

Artistic Research at the Edge of Science

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To lie down with the wolves

A woman, naked save for a thin gauze covering her loin, is lying immobile on a bare theatre stage. The scene is starkly lit by yellow light. A male voice, amplified, off-stage, reads from manifestos on the relationship between man and animal: Joseph Beuys', Oleg Kulik's, Susan Silas'. Meanwhile, two wolf-dogs and a wolf emerge from the wings, and sniff at the woman's body. The voice then reads out the words written by the artist lying upon the stage. This is a confessional, recounting a childhood spent amongst animals, a paradoxical kinship with the wild within the confines of human domesticity. 'We feel and understand each other, lying in a waste tanned skin landscape of dead animals...We smell death and feel comfortable in the uncanny valley of machined fur'. The creatures sniff at the woman's outstretched palms; they lick her palms, her forearms, her stomach.



Maja Smrekar, *K-9_topology: I Hunt Nature and Culture Hunts Me*, 2014, performance documentation (8 November 2014), Le Nadir, Bourges, France, photograph by Amar Belmabrouk, image courtesy of the artist.

Maja Smrekar's performance piece, *I Hunt Nature and Culture Hunts Me* (2014), belongs to the artistic tradition which extols man's attempted communion with the animal (and more specifically, with the canine animal).¹ Syntactically and performatively, Smrekar quotes Beuys' *I Like America and America Likes Me* (1974), for which Beuys spent three days cohabiting with a coyote. In Smrekar's piece, too, one of the animals is wild (the partially tamed wolf), and the audience is protected by a cage. By contrast, Oleg Kulik's performances – for which Kulik barks and acts like a provoked dog – display antagonism rather than coexistence. However, all three

artists hold up animals for their truthfulness, their pre-linguistic inability to deceive. There is, though, an important difference. While a piece of performance art, *I Hunt Nature and Culture Hunts Me* is, in fact, a part of a much larger series, *K-9_topology* (2014-ongoing). Like most of Smrekar's work (and unlike the performances by Beuys or Kulik), this series is driven

by findings of evolutionary biology. The starch, licked off Smrekar's body by the wolf-dogs, is symbolic of the starch diet, which has been crucial to the joint evolution of man and dog.² Another piece by Smrekar involved isolating serotonin from the blood of both Smrekar and her pet dog, Byron, creating a perfume – the olfactory basis of their relationship – which permeated one of Smrekar's gallery installations, *Ecce Canis* (2014). Indeed, as I will illustrate later, most of Smrekar's artistic practice relies on biological findings or even direct collaborations in the biochemist's laboratory.



Maja Smrekar, *K-9 topology: Ecce Canis*, 2014, installation with recycled wolf fur and manufactured scent, Kapelica Gallery, Ljubljana, Slovenia, photograph by Miha Fras, image courtesy of the artist.

Here I wish to address this research-driven element in an artistic practice. Should we say that an artistic practice, such as Smrekar's, is assisted by the research she undertakes into evolutionary biology? Or should we say (more ambitiously) that, in some sense, such a practice *constitutes* research *into* evolutionary biology? This question may seem artificial, but consider this analogy: certainly, Ian McEwan studied neurology to a considerable level to write his novel *Saturday*, the protagonist of which is a neurosurgeon, but it would be rather controversial to say that the novel *itself* contributes to neurology, or some other academic field. In some form or other, I take it that this dilemma has been at the core of arguments for and against artistic research, especially with regards to its inclusion within academic institutions.³ The issue at stake is whether we ought to see artistic research as knowledge-producing, and therefore belonging to the academy, or (merely) as art that is inspired by an academic field.⁴

I raise these questions as I hope to show their limitations, but I think it is the right way to start the debate. Here, I will consider the case of bio-art. By this term, I designate artistic projects, such as Smrekar's, which directly utilise biological technology at a level comparable to that of professional laboratories.⁵ Bio-art, due to its proximity to academic disciplines (such as bioengineering), is an especially telling case study for thinking about artistic research in general. Appropriately for this issue of *OAR*, I hope to show that the notion of a 'field' of research is useful for disentangling the difficulties.

The field of bio-art

We can identify a field of research methodologically or topologically. For example, academic analytic philosophy is a field which seems above all to be defined methodologically. It covers all kinds of topics – ethics, metaphysics, epistemology, as well as more 'applied' topics like philosophy of public affairs, philosophy of biology and even philosophy of wine – but these are united by adherence to certain research protocols: such as formulating questions that go beyond empirical findings, putting forward theses, and finding arguments for and against them.⁶ Defined topologically, however, a field of research comprises some part of the world, which one is trying to get to grips with. In this sense, almost anything could be a field of research: France, consciousness or deciduous plants. Fields that end with the suffix 'studies' seem to be defined topologically; so, under 'consciousness studies' one might bring together anthropology, philosophy and neuroscience to shed some light on the nature of conscious experience.⁷ Geography is perhaps also one academic field that is topologically defined, focussing on distinct areas of the world, but combining methods as diverse as cultural history and soil science. This is a rough and provisory distinction, but I think it is useful to help us get clearer on the sense in which bio-art might be considered a field of research.

Bio-art has become established both within academic institutions and within its own dedicated ones. After experimental beginnings in the early 1990s,⁸ the early 2000s saw artists gain increasing access to residencies within biomedical laboratories, establishment of funding streams dedicated to this kind of production such as the Arts Awards at the Wellcome Trust, and dedicated exhibitions and biennales, such as the Hybrid Art section at Ars Electronica in Linz.⁹ The establishment of SymbioticA at the University of Western Australia in 2000, a dedicated bio-art laboratory which also offers postgraduate research degrees, was another notable development. Bio-art, we can safely say, exists within a strongly interlinked, international institutional network. Interestingly, this network may have more interactions with the field of science and technology than it does with mainstream contemporary art. Museums such as Tate Modern, MoMA or the Centre Georges Pompidou have paid bio-art relatively little attention.¹⁰

Despite its increasing institutionalization, it would be problematic to designate bio-art as its own field of research under the *methodological* designation. While bio-artists might critique each other's work, they do not require it to be amended or disqualified in order to conform to some research protocol. Certainly, a degree of standardized mutual policing may exist in bio-art, and is exerted through such administrative procedures as grant applications.¹¹

However, whilst such procedures may share some features of peer review (such as being partially anonymized), they ostensibly follow a different set of criteria: in the case of the Wellcome Trust arts awards, what is assessed is potential for outreach rather than, say, engaging the right kind of scholarly literature.¹² Likewise, whilst some bio-artists also hold science PhDs (Natalie Jeremijenko, who has a PhD in computer science is one example), and others have published reports on bio-art in science journals,¹³ none of this should lead us to conclude that methodological uniformity exists within bio-art *itself*.

The institutional reality of bio-art, as is perhaps true of artistic research more broadly, then does not seem to reflect the rigors of self-control that is typical of methodologically defined academic disciplines. Besides, it seems such methodological conformity would be an undesirable outcome: arguably amounting to a kind of self-suffocation by self-regulation that Charles Harrison's piece on artistic research warns against.¹⁴ The very open-ended nature of bio-art speaks against seeing it as methodologically stable.

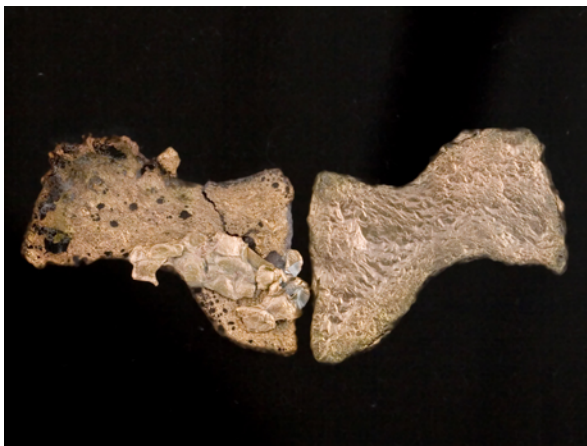
The field-as-a-methodology option, then, is one I want to quickly discount, and rather consider the more promising possibility that bio-art is a participant in a field that ought to be defined *topologically*: a field that investigates a part of reality, but does so through various tools. Then, we might count Smrekar's performance as a contribution to 'evolution studies'; Eduardo Kac's genetic art as a part of 'genome studies'; Oron Catts and Ionat Zurr's pioneering forays into artistic manipulation of living tissue as research within 'tissue engineering studies'. The topological way of conceiving bio-art aims to address, then, this interdisciplinary, open-ended and collaborative nature of bio-artists' undertakings.

Here, it is important to note an acceleration that occurred in bio-art by the turn of the millennium. Writing in the catalogue of a landmark early exhibition, *Genetische Kunst / Künstliches Leben* (Genetic Art / Artificial Life) in 1993, Peter Weibel defined his subject as follows: 'Genetic art as artistic counterpart of genetic engineering is...intended to simulate processes of life with the same modern technological tools and methods as the latter'.¹⁵ Through the 1990s, however, artists' access to bioengineering technology was still limited to commercially available services or to documentation of the scientific process.¹⁶ One of the first significant cases of an artist's direct involvement with bioengineering in an academic laboratory occurred in 2000-01, during the residency of the artists Oron Catts and Ionat Zurr at the Tissue Engineering and Organ Fabrication Laboratory in Massachusetts General Hospital at the Harvard Medical School.¹⁷ What is notable about Catts' and Zurr's *Tissue Culture and Art Project*, is the level of access Catts and Zurr enjoyed, supervising the manipulation of biological matter after their own design. This resulted in several projects such as *Pig Wings* (2000-01), whereby pig stem cells were grown in the shape of an angel's, a bat's and a pterosaur's wings, and *Disembodied Cuisine* (2000/03), for which the artists grew frog flesh in the laboratory, and consumed it at a dinner party, whilst the donor frogs' lives were happily preserved.¹⁸

Within the next decade, such collaborations became more commonplace, with artist's increasingly creating work through bioengineering techniques, often in collaboration with academic laboratories. To give some examples, Eduardo Kac's *Move 36* (2002/04) is an

installation featuring genetically modified plants; Marta de Menezes' work, *Tree of Knowledge* (2004/05) is a sculpture made of artificially grown neurons; and Maja Smrekar's *Maya Yoghurt* (2012) involves the insertion of the artist's gene into a yeast, to make it produce a more nutritious kind of yoghurt.

In the process, bio-artists acquired access to increasingly sophisticated tools. In 2004, Kac used bioengineering to encrypt the message '*cogito ergo sum*' in the plant's genetic code in *Move 36*. Eight years later, in *Maya Yoghurt*, Smrekar utilized an already more advanced technology. Her genetic modification of a yeast is functional: the human gene in the yeast is expressed as a protein, which speeds up the fermentation of the yoghurt.¹⁹ Not only is the genetic code played with, the artist also creates a functioning transgenic organism. Crucially, then, bio-art attempts to keep up with its technological progress, something that can also be clearly seen when considering the increasingly advanced works that win Hybrid Art Awards at Ars Electronica.²⁰ In this respect, this strain of bio-art also appears to be different from those artists who have emphasized do-it-yourself, amateur incursions into bio-art.²¹



Oron Catts and Ionat Zurr, *Pig Wings*, 2000–01, pig bone marrow stem cells grown over and into biodegradable polymers, 4 cm x 2 cm x 0.5 cm, installation view (detail), image courtesy of the artists.

It is precisely the proximity of bio-art to technological progress that has led many commentators to describe bio-art as possessing a unique critical purchase on its subject matter. Suzanne Anker and Dorothy Nelkin speak of the artists' 'interrogation' of science,²² Ingeborg Reichle follows Donna Haraway in framing the discussion of bio art around a bleak vision of an age of exploitative, ethically blind 'technoscience' against which bio art functions as an agent of 'subversion',²³ and the artist Claire Pentecost suggests the role of the bio-artist is one of a public amateur, who reconfigures science which is 'vested with traditional claims to truth and service to the public good, while shaped to narrow market agendas'.²⁴ This line

of thinking has also been echoed by those who sponsor bio-art. For example, the internal review of the Wellcome Trust's Sciart programme describes artists as 'scrutinisers' and 'pseudo-"public representatives" in what might otherwise remain hermetic sanctums of knowledge'.²⁵ As Eduardo Kac puts it, bio-artists 'appropriate and subvert contemporary technologies – not to make detached comments on social change, but to *enact* critical views'.²⁶ In his book on bio-art, Robert Mitchell develops this view further. For Mitchell, biotechnology itself is the proper 'medium' of bio-art. It is precisely because of the artist's actual usage of the current technological techniques, that this work exercises a certain affective pull on the audience, which allows them to take up a critical stance towards it.²⁷ To relate this discussion to our theme, we might say that bio-art participates in a topologically defined field – such as 'tissue engineering studies' or 'genetic enhancement studies' – but does so by combining bio-engineering with other approaches. The artists' distinct methodological contribution is their affective and critical uses of the technology.

The use of affect in bio-art has been mostly manifested in what we might call the ‘freakishness’ of bio-art. The artists’ subversion of biotechnology namely often involves a puckish, dystopian aesthetic. *Pig Wings*, where the levity of the pun seems inappropriate to manipulation of ‘semi-living’ tissue, are a clear example of that. Recent work corresponds to this standard. Smrekar’s *Maya Yoghurt* is a marketing campaign riffing off the organic food craze; it features stock images of happy families imbibing human-enhanced yogurt. In the presentation of the piece, the audience could also taste the yoghurt. It is presumably because we know that a real biotechnological change has been performed that, to paraphrase Robert Mitchell’s position, the viewer’s affective state is changed in a way that disposes her towards greater political involvement.²⁸ To put the point perhaps over-simply: we are more shocked by bio-art than by abstract debate, because bio-art utilizes, in culturally compelling ways, the technologies we may want to interrogate.

Here, then, emerges one rationale for bio-art as a topologically defined field of research. Any topologically defined field combines various methodologies, and the question then becomes what advantage is conferred by this kind of interdisciplinarity. Here, insofar as bio-art involves methodologies of ‘freakish’ or otherwise culturally significant presentation, which are taken to be alien to bioengineering proper, the advantage is a certain kind of critical purchase. The artists bring ethical scrutiny to the processes involved by inscribing biotechnological progress in a punchy, culturally easily legible code. Though this analysis, embraced both by academic surveyors of bio-art like Mitchell and Reichle and award-granting bodies such as the Wellcome Trust, seems popular, I wish here to point out a difficulty which arises for bio-art in this context.



Maja Smrekar, *Hu.M.C.C.* (Human Molecular Colonization Capacity), 2014, genetically modified yeast fungus (*S. cerevisiae*) and product design, image: advertising images, brand design: Boris Balant / HUMAN₁ST, image courtesy of the artist.

The problem of absorption

I will call this problem the problem of absorption, and it may be formulated as follows. Attempting to incorporate another academic methodology (bioengineering) into an artistic practice, bio-art runs the risk of becoming assimilated into bioengineering. In more general terms: any research-driven art, which incorporates an academic discipline into its practice,

runs the risk of becoming wholly assessable by the standards of that discipline. In even more general terms: any topologically defined field ('X studies'), which investigates a part of reality by employing multiple disciplines, runs the risk of becoming absorbed into one of those, methodologically homogeneous disciplines.

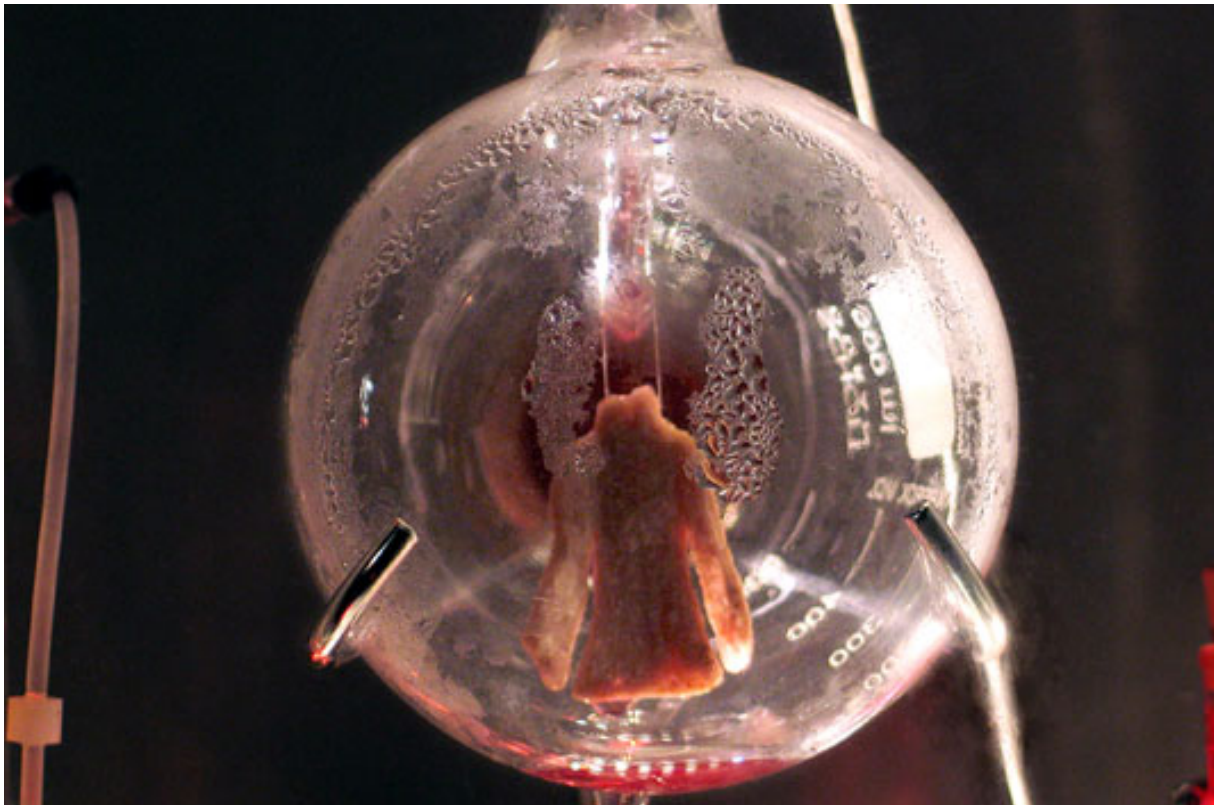
To consider this point, let me draw attention to some interesting new applications within (non-art) bioengineering. In 2013, a group of scientists took a step that seemed wholly in line with the bio-art experiments of the Tissue Culture and Art project. The vascular physiology research team at Maastricht University, headed by bioengineer Mark Post, artificially grew a beef burger patty.²⁹ Using a similar technology, Catts and Zurr made a 'semi-living steak' in 2000, using prenatal sheep skeletal muscle cells.³⁰ The public presentation of this research was also interesting: a public tasting of the patty was organized in London, and food critics and professional chefs were invited to comment on the taste of the burger and to provide recipe suggestions.³¹ This comical gesture is reminiscent of the frog flesh dinner party of Catts and Zurr's 2003 *Disembodied Cuisine*, discussed above.³² While it was at no point suggested that the burger patty was supposed to be an artwork, the work of bioengineering clearly mirrors the work of bio-art.³³

And, in fact, there are many cases of such mirroring. The artist Stelarc grafted ear-shaped tissue onto his arm, together with a microphone and a transmitter (*Ear on Arm*, 2010). While Stelarc claims he had the idea for this project prior to 1997,³⁴ it clearly recalls an infamous 1997 image of a laboratory mouse that had what looked like an ear growing out of its back. This experiment, known as the 'Vacanti Mouse', importantly contributed to reconstructive surgery in humans and became an early internet sensation, principally because it invited the misinterpretation that the mouse was a product of irresponsible genetic engineering.³⁵ *Maya Yoghurt* (2012) – where a foodstuff is modified with a human gene – seems not altogether different from a strain of rice, modified with a human gene, which caused concern amongst conservationists in the USA in the mid-2000s.³⁶ Probably the most infamous work of bio art is Eduardo Kac's infamous *GFP Bunny* (2000) – an attempt to create a glow-in-the-dark domestic rabbit, which probably never succeeded.³⁷ However, GloFish have been on the market since at least 2003, not as an artwork, but as a pet.³⁸

Some of these inventions go relatively unnoticed, existing away from the public eye until pointed out by the media (the rice, for example, quickly acquired the nickname 'frankenrice'). Others are much advertised by their makers; Google co-founder, Sergey Brin, was the creative engine behind the artificially grown burger.³⁹ Steve Baker has argued that the criterion of 'utility' distinguishes between bio-art and bioengineering,⁴⁰ but that is also not quite the case. Of the bioengineering projects, many have direct immediate practical implications in mind, but others – such as the creation of Biosteel Goats, which produced spider silk in their milk – are much more a case of blue sky thinking.⁴¹ Today's biotechnology seems to be also quite successful in producing an 'affect': be it through catchy names, branding, or simply through the inherently sensational nature of what is being produced. Therefore, it becomes harder to see how bio-art might constitute a distinct and *interdisciplinary* approach towards its subject matter. Rather, it seems bio-art simply becomes subsumed under bioengineering 'proper', perhaps as its more spectacular branch. Accordingly, it becomes difficult to see how bio-art could exercise a kind of ethical scrutiny of bioengineering.

None of what I say is meant to dispute the need for a critical interrogation of bioengineering, or indeed the need for critical bio-art. Likewise, I do not mean to deny that bio-art projects of the early 2000s did not have their own, distinct aesthetic, as can be perhaps seen in the Catts' and Zurr's lovingly presented *Victimless Leather* (2003). Certainly, through their spectacular form, pioneering bio-art projects such as these indeed raised 'serious ethical questions' about 'what kind of relationships we will form with such objects'.⁴² However, as bioengineering itself becomes more spectacular, the problem for the next generation of works of bio-art is to create greater distance; to resist becoming absorbed in bioengineering; to create a new distance between art on the one hand, and GloFish or Cultured Beef Burger on the other.

Arguably, the problem of absorption can be also detected beyond bio-art, within various research-driven artistic practices. Just as bio-art can merge with 'mere' bioengineering, so socially engaged art runs the risk of becoming 'merely' social work,⁴³ or philosophically inflected conceptual art 'merely' philosophy.⁴⁴ If interdisciplinary, topologically defined (art) practices attempt to borrow from various established fields, they can become assessable by the standards of success which govern those: scientific novelty for bio-art, social utility for socially engaged works, and philosophical rigour and profundity for works of conceptual art. My worry is that these standards will inevitably be better met by works in the 'host' discipline.



Oron Catts and Ionat Zurr, *Victimless Leather*, 2004, artificially grown tissue supported by biodegradable polymer matrix, dimensions variable, installation view, image courtesy of the artists.

Distance

The title of Maja Smrekar's *K-9_topology* series already evokes some of the problems I discuss above. The name is suggestive of science, coding and even science fiction: 'K-9' is the name of Dr Who's dog, as well as shorthand for police dogs; 'topology' is most often used to denote the study of mathematical space. Indeed, the work incorporates scientific findings, specifically, theories of the joint evolution of dog and man, and the profound impact each species has had on the development of the other. However, a certain distance from 'mere' science becomes obvious if we observe the works not as theoreticians prizing their research-driven contents apart, but simply as spectators of Smrekar's installations and performances.

K-9_topology so far consists of three works: the performance *I Hunt Nature and Culture Hunts Me* (2014), the installation *Ecce Canis* (2014), the performance *Hybrid Family* (2016), and the forthcoming bio-art project *ARTE_mis* (2017). There are different guises that Smrekar herself adopts in these works: a performer in the tradition of Beuys for *I Hunt...*, a sci-fi huntress in *Ecce Canis*, and a mother inhabiting a dilapidated bourgeois apartment in *Hybrid Family*. These personas are sometimes created for staged photographs that accompany the works, and sometimes inserted into the performances. They also establish a certain distance. In *Hybrid Family*, Smrekar spent four months in the said apartment with her two dogs (an adult and a puppy called Ada). Using a breast pump and a special diet, she compelled her body to lactate; this resulted in a final performance, admitting only up to three visitors at a time, for which she breastfed the puppy. To this spectator, it seemed not so much about the 'feat' of body art (which, in itself, was rather unassertive, the puppy emerging after an hour of conversation and play to bestow a single lick upon the artist's swollen nipple), as it was about the emotional costs inherent in any relationship.⁴⁵



Maja Smrekar, *K-9_topology: Hybrid Family*, 2016, performance at Freies Museum Berlin, image: pre-performance art photograph, photograph by Maja Smrekar and Manuel Vason, image courtesy of the artist.

What could have been another sensationalist artistic ‘first’ therefore, arguably, became a rather touching piece. It is the narrative, fictionalized elements, which lend a thematic wholeness to Smrekar’s opus. To change the example: though the installation *Ecce Canis* (2014) is conceived as an interesting exercise in bioengineering (the merging of the artist’s and her dog Byron’s serotonin), the piece itself is as much about the primeval, Surrealist, den-like installation in which the perfume is presented. This is a place of joint dwelling lined with wolf fur, recycled from old coats. It is also noteworthy that these pieces seem to rely on artistic precedents more than they do on simply showing off the bioengineering involved. As in Lord Byron’s epitaph to his Newfoundland dog or in David Lurie’s devotion to a stray at the end of J.M. Coetzee’s novel *Disgrace*, in Smrekar’s series the bond between dog and man comes to stand for an almost prelapsarian state of love. It is a love that is complete, even if it remains unfulfilled, and riddled with death.

Perhaps it is in works like these that artistic research stakes its claim to a separate identity, and resists absorption into one or another of the biological sciences. By tying in more directly with autonomously artistic concerns of fictionality, narrative, eros and even a kind of romanticism, the work becomes distinct from the proofs of concept in bioengineering, which, by the late 2010s, have ceased to amaze us anyway. Does that mean Smrekar’s works still produce knowledge? Do they belong to the university or to the gallery? The former question belongs to philosophy of art; the latter to institutional-political reality. I did not try to answer them here, though I hope my remarks are relevant for those who would.

To sum up my claims: I have argued that bio-art research ought to be considered topologically. Rather than contributing to any methodologically well-defined academic discipline, a bio-artist applies various approaches, bioengineering amongst them, to a subject matter. The problem that this has led to is the problem of absorption. Artistic research projects, insofar as they borrow methodologies from another field, inherently run the risk of becoming merely an (unremarkable) exercise within that field. Indeed, artists can become bioengineers, but then we simply have more bioengineering. The challenge for the artistic researcher is as much to maintain distance from the academic field she encounters as much as it is to acquaint herself with it.

- 1 A recording of the performance can be viewed here: <https://vimeo.com/112481726>, accessed December 28, 2016.
- 2 Interview with the artist (20.10.2016), and http://majasmrekar.org/k-9_topology, accessed December 28, 2016.
- 3 See, for example, Henk Bogdoff, ‘The Production of Knowledge in Artistic Research,’ in *The Routledge Companion to Research in the Arts*, ed. Michael Biggs and Henrik Karlsson (London: Routledge, 2010), 44–63.
- 4 This dilemma roughly mirrors Christopher Frayling’s distinction between research *for* art, and research *through* art. Frayling also considers research *into* art, for example, into techniques of painting, but that designation mostly applies to the explo-ration of medium-specific techniques. See Christopher Frayling, ‘Research in Art and Design,’ *Royal College of Art Research Papers* 1:1 (1993–4): 1–5.
- 5 I am interested here in artists who utilize biotechnology, rather than those working in traditional media, such as figurative painting or sculpture, who merely depict biotechnological themes. For discussion of ‘bio-art’ as conforming to this broader definition, see for example Ingeborg Recihle, *Art in the Age of Technoscience* (New York: Springer, 2009), 42–6.
- 6 Of course, coming up with a more precise definition of a field’s methodology will be a matter of controversy and various methodological ‘turns’. For one recent contribution, see Timothy Williamson, *The Philosophy of Philosophy* (Oxford: Blackwell, 2007).
- 7 See the *Journal of Consciousness Studies* and Center for Consciousness Studies at the University of Arizona.
- 8 Joe Davis’ *Microvenus* (1986) and Eduardo Kac’s *Genesis* (1990) were among the first DNA-manipulating artworks. See Robert Mitchell, *Bioart and the Vitality of Media* (Seattle: University of Washington Press, 2010), 40–8.
- 9 For overviews of bio-art, see Sian Ede, *Art and Science* (London: IB Tauris Publishers, 2005); Robert Mitchell, *Bioart and the Vitality of Media* (Seattle: University of Washington Press, 2010); and, Stephen Wilson, *Art + Science Now* (London: Thames & Hudson, 2010).
- 10 Searching through the databases of these three institutions, I could find little evidence of bio-artists being shown, save for a few hosted discussions and bio-artists shown as part of MoMA’s Architecture and Design department

- exhibitions. The situation is different when a well-known gallery artist (such as Marc Quinn) makes bio-art. See, for example, Quinn's *DNA portrait of Sir John Sulston* (2001), shown at the National Portrait Gallery in London.
- 11 For an insight into this procedure, see Paul Glinkowski and Anne Bamford, *Insight and Exchange: An Evaluation of the Wellcome Trust's Sciart Programme* (London: Wellcome Trust, 2009).
 - 12 According to the Wellcome Trust internal report, a 'significant minority of respondents' were concerned that the arts were utilized as a public relations exercise for science (Glinkowski and Bamford, *Insight and Exchange*, 7, 30).
 - 13 E.g. Oron Catts and Ionat Zurr, 'Growing for different ends,' *The International Journal of Biochemistry & Cell Biology* 56 (2014): 20-9.
 - 14 Charles Harrison, 'When Management Speaks...', in *Artists with PhDs: On the New Doctoral Degree in Studio Art*. 2nd ed., ed. James Elkins (Washington, DC: New Academia Publishing, 2014).
 - 15 Karl Gerbel and Katharina Gsöllpointner, *Genetische Kunst - Künstliches Leben. Ars Electronica (Festival für Kunst, Technologie und Gesellschaft)*, (Vienna: PVS-Verleger, 1993). Catalogue is accessible on the *Ars Electronica* Archive (<http://archive.aec.at/>, accessed December 2, 2016).
 - 16 In this way, Larry Miller offered viewers to protect their genetic material in the action *Genetic Code Copyright Certificate* (1992), and Chrissy Conant subjected herself to hyper-ovulation and offered her egg cells for sale in *Chrissy Caviar* (2000-01).
 - 17 *Tissue Culture and Art Project Website*, <http://www.tca.uwa.edu.au/>, accessed June 12, 2013. See also Catts and Zurr, 'Growing for different ends'.
 - 18 See: <http://lab.anhb.uwa.edu.au/tca/disembodied-cuisine/>, and <http://lab.anhb.uwa.edu.au/tca/pig-wings/>, accessed January 6, 2016.
 - 19 See: <http://www.mayayoghurt.net/>, accessed January 6, 2017.
 - 20 See: <http://archive.aec.at/prix/>, accessed January 10, 2017.
 - 21 Joe Davies' stint at MIT, and Natalie Jeremijenko's one-issue *Biotech Hobbyist Magazine* (1998) are cases in point.
 - 22 Suzanne Anker and Dorothy Nelkin, *The Molecular Gaze: Art in the Genetic Age* (Cold Spring Harbor: Cold Spring Harbor Laboratory Press, 2004), 4.
 - 23 Reichle, *Art in the Age of Technoscience*, Chapters 1 and 2. Reichle relies on Donna Haraway, *When Species Meet* (Minneapolis: University of Minnesota Press, 2008).
 - 24 Claire Pentecost, 'Outfitting the Laboratory of the Symbolic: Toward a Critical Inventory of Bioart,' in *Tactical Biopolitics: Art, Activism, and Technoscience*, ed. Beatriz DaCosta and Kavita Philip (Cambridge, Mass.: MIT Press, 2008), 107-23, here 112.
 - 25 Glinkowski and Bamford, *Insight and Exchange*, 65.
 - 26 Eduardo Kac, ed., *Signs of Life: Bio Art and Beyond* (Cambridge, Mass: MIT Press, 2007), 164.
 - 27 Mitchell, *Bioart and the Vitality of the Media*, Chapters 3-5.
 - 28 Idem, 77-91.
 - 29 See the project website at Maastricht University <https://culturedbeef.org/>, accessed January 7, 2017.
 - 30 See: <http://lab.anhb.uwa.edu.au/tca/semi-living-steak/>, accessed December 10, 2016.
 - 31 'What Does a Stem Cell Burger Taste Like?,' *BBC News*, August 5, 2013, <http://www.bbc.co.uk/news/science-environment-23529841>, accessed August 25, 2013.
 - 32 See: <http://lab.anhb.uwa.edu.au/tca/disembodied-cuisine/>, accessed December 10, 2016.
 - 33 This has been noticed by a former collaborator of Catts'; see Elizabeth Stephens, 'World's first lab-grown burger? Don't forget the semi-living steak,' *The Conversation*, August 12, 2013, <https://theconversation.com/worlds-first-lab-grown-burger-dont-forget-the-semi-living-steak-16941>, accessed January 10, 2014. For further discussion, see Erik Jönsson, 'Benevolent Technotopias and Hitherto Unimaginable Meats: Tracing the Promises of in Vitro Meat,' *Social Studies of Science* 46: 5 (2016): 725-48.
 - 34 Ben Myers, 'Future Mods,' *Bizarre Magazine*, April 2009.
 - 35 The mouse can be seen online. The image was first published as Y. Cao et al., 'Transplantation of Chondrocytes Utilizing a Polymer-Cell Construct to Produce Tissue-Engineered Cartilage in the Shape of a Human Ear,' *Plastic and Reconstructive Surgery* 100: 2 (1997) 297-304.
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 - 38 See: <https://www.glofish.com/>, accessed December, 24 2016.
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 - 41 *The Pig Wings Project*, http://www.tca.uwa.edu.au/pig/pig_project.html, accessed March 4, 2013.
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 - 43 Peter Osborne, 'Conceptual Art and/as Philosophy,' in *Rewriting Conceptual Art*, ed. Michael Newman and John Bird (London: Reaktion Books, 1999), 47-65.
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