

Lady Cassandra

These collective works are a visual exploration of notions of the body in the face of rapidly escalating technological change. The central objective was a speculative re-imagination of the body, in actively considering body augmentation - consisting of, but not limited to, scarification, tattooing and integrated technology, questioning concepts of connectivity and communication.

The collective title for the works developed in this project is Lady Cassandra, which references a mythical narrative in which warnings or concerns are greeted sceptically or not believed at all. In choosing this title I am exploring a metaphorical connection between this narrative and perceived predictions of future connectivity.

The conceptual super computer

The project's first intention was to locate a suitable metaphorical vehicle and appropriate visual signifiers in order to express the complexity of the project. Figure 1. (Sonja Hindrum 2015) The pellicle, or SCOBY (Symbiotic Culture Of Bacteria and Yeast)¹ also known as a 'mother' is a skin that forms on the top of kombucha tea (a fermented drink), was the medium chosen to explore

¹ Throughout this exegesis, the terms SCOBY, skin, and flesh analogue are used to refer to the material used as the core component in these projects. For the purpose of this paper the "mother" pellicle that forms on the top of kombucha tea will be referred to as a SCOBY as this is the more common term used by kombucha tea drinkers.

these ideas of escalating technological change. One of the influences in this decision was The Chinese University of Hong Kong claiming that 900,000 gigabytes of data can be stored in 1 gram of bacterial cells (Bioencryption 2010) This gave license to imagine the SCOBY as a super computer.



Figure 1: The pellicle, or SCOBY (Symbiotic Culture Of Bacteria and Yeast) also known as a 'mother' is a skin that forms on the top of kombucha tea (a fermented drink), (Sonja Hindrum 2015)

The SCOBY has a skin-like quality and for the purposes of these works it represents a flesh analogue. Skin is a barrier between the inner and outer world and also a barrier between private and public; it is a container of human spirit, a visual reminder of our morality and mortality; it is our first physical point of contact with an outer world via tactile experience. It is also the only human organ that simultaneously registers incoming stimuli while communicating our physical state and it provides the border that allows individuals to experience each other. Skin carries social codes and is a social context communicator.

Body augmentation has been documented throughout the evolution of civilisation, ranging from less permanent methods, such as painting, to tattoos, scarification, piercing and branding. All these practices on skin identify the individual's social and or spiritual convictions. Skin enables communication, comfort, protection and a whole range of other practices which merge fundamental properties of skin. "You can't take it off: skin is not a technology of our bodies; skin is us." (A Cranny-Francis , 2008 p3)

Given the above examples, a flesh-like material felt like an obvious medium to use. When we communicate digitally, we create a barrier between the inner and outer world, a barrier between a private and public self. In a way, the work is conceptualising this experience.

SCOBY farm

A makeshift lab was created in the studio with the use of take away containers, Tupperware and various science equipment in order to start growing the SCOBY. Figure 2. (Sonja Hindrum 2015) This space also became known as the SCOBY farm, as up to 20 skins were harvested every three to four weeks.



Figure 2: Scoby farm. (Sonja Hindrum 2015)

The decision to use a material that was easily home grown meant that the process was reasonably quick and simple. The SCOBY feed on sweet black tea and could easily be rehydrated. Also ethical approval for the research project did not need to be obtained from the Social Science Human Research Ethics Committee (HREC) or the Health and Medical HREC as appropriate.

This home grown cellulosic bacteria did not pose the same sustainability and growing challenges as actual human cells, which gave a freedom to play and experiment. The work was certainly influenced by other artists using living cells, such as the works developed from SymbioticA at The University of Western Australia; Figure 3. (Oron Catts 2008) Figure 4. (Oron Catts and Ionat Zurr 2002).

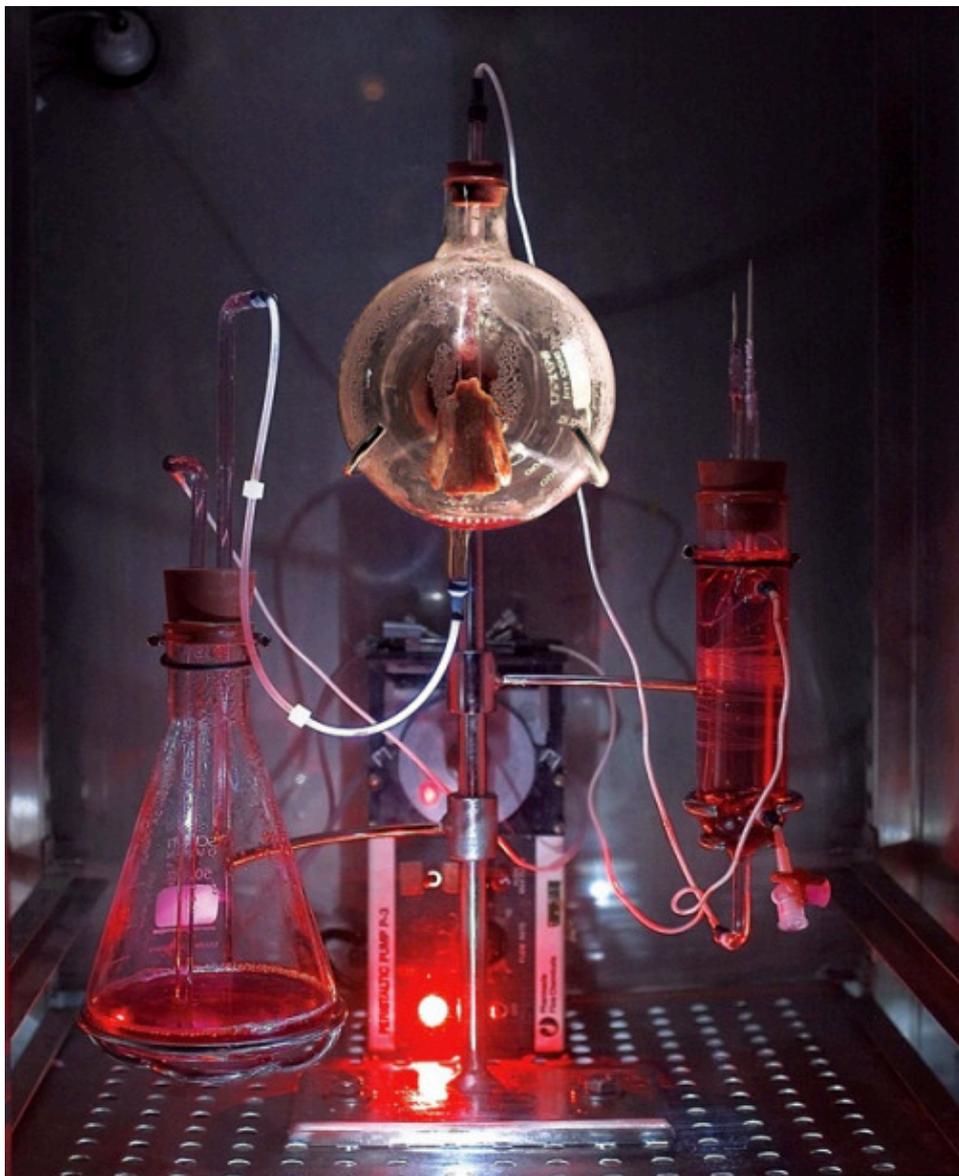


Figure 3: "Victimless Leather" (Oron Catts 2008)



Figure 4: "Semi-Living Worry Dolls" (Oron Catts and Ionat Zurr 2002)

These two works started with a catalyst which generated new growth or form, in the process of which, the catalyst is permanently lost; in contrast, the SCOBY can hibernate and be regenerated, and acts as a palette, a fixed surface, onto which ideas and concepts can be projected. This work was not about affecting the host but allowing it to continue growing or evolving.

There are a number of practitioners working with kombucha and these include but are not limited to Figure 5. (Suzanne Lee, 2011) BioCouture, Figure 6. (Naja Ryde Ankarfeldt, 2014) Microbioal skin grower and Figure 7. (Nöle Giuliani, 1998) Mickey Mouse/Organ. All three works have a flesh like articulation and influenced ideas in the project's support material.



Figure 5: BioCouture SCOBY (Suzanne Lee 2011)



Figure 6: Microbioal skin grower, SCOBY, timber, glass, kombucha (Naja Ryde Ankarfeldt, 2014)

Figure 7: Mickey Mouse/Organ. SCOBY (Nöle Giulini 1994)



The projects evolved from initial sketches, ideas and digital documentation, experimenting to find the material's limitations and developing ideas that would help support this body of work. Bacterial landscapes were grown and documented Figures 8, 9. (Sonja Hindrum, 2015) and the cellulose fibers moving in the tea were digitally recorded Figure 10. (Sonja Hindrum 2015) The SCOBY was also placed in molds and left to dry in the shape of body parts and faces. Figure 15. (Sonja Hindrum 2015) The face work proved that the material could be used as a sculptural medium, similar to stretching and moulding with wet leather.



Figure 8 : Bacterial landscape. (Sonja Hindrum 2015)



Figure 9: Bacterial landscape 2. (Sonja Hindrum 2015)



Figure 10: Cellulose fibers moving in the tea, image from video (Sonja Hindrum 2015)

Faces of communication

Figure 11. Partial Head (Stelarc, 2006) was one work that influenced the face making, as was Figure 12. Self (Marc Quinn, 1991). There were also very strong similarities between the faces I grew Figures 14, 15. (Sonja Hindrum 2015). and Figure 13. Microbial Me (Mellissa Fisher, 2015). These works are dark; Stelarc's and Quinn's works may be seen as self-obsessed, gimmicky and perhaps depraved, given that both works draw on the artists' use of biological material such as blood as their medium. Another interpretation might be that there was strength in the ideas of communication, given that we primarily use our face to communicate and this series of works is questioning future communication, it was presenting the work in a macabre and literal sense (Figures 14, 15. *ibid*).

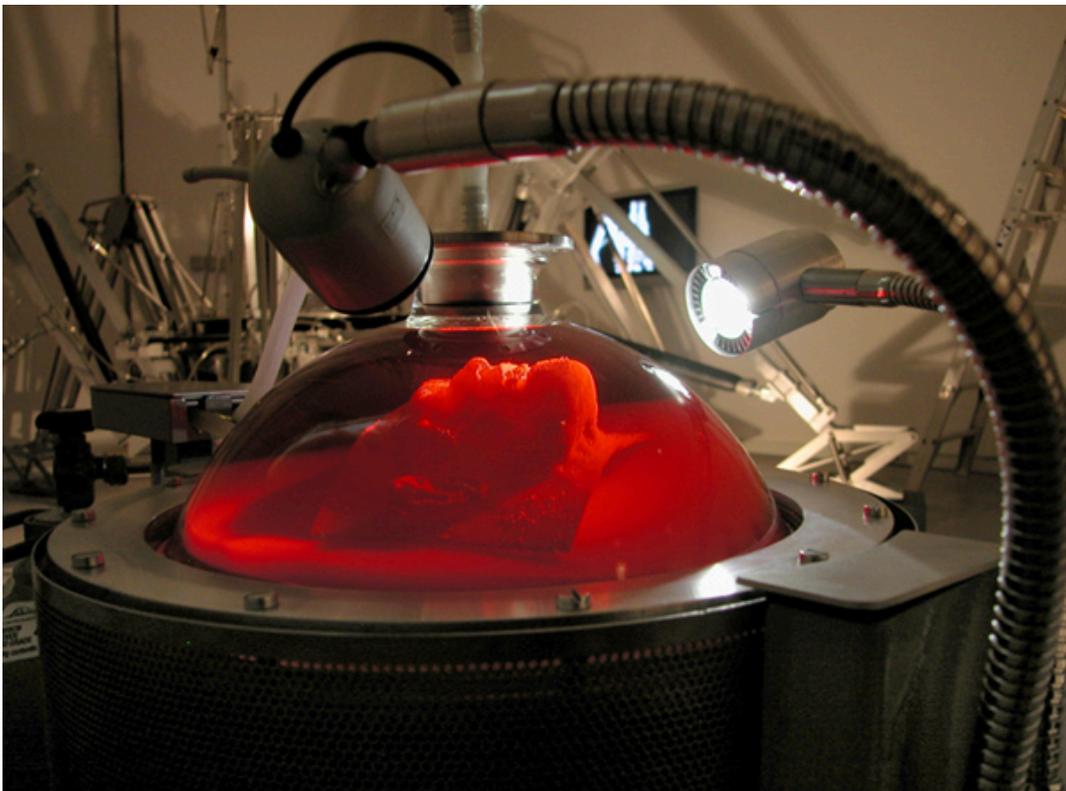


Figure 11: Partial Head Custom engineered bioreactor/incubator and circulatory system which immersed the head in nutrient kept at 37° Celsius. (Stelarc, 2006)



Figure 12: Self .A self-portrait out of his own frozen blood, (Marc Quinn, 1991).

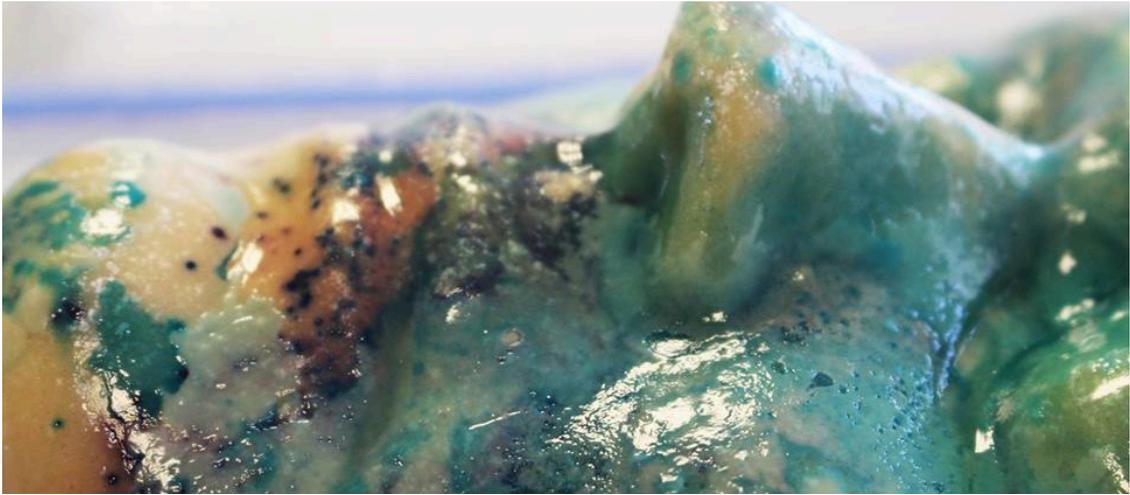


Figure 13: Microbial Me, portraits depicting the bacteria within belly buttons (Mellissa Fisher, 2015).



Figure 14: Child's toy, SCOBY and penicillin. (Sonja Hindrum 2015)

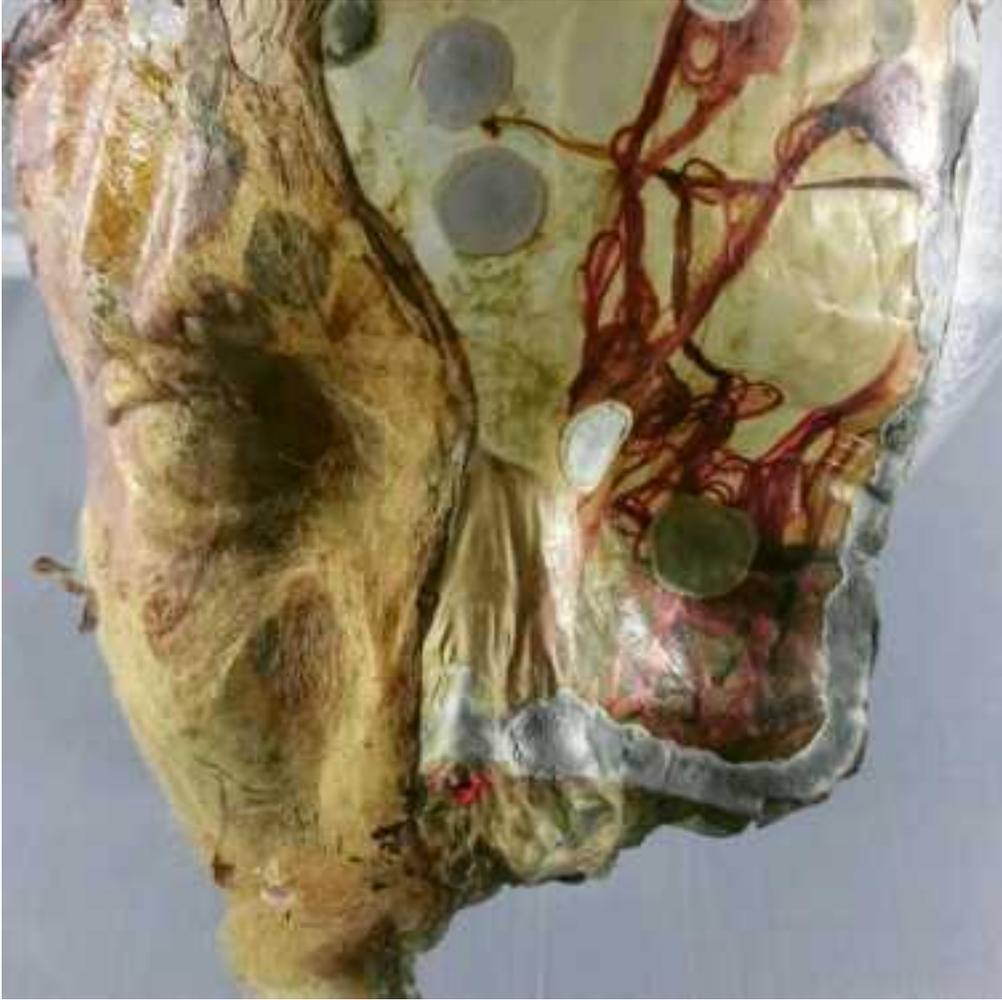


Figure 15: Face. SCOPY, silk thread, wool roving, conductive thread, penicillin (Sonja Hindrum 2015)



Figure 16: A Genomic Portrait of Sir John Sulston', Stainless steel, polycarbonate agar jelly, bacteria colonies, human DNA (Marc Quinn's 2001)

Marc Quinn's work A Genomic Portrait: Sir John Sulston, Figure 16. (Marc Quinn 2001) is not visually confronting, unlike the works previously mentioned. Quinn's work revives the primitive impulse at the heart of portraiture: preservation of a person. This work, on reflection, was most likely the biggest influence regarding the creation of projects that support Lady Cassandra.

Conceptually, faces started taking the work in a literal direction and I wanted to get under the skin of my ideas and explore abstractions rather than recognisable human forms. Recognising Quinn's redefinition of portraiture was a key moment in this shift of direction. He stripped away human form from the work, using an abstract in the aesthetic sense and was able to communicate the preservation of human elements.

Coding and basic programming

Stripping back the human form and exploring various methods of communication and ideas of language that could be applied to the SCOBY became the focus. Coding and basic programming started to become part of the work, as did placing and growing electronics in the SCOBY. Exploring different methods of coding and notions of networking started to open the work up to new ideas. One was the idea that networking was not just a supportive system of sharing information but a term used to describe a possible form of evolution (Margulis and Sagan 1986). The idea of a networking form of evolution created images of our bodies eventually networking with our technological reliance to create a new human form.

'Life did not take over the globe by combat, but by networking' (Margulis and Sagan 1986 *ibid*)

Speculation of future human networking with technology aside, in the more immediate moment, the SCOBY proved its ability to network with penicillin and natural textiles such as silk, cotton and wool. This networking, in the context of Margulis's definition of evolution cited above, was successful because the SCOBY continued to grow after the introduction of foreign elements into its environment Figure 15. (Sonja Hindrum 2015). Due to the acid content in the material, however, networking with electronics was not always a guaranteed success.

In the attempt to find a suitable metaphorical voice for this project, the work now physically evolved into samples of SCOBY that you could wear as organic jewellery or to resemble small body augmentation; unrefined, yet still exploring integrated technology, trying to avoid obvious electronic connections.

TXT Skin became the first incarnation of a wearable (wearable is the common term used to describe clothing and accessories incorporating computer and advanced electronic technologies.) TXT Skin is a skin analogue created with the visual influence of traditional scarification. TXT acronyms were explored and moulds made for the SCOBY to dry in. Figure 17. Then these fleshy skin-like tags with raised acronyms were worn by willing people as suggestive methods of future communication and body augmentation. Figure 18.



Figure 17: TXT Skin moulds, clay moulds (Sonja Hindrum 2015)



Figure 18: TXT skin being worn (Sonja Hindrum 2015)

Braille Skin was a similar approach. TXT acronyms were the message but this time the alphabet used was Braille. Braille Skin provided another way of reading the work - via the fingertips. This work also visually referenced traditional scarification. Communication with the Braille alphabet and the use of acronyms also started to influence the placement of petri dishes and other containers that were growing the SCOBY, giving the ability to leave messages such as BRB (Be Right Back) or JGI (Just Google It) in the Gallery or Studio space. Figure 19. (Sonja Hindrum 2015).



Figure 19: Petri dish Braille acronyms. (Sonja Hindrum 2015)

TXT acronyms were also stitched into the flesh analogue with conductive thread, this time using the Morse Code alphabet. This alphabet was also used when LEDs were embedded, mimicking bioluminescence under the skin's surface, worn near the neck to flash out a message. Figure 20. (Sonja Hindrum 2015) Simple electronics aligned with the SCOBY now meant that an audio Morse Code message could be transmitted across the room. Fleeting marks would also appear on the fleshy surface when it was touched with a stylus to send a message.

In developing three distinct methods of message delivery the work began to explore cross-sensory communication—utilising visual (TXT Skin), tactile (Braille) and auditory reception (Morse Code).



Figure 20. Cyborg baby (Sonja Hindrum 2015)

Other smaller works developed alongside the TXT Skin, Braille Skin and works around the Morse Code. The smaller works included an embroidery workshop. This idea was explored using social media to notify people of the opportunity to embroider a #Skintag² Figure 23. (Sonja Hindrum 2015), then to sit together beyond the online self and be present physically in the moment. Methods of inking and use of henna were also explored in creating visual marks and symbols on the flesh analogue, again using methods of code to convey messages.

Gauging public perception of the work

The work was growing in the corner of a grey room with no direct natural light. Plastic tubing, takeaway containers, Tupperware, petri dishes, test tubes, beakers and large and wondrous glass jars and vessels from a disused high school science lab formed the environment to start growing the SCOBY from the original 50mls of kombucha tea. Yet apart from the odd curious kombucha tea drinker, there were not many people willing to come to the studio.

FEED ME KILL ME SUSTAIN ME was the project's first interactive work. Three beakers of kombucha tea were part of the Field exhibition at the New Gallery UTas, curated by Amelia Rowe. This work questioned the idea of a home-grown device that could transmit and receive all your online communication.

² # Have been used in the titles of some works so that they would link back digitally to the blog <http://skinbcahons.weebly.com>, Lady Cassandra's online journal.

The next opportunity to gauge public perceptions with the work went for three weeks and was at the Postgrad Space at UTas. KILL ME FEED ME SUSTAIN ME was there with the addition of several other experimental works. A large computer screen was used to present images and videos of the work; while some of the images could be seen as confronting, they were still safely removed from the physical reality of the SCOBY.

Petri dishes with #Skintags Figure 19. (Sonja Hindrum *ibid*) were placed in the formation of the Braille alphabet and spelling out various acronyms as a method to convey messages. Another area in the space had test-tubes of kombucha and petri dishes of SCOBY suggestive of a makeup routine. This conceptual approach was supported by the use of traditional laboratory equipment to suggest the integration of science and a speculative notion of arranging your wearable #skintag as part of a beauty regime. An old hand held brass mirror was provided so that the placement of the #skintag on the body could be admired. This work was a comment on the narcissism behind the 'selfie' with the old brass mirror used to reflect that often the true self is not portrayed publicly, that there is a barrier. Figure 22. (Sonja Hindrum 2015)

Opposite this work was the invitation to wear a #skintag Figure 23. (Sonja Hindrum 2015) and take a 'selfie' to document it. The direct interaction with the flesh analogue needed supporting and encouraging.

Responses suggested that people were interested in the work; that they would interact and engage with it; they were willing to come, sit and discuss the ethics of personal data, reclaiming data and possibilities of future communicating methods. A stitching workshop (mentioned before) was also held so that #skintags could be personalised via embroidery before they were worn. The SCOBY would give a small pop as its surface was pierced and it would weep liquid; despite this disconcerting reaction, participants responded positively to the work and this was perhaps a result of the act of stitching, sitting and connecting with another human so that the confronting behavior of the flesh analogue was nullified somewhat.



Figure 22: Beauty Regime. (Sonja Hindrum 20015)

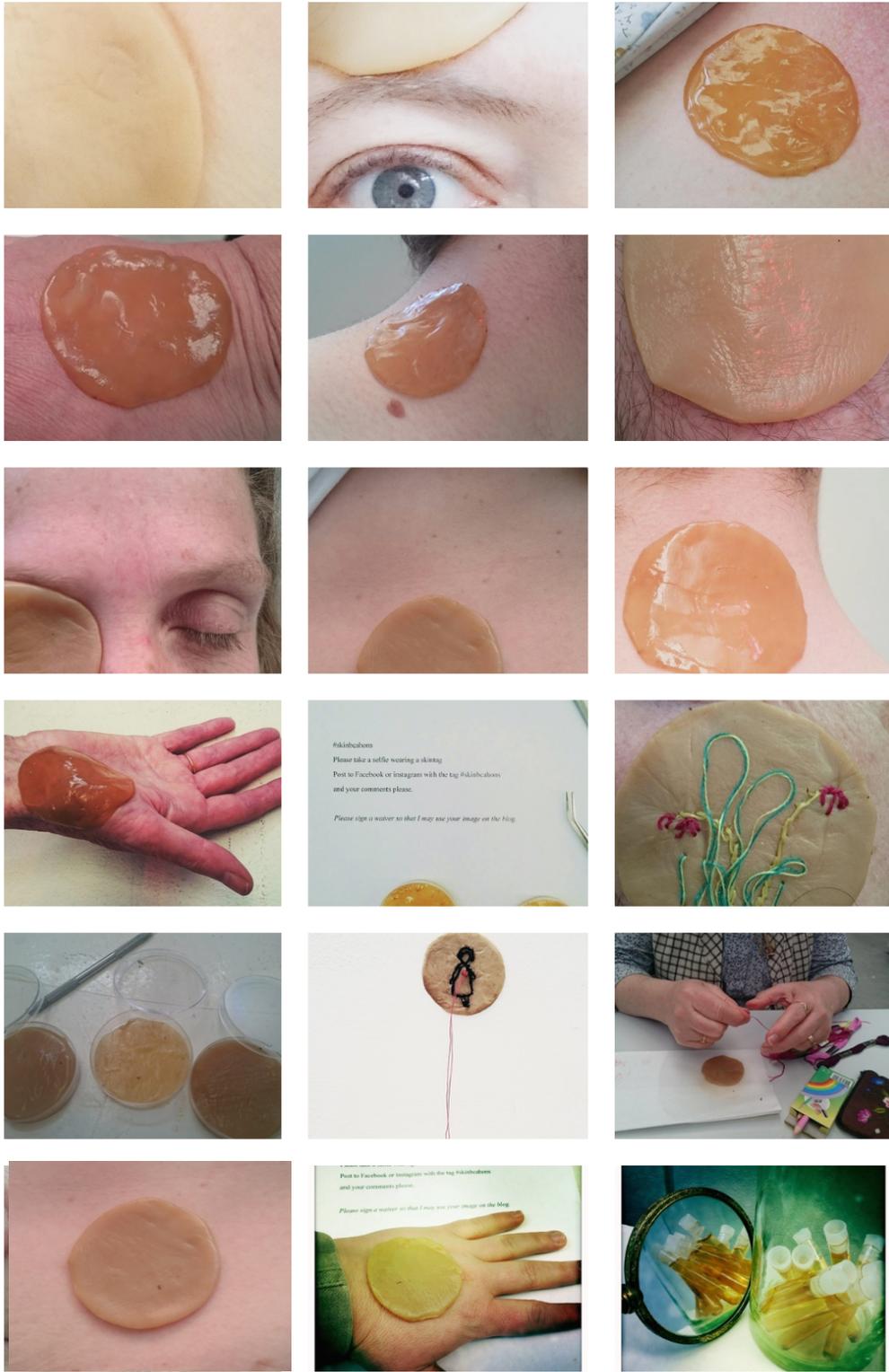


Figure 23. #skintag by Sonja Hindrum2015

Influence behind the work

Following on from the idea that “skin is us” (A. Cranny-Francis 2008 *ibid*) as discussed earlier, various cyborgs and bio-hackers became interesting. This included the work of Tim Cannon, co-founder of Grindhouse Wetware, a biotechnology startup company that creates technology to augment human capabilities. Cannon became the first person to be implanted with the Grindhouse-designed biometric sensor known as Circadi. The device automatically sent Cannon's temperature to his phone, was powered wirelessly through inductive charging, and mimicked bioluminescence with subdermal LEDs. Cannon has a RFID (Radio-frequency identification). Figure 24. and a magnetic implant in his hand, currently giving him cyborg status. (Grindhouse wetware 2015)

Epicenter, a new hi-tech office block in Sweden, offers RFID chips to be implanted in the hands of 700 people that occupy the complex. (Epicenter 2015) The RFID will give access to doors and photocopiers, with the promise of further services in the long term, including the ability to pay in the cafe with a touch of a hand.

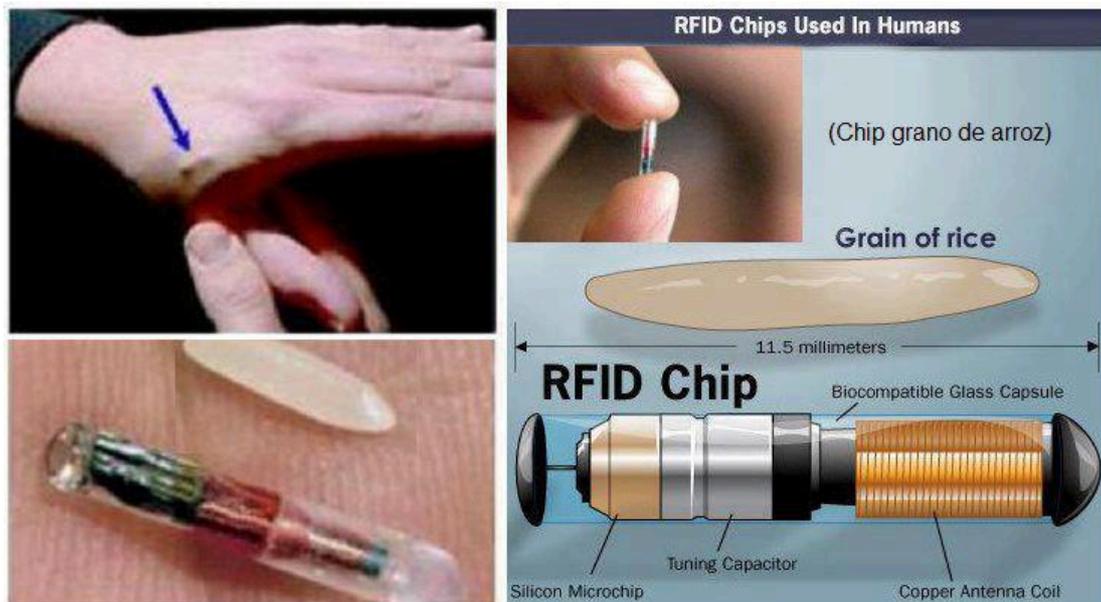


Figure 24: Radio-frequency identification

The RFID is a removable technology, but a very accessible means to embed digital information in your skin. You can purchase a RFID over the Internet and have it implanted by your local body piercer. In the context of this exegesis the RFID has been used to demonstrate that there is a wider community not opposed to wearing digital communication devices in a semi permanent form.

A more advanced example of augmentation is the work of Niel Harbisson Figure 25. - a cyborg who had an antenna implanted in his skull in an effort to 'hear' colour. He describes the sensation of the antenna reading colour as a new sense, that it is not a visual element or an audio element, that it is a vibration in his skull and an independent sense. He feels a certain tone on the chromatic scale that he then associates with a given color. From this information he is able to create innovative works and redefine the boundaries of perception.

Harbisson has used another form of code – music, sound and colour – to translate and receive information. He has proven the body’s ability to actually read and respond to constant streaming data; similarly, the prototype of neuroscientist David Eagleman’s wearable vest would vibrate so that the wearer could feel data. The vest was removable and differs from the Harbisson project in that it was not constantly streaming information for the wearer to filter. Harbisson has learnt to process the constantly vibrating messages in his skull; rather than allowing the constant data streaming to compete for his attention he filters the information, selecting the information he wished to process. In the context of this work, it validated the idea that we could augment ourselves to constantly receive data streaming and have the ability to evolve so as to read the information in a functional way.



Figure 24: Niel Harbisson.

Stelarc's paper "ZOMBIES & CYBORGS The Cadaver, the Comatose & the Chimera" (Stelarc 2010) talks about issues of identity, looking at a body invaded, augmented and extended. That the use of virtual and actual interfaces enable the body to perform in electronic spaces and addresses that what becomes important is not just the body's identity, location or mobility, but connectivity. That if we use the body as an interface, we stretch, augment and penetrate our skin so that it is no longer the barrier, but a gateway. The body can then experience a wider connectivity, rather than its current enclosed structure. Does the self become situated beyond the skin? This is an interesting question in relation to these works, as the answer would be a speculative yes—as they are suggesting a possible skin that could constantly stream data which humans could filter and respond to positively.

Chris Dancy, the self-described "most connected human" (Dancey 2015) challenges data ownership. Dancy suggests, "put the internet into products – not products on the internet" (Dancey 2015) . This would allow for our behavior to be the interface and our lives the platform. That we could log in with behavior and there would be no need for screens or keyboards. That future design should be for calm technology, kind technology and contemplation, that we would no longer have Big Brother directing us and watching us, but 'Big Mother' supporting us via our lifestyle and behaviour platform. (Dancey 2015)

Dancy currently monitors and adjusts his behavior via a series of 11 wearables including a fitbit, google glasses etc. While the consumer demand for wearables increases, there are apparently still challenges of mainstream adoption, mainly because the wearables are unattractive and often visually invasive.

Dancy has used his personal data to reprogram his lifestyle. He has learnt exactly what he needs to be his most productive self, such as blinking lights in his home as a visual reminder to slow down and focus on his breathing; these lights are connected to the devices he wears. In this case, they sense his heart rate is up and this is a signal to calm down. But what if we had one wearable that could do this, rather than 11? Dancy's work on reclaiming and redirecting his data is an inspiring idea and one that could support the notion of a communicative skin that in theory could replace all 11 devices and in turn support your most productive self.

Pairing back technologies and communication ideas opened up more possibilities to this speculative work. There were no longer the physical limitations of actual technology, only limitations of an imagination.

Cyborg baby

Cyborg baby Figure 20 and TXT skin Figure 18. and other supporting digital images in this body of work were developed as a reflection of the Cassandra metaphor. Adolescents were used as the body as this age group are beyond childhood but not yet adult and whilst they are the future, their voice is often not heard. Documented with a similar style to Bill Henson's work, using a staged tableaux so the faces of the adolescents were partly shadowed Figures 26,27³. not directly facing the viewer and with the skin being treated as a landscape. Angela Tarlinton's *Adolescents* (Angela Tarlinton 2010) also used the realm of youth to explore emerging and changing identity, hovering between two worlds: one in childhood, the other in the uncertainty of adulthood, posing the question of identity. Both Henson and Tarlinton's use of adolescents and skin as subject matter visually supported the digital documentation and referencing the Cassandra syndrome, where adolescents forecast a future that is yet to be imagined.

³ The titles for Figures 26 and 27 are written in Morse Code -.- ... (CH) and .-. ... (LH). Pronounced dah-di-dah di-di-di and di-dah-di di-di-di respectively.



Figure 26: -- ... SCOPY, digital image (Sonja Hindrum 2015)

The digital images of #skintag appeared to be a less confronting way for others to engage with the work; however, by presenting the work digitally, a grittiness had been removed. Through detachment from the SCOBY and its 'farm' (as previously explained), there was no experiencing the visceral reality of this living organism—its acidic vinegary aroma and its fart-like noises; experiencing the work digitally removed the participant from using more than one sense to engage with the work.

The SCOBY's cold slimy touch was metaphorically representing a barrier between the public and private. When you held the SCOBY it would adjust to your body temperature; as a skin it was a border that allowed a mutual experience. You had to be willing to embrace the physical challenges of the SCOBY to engage directly. When this barrier was removed, you became a voyeur, slightly disconnected from the rawness of the work. However, the idea of a coded landscape remained Figure 27. The suggestion of a reimagined body with integrated technology could be conveyed Figures 18, 20, 23, 26, 27, 28. But the connectivity was not as strong and your senses were not being engaged when experiencing the work.

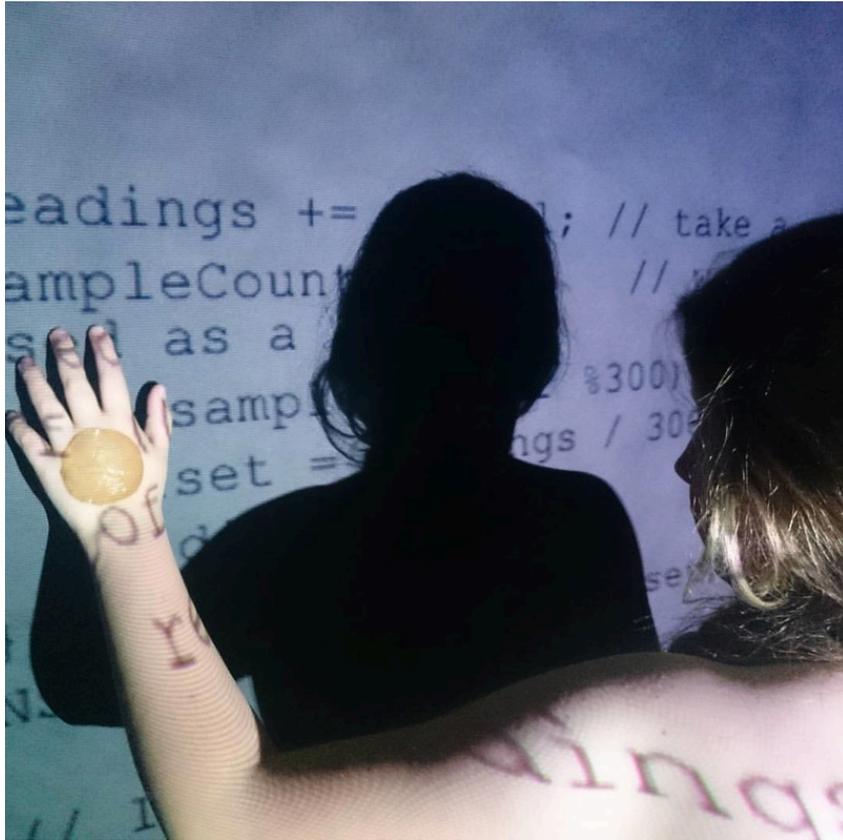


Figure 27: Coded landscape, digital image, projection, Arduino code, SCOBY (Sonja Hindrum 2015)

Weekly, fresh strong sweet black tea was used to feed and nourish the kombucha. The ritual of maintaining this environment became important as a reflection on maintaining relationships. Just as a healthy relationship requires that good open communication is maintained and tended to, so did the growing of the SCOBY. Our relationships as humans quickly become contaminated by bad networks, unhealthy connectivity, self neglect or neglect of our community. These social conventions also apply to positive data streaming and were being mirrored in the growing of the SCOBY.

Domestic lab roots: *Presenting a work that did not challenge the senses was removing the work from the makeshift home lab.*

While the works of Lady Cassandra had begun as a visual exploration of the body in the face of rapidly escalating technological change, it had now shifted from the science of possible reality (Bioencryption 2010) to works that invited engagement. When presented as a serious prediction, the work was often read as creepy (a common sentiment drawn from the feedback log of KILL ME SUSTAIN ME FEED ME); the thought of removable flesh or body augmentation using a flesh-like material was suggestive to some as inspired by *Silence of the Lambs* (a novel by Thomas Harris – 1988). However, when engagement with the SCOPY was allowed, the work became less threatening and the fun of play and discovery invited a deeper interaction with the work. Stitch skin, #skintag and Cyborg baby Figures 20,23. offered interactions that supported curiosity.

The digital images of suggested body augmentation that support Lady Cassandra are strong. A collection of these presented on the gallery walls in a large format, individually lit with the fleshy #skintag in a petri dish nestled on a plinth below each image would make a powerful visual impact and would possibly be read as a series of bodyscapes of adolescents.



Figure 27: .-. ... SCOPY, digital image (Sonja Hindrum 2015)

Abstractly the digital images supported a notion of our inner and outer selves, hiding behind a digital barrier, possibly presenting a false self. That there was limited exposure to reality and in its place, participation was voyeuristic. Would this be the future? Would the digital connection via an augmented flesh result in hiding behind a digital barrier?

But a digital presentation of Lady Cassandra would have only offered one layer of the work; there would have been no connectivity, only a voyeuristic experience. By introducing FEED ME KILL ME SUSTAIN ME there was now not only a method of physical engagement in the interaction and documentation of the response, but as the kombucha tea ferments and the SCOBY feeds and grows, the engagement of other senses can no longer be avoided.

In this format there is no direct interaction with the flesh analogue, which is central as a metaphorical visual signifier. But this home-grown bacteria, in its pungent reality, appeared to create a barrier to the connections that these works intended to conceptualise. The resolution to this was to create a more intriguing environment in which to engage with the works, one that allowed exploration and discovery rather than being directed (such as the directions of #skintag selfies). By a self-discovery of the works' possibilities, gateways are opened, more questions are asked, connections possibly made and communication could possibly happen.

The works selected to generate this interaction were inspired by the earlier coding works discussed in this paper, in particular the use of Morse Code. This was a playful work that used basic electronics and electrical connectivity to create a sound. The work also has the potential to unite others in the space with you, with one person holding a small wire connected to the work, then a series of people touching the skin of the person beside them, forming a human chain so that the last person in line touching, stroking or pinching the

SCOBY closes the circuit and generates a sound. As soon as the human connection is broken the sound stops, so the human connection is essential for the work to give an audio response.

The interaction with this work supported the individual and a small group all sharing a common curiosity; this conceptually represents the communities that are developed online, suggesting that connections can be made while removed from reality.

Conclusion

The works explored notions of scarification with the use of TXT and Braille acronyms to communicate messages. Methods of body adornment, such as tattooing, offered visually familiar vehicles to add layers of communication. The speculative suggestion that skin could become a super computer (Bioencryption 2010, ibid) gave another layer to future possibilities and integrated technologies were supported. The #skintags and TXT skins were documented digitally on adolescence, referencing the Cassandra syndrome. But there was not one work that best conveyed the questioning of future concepts of connectivity and communication, or addressed notions of the body in the face of rapidly escalating technological change. Rather, as a collection of works they are intended to question the extent to which we will augment our bodies or whether evolution (conceptualised by Margulis and Sagan, *ibid*) will provide the network for future constant connectivity as part of a future human form.

Reference

Arduino viewed 8 August 2015 <<https://www.arduino.cc>>.

Catts, O 2008, *Victimless leather, digital image*, The Victimless Leather is grown out of immortalised cell lines which cultured and form a living layer of tissue supported by a biodegradable polymer matrix in a form of miniature stitch-less coat like shape. viewed 14 April 2015,
<<http://www.tca.uwa.edu.au/vl/vl.html>>.
<<http://www.symbiotica.uwa.edu.au/residents/catts>>.

Catts, O and Zurr, I 2002, *Semi-living Worry Dolls*, crafted out of degradable polymers (PGA and P4HB) and surgical sutures. The dolls are then seeded with living cells that, throughout the exhibition, gradually replace the polymers within a micro-gravity bioreactor that acts as a surrogate body. The worry dolls become partially alive, digital image, viewed 14 April 2015,
<<http://www.biofaction.com/synth-ethic/?p=37>> .<<http://www.tca.uwa.edu.au/index.html>> .

Cranny-Francis, A 2008?, page 3. *Fabric(ated) Ontologies: the biopolitics of smart design in clothing and jewellery*, viewed 22 October 2015
<<https://opus.lib.uts.edu.au/research/bitstream/handle/10453/16705/2010006105.pdf?sequence=1>>.

Dancy, C, web page viewed 18 August 2015 <<http://www.chrisdancy.com>>.

Dancy, C, YouTube viewed 18 August 2015 <<https://youtu.be/5U-tC11KydY>>.

Epicenter, web page. viewed 17 August 2015
<<https://epicenterstockholm.com>>.

Fisher, M 2015, *Microbial Me*, portraits depicting the bacteria within belly buttons. Bacteria and agar, digital image, video, viewed 15 June 2015,
<<http://www.artsciencecsm.com/ma-art-science-student-mellissa-fisher> >
<[shows-new-bacterial-portrait-at-edon-projects-invisible-you-exhibition/](#)>.

Grindhouse, wetware viewed 17 August
<<http://www.grindhousewetware.com>>.

Harbisson, N ?, digital image viewed
<<http://www.focusoptique.tn/2014/01/neil-harbisson-le-premier-cyborg-adepte-deyeborg/>>.

Hoppenstedt, M 2013. *DIY Cyborg*, viewed 17 August.
<<http://motherboard.vice.com/blog/the-diy-cyborg>>.

Hindrum, S 2015, *... ..*, SCOBY, digital image.

Hindrum, S 2015, *... ..*, SCOBY, digital image.

Hindrum, S 2015, *Bacterial landscape*, Kombucha tea, SCOBY, penicillin, vinegar, digital image.

Hindrum, S 2015, *Bacterial landscape 2*, Kombucha tea, SCOBY, penicillin, silk threads, wool rovings, conductive threads, digital image.

Hindrum, S 2015, *Beauty regime*, SCOBY, petri dishes, test-tubes, beakers, old brass mirror, digital image.

Hindrum, S 2015, *Childs toy*, SCOBY and penicillin, digital image.

Hindrum, S 2015, *Cellulose fibres moving in the tea*, video.

Hindrum, S 2015, *Coded landscape*, projection, Arduino code reading a pulse, SCOBY, digital image.

Hindrum, S 2015, *Cyborg baby*, LED, coin battery, SCOBY, human, digital image.

Hindrum, S 2015, *Face*, SCOBY, silk thread, wool roving, conductive thread, penicillin, digital image.

Hindrum, S 2015, *FEED ME, KILL ME, SUSTAIN ME*, Beakers, kombucha tea, sugar, salt, stainless steel, cork, paper, wood, plastic, digital image.

Hindrum, S 2015, *Petri dish Braille acronyms*, SCOBY, Petri dish, digital image.

Hindrum, S 2015, *Scoby farm*. Kombucha tea, SCOBY, plastic, glass, digital image.

Hindrum, S 2015, *The pellicle, or SCOBY (Symbiotic Culture Of Bacteria and Yeast) also known as a 'mother' is a skin that forms on the top of kombucha tea (a fermented drink)* Kombucha tea, SCOBY, plastic. 70x25, digital image.

Hindrum, S 2015, *#Skintag*, SCOBY dried in mould or stitched, digital image.

Hindrum, S 2015, *TXT Skin moulds*, clay moulds with TXT acronyms, digital image.

Hindrum, S 2015, *TXT skin*, SCOBY, human, digital image.

Giulini, N 1998, *Mickey Mouse/Organ*, digital image, Viewed 15 June 2014 <<http://www.ngiulini.com/portfolio/portfolio/bodypuppets.html>>.

Margulis, L and Sagan, D 1986. *Origins of Sex : Three Billion Years of Genetic Recombination*. Pp14-15 viewed 10 August 2015, <[https://books.google.com.au/books?id=Oe6mPrxnvdIC&pg=PA89&lpg=PA89&dq=%E2%80%98Life+did+not+take+over+the+globe+by+combat,+but+by+networking%E2%80%99+\(Margulis+and+Sagan+1986&source=bl&ots=WOrA](https://books.google.com.au/books?id=Oe6mPrxnvdIC&pg=PA89&lpg=PA89&dq=%E2%80%98Life+did+not+take+over+the+globe+by+combat,+but+by+networking%E2%80%99+(Margulis+and+Sagan+1986&source=bl&ots=WOrA)>

[pY7Anj&sig=oQ_u36kdapWwURQ1dtHdl1vXC5U&hl=en&sa=X&ved=0CD0Q6AEwB2oVChMliq2tINzsyAIVCcxjCh2Xtg4T#v=onepage&q=%E2%80%98Life%20did%20not%20take%20over%20the%20globe%20by%20combat%2C%20but%20by%20networking%E2%80%99%20\(Margulis%20and%20Sagan%201986&f=false\)](http://pY7Anj&sig=oQ_u36kdapWwURQ1dtHdl1vXC5U&hl=en&sa=X&ved=0CD0Q6AEwB2oVChMliq2tINzsyAIVCcxjCh2Xtg4T#v=onepage&q=%E2%80%98Life%20did%20not%20take%20over%20the%20globe%20by%20combat%2C%20but%20by%20networking%E2%80%99%20(Margulis%20and%20Sagan%201986&f=false)).

Lee, S 2011, *BioCouture*, digital image, viewed 10 March 2015, <<http://www.designboom.com/design/suzanne-lee-biocouture-growing-textiles/>>.

Quinn, M 1991, *Self*, A self-portrait out of his own blood, viewed 12 July 2015, <<http://marcquinn.com/artworks/self>>.

Quinn, M 1991, *A Genomic Portrait: Sir John Sulston*, Digital image, DNA was extracted from samples of Sulston's sperm placed in agar culture, resulting in transparent colonies of bacteria, each grown from a single cell containing part of the full genome of John Sulston. 12.7h x 8.5w cm Polycarbonate agar jelly, bacteria colonies refrigerated stainless steel frame, Viewed 14 June 2015 <<http://marcquinn.com/artworks/single/dna-portrait-of-sir-john-sulston>>.

Radio-frequency identification, digital image, viewed 17 August 2015, <<http://freedomoutpost.com/2015/06/trendies-ready-for-ultimate-wearable-chip-implanted-in-their-skin-used-for-payments/>>.

Ryde Ankarfeldt, N 2014, *Microbial skin grower* digital image, microbial skin grower. Inside it lives a micro organism, when you feed it, it creates a microbial cellulose structure. the project is a part of "living art - live art", a collaboration between artsience students and Wetlab Waag Society, Amsterdam 2014, viewed 14 June 2014 <<http://breathingthing.com/microbial-skin>>.

Stelarc, 2006, *Partial Head*, Custom engineered bioreactor/incubator and circulatory system which immersed the head in nutrient kept at 37° Celsius, digital image, viewed 14 June 2015, <<http://stelarc.org/media/img/partial-head/partialhead1.JPG>>.

Stelarc, 2010, *ZOMBIES & CYBORGS, The Cadaver, the Comatose & the Chimera*, viewed 19 June 2015 <<http://stelarc.org/documents/zombiesandcyborgs.pdf>>.

Tarlinton, A 2010, *Adolescents*, digital images, viewed 15 June 2015, <<http://angelatarlinton.com/adolescents/>>.

Wilkins, A *Bioencryption can store almost a million gigabytes of data inside bacteria*, i09, 26 November 2010, Viewed 21 August 2015, <<http://io9.com/5699767/bioencryption-can-store-almost-a-million-gigabytes-of-data-inside-bacteria>>.

Bibliography

Artscape: *Anatomy: Series 3 - Tissue - a short documentary* by Alethea Jones, viewed 14 April 2015, Posted: Friday, 17 February 2012 at 2:47pm
<<http://www.abc.net.au/arts/stories/s3433453.htm> .

Barthes, R 1972, *Mythologies*, Vintage Books, London.

Benyus, Janine M 1997, *Biomimicry: innovation inspired by nature*. Harper Perennial, New York, USA.

BioCouture, Lee, S, viewed 10 April,
<[Biocouturewww.biocouture.co.uk](http://www.biocouture.co.uk)>.

BioCouture, Lee, S , Speaker I TED.com, viewed 10 April,
<https://www.ted.com/speakers/suzanne_lee>.

Biohack.me, viewed 17 August 2015, <<http://forum.biohack.me>>.

Bioencryption, viewed 21 August 2015,
<http://2010.igem.org/Team:Hong_Kong-CUHK>.

Bioencryption, viewed 21 August 2015,
<http://2010.igem.org/files/presentation/Hong_Kong-CUHK.pdf >.

Callen-Jones, R 2015, *Office puts chips under staff's skin*, viewed 17 August 2015, <<http://www.bbc.com/news/technology-31042477>>.

Dufresne, C, Farnworth, E, *Tea, Kombucha, and health: a review*. Food Research International 33 (2000) 409±421, viewed 8 April,
<<http://kombuchashare.com/research/Tea,%20Kombucha,%20and%20health.pdf>>.

Cranny-Francis, A 2008?, page 3. *Fabric(ated) Ontologies: the biopolitics of smart design in clothing and jewellery*, viewed 22 October 2015,
<<https://opus.lib.uts.edu.au/research/bitstream/handle/10453/16705/2010006105.pdf?sequence=1>>.

Davidson, M 1971, *Louis Braille the boy who invented books for the blind*, Scholastic Books Service, U.S.A.

Dow, S June 14 2013, *Exclusive: Bill Henson talks about life, landscapes and that other storm*, The Sydney Morning herald, viewed 11 July 2015,
<<http://www.smh.com.au/entertainment/art-and-design/exclusive-bill-henson-talks-about-life-landscapes-and-that-other-storm-20130613-2o6px.html#ixzz3fehQSmCY>>.

Harbisson, N Interview, heard 18 August 2015,
<<http://www.abc.net.au/news/2015-08-10/cyborg-man-with-antenna-in-skull-neil-harbisson-visits-perth/6686764>>.

Kelly, K 2015. *Listening to colour with Niel Harbisson*. Viewed 18 August 2015,
<<http://www.haft2.com/2015/01/20/listening-to-colour-with-neil-harbisson/>>.

Fisher, M 2015, *Microbial Me*, viewed 8 July 2015
<<https://www.youtube.com/watch?v=tUgy1DEVG00>>.

Graedon, A 2014, *The word exchange*, Wiedenfeld & Nicolson, London.

Grindhouse wetware, viewed 17 August,
<<http://www.grindhousewetware.com>>.

Hoppenstedt, M 2013. *DIY Cyborg*, viewed 17 August,
<<http://motherboard.vice.com/blog/the-diy-cyborg>>.

Kelly, J ?, *Interview with Oron Catts and Ionat Zurr* , Triple J, Retrieved 14 April 2015, <<http://www.abc.net.au/arts/headspace/triplej/morning/tissue/>> .

Jones, C (ed.) 2006. *Sensorium: embodied experience, technology and contemporary art*, MIT Press. Cambridge Massachusetts.

Kac, E (ed.) 2007, *Signs of Life: bio art and beyond*, MIT Press. Cambridge, Massachusetts.

LaTosky, S ?, *Reflection on the lip-plates of Mursi women as a source of stigma and self-esteem*, viewed 18 May 2015
<<http://www.mursi.org/pdf/latosky.pdf>>.

Liggett, J and A 1989, *The Tyranny of beauty*, Victor Gollancz Ltd. London.

Jones, C (ed.) 2006, *Sensorium, embodied experience, technology, and contemporary art*, The MIT Press, London.

Martz, L, Nigten, A, Mulder, A & Brouwer, J (eds.) 2005, *aRt & D: research and development in art*, V2_Nai Publishers. Rotterdam.

Melville. K, Thursday 16 August 2012 5.22pm, *When you wear a moko, you are the face of your ancestors*, viewed 22 May 2015,
<<http://www.abc.net.au/radionational/programs/360/tattooing-and-polynesian-identity/4203566>>.

Morse Code, viewed 15 July 2015, < <http://www.learnmorsecode.com>>.

Metadata, viewed 15 September 2015,
<<http://www.sbs.com.au/news/explainer/what-metadata-and-how-do-you-maintain-your-privacy> <http://www.sbs.com.au/news/explainer/what-metadata-and-how-do-you-maintain-your-privacy>>.

Myers, W 2012, *Bio Design. Nature . Science . Creativity*, Thames & Hudson, London.

NEOLIFE, *The Inaurural rest of the World Meeting Sociey for Literature, Science and the Arts* (SLSA) 1-3 Oct 2015, Conference program, The University club of Western Australia.

Quinn, M 1991, Self, viewed 12 July 2015,
<<http://marcquinn.com/artworks/self>>.

Radio-frequency identification, viewed 17 August 2015,
<http://freedomoutpost.com/2015/06/trendies-ready-for-ultimate-wearable-chip-implanted-in-their-skin-used-for-payments/>.

SymbioticA, at The University of Western Australia, viewed 14 April 2015,
<<http://www.symbiotica.uwa.edu.au/>>.

Stelarc, 2006, Partial Head, June 14 2015,
<<http://stelarc.org/media/img/partial-head/partialhead1.JPG>>.

Stelarc, 2010, ZOMBIES & CYBORGS, The Cadiver, the Comatose & the Chimera, viewed 19 June 2015,
<<http://stelarc.org/documents/zombiesandcyborgs.pdf>>.

SymbioticA Biological Arts, 2015, pamphlet, University Western Australia.

The myth of Cassandra, viewed 25 June 2015,
<<http://www.greekmyths-greekmythology.com/the-myth-of-cassandra/>>.

Turner, B 2005, *Body Modification, The possibility of primitiveness: Towards a sociology of body marks in cool societies*, viewed 1 August 2015, SAGE Publication Ltd. London.
<http://study.sagepub.com/sites/default/files/Ch06_Body%20Art.pdf>.

TXT acronyms, Viewed 26 May 2015,
<<http://www.netlingo.com/acronyms.php>>.

Wilkins, A *Bioencryption can store almost a million gigabytes of data inside bacteria*, i09, 26 November 2010, Viewed 21 August 2015,
<<http://io9.com/5699767/bioencryption-can-store-almost-a-million-gigabytes-of-data-inside-bacteria>>.

Wearable, viewed 18 September,
<https://en.wikipedia.org/wiki/Wearable_technology
<https://www.wearable-technologies.com>>.