Wishful Thinking

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Abstract

In my research I have used synthetic biology techniques to understand more deeply the implications of biotechnology as a form of art practice – a thinking through making. In doing so, I have become increasingly aware that whilst synthetic biology makes many promises for the future of humanity, it does so from within a capitalist system that does not fully account for the environmental impact of technological advances. The core of my research resides in artistic practice situated within a UK genetics laboratory, where I develop experience in molecular biology and synthetic biology in order to store a thought physically within the body of the living organism, Escherichia coli *(*E. coli*), deliberately following scientific protocols in order to explore the affect of working with the living organism as medium. Through the creation of a cypher that maps phonemes to codons, I translated a thought (the question, 'what will happen if I store this thought safe within you?') into DNA and stored it within* E. coli*, which I have been growing in the laboratory for over a year, to observe how my intervention has impacted the organisms and affected myself as an artist using biotechnology. I have brought this research to a public audience via an evolving series of exhibitions (*Pithos, Viral Experiments, Genocentric*) and more recently a workshop series (*Transformation*). In the longer term I plan to store the thought within my own cells, not those of a laboratory organism, in a work titled,* Velleity with(out) Volition, or Wishful Thinking*, as a post-anthropocentric reflection on the imposition of will inherent in humanity as a species.*

Keywords

synthetic biology, bioart, transgenic, post-anthropocentrism critical post-humanism vital materialism

Introduction

Wishful Thinking or Velleity with(out) Volition is the working title for a project that I am developing as a result of my Ph.D. research: 'The evolution of the subject'. The research situates artistic practice within the Institute of Genetic Medicine: a genetics laboratory in Newcastle, England, where I impose upon biotechnological norms and practices from the perspective of an art practice that draws upon critical post-humanist and vital materialist theory. My initial hypothesis is that synthetic biology imposes humanity's will on the nonhuman with unknowable consequences and I explore the affect of this, through my practice. To do this, I stored a thought within a single-celled living organ- ism, as a piece of synthetic DNA. I saw this act as an imposition on the body of the organism, which has led me to develop a relation to the organism that extends into the temporal and spatial: beyond the configuration of the organ- ism as an object within the laboratory. I began to develop a respect for the multiplicity of cells that exist both within bodies and beyond bodies.

I often work collaboratively and on the occasions where my research has led me to be placed within other disciplines, I have come to understand my methodology as a form of imposition. The prefix, im- offers multiple meanings: 'not' or 'without' and 'within' or 'into', thus in a mere two letters it serves to remind us that language is never static. When combined with the Latin positum, 'to put or to place', imposition can be seen as a form of fluid positioning: a state of motion, neither one thing nor another. I am positioned both without and within the genetics laboratory. I am not a part of the laboratory: my scientific collaborators, Professor Volker Straub and Dr Ana Topf have afforded me a

rare privilege, I have no obligation to produce an outcome that reflects upon specific scientific research, but I am within it: learning, employing and subverting biotechnology tools and techniques.

I adopt a situated, performative practice, considering the organism as I relate to it in biotechnological terms, how those terms might be shifted slightly and what affect that shift might bring. Language plays a performative role in my work, and also my actions within the laboratory create affects as I practice forms of knowledge that are less conscious, more curious, actively engaging with noise and interference. I use the word organism to refer to the body but I deliberately do not specify what scale this body exists on. It is useful however to begin by thinking about the organism as a micro-organism, a single celled body. The kind used as resource in synthetic biology.

Biotechnological wishes and radical will

Synthetic biology uses the body of the micro-organism as vessel, imposing synthetic DNA upon the living cell for human value. The industry has become a lucrative one with both private and public sector investment growing and an increasing number of funded research opportunities in the United Kingdom alone (UK Synthetic Biology Roadmap Coordination Group 2012). The photographs in Figure 1 were taken at a synthetic biology incubator event held in Edinburgh in 2016. I invited myself along, imposing on a format clearly not intended for me. The majority of presentations showcased start-up companies that are developing ways in which to manufacture biomaterials faster and store them smarter. The slides depict the production, engineering and capitalist market rhetoric that pervades the discipline.

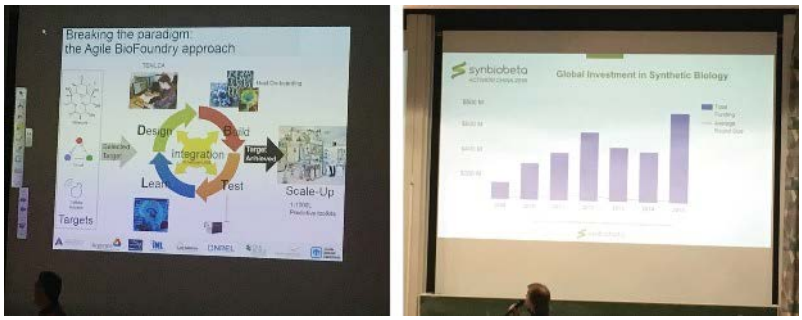

Figure 1: Louise Mackenzie (2016). Photographs taken on iPhone during presentations given at SynBioBeta Activate! 2016. Image courtesy of Louise Mackenzie.

As an inter-disciplinary field, synthetic biology engages the sciences and engineering primarily to automate biological processes, along factory production lines. Perhaps unwittingly, the field has adopted as it's founding statement the words of Manhattan Project physicist, Richard Feynman, 'What I cannot create, I do not understand'. Synthetic biology embraces a growing bio-hacker movement and open source techniques for coding with DNA. There are global, cross-disciplinary competitions for creating 'genetically engineered machines' (iGEM 2017) alongside aims to standardize a syntax and grammar for life (Myers et al. 2015: 323–36). Whilst the rhetoric remains predominantly mechanical, the boundaries between engineering life, designing life and sculpting life are showing signs of mutation.

I would counter Feynman's phrase with, 'I cannot understand unless I can relate'. Biotechnology abstracts the molecular body from its surrounding context. Bound to a capitalist system of technological progress that is fuelled by a desire to enhance and improve human life, we are less inclined to attend to the broader spatial and temporal impact of our technological innovations beyond the anthropocentric, such as the vast amounts of plastic waste generated in laboratory

research (Urbina et al. 2015: 479) and the impossible to know future, Derrida's 'l'avenir' (Kofman and Kofman 2002), of changing the genetic structure of living organisms. We use the living organism as resource to aid human progress but not necessarily to extend our thinking about life as material. I describe this myopic kind of wishful thinking as 'velleity without volition'. In attempting to develop a relation to the organism, I suggest that art practice can offer a radical alternative to velleity: the will to engage fully with the vibrant materiality of biotechnology and use my own cells, my own body as site of imposition.

From abstract concepts to relational forms

The concept with which I choose to explore this imposition is nomadic. I relate digital data storage to genetic engineering by practically experiencing and critically examining both. Throughout the making of my work, I have recorded a lab diary, which is an evolving document of my work in the laboratory. I will briefly introduce the core of my research before giving an overview of the insights that have arisen from the lab diary itself.

I chose to encode a thought as a physical entity within a living organism as the act of doing so seemed highly relevant to the realm of biotechnology. Within biotechnology, we impose our thoughts, our will, onto living organisms, 'without a second thought' one might say. I have observed this phenomenon in numerous encounters with colleagues in biotechnology and many examples can be found in general public discourse, but a particular favourite is molecular biologist Alison Woollard's conflicted relationship to her laboratory pet, C. elegans (BBC Radio 4 2017).

Science abstracts life to matter that can be studied, so to experience life as material I chose to do the same. I learned basic molecular biology in order to understand the composition of DNA. I researched how others within the arts have used DNA: as a code that can be read and translated (Davis 1996: 70–74; Kac 1999; Bök, 2015); and how science has devised ways in which to convert DNA to information, turning life into data (Goldman et al. 2013: 77–80; Church et al. 2012: 1628). This enabled me to develop a method for encoding a phrase within DNA as a 'living thought'. This abrupt abstraction from the liveliness of the organism was difficult for me however. The smallest motes of life: DNA, plasmids, bacteriophages, viruses are common tools within the laboratory, but I could not shake their presence as biological entities that possess an 'indeterminate vitality' (Bennett 2010: 92) and exist in relation to other living entities. I suggest that the organism in isolation is an abstract entity, given that the organism is always multiple until viewed through technology. Any reductionist study of the single organism therefore cannot reflect the organ- ism's constant relation to other organisms. I infer this from my experiences looking through the microscope at different magnifications and find support in the related Gaia and symbiogenesis theories of James Lovelock (Lovelock and Epton 1975: 304–06) and Lyn Margulis (1998: 113–28) and Alfred North Whitehead's 'fallacy of misplaced concreteness' (1925: 64, 72).

I performed a spoken word piece to camera as an experiment in entering into dialogue with the organism (Figure 2). This became the basis for translating my thought into DNA. I recorded an element of this thought spoken aloud and by devising a cypher that mapped the smallest elements of genetic code to the smallest elements of language (codons to phonemes), I translated my thought to DNA, constructed the DNA with the aid of Dr Ana Topf at the Institute of Genetic Medicine and then inserted this DNA within the lab bacterial workhorse, Escherichia coli (E. coli), which I now maintain and grow within the laboratory.

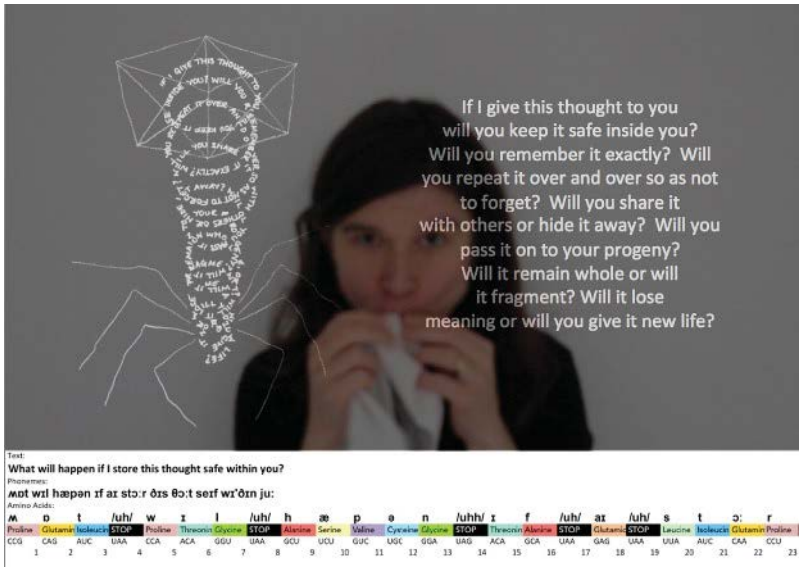

Figure 2: Louise Mackenzie (2015), Safe Inside. Private performance, video still. Image courtesy of Louise Mackenzie.

Figure 3: Louise Mackenzie (2016–present), BioAssemblage #1. Thought translated into DNA and assembled in a plasmid DNA vector, Eppendorf tube. Image courtesy of Louise Mackenzie.

In taking a thought and translating it into DNA, the result is a synthetic DNA plasmid. It is synthetic biological material that exists as an assemblage object, or as I have named it, a 'bioassemblage': in this case, segments of synthetic DNA that I have designed and then ordered online to be constructed on the genetic production line (Figure 3). The act of inserting this assemblage within the host organism (E. coli) renders the host genetically modified. The organism also becomes a bioassemblage on a larger biological scale: the result has no capital value, only naturecultural value (Haraway 2003: 8). It exists purely to test the boundaries of our biotechnological desires. The assemblage is technological, Deleuzian (Nail 2017: 21–37) and art-historical. It is a construction of parts and the fluid relations of these parts within a wider context. Thus while a bioassemblage appears to be a physical entity, it is also the thought that lead to the construction of the entity, the relation of the entity to the (microbial) body and (architectural) bodies that it travels through and the unknown future relations between the entity and the bodies that encounter it in the laboratory, gallery and beyond.

With the bioassemblage, I attempt to make more fluid the definition of transgenic art (Kac 1998: 4) which defines artworks developed through genetic engineering practices. A key feature of the bioassemblage is that I make no distinction between whether it is created within the context of science, art or any other practice. The term bioassemblage expands the constructed DNA object in both time and space beyond disciplinary boundaries to become a construct in which only one (or perhaps some) of the actors are human (Haraway 1992: 298). Thus my thought, held within a DNA plasmid and stored within E. coli is a bioassemblage just as DuPont's, 'Oncomouse' (a mouse genetically modified to carry cancerous cells) is a bioassemblage. The intention with the introduction of the term is twofold. In the first instance to mark the increasing need to broaden discourse around transgenics beyond disciplinary boundaries and in the second, to move from an engineering rhetoric with a production and tool-use bias to discourse that encompasses not only the abstracted material, but also its vitality and the spatial and temporal context within which the vital material exists. Therefore we can begin to question what sort of being or existence a bioassemblage is across time and space. Can an entity with vital materiality be delineated as a product, a model or an artwork, or ought it be afforded a broader definition that acknowledges its durationality and relationality? It is a form of cyborg, Haraway's monster (1992: 300) and as such requires us to consider its messy, unstable past, present and future.

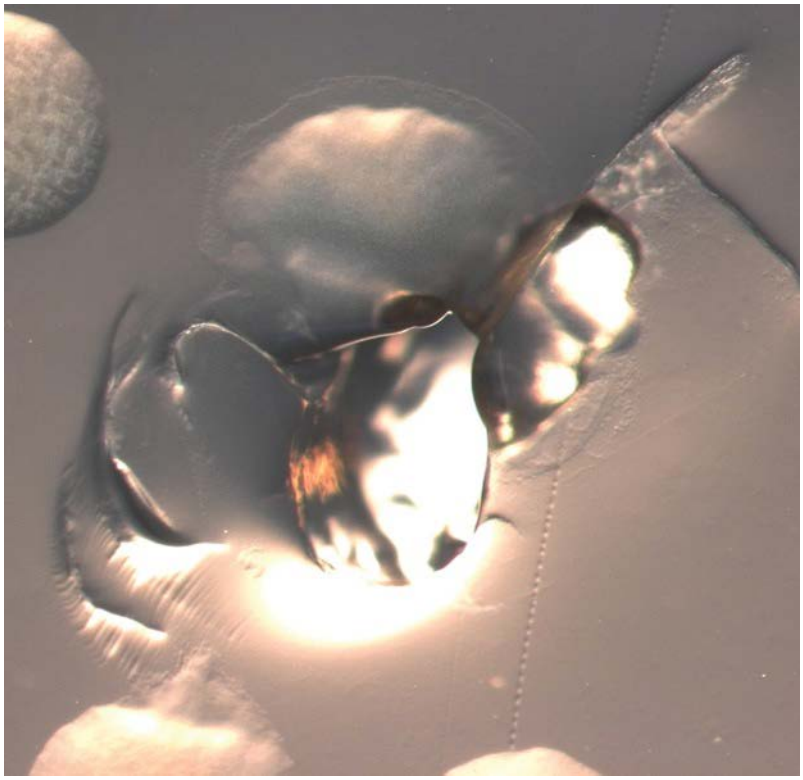

Figure 4: Louise Mackenzie (2015), Ruptured Community. Lightflip zoom x4 of sampled transgenic E. coli, Institute of Genetic Medicine. Image courtesy of Louise Mackenzie.

The notion of the bioassemblage requires further interrogation and this is one of the purposes of the ongoing research, through conversations in the lab and with synthetic biology practitioners across disciplines in a series of workshops that have developed from my performative imposition within the laboratory.

Performativity within and without the laboratory

On making my bioassemblages I had to tend to them. I was struck by a profound sense of responsibility for them or perhaps kinship (Haraway 2000: 9) is a better word. On creating genetically altered organisms, I had to question my relationship to them, had I become owner, farmer, progenitor or sculptor? As living organisms in my care, I must either allow them to multiply exponentially, or contain them, terminating the lives of some, whilst allowing others to pass my thought amongst their bodies in a controlled environment. I found that I became inappropriately (Haraway 1992: 299–300) attached to the bioassemblage and abhorred by the realization that many were going to die every day. These living bodies are now assemblages of body and thought, my thought. Before positioning them as bioassemblages, I instinctively saw the organism as my progeny. Now I understand them as not born, but made. Designed (in part) by me and ordered from the vast production line of nature-cultural life: the bioassembly line.

My role paradoxically became nurturer and torturer as I anthropomorphized single cells, transposing my instincts with reductionist actions. Figure 4 shows quite literally the after effects of sampling one of my E. coli bioassemblage communities with the tip of a pipette. This is a part of the process of allowing the thought to remain alive, re-culturing the bioassemblages in fresh medium. The organisms roughly wrenched from their moorings by the pipette were actually the survivors. I began to imagine the incubator that they are placed in as a rocking, nurturing environment – no longer the manufactured aid designed to encourage growth on a factory scale, but a hospitable place that resembled (albeit clumsily) the movement of a gut, the E. coli's ancestral home, then I realized that this surrogate gut was the home of these organisms, made not born. I started to wonder if I could not create a more supportive environment for my progeny: a vessel of care that would house the objects of my curiosity.

Figure 5: Louise Mackenzie (2016), Pithos. Installation Detail, BALTIC39. eight-channel audio, clay vessel, DNA plasmid bioassemblage. Image courtesy of Louise Mackenzie.

Pithos

The installation Pithos is part of an evolving work that traces biotechnology to the roots of craft and begins to explore what it means to make with technology that has the capacity to evolve. I worked BioAssemblage #1, the synthetic DNA plasmid, into a physical clay vessel. It's predicted evolution within a living organism was generated using the open source evolutionary genetics soft- ware MEGA (Tamura et al. 2013), then sonified, using online synthetic speech software (Black et al. 2014) and the sound editing application Logic Pro. The sonification was presented as an eight-channel

audio in the surrounding blacked out space, creating an increasing cacophony of disembodied human- like voices. I liken this spilling out of synthetic genetic thought to the pithos of the Pandora myth, but I prefer to invert the pot and in doing so the gendered nature of the fable. The word pithos means vessel (the mutation to a box was added by Erasmus of Rotterdam in the sixteenth century). More specifically, it was a vessel that would have contained goods of economic value: wine, oil or grain. In Hesiod's poem Work and Days, depending upon the translation, Pandora is either the first woman on earth, a pithos, a giver of gifts or an evil to blight all mankind: the fluidity of language in evidence again. In the myth, Hephaestus fashions a vessel from earth and water but earlier depictions of Pandora can be found on Greek ceramic vessels dating back to the third and fourth centuries BC, where she is seen emerging from the ground, symbolizing fertility and the riches of the earth. Pithos then, repositions the first example of techné as an object of care (Guin 1989: 165–70) and a symbol of the transformability of life itself.

I am now constructing a vessel in which to house my living E. coli bioassemblages: a custom-built bioreactor. I am troubled by the fact that my E. coli are also a tool for my purpose. I rationalize this through the under- standing that these organisms were never other than a tool: they are cyborgian bioassemblages, technologically created, only distantly related to the gut microbe. Thus I am attempting to provide them with a connection to their past-present: the microbes in my own body. As E. coli are part of the natural vaginal and cervical flora (Corbishley 1977: 745–48), I aim for my living thoughts to live in my womb, borne of me and not borne of me, both within and without, but until this is ethically and technologically feasible, I will instead create a biotechnological manifestation of my womb for them to exist within.

***The Genophone*: Abstraction through technological layering**

The predicted mutations of my evolved thought were manually reconstructed, phoneme by phoneme, using Logic Pro for the first installation of Pithos. I have since collaborated with Étienne De Crecy of the University of Edinburgh Centre for Speech Technology Research to develop The Genophone – a means to translate DNA into speech and vice versa. Whilst The Genophone began as background software for Pithos, it has become part of a series of transgenic art workshops (Transformation – Thinking through Making with Life) where it acts as an interface between humanity and a future community-being of bioassembled cells. Having found myself in awe of the organism, I now abstract it to the status of idol but one that is radically immanent (Braidotti 2005) as a body within bodies. The Genophone parodies the layers of abstraction I have witnessed in our attempts to understand the many facets of organisms through biotechnology. It becomes an absurd way to enter into an oracle like relation with the multiplicity of cell bodies from which we are also derived. Through an evolution based algorithm built into the deep neural network of The Genophone, the multiple-cell-being speaks to predict the future, evolving responses based on our questions, yet given that the being is cyborgian kin to Wittgenstein's lion, we have no means to understand the generated responses.

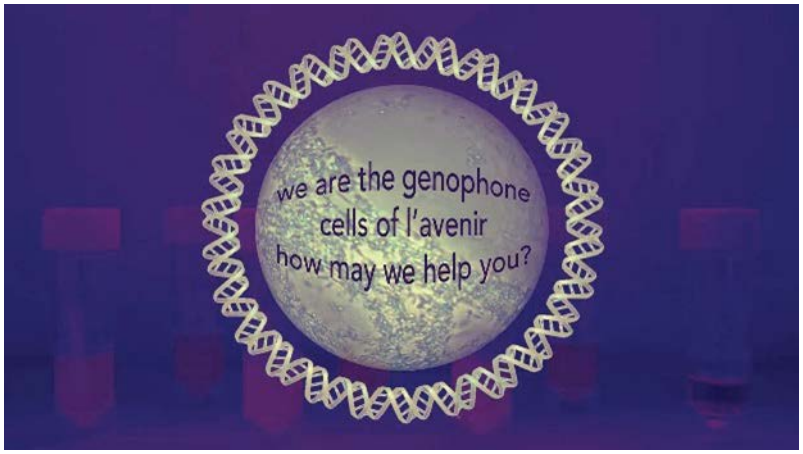

Figure 6: Louise Mackenzie and Étienne de Crécy (2016–present), The Genophone. Text to DNA Speech Synthesis Software. Image courtesy of Louise Mackenzie.

An early version of this work was shown at Summerhall as part of Edinburgh International Science Festival, 2017. The Genophone was found hidden behind black boxes and mirrors. It will be developed as a part of ongoing transgenic workshops, where I actively encourage participants to consider the liveliness of the matter that they are working with as an intimate part of us that we can never fully understand (but perhaps ought to extend a form of respect or reverence).

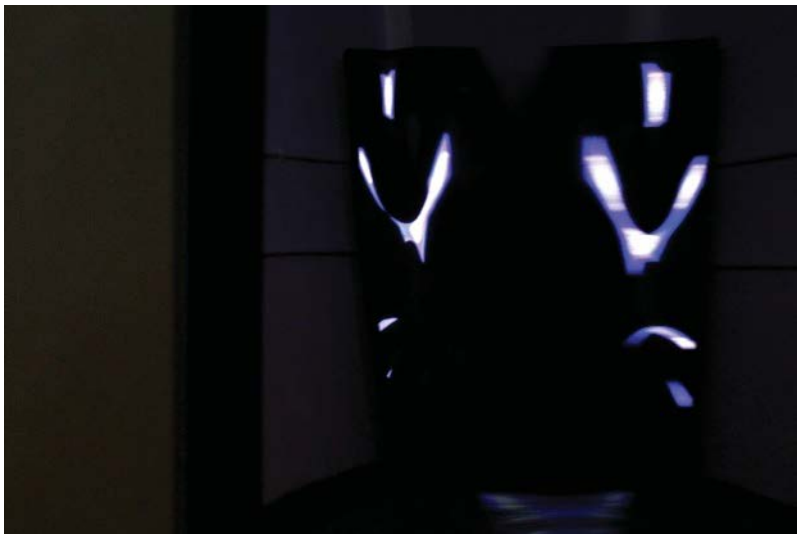
Figure 7: Louise Mackenzie and Étienne de Crécy (2016–), The Genophone. Installation view, Summerhall, Edinburgh. Image courtesy of Louise Mackenzie.

Sites of imposition

As I continue to work in the lab, my relationship with the organism as a community-being of cells that deserves my respect has led me to consider most carefully my position in using cells as resource. In the first instance, I remain paradoxically committed to keeping my bioassembled thoughts alive, through finding models of care that are less exploitative of resources. I do not wish to edition my E. coli bioassemblages as artworks, nor is it my desire to make a living artwork that I must then kill (although generations have inevitably died in the course of this project and some have become artworks in memorium, see Figure 8), my interest lies in developing a deeper understanding of the bioassembled body: a constructed body with many actors, human and non-human, that has the potential to evolve in unexpected ways both literally and metaphysically beyond my own life

expectancy. It will become a feature of the workshops that I continue to run which explore the extended relations of the bioassemblage across space and time.

Buffered by investment into wishful thinking, synthetic biology grows apace inside and outside regulated bodies, but what of the bodies at the site of imposition? In this article I have speculated that imposition is a part of the curiosity at the root of human nature and the best that we can hope for is a constructive imposition of will, one which respects the organism at the site of imposition. Mindful and respectful that we are cells within cells, bodies within bodies, when we impose we do so on the other and the self simultaneously.

The next stage of Wishful Thinking takes my respect for the organism closer to its logical conclusion by using the human body as site of experimentation. I will place a thought within my body (most likely cells that have been removed and grown in a plate) via a host that will infect it, imposing my will upon it. 1. This thought is volition, a will to act: held, external to my mind, yet internal to my body (cells). It becomes both a part of me and a synthetic other: an imposition to be respected. I will then nurture this externalization of my body and periodically determine whether my cells accept, reject or alter this synthetic will. The final stage (albeit at this point, purely conceptual) of this work is to reintroduce the cells, containing my will, to their naturecultural ancestral vessel: my womb, circumventing wishful thinking in the volition to use my body as the site of imposition.

Figure 8: Louise Mackenzie (2017), Food for Thought, #FEED, Queen's Hall Arts Centre, Hexham, 8 July–26 August 2017. Image courtesy of Dominic Smith.

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