

Exploring Life through Design. New questions, a new imagery

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Abstract: Design nowadays merges in new forms with chemical research and bioengineering, to create specific systems and processes and to use them for objects and tools. But scientific research in the orthodox sense is combined in several cases with references to aesthetic research, philosophical matters, ethic issues; the practical purpose is associated with an imaginative dimension, e.g. the pre-modern world of alchemical experimentation. The analyzed exhibitions and projects are located in a very vibrant area of cultural intersection, which includes biotech and art practices. Biodesign is spectacularized, with the aim of showcasing the process and the technologies employed, inspiring critical reflection on the boundaries between life and the artificial.

Keywords: Biodesign - Biotechnology - Design imagery - Speculative design

[Resúmenes en castellano y en portugués en las páginas 63-64]

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A territory of experimentation

Designers have shown a growing interest in interacting with the biological sciences over the past two decades, driven in part by the need to develop innovative artifacts compatible with ecosystem regeneration. The attraction for a “living artificial”, a leitmotiv for the avant-garde and radical Movements of the '60s and '70s of XX century, nowadays it's not so utopian. In the visions of the Japanese Group Metabolism, in the 1960 Manifesto “Organica” by William Katavolos, in the evolutionary construction imagined by Rudolph Doernach, –among the protagonists of the visionary design– the qualities of transmutation of new biological materials constitute a technological imaginary but also a dreamlike one. The utopian idea of materials and objects that are able to mutate and self-transform, prefigured by the avant-gardes, had the great merit of showing a wide range of researches, later developed in different directions. In the essay “Beyond Mimicry”, Paola Antonelli attempts a historical reconstruction of the roots of the relationship between biology and design, pointing out dangers and promises for the future; as she affirms, building with bacteria and other organisms is simultaneously becoming a technological possibility and a necessity (Antonelli 2012, pp. 10-17). The concept of “biological” is a crucial attractor for contemporary project at every scale, from urban to architecture to objects: it looks to the transformation of the inorganic into the organic (La Rocca 2017, p. 68). Because of this trend toward a metamorphosis of the object, design today often has to deal with uncertain boundaries between living/non-living, animate/inanimate

Contemporary biodesign research has been taking a very specific path for twenty years now, opening up new questions that broadly involve culture, blurring the boundary between artificial and biological systems. Now designers can actually incorporate in the project living organisms, that collaborate as essential actors of the production process, leading to new generations of objects.

The confrontation with the living inevitably brings one closer to issues of philosophical significance, such as the limits of science, the relationship with nature, and the ethical and aesthetic values of design; the product often assumes the value of a *conceptual device* and becomes a territory for experimentation of an evolving imagery (Scarpitti, 2020).

This paper is based on a survey, in the international scenario, of particularly significant projects and exhibitions. In bio-design research, designers are striving to assimilate the necessary scientific skills, including pursuing specialized scientific courses of study. But they also develop independent research that regards critical speculation, the matter of new nature/technology conjugations and new aesthetics.

The acquisition by designers of expertise in biotechnology and the collaboration with specific laboratories, which are being developed around the world, is crucial to this end. Among the pioneering research centers the *Waag Society* in Amsterdam. The Waag, Institute for art, science and technology, was founded in 1994 by Marleen Stikker and Caroline Nevejan, and has since evolved into a *Future Lab* for technology and society. Working in a trans-disciplinary team of designers, artists and scientists, Waag explores emerging technologies, and provides art and culture a central role in the designing of new applications for novel advances in science and technology. More specifically, we are interested in the

Open WetLab, an important section of Waag. It is a leading place for bio-art, biodesign and do-it-together biology, working together with artists, designers, scientists, and hackers. *Tissue, Culture & Art (TC&A) Project* is another pioneering research center, founded in 1996 by Oron Catts & Ionat Zurr: projects promoted specifically dealing with lab-grown food, tissue cultured clothing, semi-living sculptures and the changing relationship between humans and nonhumans¹. On these topics, the TC&A Project has curated several exhibitions in the world, created performances, showing tissue engineering as a medium for artistic expression, developing social and philosophical matters. In 2000, Catts & Zurr founded *SymbioticA*, housed within the School of Human Sciences at The University of Western Australia, enabling researchers to engage in wet biology practices. The lab both focuses on experiential practice but also on cultural issue of life manipulation; it offers many training opportunities, with residencies for artists, designers, biotechnologists². *SymbioticA* and Waag's *Wetlab*, represents an excellent example of the convergence of scientific and humanistic culture. It is also thanks to these models of institutions that—as we shall see below—biodesign research is now able to express itself at high levels of originality both in exhibitions and in the work of individual protagonists (See *Figure 1*).

Biodesign on scene

The biodesign exhibitions analyzed in our survey show research paths focused on technical-practical aspects; but it is noticeable that often its purpose goes beyond specific scientific goals, mainly the contribute to an ecological turn. In fact, the design also explores ambiguous fields and touches on themes of complex interpretation, where scientific research and imagination are combined in original ways. The use and display of advanced technologies is matched by a very vivid imagery, suggesting references to the dimension of magic and mystery; the rational method is accompanied by references to artistic, irrational aspects, aesthetic motives. Many exhibitions are also opportunities to develop a spectacularized design process and conceive a new imagery.

The exhibitions considered are situated in a fertile area without rigid boundaries between disciplines, including biotechnology, design and artistic practices; biodesign goes on the scene with the aim of showcasing innovative concepts, communicating the process and technologies employed, and inspiring critical reflection on the boundaries between life and the artificial.

Among the exhibitions analyzed, we highlight in particular: “*Visceral: The living Art Experiment*”, Science Gallery, Dublin 2011; “*Biodesign. Nature, Science, Creativity*”, MoMA New York, 2012; “*Alive. New Design Frontiers*”, UAL Central Saint Martin, Paris, 2013; “*Biodesign*”, Het Nieuwe Instituut, Rotterdam, 2014; “*Fluid Matter Exhibition*”, Eindhoven, 2016; “*Biomess*”, Art Gallery of Western, Australia, 2018; “*La fabrique du vivant*”, Centre Pompidou, Paris 2019; “*Fermenting Futures*”, Künstlerhaus, wien 2022 (See *Figure 4*).

Science Gallery and *SymbioticA*, collaborated in 2011 for the exhibition “*Visceral: The Living Art Experiment*”. *Visceral* confront audiences with the processes of modern biology, to explore our understandings of rapid developments in the life sciences and their applied

technologies. A range of award-winning work from 17 different artists will challenge visitors to consider the tension between art and science and the cultural, economic and ethical implications of biosciences today. Exploring our changing perceptions of life, the exhibition it is a clear example of how in the field of biodesign, scientific interest in the narrow sense is often accompanied by the development of speculative design.

“*Biodesign. Nature, Science, Creativity*”, edited by William Myers, is among the first extensive exhibitions that systematically explore an emerging approach to design that incorporates the use of living materials. For the greater specificity of the projects in interweaving biotechnology expertise and design, this exhibition goes beyond “Design and Elastic Mind”, curated a few years earlier at the same MoMA by Paola Antonelli (Antonelli 2008). The volume accompanying the exhibition select represents also an original attempt to reflect on the principles, methods and theories on which biodesign is based, as an unprecedented field of interdisciplinary research (Myers 2012).

The exhibition “*Alive*”, curated by Carol Collet, presents a design landscape, where fragments of a “synthetic” future are mixed with alternative design perspectives, from poetic interpretations to scientific extreme provocations. Projects are grouped around 5 themes, among these: *The new artisans*: designers co-work with fungi, bacteria, algae or plants and develop new techniques to grow and craft consumer goods. Here, design relates more to gardening and farming than to manufacturing. In the *Bio-Hackers* section designers and artists experiment the use of engineered living organisms, in collaboration with synthetic biologists or respond to cutting-edge scientific research in the field of extreme bioengineering. In *New alchemists* section, the exhibition focus on the exploration of the merging of biology, chemistry, robotics and nanotechnology to combine living (biological) with non-living (electronic and chemical) technology.

Starting in 2014, the “*Bio Art & Design (BAD) Award*” aims to stimulate emerging designers and artists to produce new multidisciplinary work. Every year in winter, the three winning projects will be on show Eindhoven, presented in a thematic exhibition alongside other bio art & design works. The open access ebook, *Emerging Bioart and Biodesign*, collect the results of the prize and represents an advanced panorama of research (Myers, 2022). BAD thematic exhibitions include “*Fluid Matter*”, that presented the winning projects of the Award 2016 alongside artworks that shared a dimension of fluidity, a recurrent topic in biodesign:

“[it] explores the theme of fluidity inside and between bodies, cells, and substances. Life’s processes abound with continuous exchanges and are often embodied in liquid form, flowing throughout complex and microscopic environments; yet, these phenomena often escape perception. It takes the intervention of artists and designers to bring them into the realm of the observable, lend them meaning, highlight their beauty, or find their material potential at different scales”³.

Anna Dumitriu and Alex May in collaboration with the Institute of Microbial Biotechnology in Vienna curated in 2022 the exhibition project “*Fermenting Futures*”; it focuses on the importance of yeasts in human history, from a cultural and aesthetic perspective,

engaging audiences in the future of this important, but under-recognised, field. The event, as we will see below, has as its focus a project that explores the possibilities of using yeasts to make compostable plastics for 3D printing.

International exhibitions reveal a generally positivistic view of nature, but one that coexists with a questioning character. In particular, where the relation with biology involves using or integrating actually living elements into the project, the research takes on an aspect of great fascination; but at the same time brings with it elements of disquiet that prompt reflection. The paradigms of post-human thought support these practices of living/artificial contamination; they postulate the concept of biofactory, that is, “a new field of technological intervention not only applied to the living, but realized through the living itself. The biofactory churns out bio-objects, i.e., technological partners that are no longer mere inanimate objects, but intimately and profoundly touch the very idea of life, and which, evidently are alive” (Marchesini 2002, p. 405). Some conceptual aspects, moreover, are suitable for a spectacularization, because of the inherently evolutionary nature of the objects: As Myers marks, “the work of bioartists and designers is often characterized by unusual materials or media, as compared with more traditional creative practices. Most notably, the work is sometimes living, changing, decaying, growing, or otherwise in an unstable state. Like with performance or other sorts of ephemeral creations, there is not a fixed moment of completeness or status, but rather elements in motion” (Myers 2022, p. 19).

Beyond manufacturing

Lydia Kallipoliti has reconstructed an unexplored genealogy of ecological material experiments that underground architectural groups conducted in the 1960s and 1970s in the exhibition “EcoRedux: Design Remedies for a Dying Planet”, and the close focus of designers on research into materials⁴. The result is a complex scene, where a generation of designers emerges, united by the inspiration of the growth processes and self-organisational capacities of the biological systems; by the attention to agricultural processes and the metabolic cycle of materials; by the idea of *cultivation* as a paradigm of the project. This last concept in particular, seemingly utopian, is reflected in contemporary biodesign, moving beyond traditional production tools and methods.

As Neri Oxman recently said:

“The vision? *Grow everything*. In the future, human-made materials will be a combination of grown and made, created using a mixture of natural and synthetic techniques. Relationships between materials, humans, and organisms of the natural world will embody complete synergy” (Oxman, 2022).

Design, traditionally based on a series of standardized mechanical processes of construction and assembly—from fabrication to disposal—in our days is moving toward a profound change of paradigm: the traditional concept of “production” can be replaced by the ideas of “growth” and “cultivation”. The idea of growing product rather than manufacturing

them has been explored and critiqued through the notion of *semi-living* by Catts (Catts, in Myers 2012, p. 271). Maurizio Montalti, founder of *OfficinaCorpuscoli*, defined as growing design a field of experimentation dealing with literally evolving objects, working on the becoming of human artifacts. Growing design is a new paradigm for the project: it is possible today, through experimental processes, to realize “cultivated” objects, deriving from the action of living organisms.

Among the most paradigmatic project “*The Growing Lab / Mycelia collection*”, writes Montalti “introduces a radical paradigm shift, focusing on care-driven processes of organic cultivation and growth, to explore the fine balance existing between the roles of the (human) individual and the one of the non-human agents, within the relational complexity characterising the dynamic ecosystem we all are part of”⁵.

Eric Klarenbeek and Maartje Dros at Studio also have explored the potential of mycelium. A long experimentation leads the Studio to develop methods of 3D-printing living organisms in combination with local raw materials. The “*Mycelium Chair*”, presented in 2018, is grown as a fully compostable artefact, fertilizer for new plants to grow at the end of his life cycle. The chair releases oxygen into the atmosphere throughout its life cycle; the production process minimises energy use by eliminating the necessity of heating materials during the printing process. The global result is an object with negative carbon footprints. Neri Oxman’s team explores the relationship between digital and biological fabrication on product and architectural scales; to build the “*Silk Pavilion*” at the MIT Media Lab, silkworms and a robot work together. *Silk Pavilion* took form as a three-meter wide dome, constructed over three weeks with a flock of 6,500 live silkworms assisted by a robotic arm. “Each silkworm spun a single silk thread filament that is about 1km long. Combined, the silkworms produced a dome-shaped thread as long as the Silk Road. By studying how the silkworm’s spinning behaviour is informed by spatial and environmental conditions, we were able to guide the silkworm’s movement to spin two-dimensional sheets rather than three-dimensional cocoons”⁶.

Claudia Pasquero and Marco Poletto –with their *ecoLogicStudio* based in London– look for other paths for biodesign. A series of complex projects are born that use fungi, algae, and bacteria in order to create art installations and objects. “*H.O.R.T.U.S. XL*”, developed in 2019 is an installation where a digital algorithm simulates the growth of a substratum inspired by coral morphology: “this is physically deposited by 3D printing machines in layers of 400 microns, supported by triangular units of 46 mm and divided into hexagonal blocks of 18.5 cm. Photosynthetic cyanobacteria are inoculated on a biogel medium into the individual triangular cells, or bio-pixel, forming the units of biological intelligence of the system. Their metabolisms, powered by photosynthesis, convert radiation into actual oxygen and biomass”⁷.

Anniko Flo works cross disciplinary between art, design and scenography, developing a work based on life science and that reflects on post-human paradigms of thought. De-centering the human means for the designer a work that plays with the fusion of reality

and performance to evoke new realities, including other beings in staged spatial events, together with a human audience.

“For ‘*Your Everyday Exuberance*’ –says Flo– I am inspired by how microorganisms play key parts in, and influence our immune system, our brain and our genome, which all used to be biological explanations of the individual self. Humans are no longer considered to be individuals, but metaorganisms, revealed as chimera, monsters (...) The line between artist, her surroundings and materials begins to blur and dissolve. Intimately entwined with our bodies and lives, clothes, and the microbes that reside within them, can be seen as monstrous hauntings of, and by, ourselves”⁸.

A recent advanced project by Officina Corpuscoli “*Bio Ex-Machina*” explores the potential of mix digital algorithms, living agents, robotic behaviour and additive bio-facturing. The specific result is a collection of bio-fabricated furniture for interior environments, showing a range of new morphologies and aesthetics. As Montalti says,

“The project focuses on designing customised, on-demand objects, as hybrid eco-systems, by programming morphogenetic processes and robotic behaviours for the synchronised deployment of algorithmically designed, bio-fabricated artefacts. By incorporating growth-time as 4th dimension, the artefacts colonise, morph and expand on the digitally computed volumes, benefiting from the transformative qualities of mycelium-agents by means of hybrid growth protocols (i.e. Bio-4D-printing)”⁹.

The prospects for living/technology hybridization are now very broad; they describe a future that posthuman theorists intend to be increasingly close to being accepted and thus realized. In this research direction, the manipulation of animals, bred for specific production purposes in combination with advanced technology, is a developing possibility, although it poses significant ethical problems.

New frontiers for materials are explored in its technical and philosophical aspect in an essay by Laura Tripaldi, *Menti parallele. Scoprire l'intelligenza dei materiali*. In particular, Tripaldi illustrates the example of a hybridization between a living organism (the spider) and nanomaterials:

“A 2017 study analyzed the effect of exposure to certain man-made nanomaterials on the physical characteristics of spider webs, showing that after ingesting graphene and carbon nanotubes, spiders are able to weave a silk up to ten times more tenacious, that is, ten times more capable of absorbing the energy of a collision, and three times stronger ordinary silk” (Tripaldi, 2020, p. 198).

We can easily imagine through this example next generations of artifacts, which may follow in the wake of the silk pavilion, but also go beyond it.

Science / alchemy imagery

The mise-en-scene of biodesign, the production process, with the laboratory and its tools, plays a protagonist role in several projects; much more than the mere presentation of a defined and definitive object. Scientific research in the orthodox sense is combined in some cases with references to the pre-modern world of alchemical experimentation; the practical purpose, though prevalent, is mixed with the evocation of an imaginative dimension. Scientific research and spiritualistic motifs, ecological intentions and interspecies communication combine to characterize projects, that also deliberately recall a mystical dimension in the transformation and manipulation of matter.

For Ernesto De Martino, it is precisely the alternative and dialectic between magic and rationality that is one of the great issues from which modernity was born (De Martino, 1987).

The central artwork of exhibition “*Fermenting Futures*” by Anna Dumitriu and Alex May explores the possibilities of using yeasts to make compostable plastics for 3D printing, using advanced biotechnology; as points out Dumitriu, it

“physically contains a CRISPR modified *Pichia pastoris* yeast that is simultaneously able to capture carbon and output lactic acid for the manufacture of biodegradable PLA plastic – for 3D printing. The sculpture comprises a glass vessel containing the bubbling modified yeast, sustained by a mass of tubes. 3D printed yeast forms, including one which incorporates the yeast-produced PLA plastic swarm across the container”¹⁰.

Nevertheless, the narrative aspect of the project refers to traditional practices, the central installation and video evoke ancient alchemical laboratories.

Similar attention to the artistic and scenic aspect we find in the exhibition “*Shadow Metabolism*”, presented at the Pratt Institute School of Architecture, NY by Remina Greenfield and Shuyi Cao. The project includes sculptures, video projections, and holograms, and aims to make visible the microbial processes as active agents in systems of decay and fermentation. A sculptural glass fermentation vessel filled with honey and water and inoculated with yeast and bacteria is the centerpiece of the installation. The designers studied fermentation at Kingdom Supercultures, a company specialized in microbial communities and their applications for food production.

“*Glass, honey, water, bacteria, yeast*. The blown-glass vessels act as living sculptures containing active microbial communities feeding on honey and water. The fermentation process is perceptible by bubbles of carbon dioxide and phenolic compounds escaping through an off-gassing valve and the sweet, sour aroma” (Cao & Greenfield, 2022).

“*The Cactus Project*”, developed since 2001 by Laura Cinti, is a living artwork that involves the fusion of human genetic material into the cactus genome. It explores the reproductive paradox in genetic engineering by making use of agrobacterium-mediated gene transfer

to introduce keratin genes into cacti cells. Their external and morphological expressions are similar to that of a plant with human hair. Designer explains the symbolic mean of the project: “The choice of working with cactis came down to their fleshy construct often appearing monolithic and at the same time innocent– protected by growing spines. Hair, on the other hand, is a reproductive sign, for it is a sign of our body changing, becoming sexual”¹¹ (See *Figure 2*).

As is known, in Buddhism the mandala is a mystical geometric diagram that refers to the universe/cosmos, its rules and mysteries. The word is derived from Sanskrit and refers to the complex harmony that connects all living beings and gods, the origin of the universe, and the impermanence of existence. Tibetan monks create these objects mainly through fine sands of different colors. Inspired by these themes Pey-Ying Lin realizes in 2016 “*Kaleidoscope of the Universes*”, an attempt to update the imagery and means of mandala within the structure of ancient rituals: “Using the notion of actual sand (soil) to culture and isolate microbes to expand the invisible biological universes for our unaided eyes, with a 3D printer controlled by brainwave as our new tool for drawing, which constructs the modern growing mandala as the reflection of our perceivable universe¹².”

In the installation “*Outside Inside*”, result of a complex multidisciplinary research presented in 2022, the designer Johanna Schmeer, explores relationships between plant species and technology. The project includes a highly spectacular part, a technologized indoor garden in which plants, lichen, and fungi grow in microclimates that hypothesize environmental conditions for the year 2100. The activities of these plants are to cool soil, remove heavy metals, and absorb CO₂ and are measured by advanced sensors; the data is processed and turned into sounds, by means of a software developed with sound artist Sam Conran. Thus, in addition to the intent of experimentation about the balance of the ecosystem, the work also aims to enable new relations and communications between vegetal and human realms (See *Figures 5 and 6*).

The design examples highlighted above, united by an inspiration to mystical themes and reference to the mystery of nature, lead us to another matter present in more recent bio-design and connected to advanced biotech: namely the increasingly mobile and uncertain boundary between living and nonliving.

The boundary living / inanimate

Design reflects on the enigmatic nature of new hybrid artifacts and explores new frontiers with the guidance of biotechnology. This takes up a scientific-philosophical question that is part of the history of human thought. It was not until the late 18th century that the clear opposition between living and nonliving came to deeply fracture the framework of natural history: “The organic becomes the living, and the living is that which produces, growing and reproducing; the inorganic is the nonliving, it is that which does not develop and reproduce” (Foucault, 2010, p. 251). This acquisition has until recently been an unquestioned boundary even for our design culture, which today instead aspires to a sensitive, performative, self-organizing artificial.

The enigmatic and ambiguous character of the living is captured and becomes a speculative matter and also a new aesthetic dimension in the contemporary project. To better understand the depth of these questions we can refer to observations by Sigmund Freud. In defining the concept of “uncanny” Freud had indicated among his examples precisely the ambiguity between a living/non-living object. *Uncanny* is translation of the German word *unheimlich*, which is the antithesis of *heimlich*, a term meaning familiar, habitual. As Freud notes, “Unheimlich, says Schelling, is everything that should have remained secret, hidden, and has instead surfaced” (Freud, 1919, p. 275).

The uncanny for Freud has the figure of an object that is transformed from an everyday object into something ambiguously threatening. Among the categories he gives examples of which the character of the uncanny can be precisely the inanimate coming to life or, conversely, the living degraded to an object.

This ambiguity of inanimate and animate, organic and inorganic, albeit in different interpretations, is a feature present in contemporary biodesign. As Mario Perniola says, reflecting on contemporary imagery of objects

“... this is the thing we are interested in and this is what the comparison is with, not the thing that thinks, nor the thing that moves, nor the thing that shines in a certain and stable sensible form, but something opaque, indeterminate and open, that is not evident to itself and that is not a machine” (Perniola, 2004, p. 12).

This theme is the focus of the exhibition “*Biomess*”, curated in 2018 by the *Tissue Culture&Art Project*. The disorder and subversiveness of rules in the living is the central concept of the installation, which aims to provoke questions about the way we classify life forms. *Biomess* celebrates and challenges the strangeness of life by using luxury retail aesthetics to make non-charismatic life forms into objects of desire. As Catts and Zurr affirm:

“Both living and semi-living entities are mysterious and not under our full control and comprehension. However, the design of the installation, reminiscent of a luxury retail outlet, brings into question human forays into a new era of exploration and exploitation of biological life as a new commodity to satisfy unfulfilled desires”¹³.

More than anyone else, Roger Caillois, with his work scientifically confirms how enigmatic and inexplicable phenomena also reign in nature, as fascinating as they are, “nothing, absolutely nothing indicates that a sort of lavish expense lacking in any intelligible purpose is not the rule, more extensive and more greatly applied than the strict vital interest or imperative to the conservation of the species” (Caillois, p. 34).

“*ArchaeaBot: A Post Climate Change, Post Singularity Life-form*” (2018-19) by Anna Dumitriu and Alex May explores the concept of life in a post-climate change future, and imagines an “ultimate” species for the end of the world. The project is an underwater robotic installation based on new research on *archaea*, a group of unicellular micro-organisms believed to be the oldest form of life on earth and apt to survive in extreme conditions.

Micro-organisms are combined with the latest innovations in artificial intelligence and machine learning. Probably it was precisely the eerie character of the project that led to its selection for the exhibition *Unknown Unknowns. An introduction to mysteries*, at the 23rd Triennale Milano International 2022. The exhibition, main editor Ersilia Vaudo, engages us in a journey through unknown worlds: from the farthest universe to dark matter, from the bottom of the oceans to the origin of our consciousness (See Figure 3).

With “*No regrets for what you haven’t been, Be the ghost you want to see in the machine*”, (BAD Award winning work 2018), Ani Liu reflects on the instability of being human. The work is presented as an installation of nine scaffold-like sculptures, all exactly Liu’s height and each containing a vitrine that is the volume of the artist’s body. All nine contain active digital materials, biological artifacts, and neurological data that represent a specific organ, bodily part, or intellectual capability generally considered to distinguish us as a species.

Teresa van Dongen explores in an original way the world of find micro-organisms that continuously excrete electrons in their metabolism. These specific bacteria as a means to generate electricity for domestic use. The result is “*Electric Life*”, presented in 2019 for the exhibition “*La Fabrique du Vivant*”, a light installation entirely powered by micro-organisms that have electrons as a waste product.

In “*Bricolage*”, Nathan Thompson, Guy Ben-Ary and Sebastian Diecke, create animated, living, biological entities that are hosted in a suspended vessel (Incubator) custom made of clay, metal and glass, and show self-assembling skills. These living automatons, or living kinetic sculptures, are created using and processing three main materials: blood, heart and silk. In an interview with “*Art the Science’s*” in 2021, Ben-Ary and Thompson discuss the theory behind their work, and new directions in working with human-derived entities.

“Furthermore, when viewers see Bricolage’s automatons, they can seem alien and uncanny. Through this alien-ness, we hope to create a shock, in the audience, to disrupt their existing cognitive models of aliveness, to question our collective deep-seated preconceptions of what is ‘living’ and to ponder what framework can be applied to this new fragmented life. We hope that Bricolage’s alien animacy encourages the viewers to re-evaluate categories of life and aliveness and the ethics that surrounds their creation”¹⁴.

A more nuanced understanding of life

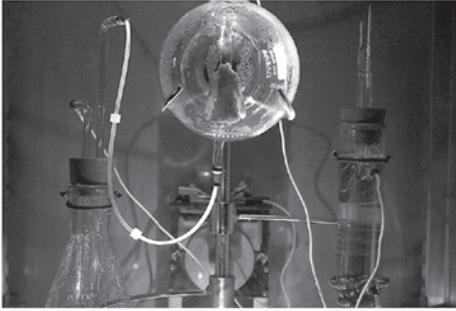
The paper highlights how –through scientific innovation– re-enter the project today complex issues of humanistic knowledge, that the rationalist project had neglected in the name of reductionism. The quota of mystery inherent in nature re-emerges as fertile ground for design project; in connection with an open, pluralistic and unconventional idea of the relationships between design, biology, technological imaginaries. It appears from the designers’ own voices, how many questions about scientific truths and the ethical and artistic implications of life manipulation.

At the same time biodesign research tends to extend in several hi-tech areas: life transforms in the wake of the computationally driven biosciences. A tendency in the biodesign is also the move towards the digital, collecting and processing data in the most advanced research.

Starting from these new horizons, designers develop the opportunities of digital/biological convergence. Researchers work across disciplines and methods –including, anthropology, theoretical biology, philosophy, and art– to critique and reimagine the possible material and conceptual practices of living that biological technologies make possible to apply to design.

Biotech, advanced electronics, robotic science, converge on an emerging, fundamental aspect of the contemporary: “things have become animated, extending beyond their physical boundaries and opening up to more complex conceptual dimensions” (Francalanci 2006, p. 65).

The search for fine-tuning of conceptual paradigms, is evident in the following ideas about the diffusion of the biodesign culture, taken from the publication celebrating 20 years of the award: “If the aim of bioart in general is to contribute to a more nuanced understanding of life, the true treasure of the awards (and the community that it cultivates) lies with feeling empowered to move in-between. Collectively refusing any clearly defined notion on what life is, never placing a limit on what life can be, and embracing the complexity of ecological entanglements, allow all kinds of different forms of life, art, and scientific research to co-exist and intra-act with one other (van der Eijk, 2022, p. 187). In relation to the above, the issue of training for those who want to be involved in biodesign is of crucial relevance; their culture should include specialized skills in the field of biotechnology, and thus the possibility of access to *ad hoc* laboratories and equipment; but no less biodesign projects and research require sensitivity to issues in the humanities. Ethical, philosophical matters, aesthetic and communicative values run through the panorama of a project that, as we have seen in the present excursus, has the merit of originality. And it is this richness of disciplinary intersections that make biodesign today so instinctively appealing to both the public and specialized critics.



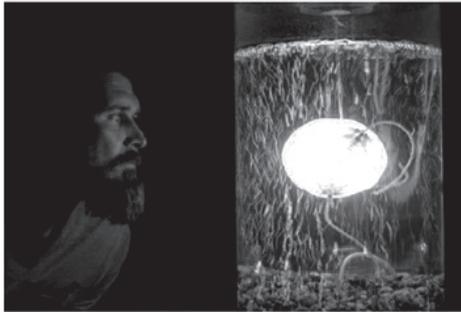
Titolo: Victimless Leather
Autore: Onor Catts e Ionat Zurr
Anno: 2004

1



Titolo: The Cactus Project
Autore: Laura Cinti e C-LAB
Anno: 2001

2



Titolo: Archea Bot
Autore: Anna Dimitriu e Alex May
Anno: 2018

3



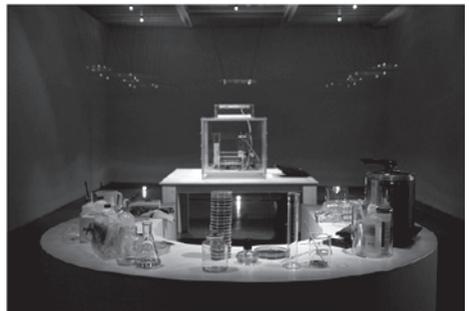
Titolo: Fermenting Future
Autore: Anna Dimitriu and Alex May
Anno: 2022

4



Titolo: The Outside Inside
Autore: Johanna Schmeer
Anno: 2020

5



Titolo: Caleidoscopio degli Universi
Autore: Pei-Ying Lin
Anno: 2015 - 2016

6

Figure 1. Victimless Leather, Onor Catts e Ionat Zurr (2004). **Figure 2.** The Cactus Project, Laura Cinti and C-Lab (2001). **Figure 3.** Archea Bot, Anna Dimitriu and Alex May (2018). **Figure 4.** Fermenting Future, Anna Dumitriu and Alex May (2022). **Figure 5.** The Outside Inside, Johanna Schmeer (2020). **Figure 6.** Caleidoscopio degli Universi, Pei Ying Lin (2015-2016).

Notes

1. The artwork of the “*Tissue, Culture & Art (TC&A) Project*”, after with the name “Symbiotica”, have been exhibited and collected by several museums and institutions such as; MoMA, NY; Mori Art Museum; National Art Museum of China; NGV; Yerba Buena Center for the Arts and more.
2. Cfr. <https://symbiotica.uwa.edu.au>.
3. Cfr. <https://www.badaward.nl>.
4. L. Kallipoliti was responsible for the exhibition “EcoRedux: Design Remedies for a Dying Planet”, (Byzantine Museum of Art of Athens, 2008; Columbia University of New York, 2009; Cooper Union, New York, 2010; Disseny Hub of Barcelona 2011). See also the dedicated monographic issue of “Architectural Design” (no. 208, Wiley & Sons, November-December 2010) and the website: <https://www-ecoredux.com>. Ecoredux assembles an unexplored genealogy of ecological material experiments that underground architectural groups conducted in the 1960s and 1970s.
5. Cfr. <https://www.officinacorpuscoi.com>
6. Cfr. <https://www.oxman.com>. Subsequent experimentation led in 2020 the Oxman team to the Silkpavilion II, an evolved version. “Building upon research developed for Silk Pavilion I, this successor project tackles challenges associated with scale and sericulture. The project utilizes an integrated kinetic mandrel designed to guide the natural spinning motion of the silkworms through clockwise rotation, fusing technology and biology to unite the woven and the spun”.
7. Cfr. <https://www.ecologicstudio.com>.
8. Cfr. <https://www.annikeflo.com>.
9. Cfr. <https://www.officinacorpuscoi.com>.
10. Cfr. <https://www.annadumitriu.co.uk>
11. L. Conti, interview by Esther Quintero on: <https://www.lesmutants.com>.
12. Cfr. <https://www.peinynglin.net>.
13. O. Catts and I. Zurr explain the project in: <https://tcaproject.net/portfolio/biomess/>. On the website there are references to other many project, as *Victimless Leather, 2004*; *Crude matter, 2012*; *Futil labor, 2015*; *Compostcubator, 2019* and other, that attest to the their long research work.
14. The interview by Rachel Stewart is available on: <https://artthescience.com/magazine/2021/09/15>

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Resumen: El diseño se fusiona hoy en día de nuevas formas con la investigación química y la bioingeniería, para crear sistemas y procesos específicos y utilizarlos en objetos y herramientas. Pero la investigación científica en el sentido ortodoxo se combina en varios casos con referencias a la investigación estética, asuntos filosóficos, cuestiones éticas; el propósito práctico se asocia con una dimensión imaginativa, por ejemplo, el mundo premoderno de la experimentación alquímica. Las exposiciones y proyectos analizados se sitúan en una zona muy vibrante de intersección cultural, que incluye prácticas biotecnológicas y artísticas. El biodiseño se espectaculariza, con el objetivo de mostrar el proceso y las tecnologías empleadas, inspirando una reflexión crítica sobre los límites entre la vida y lo artificial.

Palabras clave: Biodiseño - Biotecnología - Imágenes de diseño - Diseño especulativo

Resumo: O design atualmente se funde em novas formas com a pesquisa química e a bioengenharia, para criar sistemas e processos específicos e para utilizá-los para objetos e ferramentas. Mas a pesquisa científica no sentido ortodoxo é combinada em vários casos com referências à pesquisa estética, assuntos filosóficos, questões éticas; o propósito prático está associado a uma dimensão imaginativa, por exemplo, o mundo pré-moderno da experimentação alquímica. As exposições e projetos analisados estão localizados em uma área muito vibrante de interseção cultural, que inclui a biotecnologia e as práticas artísticas. O biodesign é espetacular, com o objetivo de mostrar o processo e as tecnologias empregadas, inspirando uma reflexão crítica sobre os limites entre a vida e o artificial.

Palavras-chave: Biodesign - Biotecnologia - Imagens de design - Design especulativo
