

Culture and Organization, 2014

<http://dx.doi.org/10.1080/14759551.2013.836194>

Biotech aesthetics: Exploring the practice of bio art

Anne Byerley (a) and Derrick Chong (b)

(a) Independent Scholar, London, UK

(b) School of Management, Royal Holloway University of London, Egham, Surrey
TW20 0EX, UK; d.chong@rhul.ac.uk (corresponding author)

Biotech aesthetics: exploring the practice of bio art

Abstract

Advances in biotechnology include contemporary artists working in laboratories to create living and semi-living works of art. This paper offers an account of how bio art can be read as an emerging contemporary art practice of the early twenty-first century. This draws on the art-historical precedent of Marcel Duchamp, who transformed objects from commonplace existence into works of art, and contemporary theories of art. Empirical data, in the form of interviews with leading bio art practitioners Oron Catts, Eduardo Kac, Kira O'Reilly, Stelarc and Paul Vanouse, are used to study how artists navigate between disciplines. In doing so, we discuss bio art as a critical practice based on a communal ethos.

Key words

Anti-aesthetic

Artistic practice

Bio art

Biotechnology

Duchamp

Biotech aesthetics: exploring the practice of bio art

‘[T]he withdrawal of the experience of aesthetic pleasure from art’

– Alexander Alberro on the meaning of conceptual art, *October* 70
(Autumn 1994, 132).

An introduction to bio art

Advances in biotechnology are rapid, with the challenge of manipulating human nature so imminent that the dialogue can no longer be reserved for scientists. Indeed theorist Eugene Thacker (in Thacker and Ruiz 2006, 5) has invited research on ‘the aesthetics of the biotech industry’, and contemporary artists are making a contribution by exploring just this permeability between disciplines. Works of art made from living and semi-living materials – so-called bio art – suggest that something intriguing is taking place. Examples from Eduardo Kac and Julia Reodica, two bio art practitioners, illustrate the convergence of art, science and technology that is central to this paper on biotech aesthetics.

In 2000 Chicago-based artist Eduardo Kac, working in a research laboratory in France, the Institut National de la Recherche Agronomique (INRA), modified the genome of a rabbit embryo to accept genetic material from a jellyfish; the embryo was then gestated to become a rabbit with a capacity to glow fluorescent green under ultraviolet lighting conditions. Kac was using biotechnology in collaboration with scientists in order to create an independent, living work of art: *GFP Bunny* (2000), which refers to ‘green fluorescent protein’, is one of the most recognizable works of bio art. [INSERT IMAGE 1] Kac wanted Alba, as the transgenic rabbit was known, to integrate into society starting with his family. This was to underscore the role genetic engineering plays in our normal, domestic lives. Kac (2003, 97) notes that transgenic

art 'must be done with great care, with acknowledgement of the complex issues thus raised, and above all, with a commitment to respect, nurture and love the life created'.

Kac's art object remains controversial. The INRA refused to release Alba. Kac responded by creating an entire *GFP Bunny* series of works. Sceptical observers have questioned Kac's working methods, including the lack of full disclosure associated with the relevant scientific research. For example, Ellen Levy (2006; 2007) has questioned whether claims that artificial life has created self-replicating evolving entities are credible. 'From an ethical point of view', according to Levy (2006, 201), 'it still matters whether genetic engineering had occurred'. In doing so, Levy (2007, 4) also acknowledges that 'there is real value to artists investigating biology through synthetic means'.

Julia Reodica's *hymNext* project (initiated in 2004-05) has the self-described 'medical artist' incorporating her own body cells into the sculptures: 'The hymen tissue cultures were a combination of my vaginal cells, rodent smooth muscle tissue and bovine collagen scaffolding grown in nutrient media' (Reodica 2007, 415). Reodica's project was featured in an issue of *New Literary History* (Davis and Morris 2007) devoted to 'biocultures', that is the multiple convergences of the biological and the cultural. [INSERT IMAGE 2] As part of her artist's statement, Reodica (2007, 415) emphasizes the bio art agenda: 'My cells are in the sculpture because I wanted myself to be new art media. In each sculpture, my DNA is a personal signature'. Sculpted from the artist's own vaginal cells, *hymNext* is an opportunity for Reodica to question the traditional value of virginity. She does so at a time when the tissue representing the hymen can be easily recreated and implanted. Repeated events of deflorations are perhaps still abhorrent to many. As Barbara Kruger (1989) has

reminded us, bodies are biological and cultural.¹ The body remains a battleground, a contested site where many cultural discourses are debated.

As such, bio art practitioners like Kac and Reodica represent an attempt to reconcile the split between art and nature. They are posing questions of how biotechnology alters our relations to the world. ‘What does it mean for a society to bring into existence a rabbit that glows green?’ (Tomasula 2002, 138). Are bio art practitioners transgressors challenging ‘western edifices of humanity and humanism’? (Puncer 2008, 478; see also Rifkin 2003). Or is bio art, as suggested by Levy (2007, 15), ‘one way to acclimatize the public to new scientific discoveries and new technologies’?

In this paper on biotech aesthetics, attention is devoted to a group of artists. This reflects a fundamental condition of bio art, namely that its practitioners view themselves as contemporary artists with their agenda grounded in artistic practices. The next section defines bio and bio art as they are used here, which includes reference to Donna Haraway’s (1997) ‘technoscience’ and Hal Foster’s (1983) ‘anti-aesthetic’. This is followed by our methodological statement, namely why and how five artists – Oron Catts of SymbioticA, Eduardo Kac, Kira O’Reilly, Stelarc and Paul Vanouse – are used as a point of entry into bio art practices. Biotech aesthetics is contextualized, in the fourth section, with reference to the art-historical precedent of Marcel Duchamp and more recent theorists of art. Drawing on the interview data, three domains emerge with a shared focus on bio art and its practitioners. Artists talking about bio art is a starting point: it includes questions regarding how the artists define the practice of bio art and their works in relation to that of their contemporaries. The second domain addresses art and science intersections: what role does bio art play in science? What role does science play in bio art? Can they inform

one another? The distribution and reception of bio art is the third domain. What is exhibited given the ‘liveness’ of bio art? What matters to the artists? This addresses the importance of critical and public reception for bio art practitioners. In the final section of the paper we draw conclusions on bio art as a critical practice based on a communal ethos.

Defining bio and bio art

‘Art, science, and technology are culturally laden terms’ (Wilson 2002, 11), which suggests that distinctions should be made between them before defining bio and bio art. ‘Science and technology are sometimes conflated together’ (Wilson 2002, 11), yet science and technology are not the same. Whereas ‘technology is seen as “knowing how”’ (such as the process of inventing and making things), ‘science is seen as “knowing why”’ (Wilson 2002, 12). Donna Haraway (1997, 50) adopts a different stance, though, as she ‘mimes the implosion of science and technology into each other’. ‘Technoscience’ serves as a ‘condensed signifier’; moreover, it is a ‘heterogeneous cultural practice’ that ‘should not be narrated or engaged only from the points of area of those called scientists or engineers’ (Haraway 1997, 50). This invites contemporary artists ‘to take responsibilities for the social relationships of science and technology’, a theme in ‘the cyborg myth’, as first advanced in the mid-1980s (Haraway 1991). Haraway’s (1991, 154 and 181) earlier work on the cyborg is ‘about transgressed boundaries, potent fusions, and dangerous possibilities’, with a key message of ‘taking responsibilities for the social relations of science and technology’. This is suggestive of a rallying call for contemporary artists to operate outside a conventional definition of art, as offered in the *Concise Oxford English*

Dictionary: ‘the expression or application of human creative skills and imagination, typically in a visual form producing works to be appreciated primarily for their beauty or emotional power’. This definition follows a Kantian perspective, which has several principles in mind. Kant’s aesthetic experience can be an experience of beauty or the sublime, that is of disinterested pleasure. Aesthetic judgement in this view is subjective but universally valid. Art is for all so it is not socially constructed. The autonomy of art saves art from instrumental uses and emphasizes a non-utilitarian orientation of art. However, the Kantian construction of art has been challenged by those who desire to situate the art object in a changing social context.

Hal Foster’s (1983, xv) term ‘anti-aesthetic’, which he advanced in an influential volume of essays on postmodern culture, is likewise instructive. The anti-aesthetic ‘is the sign not of a modern nihilism ... but rather of a critique which destructures the order of representations in order to reinscribe them’. The notion of the aesthetic, as a network of ideas, is part of Foster’s anti-aesthetic. Foster was, like Haraway, critiquing the Kantian perspective on aesthetic judgement. The anti-aesthetic ‘signals a practice, cross-disciplinary in nature, that is sensitive to cultural forms engaged in a politic’; it is also ‘rooted in a vernacular – that is, to forms that decry the ideas of a privileged aesthetic realm’ (Foster 1983, xv).

Both Haraway’s technoscience and Foster’s anti-aesthetic, which posit a social role for the artist, serve as a backdrop to address how bio and art converge and to explore the relationship between bio and art to create bio art. ‘The prevalence of “bio” words suggests that “bio” is the new “post-” or “cyber-” prefix’, according to Thacker (in Thacker and Ruiz 2006, 5). Thacker adds that ‘what people usually mean by adding “bio” is really what Aristotle means by *zoê* (bare, animal life)’. Bio is extended to include organic life with the root being the Greek *bios*, that is ‘the course

of life', thus our understanding of biology as the 'science of physical life, dealing with the morphology, physiology, origin and distribution of animals and plants', according to the *Concise Oxford English Dictionary*. Biology as the organic world includes our own bodies.

A 'certain tonality to bio' exists, according to Thacker (in Thacker and Ruiz 2006, 5), namely 'the potentially transformative or "redemptive" promises of new technologies'. The definition of biotechnology varies from the use of life (broad) to the biotech industry that emerged in the late 1970s (narrow). Moreover, a particular relationship between human beings and their natural world is invoked). In *The Global Genome*, Thacker (2005, xi) notes that 'in biotechnology, ontological questions immediately fold onto questions that are social, economic, and cultural'. This is to suggest that the internal tensions are not between biology and technology, but rather between 'biology and political economy' (Thacker 2005, xix). Cultural questions about the nature of being human and the implications of biological manipulation as technology advances are raised. 'The concept of "life itself" is being fundamentally transformed in the age of biotechnology' (Thacker 2005, xii).

'Bio art' (also rendered as bioart, BioArt and Bio Art) has been mooted as an instructive umbrella term. 'In Bio Art', according to Reodica (2007, 415), 'an artist utilizes emerging biotechnologies from the scientific and medical fields in the creation of an artwork'. Spectators are presented with the complexities of ethics and aesthetics in a work of art; this 'can include the methods involved with its creation' (Reodica 2007, 415). Bio art practitioner Adam Zaretsky (2004, 90) stakes an avant-garde position by reference to 'an eclectic fecundity to guarantee iconoclasm in a situation' marked by 'a lack of defined aesthetics'. 'We are major players in an offshoot of the art scene', he suggests, 'insofar as we are not making art about

biology. We focus on bringing our outsider ideas to life' (Zaretsky 2004, 90). This is a strong statement of the art and the role of the artist in making bio art.

A range of bio art practices – from an emerging field with artists using techniques associated with biotechnology in ways that create or manipulate life – exist, including transgenic forms, tissue culture engineering and live hybrids. First, transgenic forms are based on genetic engineering as it has evolved since the 1970s. A prime example is Kac's *GFP Bunny* or Alba. Second, tissue culture engineering includes the artistic practice of Oron Catts and Ionat Zurr (Catts and Zurr 2001, 2002, 2011; Zurr and Catts 2003). Catts and Zurr formed the Tissue Culture & Art Project that, since 1995, has had artists and researchers in residence at the University of Western Australia's school of anatomy and human biology. In 2000 SymbioticA, 'an innovative laboratory dedicated to researching, learning, critique and hands-on engagement with life sciences', was established at UWA with Catts as director, in collaboration with a cell biologist and a neuroscientist. SymbioticA follows scientific procedures so that its projects are formed from living materials that blur the dividing line between art and science. For example, *Pig Wings* is a project, according to Catts and Zurr (2001), in which 'pig's bone marrow stem cells and three dimensional bio-absorbable polymer scaffolds are used in order to grow pig bone tissue wings in the shape of the three solutions for flight in vertebrates' to create 'a physical human-animal hybrid'. Tissue culture engineering also includes Reodica's hymens. Third, live hybrids, which are associated with breeding ornamental plants, represent the lower technical end of the biotech industries. Bio art practitioners creating hybrids include George Gessert (1997; 1996; 1993), who breeds, makes and exhibits hybrid irises, and Marta de Menezes (2003), who uses butterfly wings as her canvas.²

Five artists as a point of entry into bio art

This paper benefits from access to five artists: Oron Catts of SymbioticA, Eduardo Kac, Kira O'Reilly, Stelarc and Paul Vanouse.³ Our entry into bio art, including making initial contact with the eventual interviewees, was achieved through attending and participating at the 'Eye of the Storm' symposium at Tate Britain and 'sk-interfaces: exploring borders in art, technology and society' exhibition at Casino Luxembourg, following an earlier version at FACT (Liverpool) in 2008. The selection of artists was based on recommendations and suggestions of key bio art players we received from attending these two events. Both were held in 2009. The artists most cited to us were Eduardo Kac, Oron Catts (and Ionat Zurr in the case of the Tissue Culture & Art Project and SymbioticA) and Marta de Menezes; George Gessert and Joe Davis were also noted. Together, they are considered the pioneers of using biotechnology as a medium of expression (Hauser 2003, 2008).

Kac and Catts have already been introduced. Paul Vanouse and Stelarc (Smith 2005) are also interesting cases, according to their contemporaries. Vanouse, who is based at the University of Buffalo's department of visual arts, describes his interest to investigate the 'intersection between big science and popular culture'. In the first *Latent Figure Protocol* (2007-09), a copyright symbol is derived from the DNA of an industrially-produced organism (a bacterial plasmid called pET-11a). Vanouse was seeking to illuminate ethical questions around the changing situation of organic life and the ownership of living organisms. Stelarc's contribution to bio art follows his earlier practice as a posthuman performance artist. Stelarc has challenged traditional views of being human by advertising himself as a living cyborg (Garoian and Gaudelius 2001). Engaged in 'reservoirs of organs, or bionic hybrids' (including

mechanical prosthetic devices along with biological implants), Stelarc notes that he ‘not accept the biological status quo of the body ... a body augmented with technology becomes an extended operational system’. Finally, ‘biotechnical practices’ is the term Kira O’Reilly uses; she describes how her ‘body is material and also the site in which narrative threads of the personal, sexual, social and political knot and unknot in shifting permutations’.

The selection of Catts (of SymbioticA), Kac, O’Reilly, Stelarc and Vanouse represent a cross-section of bio art practices. Kac, Catts and Stelarc are high-profile and included in other examinations of bio art (see, for example, Levy 2007). But they also adopt different bio art practices. Kac, who uses transgenic techniques, is the most ardent advocate of bio art. SymbioticA, with its interest in tissue culture engineering, was one of four exemplars of activist art selected for discussion by Thacker (2005) in *The Global Genome*. Stelarc has made a transition from his living cyborg persona of the 1980s and 1990s to bionic hybrids. Both O’Reilly, who explores the biological status of the body, and Vanouse, who uses DNA samples to create emergent representational images, are newer to the bio art community. In addition, the inclusion of O’Reilly alongside Stelarc accentuates skin as a technological interface, which is a concept of bio art. This is to say both O’Reilly and Stelarc use their own skin – the physical body of the artist – as a technological interface.

Semi-structured, or focused, interviews (lasting between 45 minutes and two hours) were conducted in Luxembourg and Chicago with these five artists. We were keen to explore the perspectives of bio art, including artistic practices, with key practitioners. We desired to hear what each artist had to say and how s/he wanted to express it. At the same time, we were also interested to know if the bio art practitioners could confirm insights and information we had already gathered through

other sources of evidence, including the specialist journal *Leonardo* and exhibition histories (Regine 2013).⁴ Such knowledge provided a check on the reliability of the interview data.

We are also aware that the bio art practitioners – informants who are also actors in our paper – are interested in how their artistic practices are viewed. Specific framing devices (which we return to later) are used in order to provide an analytical perspective in our discussion of biotech aesthetics. We believe it is important to consider bio art within a history of contemporary art production in the twentieth century; this invites discussions and debates by contemporary theorists of art. Bio art practitioners are keen to be considered artists so this framing or bracketing is not an artificial imposition; rather it is a logical consequence of them being assessed as contemporary artists. This militates against an uncritical acceptance of the interview data associated with becoming too dependent on informants. It also strengthens the validity of the study by presenting a picture that is not entirely biased by the bio art practitioners.

Framing biotech aesthetics

Bio art practitioners have adopted unorthodox materials, tools and ideas inspired by the worlds of science and technology. As such, and in order to contextualize bio art practitioners as contemporary artists, references are first made to Marcel Duchamp, a pioneering artist of the twentieth century, who is credited with an originality of vision in resisting the dominating views about art in his era. In addition, contemporary theorists of art, Alexander Alberro, Benjamin Buchloh, Arthur Danto, Hal Foster and Lucy Lippard, helped us to assess bio art practices.

‘By stripping bio-science of its pragmatic function and contextualizing it as aesthetics, gene artists reanimate issues Duchamp could have appreciated, especially those of authorship and originality, and the nature and purpose of art’ (Tomasula 2002, 137). The bio art reference to Duchamp is not surprising. Duchamp, who casts a long shadow over contemporary art practices, has been reborn for each new generation of artists. Duchamp plays an important art-historical role, of transforming objects from commonplace existence into works of art (Danto 1981). Duchamp’s *Fountain* (1917) – based on the artist purchasing a urinal, turning it upside down, baptizing it *Fountain* and signing it ‘R. Mutt’ before entering it into an exhibition where it was rejected – remains his most well-known readymade.⁵ This act represented a shift from *facture* – inscriptions of the hand of the artist as a sign of artistic production – to the role of the artist in determining an idea or concept. His artistic decision led to a charge of plagiarism, to which he issued a robust rebuttal (Duchamp 1917):

Whether Mr Mutt with his own hand made the fountain or not has no importance. He CHOSE it. He took an ordinary article of life, placed it so that its useful significance disappeared under the new title and point of view – created a new thought for that object (emphasis in the original).

Danto (1981) recognized that Duchamp’s work was not the urinal at all but the gesture of exhibiting it. Similarly, Duchamp, for Foster (1985), renounced so-called retinal painting and exhibited readymades in such a way as to debunk the transcendental pretensions of the art object. Forty years after *Fountain*, Duchamp (1957) would describe ‘the creative act’ as how ‘the artist goes from intention to realization through a chain of totally subjective reaction’.

However, it is important to remember that the reception of Duchamp – as the Duchamp we now know – was not immediate. Buchloh (1990) traces Duchamp’s contemporary reception to the early 1960s and the formation of conceptual art. The dilemma of artistic production raised by Duchamp’s readymades is, according to Buchloh, the conflict between structural specificity and random organization. The Duchampian tradition is to assign a new idea or meaning to an object randomly as though the object were an empty linguistic signifier. In particular, Robert Morris’ early work (1961-63) has been posited by Buchloh (1990, 115) as marking an ‘understanding of Duchamp that transcended the limited definition of the readymade as the mere displacement of traditional modes of artistic production by a new aesthetic of the speech act (“this is a work of art if I say so”)’. Morris ‘renewed the Duchampian quest for a nonretinal art’ (Buchloh 1990, 116). Yet Buchloh (1990, 142-143) also recognized the short-lived triumph of conceptual art in the transformation of audiences and reception and the abolition of object status and commodity form.

There are affinities between conceptual art, particularly as articulated by Lippard and Chandler (1968) and Alberro (2003; Buchloh *et al.* 1990), and bio art. Lippard and Chandler (1968) advanced the dematerialization of art. In doing so, Lippard and Chandler (1968, 32) drew on the framework of Joseph Schillinger (1895-1943), who advanced ‘the abstraction and liberation of the idea’ in *The Mathematical Basis of the Arts*. According to Lippard and Chandler (1968), some works of art may emphasize the thinking process almost exclusively. Detractors argue that such ideas-based works are not aesthetic. They mean there is not enough for the eye to look at. This echoes a criticism of Duchamp and his readymades, namely that attention is devoted to nonretinal art, thus challenging spectators to revise their concept of art (namely a retinal art that gratifies the eye).

On the emergence of conceptual art, Alberro (2003, 55) discusses ‘an art that degraded traditional materials, surfaces, and self-contained forms in favor of media not previously associated with art, and of an unprecedented transparency of operative structures of signification’. In many respects this description includes bio art, with its use of biotechnology as a medium of expression (whether transgenic forms, tissue culture engineering or live hybrids) not usually associated with art.

‘The withdrawal of the experience of aesthetic pleasure from art’ is one meaning of conceptual art, according to Alberro (in Buchloh *et al.* 1994, 132), as our epigraph has already suggested. A not dissimilar spectator response was offered by the director of Trinity College Dublin’s Science Gallery (in Catts and Zurr 2011), in reference to an exhibition celebrating the first decade of SymbioticA: ‘There is something that makes us a little uneasy, perhaps even queasy about the idea of creating art works from living tissue’. Alberro (2003, 56) also emphasizes ‘the problem of presentation’, namely exhibition and production practices of the late 1960s (see Lippard and Chandler 1968) which meant that art did not need to be hung. The living and semi-living nature of bio art has posed challenges in terms of where and how to display works.

This preliminary framing of biotech aesthetics, drawing on Duchamp, Buchloh, Lippard and Chandler and Alberro, allows us to develop three domains: artists talking about bio art; art and science intersections; and the distribution and reception of bio art. Below we address the theoretical dimensions suggested in each of the three domains.

Domain one: artists talking about bio art

What to make of Kac's assertion to us that 'bio art is something new, is something that we don't have from Duchamp, we don't have from Picasso ... we don't have from anybody and none of these artforms lead directly to it because they're all either counter to representation or based on representation'? This claim of exceptionalism should be viewed within an art world discourse. It is an attempt to fashion bio art as a new avant-garde, with Kac assuming the persona of 'outsider-artist' (see Thacker 2003a). As noted earlier, in defining bio art, Adam Zaretsky (2004, 90) presents fellow bio art practitioners as 'major players in an offshoot of the art scene' and 'bringing our outsider ideas to life'. We should locate bio art practices as having affinities with Foster's description of the anti-aesthetic (as developed earlier). For example, bio art practices are 'cross-disciplinary' and 'engaged in a politic', with contemporary visual artists drawing on advances in biotechnology to create works made out of living materials (Foster 1983, xv). Moreover, the aesthetics of the biotech industry result in works that 'decry the ideas of a privileged aesthetic realm' (Foster 1983, xv). In a similar manner, Lippard and Chandler (1968, 36) referenced Schillinger's 'perfect art product' as one that allows 'intellectual and aesthetic pleasure [to] emerge ... when the work is both visually strong and theoretically complex'. This resonates with the ambitions, according to its practitioners, of creating living and semi-living bio art.

Domain two: art and science intersections

In his essay, 'The artworld', Danto (1964, 575) raises a point relevant to bio art practitioners as they grapple with relationships between art and science: 'To mistake an artwork for a real object is no great feat when an artwork is the real object one mistakes it for. The problem is how to avoid such errors, or to remove them once they are made'. One is reminded that Danto's essay – written in direct response to Warhol's *Brillo Box* (1964) – helped to articulate the necessity of understanding the historical-theoretical context of a work in order to consider it as art (see, for example, van Maanen 2009). The distinction between Warhol's *Brillo Box* as art and an ordinary Brillo box is due to a certain theory of art, according to Danto (1964, 581), as 'it is the theory that takes it up to the world of art, and keeps it from collapsing into the real object which it is ...'. In a similar manner, Kac's *GFP Bunny* is not just a rabbit that glows green. In the world of art, it is the concept of art that keeps art from collapsing into reality. Kac's status as an artist – as opposed to being a scientist, for example – also depends on the concept of art and being able to situate his bio art practice as a response to earlier artists.

But why does art invite philosophical treatment? Danto (1974, 139) suggests an ontological classification between mere things (the so-called commonplace) and works of art: 'Art works may indeed reject interpretation but are of the right sort to receive them'. In discussing the transfiguration of the commonplace Danto posits that the kind of meanings embodied by art objects are, generally, meanings having to do with views on art. There is art that is about art; and there is art that is about the larger issues of life and death. A link exists if, when the artist makes us think about art, s/he also inspires us with a new attitude or approach to our lives. That bodies are

biological and cultural, for example, is central to Reodica's *hymNext*: the work of art is sculpted from her own vaginal cells to question the traditional value of virginity. This is about externalizing a particular way of viewing the world.

Domain three: the distribution and reception of bio art

One is reminded that the site of engagement for bio art such as Dublin's Science Gallery (which describes itself as 'a world first – a new type of venue where science and art collide') – or other prominent venues like Ars Electronica (a digital arts and media culture centre, in Linz, Austria), FACT (Liverpool), Casino Luxembourg and Tate Britain – is the art institution. This situates bio art within an art world context (see, for example, van Maanen 2009). In particular, distribution (or intermediation) is about exposure and reputation. Audience reception is core to validating artists, according to Duchamp (1957):

In the final analysis, the artist may shout from all the rooftops that he is a genius: he will have to wait for the verdict of the spectator in order that his declarations take a social value and that, finally, posterity includes him in the primers of Artist History.

Rosiland Krauss (in Buchloh *et al.* 1994, 137) recognized that the reception of Duchamp valorizes the importance of reception. However, a fallacy of the early interpretation of Duchamp's readymades was to obscure the institutional and discursive framing conditions. Yet it is precisely these framing conditions that have allowed the readymades to generate shifts in the assignment of meaning to include nonretinal art; this also allowed and the experience of the object, particularly one that is made theoretically complex by the artist, as a work of art (Buchloh 1990, 138).

Bio art can be an act of resistance, suggestive of both Foster's anti-aesthetic and Haraway's technoscience, a desire to change the art object and its sociopolitical context. In addition, bio art objects, certainly ones which are living, place different requirements on the spectator in order to experience the work. Lippard and Chandler (1968) suggested greater participation is required of the spectator owing to the temporal nature of works that dematerialize. Such a heightened act of looking by viewers also applies to bio art works.

Having addressed theoretical dimensions in each of the domains, we proceed in the next three sections to advance each domain: artists talking about bio art; art and science intersections; and the distribution and reception of bio art. For each domain we draw on the interview data in order to contextualize bio art practitioners and their art projects.

Artists talking about bio art

Of the interviewed artists, Kac is the only one who readily identifies himself as a bio art practitioner: 'Bio art is like video art: it's clear, it's unambiguous, it's short, it's direct, it's easy and that's why it has gained currency'. Others prefer 'biological arts' (Catts), 'emergent media' (Vanouse) and 'medical artist' (Reodica). Indeed O'Reilly, who also uses the descriptors 'biological arts' and 'emergent media', notes that her work is often referred to as 'live art': 'I love it when different artists use different words to describe their practices even if they're in similar realms. It allows us to play with language and representation'. All accept that the term bio art has gained recognition as a shorthand description. So what is bio art? Is bio art a movement, a tendency or style in art with a specific common philosophy or goal?

Catts finds the act of defining bio art ‘problematic’, referring to himself as ‘an artist who engages with biological arts’, and signalling the choice of media as a defining factor. He describes the process of deciding who to accept at SymbioticA based on who can make use of the available laboratory resources: ‘It’s not so much an ideological definition or something which is based on any type of manifesto, it’s really about access to resources, it’s a very pragmatic kind of approach’. In addition, Catts notes that subject matter and media are ‘almost identical in a sense’. Vanouse defines bio art as ‘being’ and says that ‘it can be about the sort of space between things, between inert and live things’.

Artistic practices by Stelarc and O’Reilly, who have as aforementioned backgrounds exploring the concept of skin as a technological interface including self-experimentation, are part of inquiries into what a body can do. Stelarc describes bio art as ‘using living material, and using it in such a way that you can create sort of sculptural forms that weren’t possible before ... that allows you to explore the notions of what’s alive, what’s dead, what’s partially living’. Similarly, following a residency at SymbioticA in 2004 working with pig’s tissue in a laboratory setting, O’Reilly has explored the similarities between a dead pig’s skin and her own in an intimate and controversial performance, *inthewrongplaceness* (2005-09). She says of this work:

I move it around the space over four or five hours. The audience can touch my body and the pig’s body, so it’s a very visceral encounter.

There’s no technology involved whatsoever, but its genesis is from animal research and science in the laboratory.

All the interviewed artists acknowledge they have relationships and exchanges with each other. But do the artists view themselves as representing an art movement? Or is this the wrong question? The very idea of an art movement has been described

as a 'residual of modernist nostalgia' (Davis and Morris 2007, 416). Indeed when asked if they viewed themselves as part of a cohesive movement, the artists responded with some disdain. 'I don't think it would be very interesting if that was the case' said Stelarc, who continued, 'we do very much come from different directions'. Likewise for Catts: 'There's no one direct kind of philosophy that drives us'; they are 'a bunch of people bundled together'. O'Reilly refers to a 'partnership', and a 'happy sort of convergence of ideas but also divergences'.

Most of the artists associated the existence of an art movement with writing a manifesto. Kac makes this explicit: 'The existence of a traditional early twentieth century apparatus shall not be the guiding principle to define whether or not we are looking at a movement'. Notions of community and cohesion are suggestive, though. Vanouse describes artists working in bio art as a 'cohesive community': 'One of the things that makes movements cohesive is when they're very much outside of the realm of the rest of the arts. We've been in the same ghetto together for some time'. Vanouse also emphasizes the high level of engagement by bio art practitioners. This includes 'assertive and engaged writings', according to Kac, 'that establish concepts and parameters, inform the public of the new aesthetics, put concepts in circulation, and coin words'. In bio art, with its attention to ideas and the thinking process, the artist is also a writer.

Two positions emerge from these data: bio art cannot be an art movement because it does not have a manifesto; bio art is an art movement as represented by a cohesive community. Kac attempts to clarify the situation: 'Bio art is the first art movement of the twenty-first century, a movement that doesn't need the traditional manifesto'. There is an artistic community of bio art practitioners engaged in a newly serious purpose, namely the creative use of biotechnology. 'We see a group of artists

who have exchanges on many levels. There is a common aesthetic, but not in the specific outcome of each artist', according to Kac.

Art and science intersections

As we have argued earlier, art projects from living material blur the dividing line between art and science. 'Bio art stands with feet in both worlds' (Wilson 2002, 23). For example, SymbioticA, according to Catts, 'enables direct and visceral engagement with scientific techniques, using the discipline of art and life sciences'. Catts also notes that bio art practitioners 'engage and manipulate life but also present this manipulated life in an artistic situation'. For Kac 'these [biotechnology] tools are used because the kind of work you want to make is of that kind'. However, 'the work is not identical to the process that leads to its making'.

Bio art practitioners may also contribute to science. Art characteristics useful for research in the commercial and scientific worlds include 'a tradition of iconoclasm', 'the valuing of social commentary' and 'the valuing of creativity and innovation' (Wilson 2002, 38). According to Catts, 'What bio artists do is allow scientists to look at the implications of their work in a different light and look at how knowledge can be applied in so many different ways'. However, the manipulation of life by artists – or the removal of scientific utility from biotechnologies – can make bio art practitioners appear frivolous. For example, Levy (2006) notes that bio art practitioners have ethical responsibilities: they are using scientific resources that would be expected to yield more productive inquiries if used by scientists.

Yet these five bio art practitioners do not view themselves as practising science at all, even though they may be faculty members of university science

departments (Catts) or working with scientists (Kac, Stelarc and Vanouse). At the same time, Kac (like his fellow artists) acknowledges biotechnology as a point of reference:

I use the media of my time to make art, as Nam June Paik used video, László Moholy-Nagy used the photogram and the Impressionists used new paints in tubes. It will be obvious in about one hundred years, or even fifty or ... when the novelty wears off and the artwork stands on its own.

Though not practising science, these bio art practitioners have a positive attitude to and respect for science. Stelarc acknowledges his scientific collaborators: 'I respect the researchers that I work with. They're essential to facilitate, assist and realize some of the works'. However, there is frustration that bio art work is labelled 'part of science' (Catts) or 'artistic research' (Stelarc). This annoys Stelarc, who sees a fundamental difference between the way art and science operate:

We were talking [before the interview] about this irritation I have that for universities to authenticate artistic practice they have to justify or re-categorize it as a form of research. We also explore and test and experiment, but, as artists our agenda is very different. The trajectory of art is to unsettle, to surprise, to shock, to provide alternative paradigms.

Catts concurs: 'I managed to offend quite a few [art world] people by responding "you obviously don't know what science is if you think that what we're doing is science"'.

Bio art, though, does have some of the ethical scrutiny, health and safety encumbrances and funding dilemmas associated with scientific experimentation. Ethical approval is required from universities or other funding bodies. For example, bio art practitioners must obtain permission to perform biopsies on themselves in

order to create works using their own genes. ‘To my surprise they seem to be very accommodating to our wildest proposals. ... but sometimes I wish that the ethics committee [at UWA] would actually be there to question some of the things that are happening’ (Catts). (This suggests that Catts desires an opportunity for an engaged exchange with university colleagues on the ethics of bio art practices. Doing so would involve the science and non-science communities.) Health and safety hurdles facing bio art practitioners for the public display of works can also be high. Kac was awarded the Golden Nica for hybrid art at Ars Electronica in 2009 for *Natural History of the Enigma* (2003-08). However, the central work Edunia – the transgenic hybrid between Kac and a petunia flower – required multiple approvals to be granted in order for it to be shown.

It is, moreover, not surprising that these bio art practitioners have mixed views on accepting commissions to fund works. Kac’s *Cypher* (2009) and *Natural History of the Enigma* (2003-08) were commissioned by French contemporary art centre Rurart and the Weisman Museum in Minneapolis, respectively:

I accepted the commission to make a sculpture, but explained that I don’t work that way. I don’t just make forms like that. To me there’s a process that begins with the creation of new life. That alone will suggest pathways that I haven’t anticipated.

Five years later, the Weisman Museum received, as part of its permanent collection, Edunia and a colossal fibreglass and metal sculpture. In a similar manner, Vanouse, who has had several commissions including one from the Henry Art Gallery in Seattle, is positive about the funding experience: ‘Arts grants are pretty loose. They generally will let you change your ideas midway through and things like that’. On the other hand, Catts has refused commissions in his position as director of SymbioticA,

including one from PETA (People for the Ethical Treatment of Animals); at the same time, PETA has criticized bio art practitioners. Catts feels the need to 'try to maintain at least an appearance of autonomy and being able to engage in a non-agenda based way so we tend to avoid things that might compromise both this perception and the ability for artists to explore what they want'.

Stelarc has sought commercial collaboration even though most of his projects, such as the *Third Hand*, the *Walking Head Project* and *Blender*, have not received external funding. This is to say self-funding has been essential. Nonetheless, Stelarc's *Ear on Arm* was funded by the Discovery Channel as part of a documentary on experimental surgery; it represents the most commercial transaction in bio art funding thus far. Stelarc's experience with the Discovery Channel also illustrates the impact funding can have on an artist: 'I thought the documentary sucked big time ... but it did allow me enough money to do the project'. Stelarc was frustrated that the documentary did not show as much of the surgery as he wished. He insisted on high-definition footage of the surgery, which he has been able to use to create videos to accompany exhibitions; however, he is not able to sell these videos as part of his contract with the Discovery Channel.

Further, these bio art practitioners are frequently vexed if they are asked to be science communicators or to spark people's interest in science. They contend that their work deals with the creative use of biotechnology by artists. According to Kac, 'Science is in the eye of the beholder, which means that you can, if you want, see science as everything. ... But let's be clear that you are doing that, not the artist'. 'The role of bio art in science is secondary', according to Catts, who is 'suspicious of artists who claim that they're contributing to science'.

The distribution and reception of bio art

Audience reception depends on an artist having his or her works being exhibited. As such distribution in art matters a great deal, so who and what gets exhibited – including how and where? The five artists we interviewed wish to shape public and critical reception of their work. They privilege particular artistic practices of value in bio art. Consider Kac's statement at the outset of our interview with him:

There is an important difference between the market for bio art and the market for bio artists. When I sell a photograph, it's a photograph even if it is part of the *GFP Bunny* series, it's not alive. We're only talking about the market for bio art when it is alive.

This reflects the thinking process and the idea behind bio art, namely representing the bio-ness of the art being created. At the same time Kac – like most bio art practitioners – adopts artistic practices that encompass more than just biological processes; they may photograph, paint or sculpt as well.

The market for bio art refers to both living works of art, which have a lifespan, and works that are preserved. In addition, the work of bio art practitioners can also include auxiliary or documentary works. Three complementary forms of work– living, preserved and documented – can thus be identified. There is a challenge in each to conventional ways of seeing, namely in how these artists desire their works to be experienced by spectators. This is about artists establishing the ideal conditions for critical and public reception of their works.

First, bio art is living so it also dies. Living bio art is deemed by these artists as aspiring to an ideal form of bio art. This also means that the experience of these living works is temporal so their specific meanings fluctuate depending on when a

spectator experiences the work (see Lippard and Chandler 1968). Demands are placed on spectators as greater participation is required. The sense of duration seems longer, as one is being asked to view the gradual process of growth and decay in a living organism. In addition, it is challenging for spectators to experience the tensions between life and death associated with living bio art: there is a sense of control and immortality associated with life; at the same time, there is sense of vulnerability and inevitability associated with death.

The display and collection of living bio art face difficulties. For example, displaying living and semi-living organisms requires sterile environments and bioreactors (i.e., devices used for growing and sustaining living cells and tissue outside of their environment) in order for them to survive. The construction of temporary laboratories within conventional exhibition spaces – ‘a very versatile space that has the same type of resources that a good biological lab would have’, according to Catts – has been mooted at UWA to house a permanent display of works by SymbioticA. Moreover, SymbioticA is working with conservators to create a ‘toolkit’ for artists and conservators to aid in the preservation of bio art works. At the same time, some works of bio art, such as Kac’s *Natural History of the Enigma* (2003-08) are very straightforward in their preservation, proving to be easier to maintain than traditional media like oil painting on canvas:

The flower is in the permanent collection of the museum, in the form of seeds. The flower will die within a month or two, but the seeds don’t. The genetic sequence is also in the collection. Long after I’m gone, the seeds should still be good. ... *Natural History of the Enigma* should outlast Velasquez by a long shot.

Second, given the challenges of displaying living and semi-living works – that is in following their ideas through – artists have developed ways to preserve their works for display. For example, the Tissue Culture & Art Project developed ‘the killing ritual’ in order to stop the growth of works like *Pig Wings* and *Semi-Living Worry Dolls* (2000), which are then preserved in glycerol. Reodica employs a similar approach with her *hymNext* project by growing hymens until they reach the desired size; she then quickly stops their growth and coats them in latex. This is about locating a living bio art work at a particular point in time, with an intention that the spectator delves into the process of artistic production and the ideas behind the artist’s practice.

Third, documented bio art reflects both technology constraints and curatorial choices. The result of documented bio art is often a photograph. Spectators are now accustomed to photography as a form of art. For example, after the Tissue Culture & Art Project began in the mid-1990s, Catts and Zurr had several sell-out shows based on large digital prints of photographs depicting their semi-living sculptures. According to Catts, these shows were ‘very traditional in the sense of what we were showing was a representation of the process ... and the objects that were developed in the laboratory’. It is also instructive to note that the most well-known bio art work, Kac’s *GFP Bunny*, is known to most spectators via documentation.

Opinions about the nature of bio art works differ, though all of the practices – biological and non-biological – are integrated. Some artists, such as Kac and Stelarc, identify their non-biological works as extensions – or auxiliary works – of the original, living, biological ones. These auxiliary works include documentary evidence such as photographs and videos; lithography (Kac’s designs for his *Edunia* seed packs) and sculpture (Stelarc’s *Ear on Arm* casts) are also evident. As Stelarc

explains, 'It is convenient to separate documentation and artwork performance. But I've never really done that. If I look at a videotape of my past performances, to me that documentation represents a half-life'.

Catts feels differently, though, with much less emphasis on the documentation. On two separate occasions during our interview, he mentions that the *Pig Wings* can be viewed at New York's MoMA as part of its permanent collection. Catts seems disappointed that the works owned by MoMA are 'just the prints', though. We interpret this as incompleteness, that the entirety of his idea cannot be communicated in a print. By way of explanation, Catts makes reference to Boris Groys (2008):

Art is becoming a process and the documentation of the process is on display. ... Groys [in *Art Power*] refers to the form of "liveness of the art" – that art goes through a living cycle or lifecycle.

In making a case for audience participation and authenticity in the liveness of a concert or a reading, Groys seems to be affirming that a performance's life is in the present. When a performance enters the economy of reproduction it is less alive. There is a similar privileging of liveness in bio art by Catts – also expressed by Kac at the outset of this section – with living bio art works having greater value relative to documented works.

Time spent at the Harvard Medical School in the late 1990s helped Catts to develop new techniques; equally as important, Ars Electronica was willing to establish a fully functioning laboratory in an exhibition setting. This has informed Catts' attitude to art market sales:

The Tissue Culture & Art Project and SymbioticA lost interest in selling anything. It is much more interesting for us to show the living sculpture. Given our critique of the commodification of life, trying to commodify a

thing in an artistic context and sell it was problematic. Since 2000 I don't think we've sold one work.

Bio art may be one way to demonstrate the materiality of the things of this world beyond their monetary exchange value. Indeed all these bio art practitioners expressed a desire to control the conditions for the critical and public reception of their works, even if it means that living bio art is less saleable to private collectors and more challenging to spectators.

Bio art: critical practice and communal ethos

Art can certainly be considered one of the most powerful and recognized generators of meaning today. The objects created by contemporary artists can help to make sense of our changing world, one that is marked by rapid technological and social advances in the context of a globalized economy. This paper has focused on the voices and works of five contemporary artists – Oron Catts of SymbioticA, Eduardo Kac, Kira O'Reilly, Stelarc and Paul Vanouse – who travel under the banner of bio art, an emerging contemporary art practice of the early twenty-first century. These micronarratives make history of contemporary art. They also allow three domains of investigation to emerge with a shared focus on bio art and its practitioners: artists talking about bio art, art and science intersections and the distribution and reception of bio art. In doing so we have a better understanding of bio art as a critical practice based on a communal ethos.

Bio art is a critical practice. We mean critical in the sense that it is in opposition to what is viewed as dominant. Questions of bio art provoke unease. These are the sort of reflections by spectators – on the concept of art and the divide

between the arts and science – that do not sit easily within the core of disciplines (in the visual arts and biotechnology, for instance) and institutions (such as art museums and science laboratories). As live bio art is physically ephemeral by definition, there is a question of whether the idea of bio art can remain in effect even after the work itself has disappeared. Bio art invites one to consider, as outlined by Lippard and Chandler (1968), how the judgement of an idea is less interesting than following the idea through. In the process of following an idea through, one learns if it is a good idea (that is fertile and open enough to suggest infinite possibilities such as offered by the legacy of Duchamp's readymades), a mediocre idea (that is exhaustible) or a bad idea (that is already exhausted or with little substance). As a form of cultural expression the idea of bio art is to explore the living and partially living by creating works of art. There are opportunities for bio art practitioners to follow their ideas through more fully.

Contemporary artists addressing science and technology have, we suggest, a distinctive sociopolitical role. There is often an overly positive attitude toward science and technology, related to the self-congratulatory and enthusiastic accounts scientists often give of their own disciplines. Artists can offer different sorts of narratives in this regard: 'Bio art results in artistic forms of expression and sculptural objects and new ways of exploring the living and the partially living', according to Stelarc. It is a way for artists to construct their practices and their domains of knowledge while entering a debate on the subject of biotechnology with the rest of the population. Such narratives help to bridge the gap between the 'two cultures' of science and the arts, expressed as a lament by C.P. Snow in his 1959 Rede Lecture, 'The Two Cultures of the Scientific Revolution' (see Davis and Morris 2007; Wilson 2002). The bio world involves complex science and technology that is often beyond the capacity of non-scientists to

discuss and communicate comfortably and with clarity. Artists who are able to engage with biotechnology in a creative manner can serve as catalysts.

A communal ethos imbues how the bio art practitioners we interviewed discuss what they do, why and how they work. Transnational exchanges occur in bio art: strong European roots are evident, such as exhibitions and conferences, even though Anglo-American identities feature in the practitioners. There is convergence and divergence. Artists come from different directions and there are no specific outcomes in bio art. There is no manifesto; even calling bio art a movement does not garner unanimous support. There are individual actions and practices of the artists. However, there is a common aesthetic including the creative use of biotechnology (or the removal of scientific utility from biotechnology to create works of art). Bio art practitioners seek to serve as a community of interpreters between disciplines. There are notions of community and cohesion. The language is of mutual respect and support. Human relations are marked by friendship, trust and virtue.

Bio art is suggestive of permeability between disciplines. Yet interdisciplinary activity also proves to be difficult. Bio art practitioners invite criticisms as biotechnology, according to Thacker (2003b, 94), 'is about a fundamental reconfiguration of the very progresses that constitute the biological domain'. Several criticisms and responses are presented as part of a rounded discussion. First, bio art is based on an infringement upon nature, one that transgresses boundaries between the natural and artificial worlds (see, for example, Thacker 2003a in response to Rifkin 2003). In this scenario, transgression is negative: it goes beyond the bounds set by the western edifices of humanity and humanism and has links to eugenics. An alternative and positive use of transgression, of the outsider-artist position, has been proffered. Kac ended our interview by reiterating the role of social relations in his bio art

practice (with reference to Alba): ‘The works have to be alive and independent from you. They have to have a life of their own. So it’s not that they are sharing their lives with you, but you with them as well’. Likewise, in their curatorial statement for ‘Visceral: the living art exhibition’ (2011), to celebrate the first decade of SymbioticA, Catts and Zurr (2011) articulate ‘a series of provocations and puzzles around the nature of living and non-living, asking us to consider the myriad of possible implications of our new biological toolkit’.

A second criticism is that bio art is driven by economic imperatives such that it is public relations for the biotech industry (see, for example, Thacker 2003a in response to Rifkin 2003). Catts counters such utilitarian readings by suggesting that ‘bio artists make scientists more aware of the social role they’re playing and not just as value-free knowledge producers’. Stelarc addresses the charge with his current artistic practice ‘of not accepting the biological status quo of the body ... rather a body augmented with technology becomes an extended operational system’. Furthermore, according to Stelarc, ‘Bio art challenges not only our aesthetic but also our conceptual paradigms of what life is and what a body is and what constitutes life’.

Lack of public access to documentation of the scientific procedures conducted as part of bio art practices – with the focus instead being on the artists declaring the result in works of art – is a third, and final, criticism (see, for example, Levy 2006; 2007). Unless ethical considerations are addressed, there is an emphasis on technical issues that can result in bio art practitioners being perceived as advocating a more advanced biotechnology as the answer, what Thacker (2003b, 6) labels ‘technophilia’. Documentation would also offer fuller recognition of scientific collaborators in the creative process, as with living bio art, where art production and exhibition coincide.

Notwithstanding one's sense of aesthetics and perceptions of art, which may be considerable, bio art aids our understanding of works of art as social and political objects. In navigating what is a complex and changing landscape, the social cohesion and trust bio art practitioners have developed as a community is beneficial if we accept that they are contribute to sociopolitical visions social sciences.

References

- Alberro, A. 2003. *Conceptual Art and the Politics of Publicity*. Cambridge, MA and London: MIT Press.
- Alberro, A. and B. Stimson., eds. 2009. *Institutional Critique: An Anthology of Artists' Writing*. Cambridge, MA and London: MIT Press.
- Arts Catalyst. 2009. "Eye of the Storm" (symposium). London: Tate Britain.
- Buchloh, B. 1990. "Conceptual Art 1962-1969: From the Aesthetics of Administration to the Critique of Institutions." *October* 55 (Winter): 106-143.
- Buchloh, B., R. Krauss, A. Alberro, T. de Duve, M. Buskirk and Y-A. Bois. 1994. "Conceptual Art the Reception of Duchamp." *October* 70 (Autumn): 126-146.
- Catts, O. and I. Zurr. 2001. "The Aesthetics of Parts: Humans and Other Animals Are "Becoming" Each Other." Accessed 1 July 2013.
<http://www.tca.uwa.edu.au/pig/parts.html>.
- Catts, O. and I. Zurr. 2002. "Growing Semi-Living Sculptures: The Tissue Culture & Art Project." *Leonardo* 35(4): 365-370.
- Catts, O. and I. Zurr. 2011. "Visceral: The Living Art Exhibition." Dublin: Science Gallery, Trinity College Dublin. Accessed 1 July 2013.
<http://sciencegallery.com/visceral>.
- Danto, A. 1964. "The Artworld." *Journal of Philosophy* 61 (October): 571-584.
- Danto, A. 1981. *The Transfiguration of the Commonplace: A Philosophy of Art*. Cambridge, MA and London: Harvard University Press.
- Davis, L.J. and D.B. Morris. 2007. "Biocultures Manifesto." *New Literary History* 38(3): 411-418.

- De Menezes, M. 2003. "The Artificial Natural: Manipulating Butterfly Wing Patterns for Artistic Purposes." *Leonardo* 36(1): 29-32.
- Duchamp, M. 1917. "The Richard Mutt Case." *The Blind Man* 2 (May). Accessed 1 July 2013. <http://radicalart.info/things/readymade/duchamp/text.html>.
- Duchamp, M. 1957. "The Creative Act: Lecture to the American Federation of Arts." <http://radicalart.info/things/readymade/duchamp/text.html>. Accessed 1 July 2013.
- European Commission. 2004. "Biotechnological Art: The Mysteries of a Mutant Art." *RTDinfo: Magazine on European research* (March). Accessed 1 July 2013. http://ec.europa.eu/research/rtdinfo/special_as/article_814_en.html.
- Foster, H. 1985. *Recodings: Art, Spectacle, Cultural Politics*. Townsend, WA: Bay Press.
- Foster, H. 1996. *The Return of the Real*. Cambridge, MA and London: MIT Press.
- Foster, H., ed. 1983. *The Anti-Aesthetic: Essays on Postmodern Culture*. Port Townsend, WA: Bay Press.
- Garoain, C.R. and Y.M. Gaudelius. 2001. "Cyborg Pedagogy: Performing Resistance in the Digital Age." *Studies in Education* 42(4): 333-347.
- Gessert, G. 1993. "Notes on Genetic Art." *Leonardo* 26(3): 205-211.
- Gessert, G. 1996. "Bastard Flowers." *Leonardo* 29(4): 291-298.
- Gessert, G. 1997. "Art and Biology." *Leonardo* 30(3): 169-170.
- Groys, B. 2008. *Art Power*. Cambridge, MA: MIT Press.
- Haraway, D. 1991. *Simians, Cyborgs and Women: The Reinvention of Nature*. New York: Routledge.
- Haraway, D. 1997. *Modest_Witness@Second_Millennium.FemaleMan[©]_Meets_OncoMouseTM: Feminism and Technoscience*. New York and London: Routledge.

- Hauser, J. 2003. "L'Art Biotech" (exhibition). Luxembourg: Casino Luxembourg.
- Hauser, J. 2009. "sk-interfaces: Exploring Borders in Art, Technology and Society" (exhibition). Luxembourg: Casino Luxembourg.
- Hauser, J., ed. 2008. *sk-interfaces: Exploring Borders – Creating Membranes in Art, Technology and Society*. Liverpool and Chicago: Liverpool University Press.
- Hayles, N.K. 1999. *How We Became Postmodern: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago: University of Chicago Press.
- Kac, E. 2003. "GFP Bunny." *Leonardo* 36(2): 97-102.
- Kac, E., ed. 2007. *Signs of Life: Bio Art and Beyond*. Cambridge, MA and London: MIT Press.
- Kruger, B. 1989, *Untitled (Your body is a battleground)*. Accessed 1 July 2013.
<http://www.arthistoryarchive.com/arthistory/feminist/Barbara-Kruger.html>.
- Levy, E. 2006. "Art Enters the Biotechnology Debate: Questions of Ethics." In E. King and G. Levin, eds., *Ethics and the Visual Arts*. New York: Allworth Press, 199-216.
- Levy, E. 2007. "Defining Life: Artists Challenge Conventional Classifications." Accessed 1 July 2013.
http://a.parsons.edu/~vesnav/nanobioart/parsons/files/2010/02/Ellen_Levy_BioArt.pdf.
- Lippard, L. and Chandler, D. 1968. "The Dematerialization of Art." *Art International* 12(2): 31-36.
- Munster, A. 2005. "Why Is Bioart Not Terrorism? Some Critical Nodes in the Networks of Infomatic Life." *Culture Machine* 7: 31-38.
- Puncer, M. 2008. "Artistic Research on Life Forms: Exploring the Intersection of Science, Art and Life in the Context of Globalization." *Leonardo* 41(5): 468-477.

- Regine. 2013. "We Make Money Not Art." Accessed 1 July 2013. <http://www.we-make-money-not-art.com/archives/bioart/>.
- Reodica, J. 2007. "hymNext Project." *New Literary History* 38(3): 414-415.
- Rifkin, J. 2003. "Dazzled by the Science: Biologists Who Dress Up High-Tech Eugenics as New Art Form Are Dangerously Deluded." *Guardian*, 13 January. Accessed 1 July 2013. <http://www.guardian.co.uk/education/2003/jan/14/highereducation.uk>.
- Smith, M., ed. 2005. *Stelarc: The Monograph*. Cambridge, MA and London: MIT Press.
- Thacker, E. 2003a. "Aesthetic Biology, Biological Art." Accessed 1 July 2013. http://www.noemalab.org/sections/ideas/ideas_articles/pdf/thacker_aesthetic_biology.pdf
- Thacker, E. 2003b. "Data Made Flesh: Biotechnology and the Discourse of the Posthuman." *Cultural Critique* 53(3): 72-97.
- Thacker, E. 2004. *Biomedica*. Minneapolis: University of Minnesota Press.
- Thacker, E. 2005. *The Global Genome: Biotechnology, Politics, and Culture*. Cambridge, MA and London: MIT Press.
- Thacker, E. and N. Ruiz. 2006. "An Era of Zoê and Bios? A conversation with Eugene Thacker." *Kritikos* (August). Accessed 1 July 2013. <http://intertheory.org/thacker-ruiz.htm>.
- Tomasula, S. 2002. "Genetic Art and the Aesthetics of Biology." *Leonardo* 35(2): 137-144.
- Van Maanen, H. 2009. *How to Study Art Worlds: On the Societal Function of Aesthetic Values*. Amsterdam: Amsterdam University Press.

Wilson, S. 2002. *Information Arts: Intersection of Art, Science, and Technology*.

Cambridge, MA and London: MIT Press.

Youngs, A. 2000, "The Fine Art of Creating Life." *Leonardo* 33(5): 377-380.

Zaretsky, A. 2004. "Viva Vivo! Living Art is Dead." *Leonardo* 37(1): 90-92.

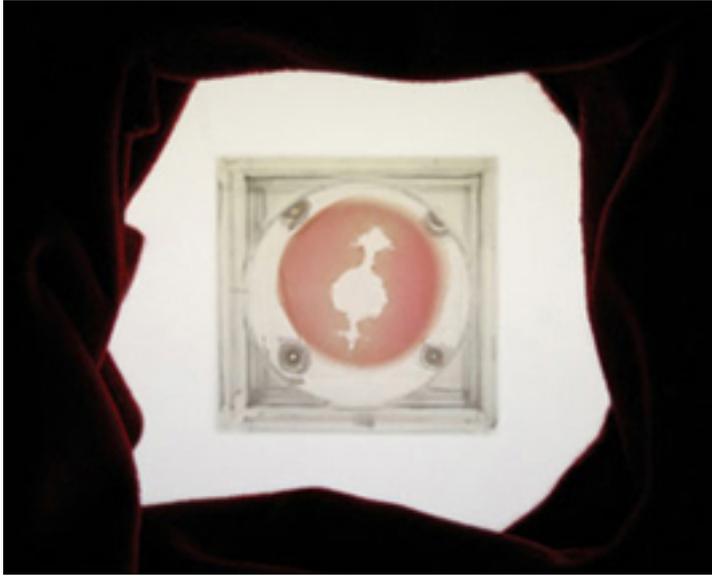
Zurr, I. and O. Catts. 2003. "The Ethical Claims of Bio Art: Killing the Other or Self-Cannibalism?." Accessed 1 July 2013.

<http://www.tca.uwa.deu.au/publication/TheEthicalClaims ofBioArt.pdf>.

Image 1: Kac, *GFP Bunny* (2000)
Source: <http://www.ekac.org/>



Image 2: Reodica, *hymNext* (2004)
Source: <http://www.phoresis.org/>



Notes

¹ Barbara Kruger's *Untitled (Your body is a battleground)* was designed for the 1989 march on Washington, D.C., in support of women's rights and the abortion-rights movement.

² George Gessert, who started breeding ornamental plants in his garden in Eugene, Oregon, had his first exhibitions in the late 1980s. Comparisons have been drawn to photographer Edward Steichen's exhibition of delphiniums as a form of genetic art at New York's Museum of Modern Art in 1936 (see Youngs 2000). Marta de Menezes has adopted butterfly wings as her canvas. She uses a needle coupled with a heat generator to alter the wing patterns of butterflies; this is not a genetic process, though, as each butterfly retains its natural origin.

³ For representations of works by the five artists, see their individual websites: Catts <http://www.tca.uwa.edu.au/> and <http://www.symbiotica.uwa.edu.au/>; Kac <http://www.ekac.org/>; O'Reilly <http://www.kiraoreilly.com/blog/>; Stelarc http://stelarc.org/_..swf; and Vanouse <http://www.contrib.andrew.cmu.edu/~pv28/>.

⁴ The we-make-money-not-art.com website includes bio art as a category, with Regine serving as a writer on bio art dating back to 2007.

⁵ The name readymade derives from Duchamp's practice of selecting a mass produced item, such as a urinal or bottle racks, to be a work of art. *Fountain* (1917) is the most famous readymade. (The original from 1917 is known to us primarily from a photograph taken by Alfred Stieglitz; the original was lost with replicas authorized by Duchamp in the mid-1960s.) Duchamp had a distaste for retinal art (or art that gratified the eye). With the readymade, Duchamp isolated the commonplace, prefabricated object from its functional context; and he elevated the object to the

status of art by this act of artistic selection. For Duchamp, the readymade subtracted from the concept of art everything to with the artistic. In doing so, Duchamp was challenging the boundaries of art (which has continued to occupy subsequent generations of contemporary artists).