the presence of the living world in their daily lives.

These images come to mind whenever I read the words of RISD Nature Lab founder and faculty member, Edna Lawrence: “Nature has been the inspiration for the Arts through the history of man—cave paintings, structures, buildings…one can always turn to it as a source for ideas and inventions.” From 1922 until 1975, Lawrence shared with RISD students her passion for deciphering patterns and forms from nature and, in her words, the “reasons for nature’s creations.” All first-year students attended Lawrence’s nature drawing class, working from a vast collection of preserved and sometimes living specimens that she had assembled for study. It was a time, however, before the modern ecology and conservation movements, students’ zoology textbooks didn’t yet include the structure of DNA and biotechnology was limited to agricultural and medical research. Today our understanding of living systems has many dimensions

beyond inspiration, challenging the way we think about nature and our place in it.

Much to her credit and foresight, Lawrence yearned to have her students experience nature at multiple scales and late in her career advocated for the school to purchase a microscope and projection system to make visible the unseen world. Recent major investments in microscopy and other imaging systems at the Nature Lab (including high-speed cameras, 3D scanners, and geographic information systems) now provide students unprecedented access to research-grade equipment for visualizing living systems from micro to the macro. Moreover, the Lab has become a platform for broader investigation in emerging areas of bio-centric design practice, such as biomimetics and biophilic design, and provides space to ask fundamental questions about mechanisms for collaboration across art, design and science disciplines. I think Edna Lawrence would be impressed.

Biodesign: From Inspiration to Integration, celebrates the culmination of the Nature Lab's 80th anniversary year and exemplifies the fascinating and complex ways that future RISD students may engage with nature through the lens of art and design. On behalf of the entire Nature Lab team, I thank all the artists and designers who have contributed to the exhibition and William Myers for leading the curatorial team responsible for selecting and presenting their work. I especially would like to thank Lucia Monge from the Nature Lab and David Kim from RISD CoWorks for initiating this project and guiding it capably to completion. Their hard work, dedication and vision have catalyzed important conversations about our relationship with the living world in the 21st century.

What are Biodesign and Bioart, and Why Should I Care?

William Myers

Biodesign is the integration of design with biological systems, often to achieve better ecological performance. In contrast to design that mimics nature or draws on biology for inspiration, biodesign incorporates living organisms into design as building blocks, material sources, energy generators, digital storage systems, or environmental remediators, just to name a few possibilities. Biodesign is both opportunistic and rational in recognizing the tremendous power and potential in organisms and their supportive interactions with larger and ever-changing ecosystems. Biodesign can also be a means of communication and discovery, a way to provoke debate and explore the alluring promises and alarming perils of manipulating life.

This emerging approach is often a response to the growing urgency to build and manufacture more sustainably in light of the climate crisis. In turn, this leads to unprecedented collaborations between designers and life scientists, such as biologists who increasingly understand how organisms function at the molecular level. The recent proliferation of such cross-disciplinary activity is occurring in schools, labs and in small DIY-Bio groups around the world. One important outcome of this new practice has been the development of critical and speculative projects that blur the border between art and design and which envision the effects of new technologies and scientific research on human behavior and culture.

There are differences between biodesign and bioart, and they have mainly to do with techniques and goals. Biodesigners most often emerge from training at a design school and their methods are shaped by a pedagogy that encourages hands-on experimentation, iteration, optimization, and a centrality of the needs of the user. Related to the latter, designers create interfaces, objects, platforms, or images that are directed towards others, meant to be distributed and experienced. In contrast, bioartists will often engage in similar activities including lab work and collaboration with scientists, but are generally more concerned with creating work that conveys an original aesthetic experience. They are also often deliberate about the cultural context from which their work emerges and how it responds to, contests, or otherwise relates to that context. In another departure from biodesign, the work of bioartists does not necessarily have to speak to or be usable in a meaningful way by others; accessibility is not a mandate.

Often bioart is defined as art that uses living material as media, since many a bioartist will use Petri dishes and collaborate with living microbes in their work. But the practice stretches far beyond this boundary, just as Surrealism was not limited to painting and sculpture, bioartists utilize a variety of media. What unites them is what is driving them, which is the need to react to our shifting, collective definitions of what is natural, what is alive, and what constitutes an identity—all upended by advances in life sciences research and its application as biotechnology. Bioartists therefore work in media ranging from photography and performance to DNA editing.

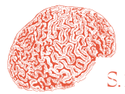
Both the artists and designers working in this area, and particularly those in the exhibition *Biodesign: From Inspiration to Integration*, seem to share a common affinity towards the non-human. They have embraced the humbleness that results from pondering the intricate interdependencies, resiliency, and the devilish complexity of the biological world. They also find themselves in an environment in climate crisis, where natural resources are spoiled and disappear at accelerating rates while our understanding of the biosphere and the human self, compli-cated by research into the microbiome and epigenetic effects, is hurtling forward.

These conditions make for shifting, sometimes frightening, but fertile ground for creativity and radical experimentation. Keeping in mind the long history of wasteful mistakes, misunderstandings and fear that have characterized the relationship between humans and the natural world, such experimentation is likely to produce at least some unintended consequences. We are therefore wise to be cautious and to be skeptical about our own level of understanding, both personally and collectively. It is worth remembering that the germ theory of disease was only widely accepted in the late 19th century, that antibiotics usage only ramped up in the 1930s, the human genome project was completed less

than 20 years ago, and that as recently as 2012 it was discovered that much of what was considered for years to be “junk” vestigial DNA is in fact essential, making for intricately coded, multi-dimensional switches.

The artworks, design prototypes, and speculative narratives emerging from these fields, include proposals that rely on experimental technologies, prompt several questions. What are the implications and likely outcomes of integrating living matter into the built environment or of artists having the ability to wield a tool like CRISPR Cas9 to invent a new form of life? Do these experiments, demonstrating an embrace of biological matter long feared such as microbes as well as an eagerness to collaborate with specialists in the life sciences, amount to a paradigm shift in design and art practices, akin to how the industrial revolution witnessed an embrace of physics and chemistry? Or might this signal a return to a broader consilience, as seen before the Scientific Revolution, when architects like Christopher Wren were also scientists and artists like Francesco di Giorgio Martini were also engineers? If so, how does this change compare to other field-changing shifts in the trajectory of artistic and technological developments, from industrialization to the invention of photography?

As answers to these questions unfold, space for cross-disciplinary collaboration and creativity prompted by scientific research will only expand, propelled by global imperatives such as the urgency to develop cleaner technologies and the evolving definitions of life and nature. This convergence of fields, as well as of the expert and the amateur that characterizes biodesign, may ultimately be necessary to alleviate the negative impacts of the legacies of the industrial revolution; bioartists, meanwhile will progress in translating and responding to cultural shifts we do not yet have the words to describe. In *Biodesign: From Inspiration to Integration* works that offer questions as well as answers congregate, assembled with the hope that increasing attention will be paid to the artists and designers represented, for they are inviting us to reexamine our relationship to the living world as well as offering us approaches to making that relationship mutually beneficial, at last.



S. RADIANS, the lesser starlet coral or the shallow-water starlet coral (*Siderastrea radians*) are stony corals in the family Siderastreidae. They are found in shallow parts of the western Atlantic Ocean as small, solid mounds or encrusting sheets.

BACTERIA are a type of biological cell. They constitute a large domain of prokaryotic microorganisms. Typically a few micrometres in length, bacteria have a number of shapes, ranging from spheres to rods and spirals.

CHLORELLA VULGARIS is a green eukaryotic microalgae, which has been present on earth since the Precambrian period. *C. vulgaris* is seen as a promising source of bioenergy.

AVENA SATIVA, sometimes called the common oat, is a species of cereal grain grown for its seed. While oats are suitable for human consumption as oatmeal and rolled oats, one of the most common uses is as livestock feed.

BOMBYX MORI is the domestic silkmoth; the larva (or caterpillar) of this moth species is the silkworm. It is an economically important insect, being a primary producer of silk.

GANODERMA RESINACEUM, a genus of polypore fungi in the family *Ganodermataceae*, includes about 80 species, many from tropical regions.

GALLUS GALLUS DOMESTICUS is a type of domesticated fowl, a subspecies of the red junglefowl. It is one of the most common livestock animals, with a total population of more than 19 billion as of 2011.

STENOCARPUS SINUATUS, known as the Firewheel Tree, is an Australian rainforest tree in the *Protea* family. The ornamental flowers are bright red in umbels, in a circular formation.

RATTUS NOVEGICUS, also known as the common rat, street rat, sewer rat, Hanover rat, Norway rat, Norwegian rat, Parisian rat or wharf rat, is one of the best known and most common rat species.

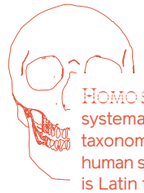
PICHIA PASTORIS is a species of methylotrophic yeast. *Pichia* is widely used for protein production using recombinant DNA techniques. Hence it is used in biochemical and genetic research in academia and the biotechnical industry.

BOS TAURUS, colloquially cows, are the most common type of large domesticated ungulates. They are a prominent modern member of the subfamily *Bovinae* and the most widespread species of the genus *Bos*.

ZEA MAYS, or more familiarly corn, is a cereal grain first domesticated by indigenous peoples in southern Mexico about 10,000 years ago.

Contributors

Each species or biological component on this list contributes to at least one work in the exhibition, through direct integration or by providing inspiration to the creator. These illustrations appear on the wall labels next to each project.

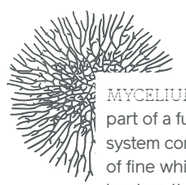


HOMO SAPIENS is the systematic name used in taxonomy for the only extant human species. The name is Latin for "wise man" and was introduced in 1758 by Carl Linnaeus.

S. LYCOPERSICON, or the tomato, is the edible, often red, fruit of the plant *Solanum lycopersicum*, commonly known as a tomato plant. It belongs to the nightshade family, Solanaceae, a species that originated in western South America.

SIPHONOPHORES are an order of hydrozoans, a class of marine animals belonging to the phylum *Cnidaria*. According to the World Register of Marine Species, the order contains 188 species.

COCOS NUCIFERA, is a member of the palm tree family and the only living species of the genus *Cocos*. The term "coconut" can refer to the whole coconut palm, the seed, or the fruit, which is a drupe.



MYCELIUM is the vegetative part of a fungus, akin to a root system consisting of a network of fine white filaments called hyphae that branch out and absorb nutrients. Mycelium readily grows in soils and organic matter and exhibits robust material qualities.

Silk Poems

Jen Bervin
in collaboration with Fiorenzo Omenetto, Tufts University Silk Lab
Film by Charlotte Lagarde

Silk Poems explores the concept of biocompatibility and the intersection of text and textile. The work is the result of collaborations with designers, material scientists, and literary scholars, and draws from research conducted in more than 30 international biomedical and nanotechnology labs, libraries and textile archives.

The poem is printed at the nanoscale and resides in a silk biosensor. Due to the biocompatibility of liquid silk, the poem can be successfully implanted in the human body and exposed to the flow of blood, without being rejected by the immune system. The poem is written from the perspective of a silkworm, addressed to the imagined person with the silk biosensor implanted under their skin. It is written in a six-character strings, eliminating spaces between words and splitting them over multiple lines. This use of six-characters in English letters mirrors a repeating chain of six molecules found on an amino acid the silkworm produces in the process of making silk. The words, in turn, are arranged in a curvilinear pattern echoing how the silkworm forms its cocoon. The work is rooted in the belief that reading such a senor inside the body is not a neutral context, rather one pre-inscribed with concern, written in a material with a 5,000 year old international history. The work explores the linguistic and cultural boundaries involved with placing biocompatible material inside the human body while channeling a wide range of influences and references, from the recursive forms of Islamic scripture to the ancient practices of Chinese sericulture.

Materials:
Liquified silk fibroin, gold spatter

Affiliations:
Provost's Fellow and Artist in Research, RISD Glass

The Indoor Microbiome

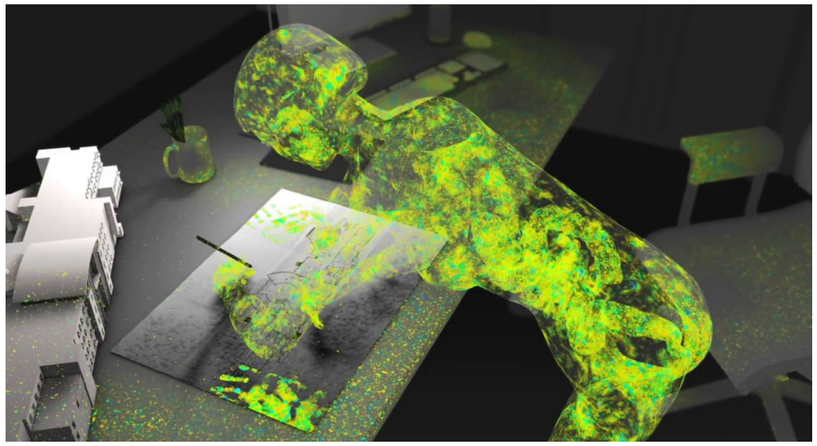
Biology and the Built Environment Center
(BioBE Center)

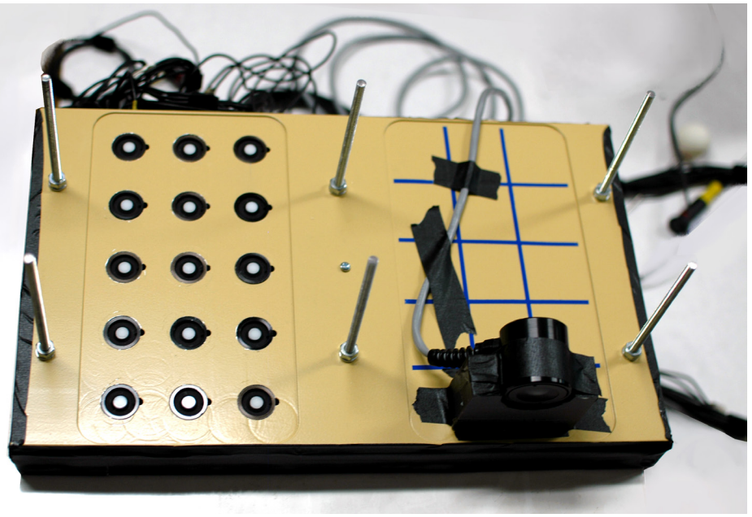
The Biology and the Built Environment Center (BioBE Center) at the University of Oregon develops research-driven approaches to understand the microbiome of the built environment. Trillions of microbes, some helpful, others neutral, and still others harmful to human health, reside in every indoor space we occupy, yet this invisible terrain is little understood. How it impacts us and the ways in which design details, such as ventilation, lighting, and material choices might effect it is of growing interest. Here the center is exhibiting four projects: *Materials and Lillis, Lightbox Project, Plants and Skin* and *Microbial Cloud.*

Materials and Lillis explores how building materials can impact the microbial community, and investigates the outcome when materials are no longer influenced by the human microbial cloud. The *Lightbox Project* examines the effect of daylight upon bacterial communities residing in dust. For 90 days, dust-filled boxes were installed on a roof to catch daylight. Using genetic sequencing to identify the bacterial species, different bacterial communities emerged depending on the amount of light. In *Plants and Skin* the center has taken samples of plant and soil bacteria, transferred them to human skin and investigated how the bacteria persists throughout its time there. In *The Microbial Cloud,* the center uses a climate chamber to measure individuals' airborne bacterial emissions, or microbial clouds.

Materials:
Mixed media

Affiliations:
University of Oregon, Eugene, Institute for Health in the Built Environment





To Flavour Our Tears

To Flavour our Tears (TFOT) is an experimental restaurant that places humans back into the food chain by investigating the human body as a food source for other species. Through researching the culinary needs of insects, decomposers and other organisms that dine on human cells, the artists hope to intimately and materially reconnect humans with the metabolic flow of the planet and our role in shaping it.

On view is just one component of the project, the *Saprophytic Supper*, a 24 Hour Buffet where humans can examine the microorganisms that feast on their skin cells. These organisms, called saprophytes, reside in many parts of our bodies and provide the thankless service of helping to dispose of our dead cells, occupying an odd midpoint between parasite and symbiont. The model and video on display represent this and the many other components of TFOT.

The multi-part work includes: a *Moth Bar* where human visitors can shed tears for thirsty moths, using specialized tools and practices if they can't cry on cue; an *AnthroAquaponics System* where fish feed on the dead skin cells of human feet, and in turn, provide nutrients for a plant growing system which feeds humans; an *AlterGastronomy VR* room where visitors can embody a wolf devouring a jogger; the *Fat Flavouring Lab* where R&D in flavoring fat, skin, blood, sweat, and pee happens; and the *Rooftop Garden Burial Site* where a few lucky decomposers get to consume the remains of deceased humans.

Materials:
Mixed media

Affiliations:
Supported by the Pixelache 2016 festival: Interfaces for Empathy

GANODERMA RESINACEUM

New Experiments in Mycelium

Since its founding in 2007 Ecovative has worked to develop a variety of materials which, unlike conventional synthetics, can have a positive impact on our earth's ecosystem. The focus of their research is mycelium, the vegetative part of a fungus with a network of fine white filaments called *hyphae*. These readily grow in soils and other organic matter under a variety of conditions. When mushroom spores germinate, they produce single cell-wide hyphae, and masses of these interwoven cells make up mycelium. This substance has robust material qualities and, when constructed into a building material, can be stronger than concrete bricks and withstand dramatic shifts in temperature.

Ecovative, founded by Eben Bayer and Gavin McIntyre, is dedicated to using mycelium to develop complex, high-performance structures that include foams, insulation, food packaging and lampshades. Their long-term aim is to alleviate our dependence on synthetic materials like Styrofoam which can sit in landfills for hundreds of years and leach toxic compounds into the earth.

Materials:
Mycelium, agricultural wastes

Algae Powered Thermometer

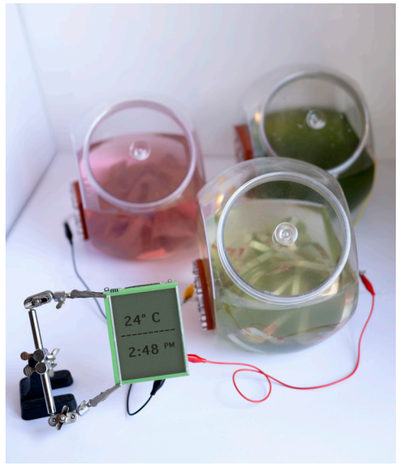
Fabienne Felder
and Waldemar Matuska

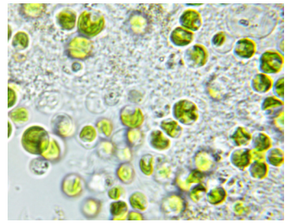
This project uses three different species of algae, held within several separate containers as a source of bioenergy to power an electrical thermometer. Each container is called a bio-electrochemical device or photo-microbial fuel cell (pMFC) and could be described as a biological solar panel. The system harnesses electrons and protons produced by the plants' photosynthetic process as well as naturally occurring microbial digestion. They are fed through a positive (cathodic) and negative (anodic) component in the cell to produce electricity. The pMFCs can be linked up as needed in series and parallel circuits.

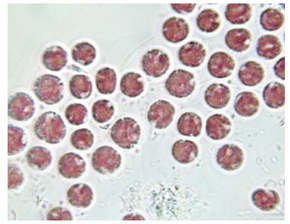
Felder draws from research undertaken by the University of Cambridge on generating electricity from algae as well as experience working at Genspace in Brooklyn, New York, the first community biotech lab in the United States. The work takes into account various algae species' metabolism and molecular biology and harnesses their activity to fuel an electrical thermometer. Algae are a diverse group of photosynthetic species found in numerous environments all over the planet including soil, glaciers, and the ocean.

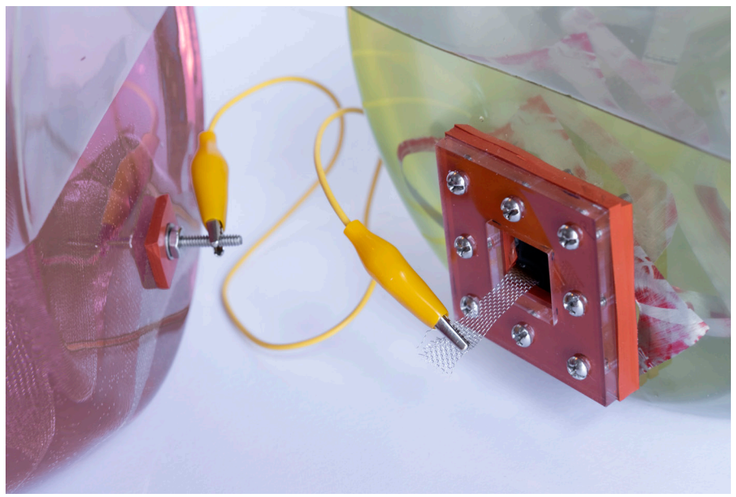
Materials:
Anodic chamber: algae, stainless steel; Cathode: platinum on vulcan cloth, proton exchange membrane; Thermometer: off-the-shelf window thermometer; Containers: plastic container with handle, rubber tube and inflation bulb for aeration.

Affiliations:
Lumot Design, Genspace, THINGCONNECT









Zoe — A Living Sea Sculpture

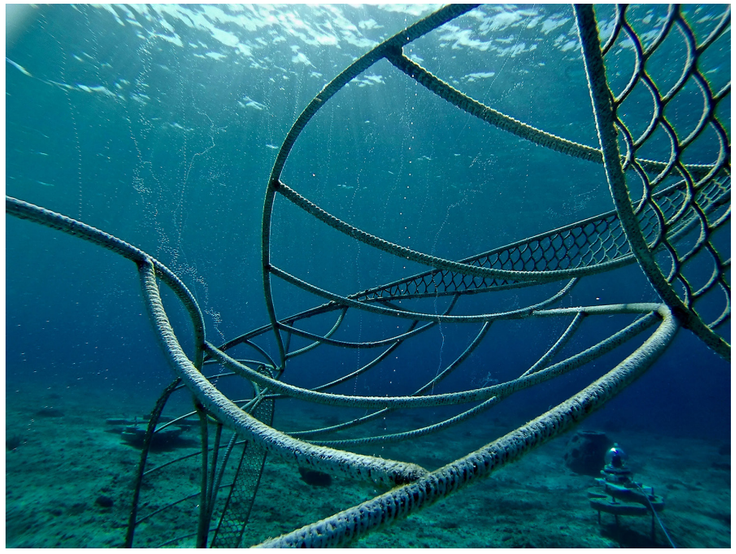
Colleen Flanigan

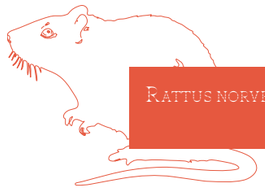
Zoe is a sea sculpture that offers a foothold habitat for corals, an endangered cornerstone species that, in turn, supports countless other forms of life. Due to ocean acidification and water temperature changes, coral reefs around the globe are rapidly dying off. Flanigan's work responds to this bleak reality, using biological and climate research to inform her sculptural creations.

The form of the installation is reminiscent of the double-helix of DNA and is located on the sea bottom near Cozumel, Mexico. The work is a memorial to Zoe Anderson, a young woman who lost her life due to carbon monoxide poisoning in 2012. Anderson was passionate about coral, and Flanigan's living sculpture pays tribute to her, as *Zoe* supports the regeneration of different species of coral by providing a refuge. The living sculpture is constructed from bare welded steel through which is conducted a low electrical voltage; this attracts minerals and hastens the growth of new corals.

Materials:
Milled steel, electrolysis, underwater webcam

Affiliations:
Leridian Dynamics, inc. — Livestreaming Programmer and Online Diffusion, View Into the Blue — Livestreaming Underwater Webcam Provider, Biorock Technology — Electrical Engineer, Qualti Innovaciones Marinas — Anchoring System, Tenrethe — Tech Consulting and Web Development





Rattus norvegicus

Burial Globes: Rat Models

Kathy High

This work is a memorial to transgenic rats and highlights how heavily scientific research relies on these warm-blooded creatures that nurse their young, socialize, and even laugh during play. More than 80 million rats are used for research purposes each year in the United States alone, many of them transgenic rats, altered to have features like susceptibility to autoimmune disease in order to test treatments on them. Numerous significant medical breakthroughs have emerged via disease models that have involved using such animals.

Burial Globes: Rat Models features five globe-like glass sculptures shaped like white blood cells. Each holds the cremated ashes of one transgenic rats, each of which High worked with in her previous project *Embracing Animal*. Next to each globe are the rats' names: Flowers, Tara, Mathilda, Star and Echo; also displayed are the disease types that killed each animal. The choice to name the lab animals is a deliberate commemoration, a gesture of respect, if only at a small scale, to contest the anonymity of so many millions of animals that are vital to scientific research.

Materials:
Glass, paper, rat cremation ashes of *transgenic laboratory rat models HLA B27 — retired breeders*

Ani Liu

The Materiality for Potential Consciousness

Holding Back is Another Kind of Need

The advance of medical technology increasingly allows us to redesign ourselves and imagine new futures. These evolving technologies are restructuring our mental and physical identity and prompt us to question what makes us think and feel *human*.

Experimental designer Ani Liu explores the cultural, social, and emotional implications and outcomes of new technologies. Here, she presents two projects, *Holding Back is Another Kind of Need* and *The Materiality for Potential Consciousness*, both of which encourage the viewer to be mindful of how new technologies alter our understanding of our identity.

Holding Back is Another Kind of Need responds to recent research in neuroscience that shows correlation between olfactory stimuli and behavioral responses. Here, Liu stages an interface wherein the visitor can have a window into her emotional landscape, providing a scent that is captured from individuals that are important to her.

The Materiality for Possible Consciousness investigates how merging and evolving technologies can alter people's notion of their identity. Exploring mind-body dualism, trans-humanism and artificial intelligence, Liu's project combines biological, electronic, and computational sciences to critique how we perceive ourselves with the ever-changing technologies surrounding us.

Materials:
For *The Materiality for Potential Consciousness*: a preserved brain, the material composition of a brain (water, fat, protein, minerals), and the material composition of a computational brain.
For *Holding Back is Another Kind of Need*: Perfume extracted from a human, sweat, oil, acrylic, glass, rubber, aluminum, atomizers

Perfumes developed in conjunction with chemist Noam Prywes

Hy-Fi

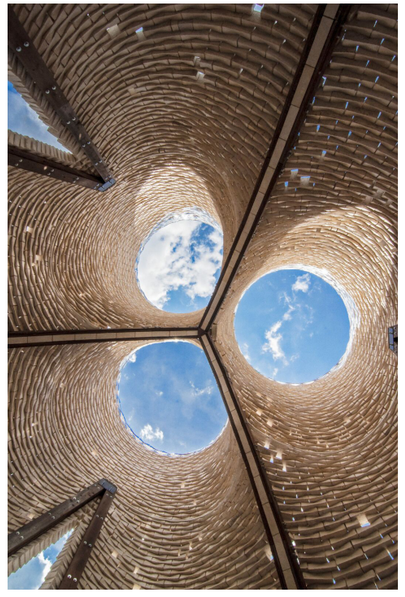
Each year MoMA PS1 in New York City selects a proposal from an emerging architectural talent to develop a temporary, outdoor installation. The winners of the Young Architect's Program (YAP) are challenged to demonstrate new approaches to all phases of the work. The winning entry for the 15th annual award was from David Benjamin and his studio The Living, which proposed a novel cluster of structures made from mushroom-based mycelium bricks, that were grown, constructed, and eventually composted using a tiny fraction of the energy required for typical building materials.

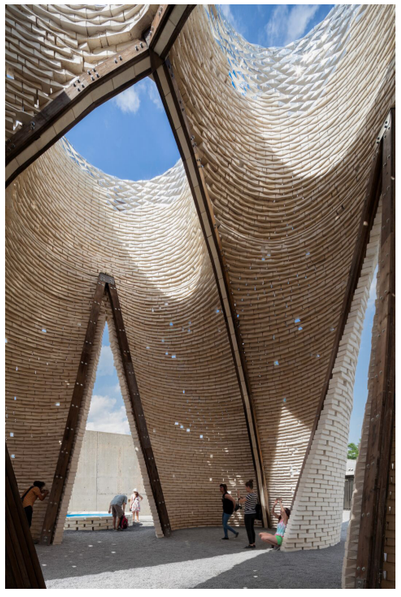
Hy-Fi is a 13 meter-tall tower constructed from 10,000 biodegradable bricks which can be grown in just five days. The lightweight, low cost, and sustainable structures are comprised of corn stalk and other agricultural waste that were inoculated with fungal spores which develop a root system of mycelium making the bricks rigid. The material is durable and has an excellent thermal performance.

The tower was constructed in 2014 and, after being the center of cultural events for three months during the summer, was disassembled, with the bricks going to local community gardens to safely biodegrade. The project not only demonstrates an emerging approach to more ecologically sound architecture but its development, sourcing, and ultimate disposal made a priority of engaging the local community.

Materials:
Mycelium, agricultural waste, hempcrete, repurposed scaffolding boards, polymer mirror film

Affiliations:
Museum of Modern Art and MoMA PS1





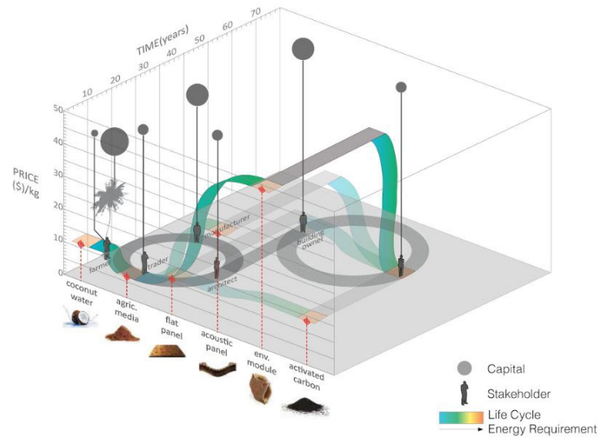
Mae-ling Lokko

AgroDerivatives: Permutations on Generative Citizenship

Global population growth, urban densification, and climate change will place unprecedented pressure on our energy resources and ecosystems. Agricultural by-products present a frequently overlooked yet abundant and renewable material stream. With *Agroderivatives*, designer Mae-Ling Lokko examines the upcycling of agricultural wastes and biopolymer materials into affordable, high-performance building material systems for indoor air quality, humidity control, and water quality control applications.

Based on accompanying biocomposite module prototypes, developed in collaboration with e2e Materials, Ecovative Design and Ecofibers Ghana, *AgroDerivatives* assesses the potential of global transdisciplinary academic collaboration. By initiating academic-industrial partnerships to engage local populations and activate upcycling systems, an underlying aim of the project is to advance the goals of social and environmental justice movements.

Materials:
Mixed media and biomaterial samples

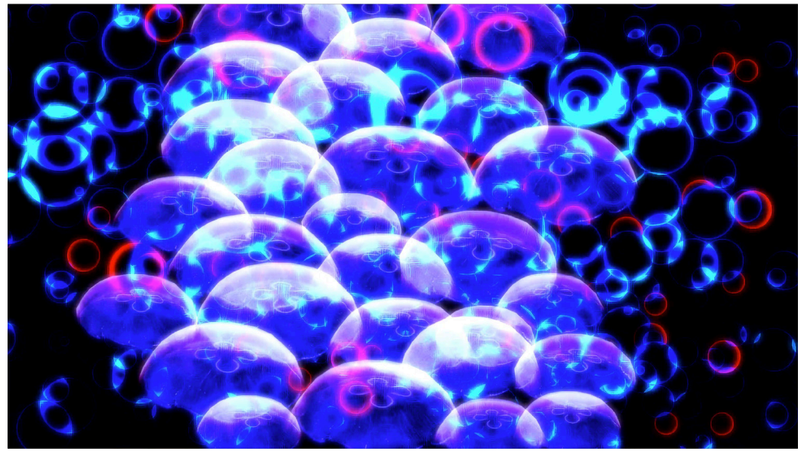


Aquatic Lifeforms No. 2

This work is an animated software painting based on the biology and motion of the *Aurelia aurita*, commonly known as Moon Jellyfish. Mansion has taken inspiration from studies on the bending kinematics of swimming creatures undertaken by Dr. John Costello, a biologist and jellyfish expert at Providence College. Utilizing data from Costello's research, the artist has constructed animated computational forms by writing custom software. The motility of the organisms appears life-like, yet their forms are based on simple line drawings and geometric algorithms.

For this work, the artist also developed and applied several custom "shaders"—programs that speak directly to a computer's graphical processor. These shaders are responsible for giving the photo-real texture to the creatures, and the hyper-coloration used throughout the work. Starting from natural motion and form, Mansion builds several layers of abstraction to de-emphasize realism and refocus the viewer on a more expressionistic composition of aquatic life.

Materials:
Custom software
and projection



Fifty Sisters
Morphogenesis Series

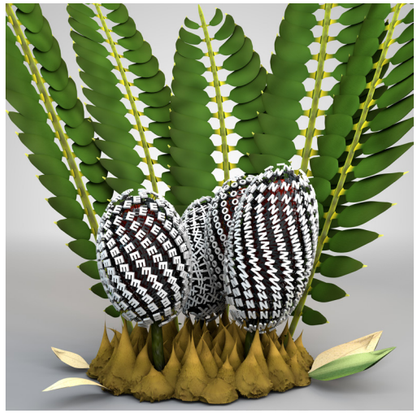
Beginning more than 300 million years ago, geological processes transformed plants into coal and oil, the fossil fuels that power modern civilization. The works *Fifty Sisters* and *Morphogenesis Series* explore how the oil industry has grown over the last century and how it continues to shape human endeavors.

In *Fifty Sisters* computer synthesized plant-forms are algorithmically "grown" from running code that uses artificial evolution and generative grammars. The images are derived from graphics of oil company logos. The title refers to the so-called *Seven Sisters*: the seven oil companies that dominated oil production from the 1940s until the oil crisis of the 1970s. The work reflects how oil production shapes our environment through climate change, the petrochemical haze, and oil spills, whilst reminding us that oil originated from plants.

Morphogenesis is a series of images, developed via custom computer software, of numerous native Australian plant species. The software generates 3D geometric models rendered as digital images which are printed on archival photo media.

Materials:
Digital prints (dimensions variable), Custom evolutionary software developed by the artist

Affiliations: Monash University, Australia



Pichia pastoris
and naturally
occurring yeast

Zoa™ Biofabricated Materials

Modern Meadow
Suzanne Lee, Amy Congdon

Modern Meadow is pioneering biologically advanced, animal-free, materials by harnessing the power of design, biology, and materials science. Modern Meadow's first biofabricated materials brand, Zoa™, opens up a world of possibilities.

Zoa™, 'A new animal is born' references animal leather grain patterns, exploding their scale to play with an abstraction unseen in the natural world. The prototype embodies a design process informed and inspired, but not bound by nature. Here, Zoa™ assumes the form of liquid leather and constructs a t-shirt through liquid assembly instead of stitching. Zoa™ biofabricated materials are tunable structures — able to morph to any shape, hold to any mold, take on any texture, and combine with other any materials to be any size, seamlessly.

Through DNA editing, Modern Meadow designs non-animal cells to produce collagen, the predominant protein found in skin, which is then grown, purified, and assembled to create materials with the same natural building blocks that make up traditional leather. Freed from the structure of a natural hide, biofabrication enables new design and performance possibilities that could not be achieved with traditional leather.

Materials:
Biofabricated material, cotton and technical spacer fabrics

Bistro In Vitro

Next Nature Network
Website and video developed by Next Nature Network and Submarine Channel
Illustrations in the Bistro In Vitro Cookbook by Silvia Celiberti

By 2050, the world's population is expected to reach nine billion and the demand for meat worldwide will outstrip the environment's capability to supply it. Mindful of animal welfare, climate change and global food shortages, *Bistro In Vitro* is a fictional design project and documentary exploring the potential of in-vitro meat grown from stem cells.

Bistro In Vitro is presented as a virtual restaurant, which reflects the prospects and aesthetics of lab-grown meat. Conscious of the negative reactions surrounding this endeavor, the work investigates how lab grown meat could venture into our food culture and how it might become a sustainable, animal-friendly alternative to the conventional consumption of meat.

Individuals are encouraged to explore dozens of fictional recipes, collected in the *In Vitro Meat Cookbook*, and put together their own customized menu.

Materials:
Glass, silicone, oil, ceramic, berries, sugar, wool, paper

Pink Chicken Project

(Non)human (Non)sense Collective
Leo Fidjeland & Linnea Våglund

Every year 60 billion chickens are killed and consumed globally, and their bones leave a distinct trace in the earth's rock strata. To signal this identifier of our new geological age, the Anthropocene, this project proposes genetically modifying chickens to have pink bones and features, using a gene from the cochineal insect to produce a pigment that will be fossilized when combined with the calcium from bones. Spreading this gene with the newly invented CRISPR gene-drive technique, the entire *Gallus gallus domesticus* species could be permanently altered, on a global scale, in just a few years. This would color the stratum of the Anthropocene pink: a symbolic color coded as the specular opposite of hetero masculine supremacy.

The artists point out that the current devastation of our planet is not the result of activities undertaken by the whole species *Homo sapiens*; instead it derives from a small group of humans in power. The *Pink Chicken Project* abhors the current violence inflicted upon the non-human world, while embracing the irony that what it proposes is itself an act of violence through the non-consensual modification of the bodies of billions of chickens.

Materials:
Chicken body, bones, egg, and fossil

Interwoven and Harvest— Exercises in Rootsystem Domestication

Diana Scherer

In works blending botany and photography with the history of design, Scherer directs the growth of plant roots to achieve new yet familiar forms. The artist's process begins with material research into biology, the testing of several plant species, like grasses and grains, to see how well they respond to a growth environment that is carefully shaped and layered to produce patterned root growth. In a process that can take up to a year, once growth has progressed enough, the roots are cut, separated from the rest of the plants, and treated to remain stable.

The results of this process, directed by careful choices of patterns in three dimensions, produce compositions of woven roots that make clear references to the history of decorative design such as Art Nouveau, yet depart from them in important ways. Here, the maker wields only limited control, opening the door to the unpredictability of biology, and welcoming the serendipitous irregularities and asymmetries that make each work unique. The artist collaborates with biologists at the Radbound University in the Netherlands and cites the work of Karl Blossfeldt as an important influence, the pioneer in photographing plant forms who was active in the late 19th century.

Materials:
Soil and oat grass seed

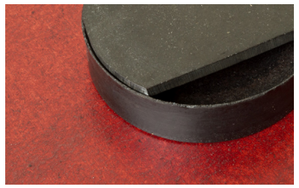
Blood Related

Blood Related is a collection of raven black objects that have been made entirely from blood, gathered from the abundant waste generated by the meat industry. Blood and its deep red color have numerous vivid cultural associations, from romantic passion and revolution to religious ritual and pain. Due to these powerful connections, it is difficult to be impartial about blood or objects made from it, which tend to both attract and repel some viewers.

Stittgen creates these objects by drying blood until it becomes a powder, which is then heated and pressed until the glue-like albumin protein, already present in blood, binds it into a solid. The object collection includes a totem, a record that plays a recording of a cow's heartbeat, and a jewelry box. The works challenge the stigma around using a substance like leftover blood as a biomaterial while also raising awareness of the torrents of industrial waste created by our modern lives. Every year billions of liters of blood are simply disposed of, the byproduct of our consumption of animals, with no material-related industry yet finding a use for it.

Materials:
Blood

Made possible with support from the Creative Industries Fund NL



Megan Valanidas

A Place For Plastics— Bioplastics, Bacteria and Our Thoughtless Acts

VARIOUS SOIL AND SEWAGE BACTERIA

Due to human carelessness, plastic waste ends up damaging ecosystems around the world. This project responds to this ongoing problem with bioplastic objects designed to decompose when discarded in the environment. Instead of polluting landscapes, these prototypes are made to respond to the presence of bacteria from wherever they end up, prompting their dissolution.

In this work, Valanidas focuses on utilizing soil-degradable plastics in single-use goods and packaging. Examples of prototypes include a beverage cup, chip bag, and mailer with bubble cushioning, created from bioplastic that can be safely flushed with wastewater. The biopolymers used in each is broken down readily by various local bacteria. The constitute components left over are non-toxic and can become part of subsequent biological processes.

Materials:
Biopolymers, resin, rubbish

Affiliations:
RISD, James Madison University

Ui Westphal

The Cultivar Series (Lycopersicum III, Capsicum I, Phaseolus vulgaris I)

Studies in the *Cultivar Series* highlight the spectacular variety among fruits, roots, and vegetables that result from mutations and polymorphism. The colors and shapes seen here cover a wide spectrum, unlike the uniformity we usually encounter in supermarkets when shopping for tomatoes, peppers, or beans. The artist gathered these "survivors" of biological variation from farmers' markets and seed banks in several cities, then photographed and arranged them with intense focus and drama. The *Cultivar Series* is based on Westphal's long-term research on crop diversity, and on the food industry's portrayal of natural produce. The series also helps illuminate the impressive adaptability of plants and the ways in which artificial selection is entwined with our culinary heritage.

Materials:
Digitally printed photography

Solanum lycopersicum
capsicum (various)
Phaseolus vulgaris

Uli Westphal

The Cultivar Series (Zea Mays I)

Zea mays

This study in the *Cultivar Series* was commissioned for this exhibition by the RISD Nature Lab and focuses on the diversity of maize cultivars grown before the age of industrial monocultures. For this work the artist collaborated with scientists at seed banks and research centers in Tucson, Arizona and Texcoco, Mexico, visiting their locations and examining hundreds of specimens.

The sample seen here in the display jar is *Toesinte*, an ancient wild grass in the *Poaceae* family with a short stalk of kernel seeds, understood to be the likely ancestor of the varieties of corn widely grown and consumed around the world today. Thousands of years of selection by humans have yielded dramatic changes, including more kernels, bigger cobs, more rows of kernels, and greater edibility.

Materials:
Digitally printed photography

Affiliations:
RISD Nature Lab

Special thanks to
Liz Fairchild, Nicholas Garber, Sheryl Joy, Dr. Denise Costich, Dr. Martha Willcox, and Dennis Baldwin.

Suicide Soda

Ui Vestphal

This new project grows out of the *Zea mays* study in the *Cultivar Series* and critically examines the product of more than half of all corn grown for human consumption in the United States: high fructose corn syrup (HFCS). This is widely used in thousands of food products, including soda, and is linked with obesity, diabetes, high blood-pressure, tooth-decay, and other ailments when consumed in excess. The name of the work comes from what teenagers call a drink that blends all the different sodas available at a soda fountain. It also refers to the role that HFCS plays in diabetes-induced death.

Soda has negative impacts on public health, even when made with cane sugar instead of that derived from corn. This is particularly problematic in developing countries where communities may lack access to safe drinking water, as cheap soda offers an attractive alternative. The long-term negative impact on health and well-being in these regions, some of them the very lands from which ancient corn varieties first sprang, is a tragic outcome of the history of cultivation, trade, and the legacy of poverty.

Materials:
High fructose corn syrup based soda in plastic bottles

Affiliations:
MU Artspace,
RISD Nature Lab

Organs-on-Chips

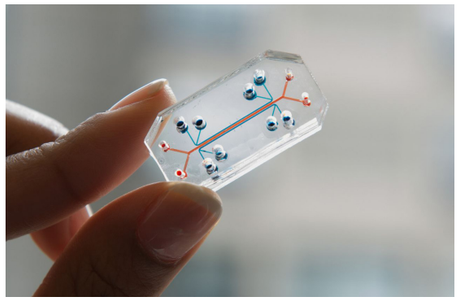
The Wyss Institute for Biologically Inspired Engineering

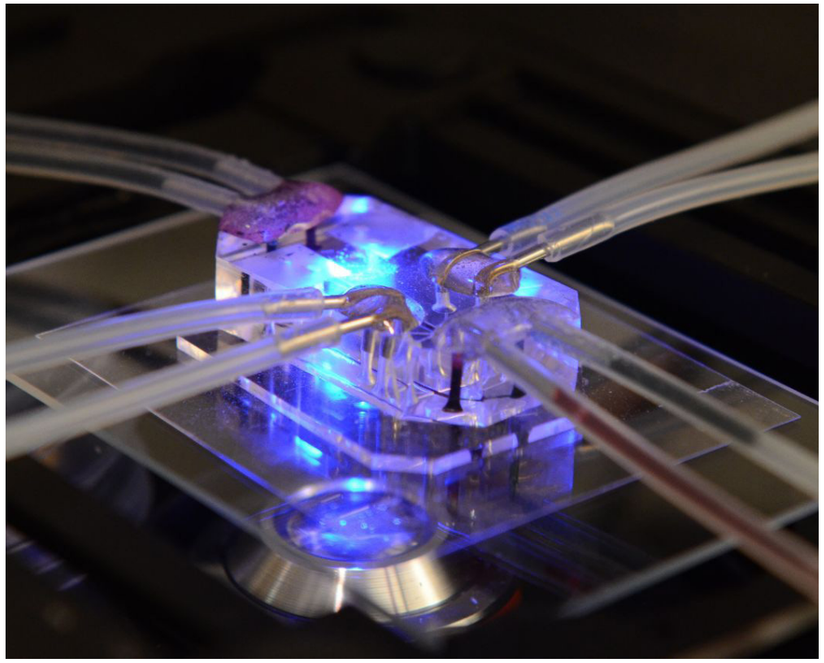
Organs-on-Chips are devices created with computer microchip manufacturing methods that use human cells to model the function of human tissue, organs, and multi-organ physiology. The technology offers a potential alternative to traditional animal testing, and is a more affordable and accelerated in vitro platform to develop new drugs and personalized medicines.

Developed by the Wyss Institute for Biologically Inspired Engineering at Harvard, led by Founding Director Donald Ingber, an *Organ-on-Chip* is a multi-channel 3D microfluidic cell culture system that simulates the processes and physiological responses of living human tissues and organs. To date, Wyss Institute researchers and a multidisciplinary team of collaborators have developed 15 different chips. Each of these microdevices is composed of a clear flexible polymer that contains hollow channels lined with living human organ-specific cells interfaced with artificial vasculature, allowing the mechanical mimicking of the physical microenvironment of living organs, such as breathing motions in the lungs.

The *Organs-on-Chips* have been widely recognized as a breakthrough technology, following an approach of biotechnical integration that is at once elegant, ethical, and utilitarian. In 2015 the chips became part of the permanent design collection of the Museum of Modern Art (MoMA).

Materials:
PDMS (silicon), acrylic





bactoyou

Yuxin Cheng, Arian Ghousi,
Juliette Van Haren,
Ignacio Garnham Brades

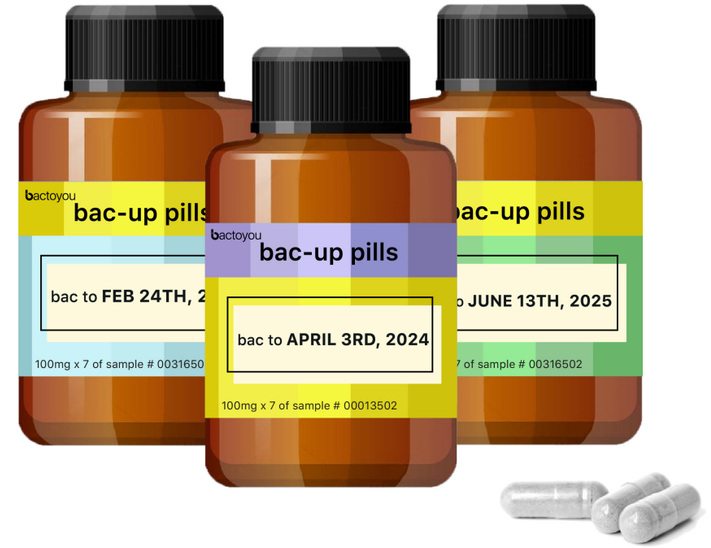
This speculative project proposes a new kind of home appliance: a microbial time machine that empowers us to collect, sequence, explore, and back-up our previous, personal microbial states. By creating a historical database of our microbiomes, the distinctive and every-changing population of microbes that exist inside and on our bodies, the system allows its users to “jump back in time.” This would be done by reconstituting one’s microbiome to mirror that which existed in the past.

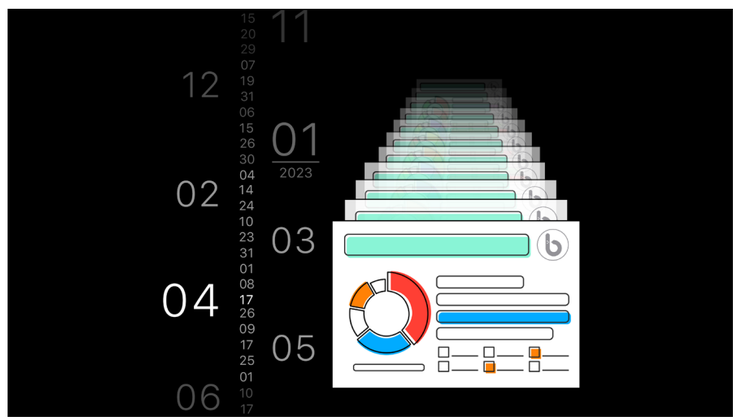
bactoyou offers a solution to microbiome changes or depletion as a result of antibiotic treatments, chemotherapy, long term travel, and other events that influence the microbiome. By using this new tool, users would become more aware of their microbiome by collecting samples in an easy and user-friendly way, breaking the paradigms of traditional fecal sampling methods. Through this service, users would also gain control of sensitive, personal data about their health.

bactoyou was created by a student team competing in the 2018 Biodesign Challenge, an annual competition which encourages university students to envision potential future applications of biotechnology.

Materials:
Mixed media

Affiliations: The New School Parsons School of Design





Beyond 100%

Tung Li, Jaeky
Cheong, Sihyung Chang

Beyond 100% is a speculative design project developed for the annual Biodesign Challenge; it envisions a future in which humans are genetically modified to acquire, manage and share nutrition. Their narrative is set in 2070, by which time the global population of 10.5 billion people finds itself facing an emerging crisis of food shortage.

The altered humans of the future gain increased capability to enjoyably eat natural resources such as hay, algae, fungi, and insects. In order to ensure humanity's survival, any citizen who gathers over 100% of the recommended amount of nutrition is obligated to share with others who are under-nourished. 30% of excess nutritional resources is gathered as taxes from around the world, then redistributed to those in need. In this imagined future many of our social scripts are re-written and what was normal in our time appears backward and alien. *Beyond 100%* presents a narrative characterized by maximizing the utility of every resource, providing a stark contrast to our everyday wastefulness while also exploring how fundamental aspects of our lives may change due to biotechnology's advance.

Materials:
Digital images, plastics

Affiliations:
Parsons School
of Design

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Jen Bervin,
11 The Indoor Microbiome
BioBE Center
12 To Flavour Our Tears
The Center for Genomic Gastronomy
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Ecovative
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33 Beyond 100%
Beyond 100%

Jen Bervin

Jen Bervin is a designer who holds an MA in creative writing and poetry at University of Denver and a BFA in studio art from the School of the Art Institute of Chicago. Bervin has exhibited her work extensively, including at the Granoff Center for the Arts, BRIC, and the Des Moines Art Center among others. Bervin has curated exhibitions internationally, published 10 books, including *Silk Poems*, and has earned numerous awards for her practice from the likes of the Asian Arts Council, New York Foundation for the Arts, and the Bogliasco Foundation.

The BioBE Center

The BioBE Center is a research-lead organization examining ways to approach and understand the microbiome of the built environment. Aiming to improve human health and environmental sustainability, the center provides an educational platform in order to optimize the design and operation of buildings, while promoting human health.

Center for Genomic Gastronomy

The Center for Genomic Gastronomy is an artist-led organization exploring the development of biotechnologies and biodiversity of human food systems. Collaborating with farmers, hackers, scientists and chefs, the organization presents its work via exhibitions, research publications, meals and lectures. The Center has exhibited its work globally, including at the Science Gallery Dublin, Dutch Design Week and MAAT Museum, among others.

Ecovative

Ecovative is a design practice which invents, develops and produces environmentally friendly materials which have a positive impact on the world's ecosystem. The practice is committed to working with consumers and industry leaders to decrease the level of unsustainable materials across the globe. Its goal is to encourage individuals and companies to achieve their sustainability goals without having an extra cost or an impact on performance.

https://ecovativedesign.com/

Fabienne Felder

Fabienne Felder is a Swiss designer and the founder of Lumot (Bio) Design in New York. She holds a BSc in business studies from the Cass Business School, City University of London, and an MSc in product and spatial design from Kingston University in association with the University of Cambridge. She is a member of Genspace and works closely with the University of Cambridge in developing her research.

Colleen Flanigan

Colleen Flanigan is a visual artist, public speaker, and conservation activist. Flanigan holds a BA in design from the University of California and a post-baccalaureate degree in metals from the Oregon College of Art and Craft. Flanigan has exhibited her work internationally, including at The IMC Lab + Gallery and The Creators Collective Preview Pod. She also has been a TEDx speaker, and is the first artist to be certified by the Global Coral Reef Alliance in Biorock mineral accretion, a method for coral reef restoration.

Kathy High

Kathy High is an artist and professor of video and new media at the Department of Arts, Rensselaer Polytechnic Institute. High's work has been exhibited at major museums, including the Museum of Modern Art in New York and the Guggenheim Museum. High hosts bio/ecology and art workshops and is creating an urban nature center in North Troy (NATURE Lab) with media organization The Sanctuary for Independent Media. High holds a video and film interdisciplinary degree from the Center for Media Study at Colgate University and has an MA in humanities, S.U.N.Y at Buffalo.

Ani Liu

Ani Liu is an experimental artist, researcher and design educator. Liu has taught at the Harvard Graduate School of Design, served as a design critic on numerous design panels and has exhibited her work in the United States and China including the Boston Museum of Fine Arts, the Asian Art Museum, MIT Museum, MIT Media Lab, Mana Contemporary, Harvard University, and the Shenzhen Design Society. Liu has a BA from Dartmouth College, an MA in architecture from Harvard University, and an MSc from the Massachusetts Institute of Technology.

The Living

The Living is a research-based design practice founded by David Benjamin and based in New York city with a focus on architectural applications for biological systems and un-conventional building materials. The practice explores developing sustainability innovations, utilizing low-carbon materials, and bringing the use of machine learning and A.I. to the physical world.

Mae-ling Lokko

Mae-ling Lokko is an architectural technologist and founder of AMBIS Technologies Inc. and Willow Technologies, Ltd. Lokko holds a BA from Tufts University, a PhD and an MSc in architectural science from RPI's Center for Architecture, Science and Ecology. She has exhibited her work inter-nationally, including at the upcoming 2018 Istanbul Biennial, Liverpool Biennial, ANO Institute of Contemporary Arts, Chale Wote Festival and Advanced Energy Conference. Lokko teaches seminars on energy and ecology in relation to the built environment, waste upcycling, and eco-effective material life cycle design.

Mikhail Mansion

Mikhail Mansion is a software artist, algorithmic expressionist and director of technology at Tellart. He combines handcraft with computation and mechanism to poetically explore natural systems. Mansion holds a BFA in electronic media arts and technology and a MFA in digital and media from Rhode Island School of Design.

Jon McCormack

Jon McCormack is a researcher, artist, professor of computer science and director of SensiLab at Monash University in Melbourne, Australia. McCormack holds a diploma of art from Swinburne University and a PhD in computer science from Monash University. McCormack's work has been exhibited internationally, including at the Museum of Modern Art, Tate Gallery and the Australian Centre for the Moving Image, among others. He has received over 16 awards for his research including prizes from the Ars Electronica, Images du Futur, and New Voices, New Visions.

Modern Meadow

Modern Meadow pioneers biologically advanced materials. The company harnesses the power of design, biology, and material science to produce the world's first biofabricated materials brand, Zoa™. Modern Meadow materials enable new design and performance possibilities, and by partnering with some of the world's most well-known consumer brands, it aims to bring new life to the material world.

The Next Nature Network

The Next Nature Network is an Amsterdam-based organization that develops innovative tools to shift people's mindsets surrounding the natural world and technology. Founded by Koert van Mensvoort, a philosopher, artist and scientist, the organization curates experimental projects that aim to alter human perception and behavior towards emerging

technologies. The Network's projects have been the subject of media coverage world-wide and have been exhibited in several major museum exhibitions.

https://www.nextnature.net/

The (Non)human (Non)sense Collective

The (Non)human (Non)sense Collective consists of designers Leo Fidjeland and Linnea Våglund who are graduates from MA Material Futures at Central Saint Martins. Våglund and Fidjeland are recipients of the The Michael Treschow Scholarship, Ulla Fröberg–Cramer's scholarship, and the iGEM Gold Medal. The Collective has exhibited worldwide including at the United Nations Convention on Biodiversity and the Embassy of Food at the Dutch Design Week, among others. In addition they have been invited speakers at the Future Architecture Platform at the Museum of Architecture and Design (MAO), Ljubljana.

Diana Scherer

Diana Scherer is an Amsterdam-based German designer who studied fine art at the Rietveld Academy in Amsterdam. Scherer has exhibited her work in both group and solo shows internationally, including at the Textile Museum Tilburg, Mediamatic Amsterdam, Photography Museum Rotterdam, and New Orleans Museum of Art. Scherer has also published two books on her experimental practice, including *Nurture Studies* (2012) and *Mädchen* (2015).

Basse Stittgen

Basse Stittgen is a designer who holds a BA in product design at the HfG Schwäbisch Gmünd and an MA in social design at the Design Academy Eindhoven. Stittgen has exhibited his work at numerous galleries, including the Science Gallery Melbourne and is also a design educator. In addition, Stittgen has assisted teaching at the Design Academy Eindhoven and has earned numerous awards for his practice including first prize for the Aed Neuland Award in the product design category.

Megan Valanidas

Megan Valanidas is a designer and researcher at Brown University. She holds a BA in fine and studio arts from the University of Arizona and an MA in industrial and product design from the Rhode Island School of Design (RISD). Valanidas has been a sustainable futures instructor at RISD where she has taught industrial design with a focus on research. In addition, Valandias has been a science educator, focusing on sustainable farming.

Uli Westphal

Uli Westphal is a Berlin-based artist who holds a visual arts degree from Aki – Academy for Fine Arts and Design, at the Maryland Institute, College of Art and at the Institute for Art in Context - Universität der Künste. Westphal has lectured and exhibited his work worldwide, including at the Museum of Modern Art and Design in Denmark, Stedelijk Museum

Schiedam, Serre dei Giardini Margherita and the Dokhuis Gallery, among others.

The Wyss Institute

The Wyss Institute for Biologically Inspired Engineering is an organization at Harvard University researching the usage of biological design principles to create devices and materials applicable for medical science. The Institute's research focuses on developing biologically inspired materials and devices for applications in sustainable architecture, healthcare, robotics, and manufacturing. Donald E. Ingber is the founding director of the institute and has authored more than 430 science publications and presented over 500 lectures worldwide on his breakthrough bio-inspired technologies.

bactoyou

bactoyou consists of four graduate students from Parsons School of Design: Arian Ghousi, Juliette Stephanie Van Haren, Yuxin Cheng, and Ignacio Garnham Brandes. The team has diverse expertise in bio-engineering, product design, communication design and business development, and showcased their project at the Biodesign Challenge at the Museum of Modern Art in 2018.

Beyond 100%

Beyond 100% consists of three graduate students from the Parsons School of Design: Tung Lin, Jaeky Cheony, and Siho Chang. The team has a range of experience in design strategy, design education, graphic design, and photography. Their project was featured at the Biodesign Challenge hosted by the Museum of Modern Art in 2018.

William Myers

William Myers is a curator, writer, and teacher based in Amsterdam. His book *Biodesign* (new edition 2018), published by MoMA, identifies the emerging practice of designers and architects integrating biological processes in their work. *Bio Art: Altered Realities* (2015), published by Thames & Hudson, profiles art that uses biology in new ways or responds to advances in the life sciences that are altering our notions of identity, nature, and the definition of life. His writing and exhibitions have been profiled in the journal *Science*, *The New York Times*, *The Wall Street Journal*, *New York Magazine*, *Smithsonian Magazine*, *Volkskrant*, and *Folha de São Paulo*, among others. William has lectured at Harvard University, the Tate Modern, Universitário Belas Artes de São Paulo, International University of Catalunya, Oxford University, Leiden University, and Royal College of Art. He has worked for MoMA, the Guggenheim Museum, the Smithsonian Cooper-Hewitt National Design Museum, Science Gallery Dublin, Vitra, TU Delft, and The New Institute in Rotterdam.

Lucia Monge

Lucia Monge is a Peruvian artist with a background in education, and art and science collaborations. She came to RISD drawn by Nature Lab and worked there as a graduate research assistant while pursuing an MFA in sculpture. Upon graduation she joined Nature Lab staff and currently serves as the coordinator and researcher for C-AIM, a National Science

Foundation grant. Throughout her different positions at the lab, Lucia's main motivation has been to share Nature Lab's unique resources with others and create opportunities for collaboration and exchange through programming and outreach.

Her artistic research focuses on the way humans position themselves within the natural world with a special focus on our relationship to plants. For the past eight years she has organized *Plantón Móvil*, a yearly "walking forest" performance that leads to the creation of public green areas in cities such as Lima, London, Minneapolis and Providence. She has exhibited widely in South America, Europe, and the United States as well as at the United Nations Climate Change Conference (COP21). Most recently, throughout 2018, she has participated in residencies at Whitechapel Gallery and Guapamacátaro Center for Art & Ecology and received a Fellowship from the Oak Spring Foundation and an Education Partnership Grant from Rhode Island State Council on the Arts.

Lucia is an Adjunct Professor in the Department of Visual Arts at Brown University and an affiliated researcher at the Centre for Water Research and Development in the University of Witwatersrand in Johannesburg.

David Kim

David Kim is the Program Manager of Co-Works, the premier interdisciplinary lab and curricular incubator at the Rhode Island School of Design (RISD). Brought on in 2014 to build RISD Co-Works from the ground up, Kim leads the development of cross-departmental courses and interdisciplinary resources. Having worked as a biochemical research scientist, Kim returned to school for Interdisciplinary Computing in the Arts at the University of California San Diego (UCSD) in 2009 and the Digital Media MFA at RISD in 2012. He also works as a biomedical design consultant and has been the educational director of an art and architecture nonprofit, the director of digital stage effects for a contemporary dance company, a maths and science educator, and has designed and taught interdisciplinary art + science curricula at the School of Visual Arts, Brown University, UCSD, and RISD.

Kim's eclectic professional and educational backgrounds support an art practice devoted to cultivating biological, digital, and social systems as vehicles for personal catharsis, intersectional discourse, and social justice community organizing. A member of the international art collective Biome Arts, David's work and collaborations have been featured in *Wired*, *The Boston Globe*, *The New York Times,* and *Art in America*. Kim has also been a curator for interdisciplinary and social justice aligned exhibitions at Brown University and the Los Angeles Museum of Tolerance; he is especially honored to support a community of like-minded artists, designers, and scientists as a member of the curatorial team for *Biodesign: Inspiration to Integration* at RISD.

Neal Overstrom

Neal Overstrom is a biologist, designer, educator and the Director of the Nature Lab at Rhode Island School of Design. His professional work has focused on promoting environmental literacy through informal learning experiences. Prior to coming to RISD he held senior posts for exhibit development, research and zoological management at the Mystic Aquarium in Mystic, Connecticut and was a Design Associate for Kent + Frost Landscape Architecture.

Conducting field studies in regions ranging from sub-Arctic Hudson's Bay, Canada to the Gulf of California, Mexico, Neal has authored or co-authored scientific publications on topics ranging from shark development and reproduction to marine mammal biology and behavior. He also served as project director for a major public aquarium expansion featuring innovative fish, bird, and marine mammal habitats with more than two million gallons of re-circulating seawater systems and a multimedia ocean education center.

Neal earned a Bachelor of Science degree in biology from the University of Connecticut, a Master of Arts in zoology from Connecticut College, and a Master of Landscape Architecture from the University of Massachusetts, Amherst. In 2009 he was named the University of Massachusetts Olmsted Scholar, exploring the intersection of living systems, technology, and aesthetics in designing for sustainability. His current interests involve investigating the biological influences on design, particularly the ways in which pattern, form and living elements in the built environment can reinforce our human-nature connection.

Julia van den Hout

Julia van den Hout is founder of Original Copy, a communications office that specializes in editorial, curatorial, and research projects within architecture and design. Julia is also co-founder and editor of *CLOG*, a quarterly publication that aims to slow down the rapid pace at which information is distributed, debated, and consumed today, and provide a platform for the discussion of subjects particularly relevant now.

With Original Copy, Julia co-curated *5x5: Participatory Provocations*, a traveling exhibition of 25 young American architects. As part of *CLOG*, Julia curated *New Views: The Rendered Image in Architecture* at the Art Institute of Chicago, and she was on the curatorial team for *Spontaneous Interventions*, the US Pavilion at the 13th International Venice Biennale in 2012.

From 2008 to 2014, Julia was Press Director at Steven Holl Architects, where she was responsible for developing and coordinating the PR strategy for over 30 projects and competitions, organizing the opening and publication of more than 10 completed projects, and the coordination of multiple traveling exhibitions.

Peter Rogers

Peter is an artist and conservationist currently studying at Rhode Island School of Design's digital and media program. Growing up in Silicon Valley in the aughts with an interest in ecology, Peter became engaged in using the internet as a vehicle for conservation awareness.

At the University of Michigan, Peter continued his studies in ecology, internet communications and environmental conservation, graduating in 2016 with a BS in evolutionary anthropology and a BA in art and design. During and after his studies at the University of Michigan, Peter worked with the Little Fireface Project, a conservationist organization dedicated to using social media as a platform for conservation awareness.

Peter first came into contact with the Little Fireface Project through his studies on the Javan Slow Loris, a primate whose status as a critically endangered species was precipitated by viral videos of slow lorises as pets. The Little Fireface Project aims to utilize those same avenues of communication to generate conservation awareness and discourage the exotic pet trade. Peter's work with the Little Fireface Project included studying how internet platforms can be utilized as a means to spread conservation awareness, field research at the Little Fireface Project's research station, community outreach, and representation of the project at primatology conferences.

At the Rhode Island School of Design, Peter has continued his research into the Internet as a platform for conservation awareness. His research also explores the use of art as a vehicle for conservation efforts, and internet communities as virtual ecosystems.

Angela Torchio

Angela Torchio is currently pursuing an MFA in graphic design from the Rhode Island School of Design. She has over a decade of experience in the contemporary art world having held positions in communications and publishing at companies including Phaidon Press, Black Dog Publishing, and the Canadian Art Foundation. She has taught at Ontario College of Art and Design and RISD, and she has published a catalogue for the International Architecture Biennale Rotterdam as well as essays on Matthew Barney's work.

Angela holds master's degrees in contemporary art and archaeology from the University of Manchester and UCL, and is interested in the parallels between the two fields. Her research is focused on value and representation in contemporary and ancient cultures. Her previous work examined the ways technological advancements altered the perception and value of metallurgy in the Aegean bronze age. She is currently concentrating on the correlations between identity, value, and representation in contemporary culture from an aesthetic vantagepoint. This research investigates the aesthetic choices in depictions of dinosaurs and other extinct animals, and examines indicators that those animals hold a different value than extant animals.