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Bio Art and the Biotechnological Singularity

By *Tom Kohut*

In her introductory text for *Artlink*'s September 2014 issue on "Life in the Anthroposcene," Suzanne Anker notes three main trends in the field of bio art: 1) "imagery garnered through methods such as MRI, atomic force microscopy, electrophoresis, gene sequencing and PCR technologies [involving images of] chromosomes, body scans, genotypic and phenotypic variations and laboratory-fabricated animals" in traditional art making contexts such as painting, sculpture, film, photography or video art; 2) "the incorporation of 3D computer modelling software, artificial life, robotics, biodegradable scaffolding and an interest in new media installations, rapid prototype sculpture and algorithmic codes"; and 3) "the inclusion of wet laboratory practices such as tissue engineering, the cloning of animal and plant cells, transgenic microorganisms and ecological investigations" in which artists "employ living matter as their medium" (14). In what follows, I will examine four examples of the two last category of art works – works that employ living matter as their primary medium or present prototypical models for future life forms – in order to demonstrate the means by which bio art, as the mode of art that incorporates biotechnological science and engineering into its mode of operation, raises ethical/political concerns as to the implications and the effects of these scientific and engineering practices, before opening onto an ontological terrain in which the relations between art, science and the real come under scrutiny.

More generally, the use of living matter as medium in bio art has evoked ethical concerns about the "use of life," beyond a (groundless) fear of infection by *Escherichia coli* (*E. coli*), as used in two of the art works discussed below, or other bacterial/viral material when encountered outside of the laboratory and security-clearance habitats associated with the storage of pathogens. Similarly, some visitors to bio art exhibitions have expressed discomfort and unease when confronted with fragments of animal or human tissue (as in the work of Tissue Culture & Art or the later work of Stelarc) in a gallery context (evidence for this unease is necessarily anecdotal, but this author has observed first-hand these fear-reactions in otherwise enthusiastic contemporary art gallery attendees and participants). Beyond the cognitively dissonant experience of seeing biological science and engineering laboratory techniques decontextualised from their usual milieu, there are critics of biotechnology, as the application of the biosciences, who extend their critique of the ethics of biotechnological practice to include bio art, finding sinister implications there; Paul Virilio, for example, in *Art and Fear* (2000) likens the work of performance, body modification and, in collaboration with Tissue Culture & Art, bio artist Stelarc to "the heyday of a certain Dr. Joseph Mengele who performed experiments we all know about, AUSCHWITZ-BIRKENAU for a time becoming the *biggest genetic laboratory in the world*" (43, emphasis in the original). If the connection between artists working in the relatively isolated sphere of art galleries and arguably one of the worst war criminals in human history seems hyperbolic, it is a hyperbole that registers the force of the general mistrust that biotechnology and biotechnological procedures seem to engender in

the general public. Echoing Virilio's concerns but at a lower level of intensity, social theorist Jeremy Rifkin asks rhetorically: "Can any reasonable person believe for a moment that such unprecedented power," promised and/or implied by biotechnology, "is without substantial risk?" (36); certainly, genetic science's dubious past in racial eugenics, not to mention the often draconian when not actively destructive behaviour of financial biotech interests such as Monsanto, suggest that we would be well-advised to submit biotechnological endeavours, as well as the science that underpins them, to careful ethical and social/political scrutiny. These ethical-political concerns refract back onto bio art works, and it is therefore noteworthy that the bio artists and their works that are the focus of this paper describe their work by means of foregrounding its potential for ethical or ideological critique, prior to any ontological questions that their work might pose. These works – Eduardo Kac's *Genesis* (1998/9), Tissue Culture & Art's *Semi-Living Worry Dolls* (2000), Niki Sperou's *Trust* (2013) and Pinar Yoldas's *An Ecosystem of Excess* (2014) – advance their critique in ethical/ideological terms, whether as a critique of anthropocentrism in the biological sciences and technology, the spectacle of scientific procedure as guarantor of truth and authority or the relation between biotech products and the natural environment. The critique of the ethical/ideological norms of bioscience and biotechnology, however, is usually expressed in terms of bioscience/tech's conceptual limitations vis-à-vis immanent critique: while the biosciences and technological applications certainly have, for example, ethical standards regarding research practices, protection of the environment etc., these depend on a series of normative procedures and protocols that themselves import implicit ontological structures. The works under discussion here deal both with the normative critique as well as the ontological investigation.

In what follows, we will look into the four works and how the artists describe and understand these works individually, before examining their ethical, political and speculative implications. Beginning, appropriately enough, with *Genesis* (Figure 1), Kac describes the work as:

> a transgenic artwork that explores the intricate relationship between biology, belief systems, information technology, dialogic interaction, ethics and the Internet. The key element is an "artist's gene," a synthetic gene that was created by translating a sentence from the biblical Book of Genesis [specifically, "Let man have dominion over the fish of the sea, the fowl of the air and over every living being that moves upon the earth" (Genesis 1:26)] into Morse code and converting the Morse code into DNA base pairs…. The biblical citation was chosen for what it implies about the dubious notion – divinely sanctioned – of humanity's supremacy over nature. Morse code was chosen because, as the first use of radiotelegraphy, it represents the dawn of the information age – the genesis of global communication. The Genesis gene was incorporated into [*E. coli*] bacteria, which were shown in the gallery. Participants on the Web could turn on an ultraviolet light in the gallery, causing real biological mutations in the bacteria. After the show, the DNA of the bacteria was translated back into Morse code, and then back to English. The mutation that took place in the DNA had changed the original sentence from the Bible … [and] was posted on the Genesis website. ("Life Transformation – Art Mutation" 164)

Figure 1: Eduardo Kac, *Genesis* installation view, Centre of Contemporary Art, Linz, 1998/9. Photo courtesy Eduardo Kac, http://www.ekac.org/geninfo.html

The installation of the biblical legitimation of anthropocentric terrestrial domination receives, as it were, a bacterial rejoinder, one which interestingly effaces the name of the dominator: "Let aan have dominion over the fish of the sea, the fowl of the air and over every living thing that ioves va eon earth" (Kac "Works from the *Genesis* Series"). The response of the bacteria (which, in addition to the partial erasure of "aan," also re-enforces the theological resonances of Kac's work with the reference to "iove"/Jove and temporality via "eon") indicates an obduracy on the part of the manipulated bio matter, but also a certain pliancy of signification: "The ability to change the sentence [from the Bible] is a symbolic gesture: it means that we do not accept its meaning in the form we inherited it, and that new meanings emerge as we seek to change it" (Kac, "Life Transformation – Art Mutation" 164). Kac works with the symbolic meaning of "living matter" and its manipulations through his transcoding of bacterial growth into the symbolic structures of Western culture.

As with Kacs, Oran Catts and Ionat Zurr, aka Tissue Culture & Art (TC&A), make careful use of socially available symbolic structures to foreground their examination of the ethical nature of the relation between human and non-human life through their introduction of a new ontological category; in addition to the categories of living, non-living and never-living, TC&A present the "semi-living." Semi-living organisms are "a part of a complex living being sustained alive and separate from that being" (Catts and Zurr, "Semi-Living Art" 231). The use of the semi-living organisms – organic tissue kept alive *in vitro* rather than *in vivo* – is part of the quotidian activity of biological laboratories, and thus the term "culture" in Tissue *Culture* & Art is exposed to an amphiboly: culture, in the sense of "art and culture" and culture in the sense of "tissue culture" or "bacterial culture," the growing of tissue or bacteria in laboratory conditions (in a Petri dish etc.). Thus, "the work [of TC&A] is the first attempt to explore the prospect for combining the techno-scientific knowledge of tissue-culture with an artistic practice" (Catts and Zurr, "The Art of the Semi-Living and Partial Life" 140). What they achieve is not, as might initially appear, an aestheticisation of science, but rather the exposure of the normative *modus operandi* of the life sciences to ethical investigation by means of art: "Looking at prevailing ideologies behind the biotech industries, we [Catts and Zurr] decided that the only way to further explore this idea should be to approach it as an artistic project. Creating real, semi-living sculptures would enable us to suggest, explore, critique and provoke the public, and to create a space in which we could explore the reactions, emotions and attitudes towards them" (Catts and Zurr, "Semi-Living Art" 235). *Semi-Living Worry Dolls* (Figure 2) exemplify this approach; first exhibited at Ars Electronica (Linz, Austria, 2000), TC&A:

> constructed a tissue culture laboratory *in situ* (in the gallery) that enabled us to show the living sculptures and feed them daily. The Feeding Ritual is now an integral part

of our installations, in which we invite the public to view the procedure through peepholes in the laboratory we have constructed in the gallery. The Feeding Rituals [and, later, the Killing Rituals in which the dolls are exposed to the environment and die] attempt not only to demystify some of the processes involved in creating semi-living entities, but also to emphasise the notion that life that we created needs care for its survival. (Catts and Zurr, "Semi-Living Art" 238)

Figure 2: Tissue Culture & Art, *Semi-Living Worry Dolls*, 2000. Photo courtesy Oron Catts and Ionat Zurr, <tcaproject.org/semi-living-worry-dolls/>

The worry dolls, based on those given to Guatemalan children to allay worries and fears, are constructed in an "art(ificial) womb" in which TC&A construct biodegradable/bioabsorbable polymer scaffolding, with surgical suturing to hold them in form, before seeding the dolls with living human or animal cells. These cells grow to resemble small human figures of indeterminate gender, and audiences are encouraged to tell the dolls their worries, perhaps about the nature of the biotechnological operations on display.

This staging-as-demystification of biotechnological operations is carried out in Niki Sperou's *Trust* (Figure 3). Sperou, artist-in-residence at the Flinders University Department of Medical Biotechnology, derives her work from standard biotech procedures and protocols (in the case of *Trust*, toxicity testing via zones of inhibition assays). In Sperou, these techniques are filtered through a mythopoetics, which she postulates as being inherent in biotechnology in particular and in the sciences more generally: "Biotechnology offers the potential for rejuvenation towards immortality and for freedom from hunger and toil. This utopian view describes an existence not unlike the Golden Age of Man in ancient Greek mythology. Golden Age humans enjoyed a life of abundance and possessed a body that was perpetually youthful without knowing true death" (Sperou, "Verisimilitude" 90).

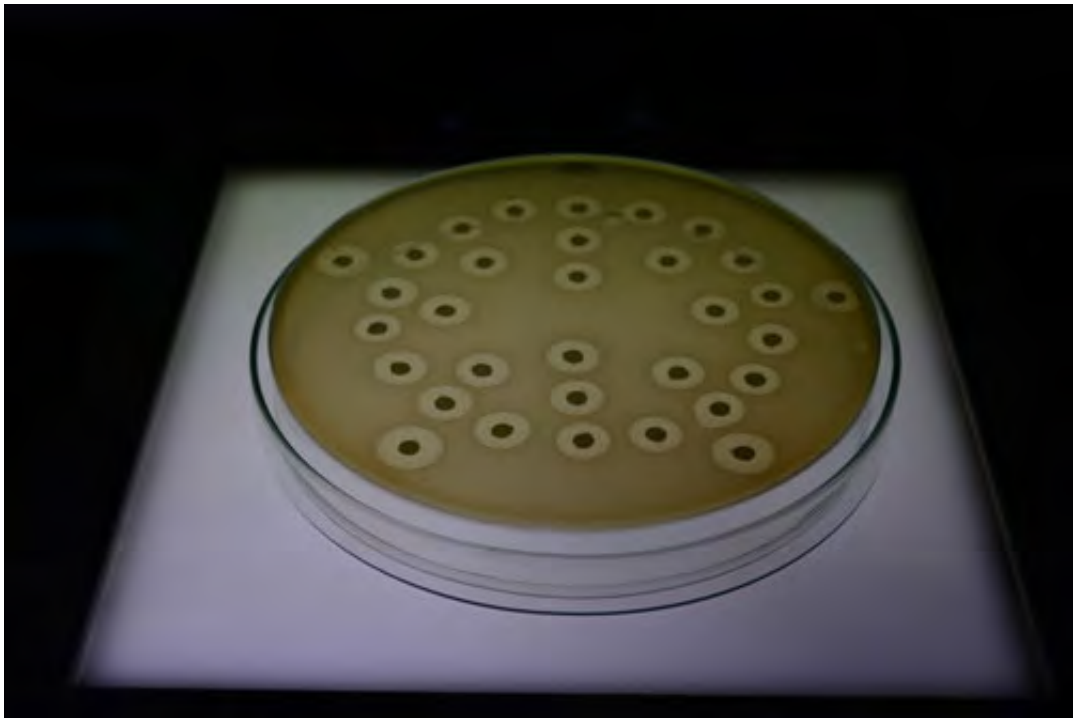

Figure 3: Niki Sperou, *Trust*, 2013. Photo by Samuel and Niki Sperou.

Trust consists of three petri dishes containing the results of zones of inhibition assays, which test the relative effectiveness of anti-bacterials. The zones as such are arranged on an *E. coli* lawn to form symbolic patterns signifying mercury, silver and antimony, ingredients of the universal panacea of the Philosopher's Stone; heavy metals, Sperou reminds us, have anti-bacterial properties, but are nevertheless lethal beyond certain dosages. Similarly, *Trust* as a title is ambiguous; we *trust* in the promise of the sciences to bring about the Golden Age of extended life and the elimination of disease and debility that the biosciences and their applications in particular have used as an alibi (Sperou, "Zones of Inhibition"). We also trust not only in the sciences' utopian visions, but also in their veracity – not so much that "science might be wrong about nature" (Sperou's commitment to the importance of empirical experiment and verification counters this interpretation), but that scientists may not always be entirely candid about the results of or the motivations for their activities, whether due to external factors (e.g. pressure from granting or funding sources) or internal motives. We *trust* scientists to advise us if a particular biotechnological development has deleterious consequences, as we trust that biotechnology, and the applied sciences more generally, are dedicated to the amelioration of the human tendency toward illness, incapacity and, ultimately, death; Sperou sutures these political-ethical-eschatological concerns to the Myth of the Philosopher's Stone as a critique of the conditions that make her own artistic practice possible. As she notes:

> My own artwork *Trust* alluded to the misplaced conviction in the modernist ideologies of progress and products, based on the common good and goods.… Scientists are currently mining the natural world for novel compounds since antibiotics no longer retain potency due to the pressures of capitalism and imprudent use. Microbes evolve, defeating out quest for a panacea. We should be mindful of short-sighted solutions. (Sperou, "Toxicity" 59)

The use of the bacterial substrate in *Trust as* a mode of symbolization connects with Kac's *Genesis* in the latter work's development of bacteria as a mode of writing and TC&A's use of living cells as a novel medium for sculpture. In the case of the last work that we will be examining, Pinar Yoldas's *An Ecosystem of Excess*, we have something slightly different. Yoldas, rather than working with already existing biomatter, be it *E. coli* or human/animal tissue with their own behaviours regarding self-replication, growth and mortality, has constructed prototypical life forms, which might very well exist in the near future. Theorist Ingeborg Reichle elaborates:

> *An Ecosystem of Excess* presents prototypes of neoplasmic organisms, which develop novel survival strategies by adapting to the highly toxic marine environment [of the Pacific Trash Vortex] created by the waste of our affluent mass consumer societies. The prototype *Stomaximus* [Figure 4], for example, represents a digestive organ in the form of a maximised stomach with chambers lined with a variety of bacteria specialised in metabolizing different plastics, like high density (HPE) and low density (LDPE) polyethylenes, polypropylene (PP) and many others. (31-32)

Figure 4: Pinar Yoldas, *An Ecosystem of Excess*, 2014. Photo courtesy Pinar Yoldas, http://www.pinaryoldas.info/VIDA/?p=41

These semi-plastic organs without bodies, as it were, would emerge, assuming they could live *in vivo*, from a "post-human eco-system," an increasingly toxic ocean that is itself "a site of interchange between the organic and the synthetic, a site of fusion between nature and culture"

(Yoldas "Aksioma"). Although bacterial and other biological agents are increasingly being used in order to clean up oil spills and other marine toxic events, the species emerging from the *Ecosystem of* (Human) *Excess* are specifically imagined as a reproach to our own haphazard sense of environmental concern: "*Ecologies of Excess*," Yoldas emphasises, "is born at the intersection of ecological and feminist thinking; hence, it negates the utilitarian, anthropocentric approach which disregards the intrinsic value of any life forms regardless of its use value to human subjects" ("Aksioma"). The ethical-political point of these art works represents a complex imbrication of responsibilities not only to "natural" environments, but, crucially, also to synthetic environments such as the Pacific Trash Vortex, thereby giving a moral impetus to Canadian poet Christopher Dewdney's remark that: "Vinyl is as natural as lichen"). Both natural (lichen) and synthetic (plastics, vinyl) environments require levels of responsible watchfulness – exemplified in the fragile beauty of Yoldas's works – if terrestrial, let alone human, life is to remain sustainable.

Taken as a whole, the four works under discussion offer a variety of affordances for ethical-political critique of bioscience, bioengineering and biotechnology: the critique of anthropocentric dominance over nature in *Genesis*; the demystification of laboratory practice and the insertion of the thematics of care and concern in *Semi-Living Worry Dolls*; the implicit dangers of the reckless use of antibiotics and other technological controls over disease and death, as well as the need to subject these promises to critical scrutiny, in *Trust*; the potential for new life forms whose existence is predicated on the inadvertent development of toxic environments created by the industrial detritus of relatively advanced technological societies in *An Ecosystem of Excess*. These works explicitly depend on the technologies that they critique for their conceptualization and actualization. However, as works of art, they are able to stand away, as it were, from the normative procedures of those technologies and the scientific methods and knowledges that underwrite them, thereby enabling the space for this critique. The implication, then, is that although biotechnological practice routinely and, it should be emphasised, in good faith takes ethical audits of its activities through the enforcement of responsible laboratory techniques and caution with regard to rigorous testing for potentially harmful outcomes, there is a degree to which the internal ethical critique of the biosciences and biotechnologies necessarily runs against a particular immanent limit. This limit, seemingly endorsed by these bio artworks, is an onto-epistemological limit that stipulates the necessity of a position outside of the sciences as such from which to launch critique. As Heidegger's well-known assertion in *What is Called Thinking?* has it: "Science does not think." Heidegger elaborates: "[S]cience always and in its own fashion has to do with thinking: That fashion, however, is genuine and consequentially fruitful only after the gulf has become visible that lies between thinking and the sciences, lies their unbridgeably. There is no bridge here – only a leap" (8). The gap, while unbridgeable from the point of view of science, is not necessarily so from the point of view of thinking: "[S]ince science does not think, thinking must in its present situation give to the sciences that searching attention which they are incapable of giving themselves" (135). What thinking presents to science is its own determination by a "basic trait of the modern era," that is, an "object-materiality which is established and maintained in power by the scientific objectification of all fields and areas" (135). It is in this way that the "essential nature" of the human being is misconstrued:

> Man [sic] can be conceived as an organism, and has been so conceived for a long time. Man so conceived is then ranked with plants and animals, regardless of whether we assume that rank in order to show an evolution, or classify the genera of organisms in some other way. Even when man is marked out as the rational living being, he is still seen in a way in which his character as an organism remains decisive – through biological phenomena, in the sense of animal and vegetable beings, may be subordinated to that rational and personal character of man which determines his life of the spirit. All anthropology continues to be dominated by the idea that man is an organism. Philosophical anthropology as well as scientific anthropology will *not* use man's essential nature as the starting point for their definition of man. (Heidegger, *What is Called Thinking?* 148, emphasis in original)

This, in short, is what Heidegger means in the provocation of "science does not think": that science's emphasis on the biological/material substrate misses the ontological import of the phenomena for which science attempts to account. The "does not think" of science is this "biologization" of the human, which misconstrues, if not actively suppresses, what Heidegger refers to as that which responds to the call of thinking. Hence, an abyssal separation is formed between science and thinking.

While Heidegger suggests this gap cannot be bridged – that is, there can be no meaningful exchange between the matter of science and the ontological questions dealt with by thought – it is possible to "leap" over the gap. How this might be possible might become clear by returning to the artworks under discussion. Certainly, it is possible to describe the four works in Heideggerian language: *Genesis* presents a decentering of the anthropocentric world-view that has onto-theological implications (the bacterial insertion of Iove/Jove into their message, as well as the Old Testament source that inaugurates the project); the *Semi-Living Worry Dolls* enact Heideggerian themes of care and concern, two of the characteristic attunements of Dasein; *Trust* and *An Ecosystem of Excess* explore the horizon of finitude beyond which human ratiocination cannot grasp. In all of these cases, the activities of science are scrutinised, as we noted, in terms of ethical and ideological/political norms, but we also noted that the object of scrutiny – bioscience and biotechnology – generates that which scrutinises it. The question can be put thusly: how is it that art can appear to leap the gap between science and thinking? At the end of his 1955 text "The Question Concerning Technology," Heidegger gives an indication of an answer: that it is art that, being "akin" to technology and the science that it makes possible while being "fundamentally different from it," might serve as a "saving power" against the dangers presented to ontological thinking by science and technology (35). Heidegger's remarks are particularly enigmatic on this point, but it is possible, at this point, to risk the assertion that art, and particularly art that is intimately connected to the science/technology relation such as bio art, is capable, through its ability of producing ontological rejoinders and necessary adjustments to the ambit of the sciences' normative procedures, of making the leap between science and thinking.

All of this depends on two related assertions on Heidegger's part: that science as such cannot make claims of philosophical merit about itself and that the biological substrate of human beings is conceptually irrelevant. These assertions have not gone unchallenged. Quentin Meillassoux's *After Finitude* begins by examining the assertions of astrophysics, e.g. the date of the origin of the universe (13.5 billion years ago), the date of the accretion of the earth (4.56 billion years ago), the date of the origin of life on earth (3.5 billion years ago) and the date of the origin of humanity (*Homo habilis*, 2 million years ago), and the scandal that these present to thought. "How," Meillassoux asks, "are we to grasp the *meaning* of scientific statements bearing explicitly on a manifestation of the world that is posited as anterior to the emergence of thought and even of life – *posited, that is, anterior to every form of human relation to the world*?" (9-10, emphasis in original). The answer that Meillassoux comes to is that the assertion "science does not think" is not a delimitation of the capabilities of science, but a failure of thought itself:

> While the "man of science" has intensified the decentring due to scientific knowledge by uncovering diachronic occurrences of increasingly ancient provenance, the "man of philosophy" has been narrowing the ambit of correlation [between thought and being] towards an originally finite "being-in-the-world," or an epoch of Being or a linguistic community; which is to say, an even narrower "zone," terrain or habitat, but one of which the philosopher remains lord and master by virtue of the alleged singularity of her brand of knowledge. (121)

"Ancestral" phenomena, that is, "diachronic occurrences of … ancient provenance" are an affront to post-Heideggerian (as well as analytic, post-Wittgensteinian) thinking in the phenomena's manifestation of a reality outside of the correlation between human thought and the world, a correlation which renders all beings as beings-for-us or as they are manifested in our thinking. Meillassoux therefore calls for a "speculative materialism" that would answer the question "*how is*

thought able to think what there can be when there is no thought? (121, emphasis in original). Ray Brassier, in *Nihil Unbound*, adds to Meillassoux's ancestrality by asserting the scandal of *posteriority*, in particular, the end of the world and of the universe itself, brought into thought by conceptualizing the end of the world and universe as having already happened: "[T]he posteriority of extinction indexes a physical annihilation which no amount of chronological tinkering can transform into a correlate 'for us,' since no matter how proximal or distal the position allocated to it in space-time, it has *already* cancelled the sufficiency of the correlation" (229). These scientific claims about the beginning and ending of the universe, challenge philosophy (or, more generally, "thought"), to speculate beyond the "correlationist circle," that is, the framework in which any statement about human-independent reality becomes, qua statement, a statement about reality-for-human-beings (Meillassoux 5); these challenges force philosophy qua philosophy into an encounter it is ill-equipped to meet. For both Meillassoux and Brassier, then, the abyss between science and thinking announced by Heidegger cannot be maintained; science and thought "stand on equal terms before the real": "Once we have discounted the claim that the empirical-transcendental division of labour," implied by the philosophical assertion that science does not think, "presents a satisfactory resolution of the speculative problems put to philosophy by science, we can re-establish the notion of a non-correlational reality the better to explicate the speculative implications of its scientific exploration" (Brassier, *Nihil Unbound* 63).

Science and philosophy, in this recalibration, are "on equal terms before the real" (Brassier, *Nihil Unbound* 62). Meillassoux and Brassier are quite precise here; it is not that the claims of science supplant philosophical thinking, just as philosophical thinking may no longer dismiss scientific thought as illegitimate *tout court*, but rather that science's claims offer new speculative opportunities to think the real. There is, in this context, a further issue to be addressed: where does art fit into all of this? While Meillassoux and Brassier do not, in *After Finitude* or *Nihil Unbound*, explicitly discuss art, is it not possible to understand art less in terms of the Heideggerian leap (an illegitimate move, anyways), but as a source of novel claims about the real – indeed, about the real that is independent of the thought-being correlation? Returning to the works under discussion once again, the speculative affordances of *Genesis* and *Semi-Living Worry Dolls* now seem somewhat hampered by a residual anthropocentrism; in the case of the former, the bacterial message is "for us," however salutary a warning about species-arrogance it might be, whereas the scaffolding of the ontologically novel category of the semi-living into an infantilised, humanoid form affirms that even the semi-living are comfortably "for us," despite the alienation effects of the laboratory *mise-en-scène*. However, the possibilities afforded by Sperou and Yoldas's work become increasingly radiant. In the case of *Trust*, while it is true that the *E. coli* bacteria's reaction to the toxic assay is embedded in human mythos (the Philosopher's Stone) and, hence, "for us," it is also one that presents an image of the *telos* of biotechnology, i.e. the eradication of debility and death through a substrate that is itself composed of such debility and death (bacterial infection, chemical poisoning). *Telos* is meant quite literally here: as intrinsic goal and purpose, the origin of life in alchemical invocation and its conclusion in human extension *and* extinction, the latter, claims Brassier, pre-emptively rendering correlationism moot (*Nihil Unbound* 230). If, classically, *telos* is distinguished from *technè*, *Trust* can, arguably, instantiate an important biotechnological singularity beyond a critique of anthropocentrism: the speculative collapse of (intrinsic, natural) *telos* and (extrinsic, rationalised) *technè*. This is made particularly clear in *An Ecosystem of Excess* whose possible organisms do more than render the difference between the natural and synthetic, the given and the made, ambiguous, but collapse the distinction, rendering it althogether irrelevantt. It is in this in-distinction, this speculative collapse between the given and the made that provides us with the sense of bio art manifesting a biotechnological singularity. Brassier, discussing critiques of "Prometheanism" – the trans/posthumanist idea that nanotechnology, cognitive science, information technology and biotechnology can/should reconfigure and reconstruct nature – explains what is at stake in this collapse of the given and the made:

> The sin of Prometheanism [according to its Heideggerian critics] consists in

> destroying the equilibrium between the made and the given – between what human beings generate through their own resources, both cognitive and practical, and the way the world is, whether characterised cosmologically, biologically or historically. The Promethean trespass resides in *making the given*. By insisting on the possibility of bridging the ontological hiatus separating the given and the made. ("Prometheanism and Its Critics" 478)

Bio art, particularly as instantiated by Sperou and Yoldas, afford us the opportunity to enact this very bridging not by means of an ontological leap as per Heidegger, but through the generation of a *speculative biology* that takes as its starting point the collapse of the given and the made. Ingeborg Riechle uses the term *speculative biology* in her analysis of Yoldas's work to designate the imaging or constructing of semi-living or transgenic organisms that do not yet exist. But in this particular context, speculative biology means something much larger: the artistic encoding of biology's speculative opportunities, that is, biology's possibilities of and for thought.

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