Sneha Solanki

Credits and Thanks

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Links

- AV Festival - http://www.avfestival.co.uk/
- Sarah Blood - http://sarahblood.com/
- Centre for Bacterial Cell Biology - http://www.ncl.ac.uk/cbcb/about/
- Dilston Physic Garden - http://www.dilstonphysicgarden.com/
- Intersections - http://intersectionspublicart.org.uk/
- Lindsay Duncanson - http://productofboy.net/
- Museum of Witchcraft - http://www.museumofwitchcraft.com/
- Polytechnic - http://ptechnic.org/
- Synthesis - http://synthesislab.org/
- Synthetic Biology Research Group - http://bio-nexus.ncl.ac.uk/
- VANE Gallery - http://www.vane.org.uk/

Design

Sneha Solanki, 2012.
Photography: the artist, unless stated.

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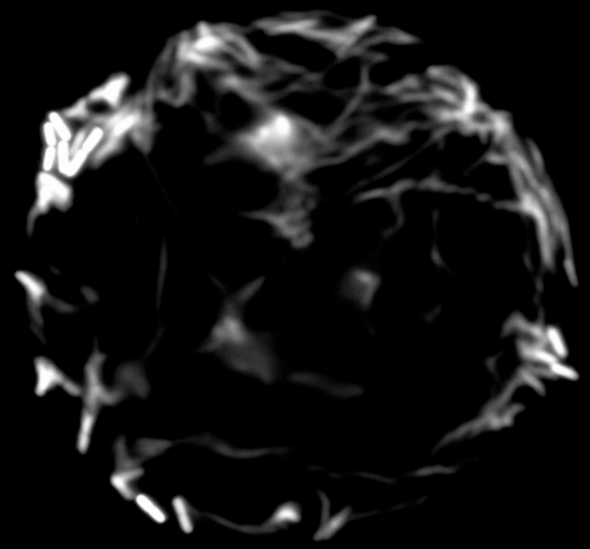
Supported by
Synthetic Biology Research Group | AV FESTIVAL | intersections | polytechnic | THE MUSEUM OF WITCHCRAFT


super-natural pt.1



SUPER-NATURAL

Sneha Solanki

TITUBA, a construct of synthetic biology and a woman from our historical past, necromatically raised from the dead to inhabit a new body in the 21st century, a *sui generis*.

In our time, Tituba was created in a laboratory from genetic ATCG data, enzymes, proteins and chemical reactions. Coded into closed circular structural systems of modification and immunity.

She became a host of e-coli and then in her final transformation to b.subtilis 168. She was heat-shocked from -80˚c to 42˚c, centrifuged at 180 rpm, streaked across agar plates, incubated for hours at 37˚c, scraped from a plate, inoculated with antibiotics, fed with a nutritious broth, grown and cloned, again for hours at 37˚C. She followed protocols and procedures. Her optical density was measured and her DNA was laid bare to run electrified across a gel. She was amplified, digested, ligated and transformed. Finally, suspended in -80˚c deep freeze, she awaits further transformations.

In 1692 her ordeal was a little different. She was a slave of Reverend Samuel Parrish in Salem, Massachusetts. Her origin and identity oscillates between a speculative historical analysis- was she a voodoo sorceress of African descent, a fetish worshiping Arawak Indian from the Caribbean or a 'native Indian' coersed by beastial spirits from the netherworld ?[1]

To the puritan immigrants she was the 'other' and a confidante of the devil. Consequently she became the first to be accused of practising witchcraft during the infamous Salem witchcraft trials.

Omnipotent in culture, the witch is often described as a mystery, as a myth, a fictional character, a form of fantasy and predominantly gendered as female. Historian Dianne Purkiss proclaims the witch is a fantasy figure created by women as a blank canvas on which to “express their fears and desires as women”[2]. A point explicitly performed as a reclamation in 1969 by 'W.I.T.C.H.', 'Womens International Terrorist Conspiracy from Hell'[3], a radical feminist group

from New York, and in recent years by Romanian witches planning to hex their president, Traian Basescu using poisonous plants, cat excrement and chants for implementing a tax on mystics, healers, witches and astrologers[4].
Malcolm Gaskill, an expert in witchcraft and reader in early modern history, describes witches as “ambiguous symbols and conduits of encoded meanings”[5].
Some argue, even in the present day that the witch posesses an extending 'evil' from an intangible place with the sole purpose to cause maleficium[6]. In some parts of the world being labeled a witch can have extremely serious and detrimental consequences, initially epitomised on a large and socio-politically networked scale by the European and 'New World' witchcraft trials between the 14th and 17th Century. The visible effects of these trials, noted by Gaskill, characterise witchcraft as a “divided self, caught between the old world and new”[7] at the beginning of modernity, imperialism and capitalism.

Judgments and perceptions of witchcraft swing between the extremities of fantasy and realism, further polarised by contrasting interpretations and inconceivable far-fetched descriptions. Abetted by its' intangible abstruse nature, witchcraft defies any fixed rendition. Historical observations however do reveal that witchcraft is a global concept rooted in religion, politics, science, history and culture. An immaterial manifestation materialising from socio-political effects, and transformed into a biopolitical vector. Super-natural draws from this historical resonance, aligning the materiality of Synthetic Biology[8] with the immaterial culture of witchcraft.

Tituba's surface into the present, into a new form and a new transmutative space of the emergent life sciences predicts once again a peak in society, a revolutionary change, a paradigm shift[9]. An entity computationally engineered, chemically animated, biologically nurtured and inoculated with occult reasoning, Tituba becomes a body on which to construct a narrative of uncertainty and transition at the edge of a *radical technological shift*.

References

1. Tituba was a 17th-century slave belonging to Reverend Samuel Parris of Salem, Massachusetts. Tituba was also the first to be accused of practicing witchcraft during the Salem witch trials which took place in 1692. Arthur Millar also fictionalised Tituba in '*The Crucible*', 1952, a play dramatising the trials of Salem.

2. Diane Purkiss, *The Witch in History. Early Modern and Twentieth-Century Representations*. Routledge, London and New York. 1996, pp. 2.

3. W.I.T.C.H., a feminist group (1969-1970) from New York, USA confronted institutional conditioning citing hexes (spells) as performance and guerrilla actions.

4. Matthew Weaver. *Romanian witches to cast anti-government spell*. The Guardian, Friday 7 January 2011, pp. 23.

5. Malcolm Gaskill. *Witchcraft, A very Short Introduction.* Oxford University Press, Oxford. 2010, pp. 8.

6. Maleficium, a latin term describing 'wrong doing', usually in context to malevolent sorcery or any other magical act intended to cause harm.

7. Malcolm Gaskill. *Witchcraft, A very Short Introduction*. Oxford University Press, Oxford. 2010, pp. 90.

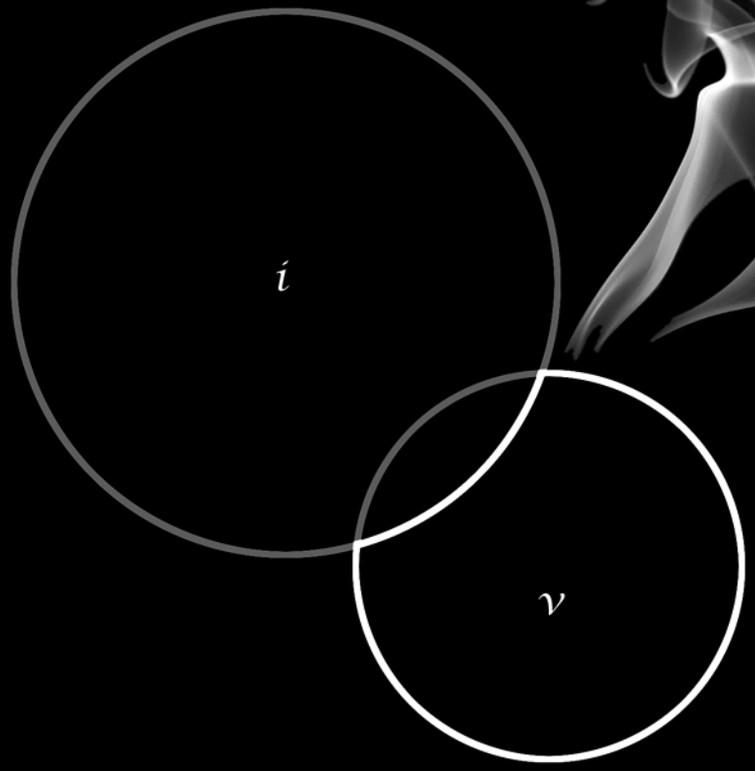
8. Synthetic Biology is an emerging area in genetic and molecular sciences which integrates engineering principles with biology, computer sciences and chemistry to create ‘synthetic’ life that can behave naturally as in nature or to act un-naturally.

   It can currently be defined by the creation of life by-

   a) modifying existing molecules, the 'top down' method.

   b) or creating non-existing molecules (protocells), 'the bottom-up' method.

9. A 'paradigm shift' was one of the key features of the enlightenment in Europe and North America. Thomas Kuhn later describes the Paradigm Shift as “*a revolution, a transformation, a sort of metamorphosis. It just does not happen, but rather it is driven by agents of change*”. Thomas S. Kuhn, *The Structure of Scientific Revolutions*. University of Chicago Press, Chicago, 2nd edition. 1970, pp. 10.



NheI NheI

i (pJ201:62898 / SpaS2) + v (pGFPrrnB)

EcoR1 EcoR1

amyE B.Subtilis 168 / Tituba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1191 GAATTCATTT ATTGACATTT TATTTAAATT ATGATATAAT GGAAAAGTAA GTTTTTTCTG AAAATAGAAA
1261 TCCTTCAAGT GAAAGTGTTA AAAAAATGAA ATGATTTTGT CATGAAAGGA GGTGACCAAT ATGTCAAAGT
1331 TCGATGATTT CGATTTGGAT GTTGTGAAAG TCTCTAAACA AGACTCAAAA ATCACTCCGC AATGGAAAAG
1401 TGAATCACTT TGTACACCAG GATGTGTAAC TGGTGCATTG CAAACTTGCT TCCTTCAAAC ACTAACTTGT
1471 AACTGCAAAA TCTCTAAATA AAAACGGTAT AGGAGGAACT ACTATGGCTA GCAAAAA
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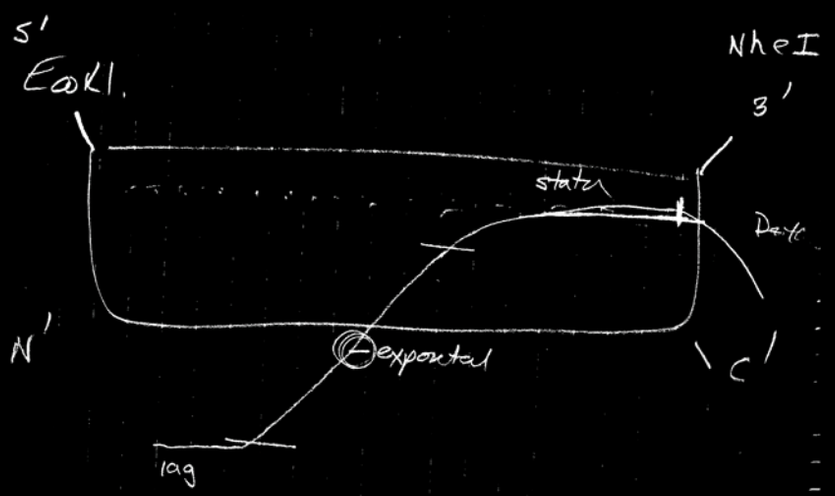
DNA fragment synthesised (SpaS_WT) is 342 bp.



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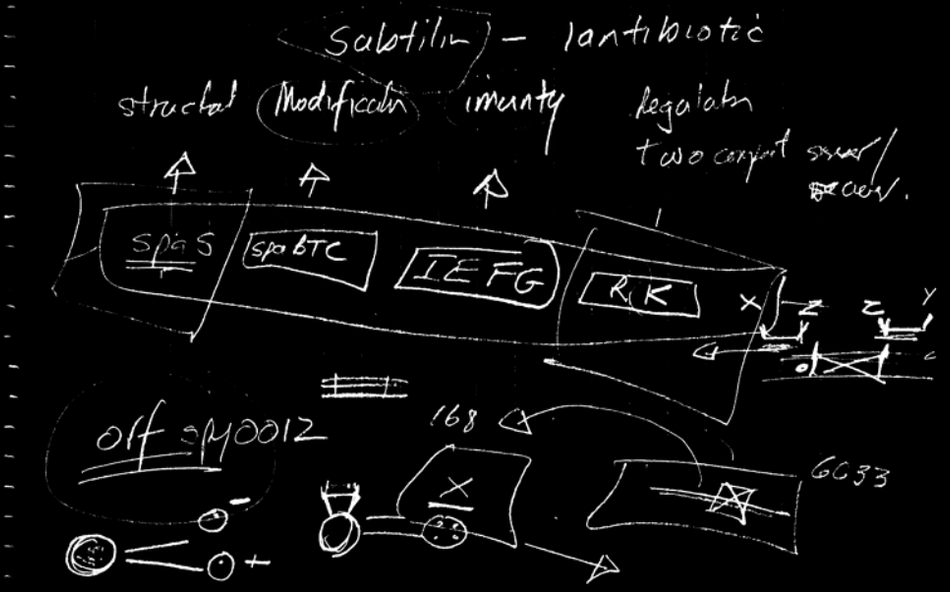
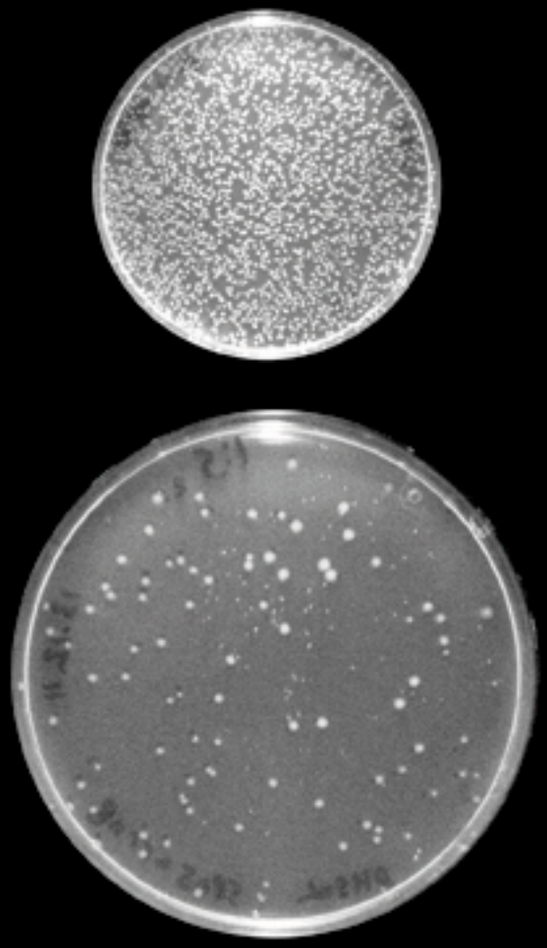


5.

sense . regulation . immunity | transporter . sensor . receiver

accularisation . witch . society | magic . divination. socery



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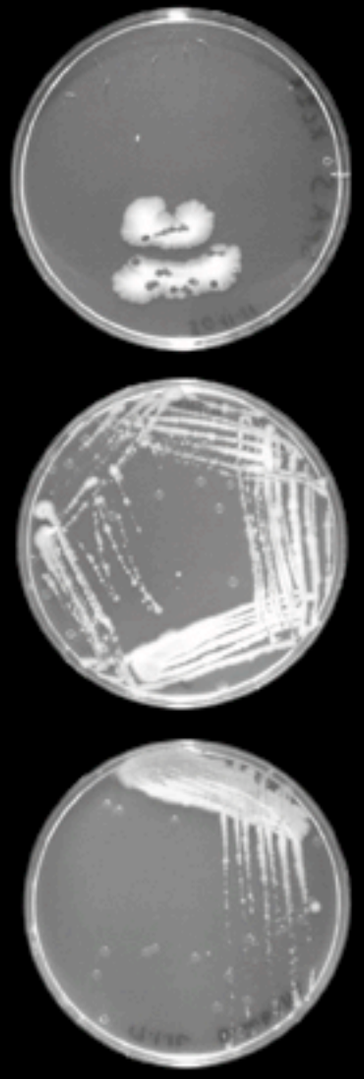

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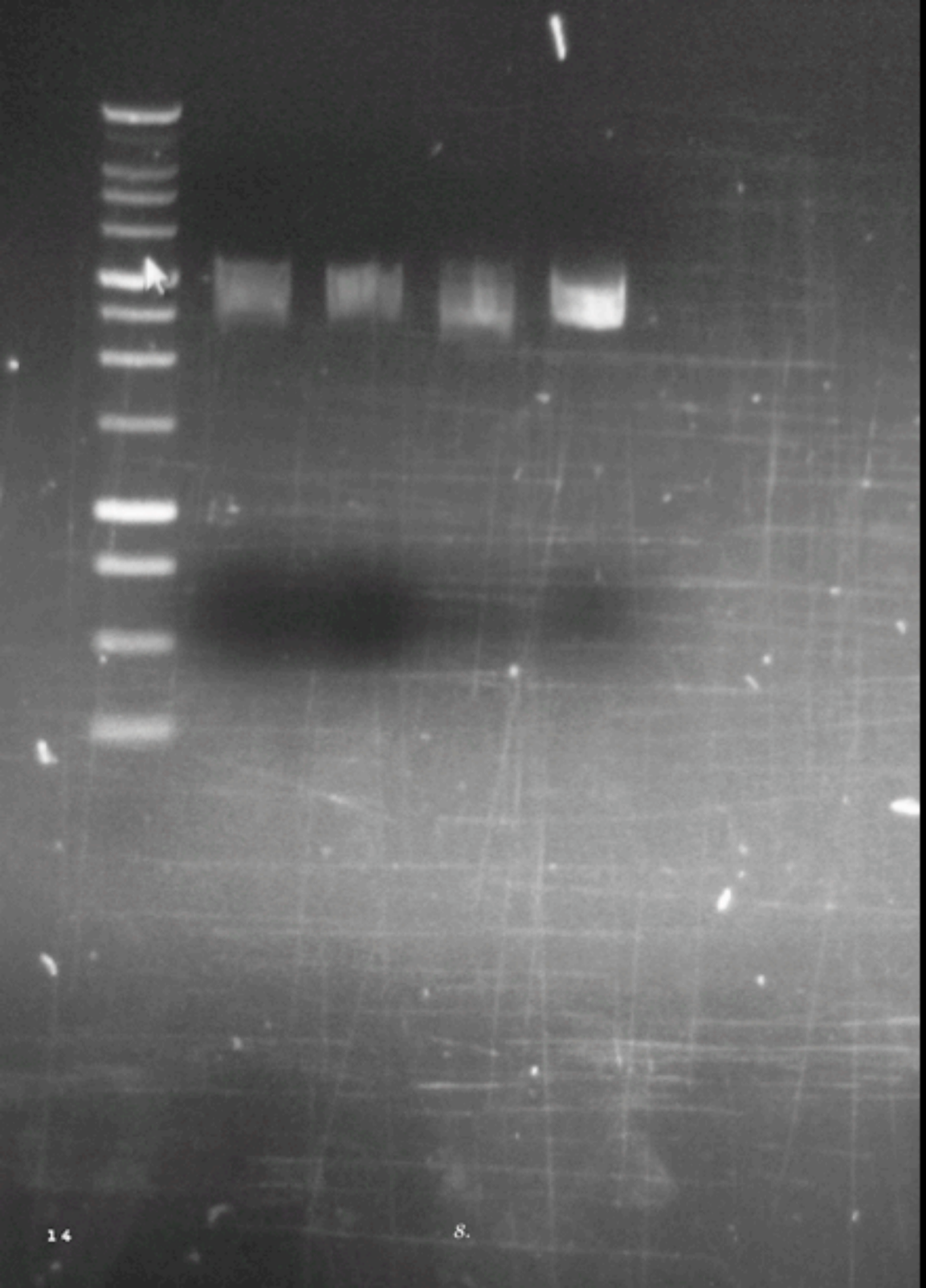

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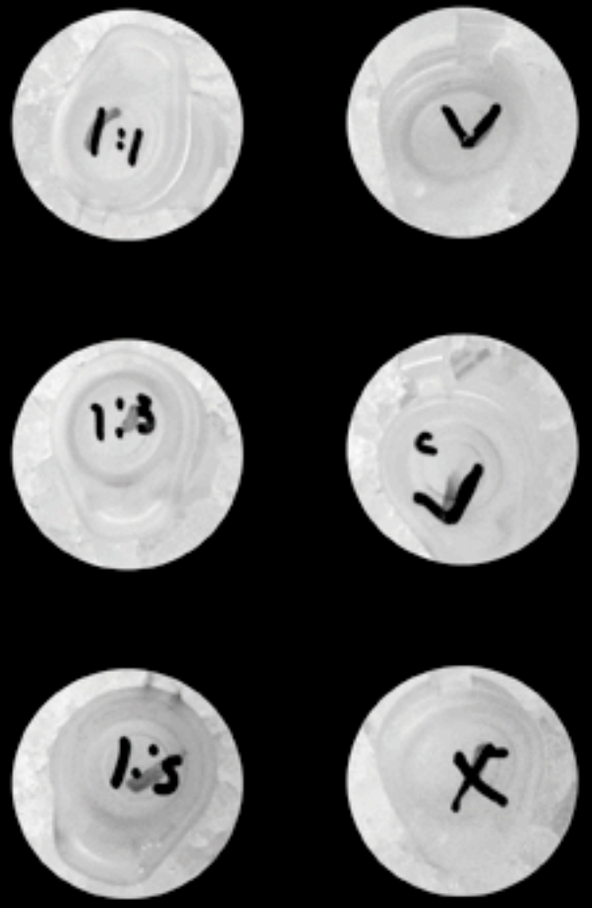


9.

B. Subtilis 168 Transformation protocol - also works for mutants but Frequency low.

*1. Inoculate 5ml of MM competence media with strain in 15ml falcon tube. & inc 37°C 180rpm O/N.

*2. Next day trasfer 0.3ml of O/N culture into fresh 5ml MM competence media in 50ml falcon tubes & inc for 3hrs @ 37°C 180rpm

*3. Add 5ml of pre-warmed starvation medium & incubate for a further 2hrs @ 37°C + 180rpm.

*4. Transfer 0.4ml of the culture to 1.5ml microfuge tube & add 10µl DNA (5-10µl depending on conc as need ~ 10µg DNA for transformation) (include any controls ie -ve no plasmid)

5. Incubate 1hr @ 37°C @ 180rpm - place tubes on side to ensure maximum aeration (2-3hrs pg 79 @ 28°C)

(Chloramphenicol)

6. Plate out 200µl / plate ∴ 2 plates with appropriate antibiotics & inc O/N 37°C (18hrs pg 79 @ 28°C)

agar, chloramphenicol + starch for amylase test

Require - Spizizen minimal media - SMM media (see recipe over page)
- Solution E (40% glucose) - 10ml & filter sterilise - do not autoclave
- Tryptophan solution (168!) @ 2mg/ml in H_2O
- Solution F (1M $MgSO_4$)
- 20% casamino acids

see over 10ml each

- Prepare sterile 10ml stocks of each soln & divide into 1ml aliquot & store in box in fridge 4°C -

Prepare SMM media - 1L.

- 2.0g ammonium sulphate
- 14.0g dipotassium hydrogen phosphate
- 6.0g potassium dihydrogen phosphate
- 1.0g sodium citrate dehydrate (trisodium citrate)
- 0.2g magnesium sulphate

Make up to 1L, split into 5x 200ml bottles & autoclave

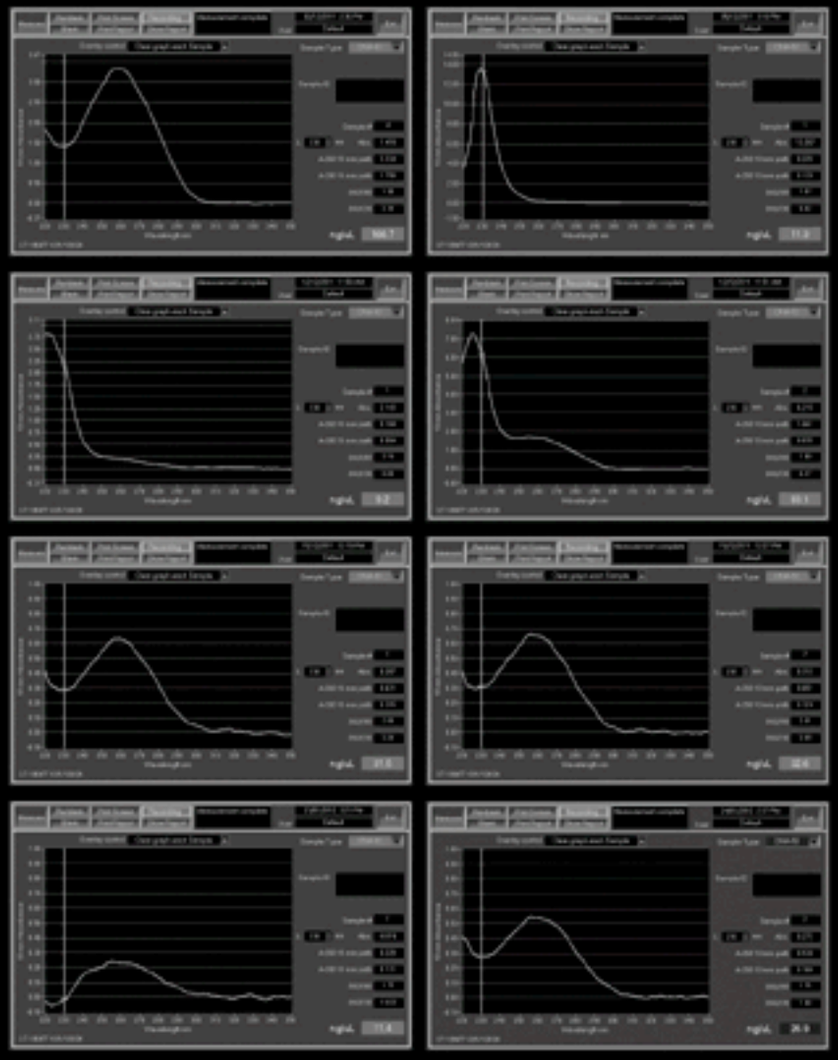
Prepare MM competence media just prior to use!

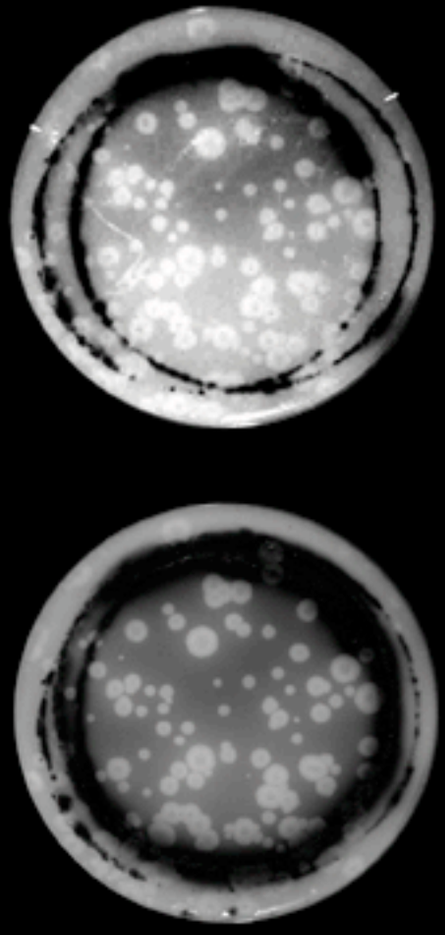
For 5ml require	10ml
- SMM media (5ml)	(10ml)
- Soln E (40% glucose)	(62.5µl) (125µl)
- Tryptophan soln (168)	(50µl) (100µl)
- Soln F	(30µl) (60µl)
- casaminoacids	(5µl) (10µl)
- Fe-NH_4-citrate	(2.5µl) (5µl)

Prepare Starvation media

For 5ml require

- SMM media (5ml)
- Soln E (40% glucose (62.5µl)
- Soln F ($MgSO_4$) (30µl)





12.

13.

pGFP rrnB for 50°C

pGFP rrnB rev 51°C

TM 46°C

product is

+ ~ 1006p outside

dong site 342

~ 542 bp product

use half volumes!

Screening of Em sensitive colonies by PCR

Puregene DNA isolation

Grow overnight ~~15ml~~ cultures in ~~THB containing 30µg/ml hyaluronidase~~ 7.5ml appropriate media

Cell lysis

1. Pellet cells by centrifugation at 3600 x g for 15 minutes.
2. Pour off supernatant.
3. Add 1ml cell suspension solution to the pellet and gently pipet up and down to resuspend the cells. Transfer to a 1.5ml eppendorf tube.
4. Add ~~25µl mutanolysin,~~ 100µl lysozyme and 15µl lytic enzyme solution. Invert tube 25 times to mix.
5. Incubate at 37°C for 3hrs to digest cell walls. Invert tubes occasionally during the incubation.
6. Centrifuge at 13000rpm for 1 min to pellet the cells (this may need a longer spin.) Remove the supernatant.
7. Add 1ml cell lysis solution to the cell pellet and gently pipet up and down to lyse the cells. Heat the samples to 80°C for 30mins, mixing every 5-10mins.

RNase treatment

1. Add 15µl RNase A solution to the cell lysate.
2. Mix by inverting 25 times and incubate at 37°C for 60mins

Protein precipitation

1. Cool samples on ice
2. ~~Divide equally between 2 1.5ml eppendorf tubes.~~
3. Add 0.5ml protein precipitation solution to each tube.
4. Vortex vigorously at high speed for 20 secs to mix the protein precipitation solution uniformly with the cell lysate. Place samples on ice for 5mins
5. Centrifuge at 13000rpm for 30secs or until the precipitated proteins form a tight pellet.

DNA precipitation

1. Pour the supernatant containing the DNA into a clean eppendorf tube. (the samples may be kept at -20°C overnight at this stage.)
2. Add 0.5ml isopropanol to each tube.
3. Mix by inverting gently 50 times.
4. Centrifuge at 13000rpm for 1min. The DNA should be visible as a small white pellet.
5. Pour off the supernatant and drain the tube on clean absorbent paper. Add 0.5ml 70% ethanol and invert tube several times to wash the DNA.
6. Centrifuge at 13000rpm for 1min. Carefully pour off the ethanol.
7. Drain the tubes on clean absorbent paper. Allow to air dry for 10-15mins.

DNA hydration

1. Add 100µl DNA hydration solution to each tube.
2. Rehydrate DNA by incubating the sample for 1hr at 65°C and overnight at room temp. Tap tube periodically to aid in dispersing the DNA.
3. For storage, centrifuge briefly and store at -20°C.

16.

17.

Fed Brain & Heart

kept warm & wet

Heat-shocked, frozen
&
transformed

DIGESTED, EXTRACTED & LIGATED

TRANSFORMISM: NOVEL FORMS AND NEW MATERIALITIES

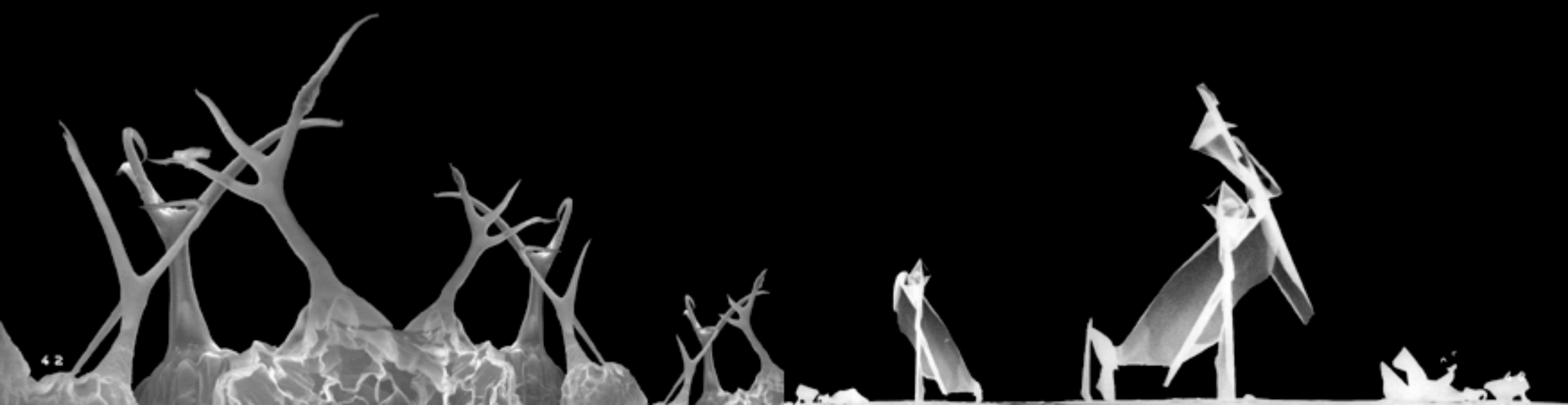
Melanie Jackson

There is an excitement around Synthetic Biology, with its aspiration to make endless new forms infinitely possible. Synthetic biology sets out to create new life to understand what already is, and develop the capacity to re-programme it to create forms and functions that cannot be found in nature, and to improve what can be. With an engineering approach to biology, it extends our taxonomies of the animate and inanimate, of the sentient and the inorganic and folds them in new ways. It dreams up complex systems such as gourds that can be programmed to grow into fully-fledged houses, windows that create energy as they let in light through photosynthesis, drains that convert waste into energy, trees that can form useful structures such as bridges or towers, bio-robots that seek out pests such as flies, snails and rats to convert their bodies into sustainable bio-electricity, new foods that have a subtractive calorific content, bacterial coatings that transform pollutants and CO2 into armorial masques healing concrete cracks, bio-sensors that glow, or change colour with the contamination of undesirable presences. It wants materials to be smart, responsive, full of switches, choices, thoughtfulness – it can think itself evolutionary and revolutionary.

With this giddy wish-list of future applications so generates an ever-expanding glossary to articulate its actions and desires, along with a host of new nouns to describe its agents. Like its very methods of re-modelling existing living parts to do new work, it appropriates terms and language to accommodate its new modus. For instance, for when things get too complex, when the minutiae of detail too long to recall - it creates *abstractions* and *abstraction hierarchies*. These are 'black boxed' ideas, units, or substrates: blocks of pre-calculated acted upon matter that can perform a specific function. They don't need explanation or extrapolation, just ready implementation, like a circuit or section of code. They can be synthetically replicated and used as building blocks of known functionality. Though synthetic biology applies an enlightenment engineering logic and pragmatism to its methodology and its terminology, it is suffused with the musings pursued in folktale and mythology: to make giant, fecund, to shapeshift, and transform. It premises itself on empirical systems and standardized parts, and incants the language of engineering, electronics and

a.

b.



programming code to living systems. However, when the narrative is articulated in terms of its aspirations and applications, the story chimes with the realm of the magical, of the sacred, the mythical. Many of its storylines are recited by those who read from a trajectory of an evolutionary technology, from the written word to the printing press to a synthetically programmed future. They take the speaking position of what Donna Haraway names the *modest witness*, the

> *legitimate and authorized ventriloquist for the object world, adding nothing from his mere opinions, from his biasing embodiment... He bears witness: he is objective; he guarantees the clarity and purity of objects. His subjectivity is his objectivity. His narratives have a magical power - they lose all trace of their history as stories, as products of partisan projects, as contestable representations, or as constructed documents in their potent capacity to define the facts. The narratives become clear mirrors, fully magical mirrors, without once appealing to the transcendental or the magical.*
>
> Donna J. Haraway, Modest_Witness@Second_Millennium. The Haraway Reader, Routledge.[1]

The visionaries of synthetic biology fear that intellectual progress could be hampered by uninformed objection, and that public resistance is essentially an irrational response to the progression of thought by those haunted by ghoulishness, unable to cope with the potential of taxonomical reconfiguration. Capitalism also presents a façade of logic and naturalised inevitability, despite it's suffusion with mythologising and fantasy. If we recognise the genre of the storytelling around synthetic biology as science fiction rather than a naturalised evolutionary timeline - we can recognise it as a revolutionary technology, a technology that we are scripting rather than an inevitable unfolding. We have of course always used tools and technologies to transcend and extend our own physical and imaginative boundaries, and incantations of expansion and transcendence can lead us to different narrative outcomes. We all use stories to understand science – even though scientists may not always acknowledge that they are engaged in an act of storytelling. Can synthetic biology trigger a discourse that recognises mythopoesis - the power of stories to create as well as describe reality? Will these new 'superfolds' of mindfulness and matter, of the human, and non-human – the organic and inorganic offer radical new formulations of subjectivity, new modes of being? Could Haraway's own cyborgs find space to configure within this new science? Might it instead simply invite capitalism and militarism to extend it's grasp to the life of the cell and beyond, instrumentalising commodified and alienated subjectivities at the scale of the infinitesimal?

Synthetic biology shares an imperative with nanotechnology, they are close disciplines projected to converge. They take raw material – whether they be genes or atoms - and manipulate them at the nanoscale (a billionth of a metre), to project their behaviours outwards into manifold new dimensions.

> *In the nanoworld, nature can be harnessed anew as a force of production. The self-organising abilities of DNA are mobilised in nanomachines. All that frenetic activity of bacterial self-replication, molecular self-assembly and self-organisation, biological stimulus and response systems and viral architecture rebadges nanoscale and mesoscopic elements - enzymes, nucleic acids, ribosomes, chloroplasts, mitochondrions, flagella and the like - as a new working class, grafting away inside living cells, constructing, reconstructing, destroying, clearing, cleaning, sweeping, accelerating, bending, twisting, rotating, operating, shooting, combining.*
>
> From *The Urpflanze* (Part 2) Melanie Jackson and Esther Leslie, 2013.[2]

Though much of the work of synthetic biology takes place in the realm of the digital, modeling, calculating, projecting outwards – the 'wet' work remains

visceral and embodied in ritual and methodical physical process. Much work in synthetic biology requires a 'chassis' – a substrate on which gene transfer, synthesis and replication can take place. This is often e-coli – profuse in the gut and one of the most populous bacteria on earth – and in the popular imagination, a deathly infection. To create new organisms with re-scripted ATCG genetic data, strands of DNA are combined with e-coli – by processes of heat shocking, centrifuge, streaking, incubation, scraping, electrification, inoculation with anti-biotic, feeding with broth, cloning, amplification, ligation and transformation.[3] This harbouring of work, embodied states, making use of entropy and of replication takes us to the very core of where the narrative arcs might project into the future. There is an opening here of the boundaries through and between objects, signs, bodies, nonhuman and human events, thoughtfulness and matter, production, exchange, entropy. These new entanglements are however of human initiative, they will be developed within political economies, and the spectres of salvation and extinction hover around them.

One of leading arguments for us to fully embrace synthetic biology with light touch regulation and a well funded future is its potential to ameliorate industrial over-production. We aspire to do this by coercion of nature at the nanoscale, by directing its own tendency to produce, replicate and self assemble, in tasks that compensate for our own disastrously flawed relation to work and production. We intend to set it to work to detect and deliver targeted drugs to cancers, (many themselves caused by industrial excess), re-balance atmospheres, grow plants that can thrive in exhausted soils, tackle obesity and eating disorders, malnutrition, create new forms of energy, turn base matter and waste into new forces of production. It is the voice that is the most dominant, along with the whispered incantation of the new term the *genetic economy.* This narrative does not necessitate us to rethink the nature of the productivism that is causing crisis, but applies a (patentable) intelligence to localized problems. It could promise a new relationship with objects, with entropy and corporeality, production and excess - but it does not require us to reconsider our relationship with obsolescence. It could extend the trajectory of generating novel forms to support current patterns of consumption.

Though synthetic biology is born out of symbiosis of the material and the theoretical and is opens up new ways of thinking dynamically about these relations, for others the shrinking of scale offers a potential dissolution of the biological and material altogether. Some avatars of technological singularity embrace the idea that technology will soon bring about a greater-than-human intelligence, and a greater than human chassis for this intelligence. Like Plato's realm of pure forms that disavows hair and dirt, the body itself could be jettisoned for a purer, more ethereal substrate. There is a sense that biology and entropy interrupt rather than catalyse the ecstacy of consciousness, a divine submission to disembodiment of thought:

> *If we radically upgrade our bodies with biotech, we might find that in addition to augmenting our biological capabilities, we're also going to be replacing more of our biology with non-biological components, so that things are backed up and decentralized and not subject to entropy. More and more of the data processing that makes up our consciousness is going to be non-biological, and eventually we might be able to discard biology altogether, because we'll have finally invented a computational substrate that supports the human mind. At that point, if we're doing computing at the nano scale, or the femto scale, which is even smaller, you could see extraordinary things... What if we could store all of the computing capacity of the world's computer networks in something that operates at the femto scale? What if we could have thinking, dreaming, conscious minds operating at the femto scale? That would be a substrate independent mind. You can even go beyond that. John Smart has this really interesting idea he calls the Transcension Hypothesis. It's this idea that that all civilizations hit a technological singularity, after which they stop expanding outwards, and instead become subject to STEM compression that pushes them inward into denser and denser computational states until eventually we disappear out of the visible universe, and we enter into a black-hole-like condition.*
>
> Jason Silva, *A Timothy Leary for the Viral Video Age*, Ross Andersen, The Atlantic, April 12 2012.[4]

In late February of 1692, The Reverend Samuel Parris called a doctor to come to the aid of his daughter, Betty, and to his eleven-year-old niece, Abigail both of whom were suffering from spontaneous fits. Tituba, a slave in the household was blamed for introducing the girls to witchcraft, and subsequently her story too has been subject to metamorphosis. It has changed form and significance across time, religious, ethical and political value systems. Her ethnicity has been described variously including Arawak Indian, Indian, half-Indian, Black African, Caribbean, half Caribbean, half White. Though her confession in the written court record is to an entirely European notion of witchcraft she is connected in posthumously published historical accounts to telling voodoo stories, practicing voodoo rites, sparking hysteria and a spate of further trials. She has been attributed with various forms of magical agency from shapeshifting to sorcery, fortune telling to divination. She has been a concubine, a wife, a singleton, a mother, a victim of physical violence, executed, accused and exonerated. She disappeared from the historical record, to reappear in countless subsequent fictive and analytical re-formulations. In Sneha Solanki's work Super-natural it is not the artist or the scientist that is identified with witchcraft or magical transformation, but the organism they have synthesized together. Tituba is given agency as a biological physical entity, classified, categorized - and, just like her historical counterpart, utterly prone to further acts of metamorphosis.

> *Morphology is linked to Morpheus, the God of dreams, who shapes and reshapes himself and our worlds of reverie. Morpheus sends human forms into dreams. His brother Phobetos made the plants dream. The third son of Hypnos, named Phantasos, made the stones and other inanimate objects dream- and the dream elements over which he presided were the most unreal, tricky, fantastical. Dreams can adopt any form, any shape. Dreams are infinite forms. Morphology is the imagination of infinite variety. Morpheus sleeps in a dark cave lined with poppies. Does dream dream itself? Does matter form itself? Proteus the sea god also had the ability to foretell the future. He adopted different shapes in order to avoid revealing what was to come. He would only divine for those who could capture him...*
>
> From *The Urpflanze* (Part 2) Melanie Jackson and Esther Leslie, 2013.[5]

References

1. Donna J. Haraway, *Modest_Witness@Second_Millennium*. The Haraway Reader. Routledge, New York and London, 2003. pp 224.

2. From *The Urpflanze* (Part 2) Melanie Jackson and Esther Leslie, 2013.

3. *Super-natural*, Sneha Solanki, 2012.

4. Jason Silva, *A Timothy Leary for the Viral Video Age*, Ross Andersen. The Atlantic, April 12 2012.
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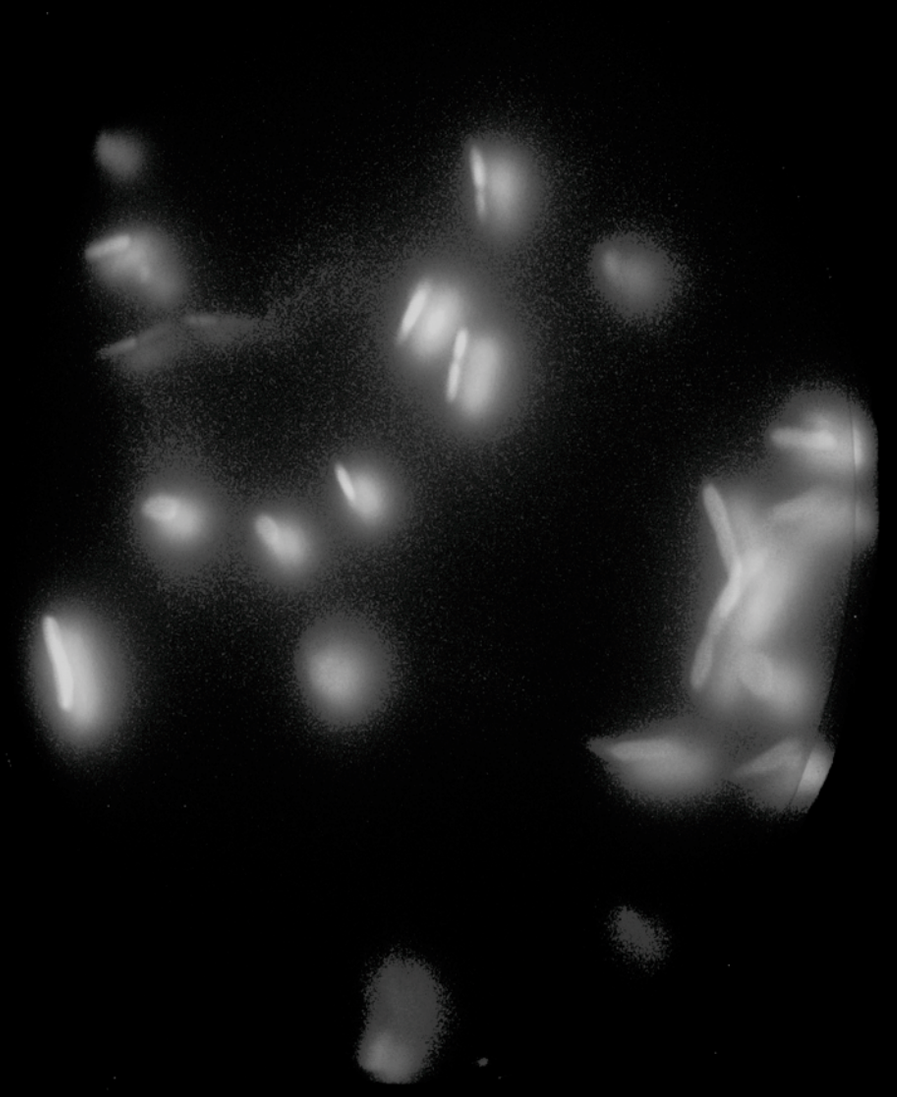
Images

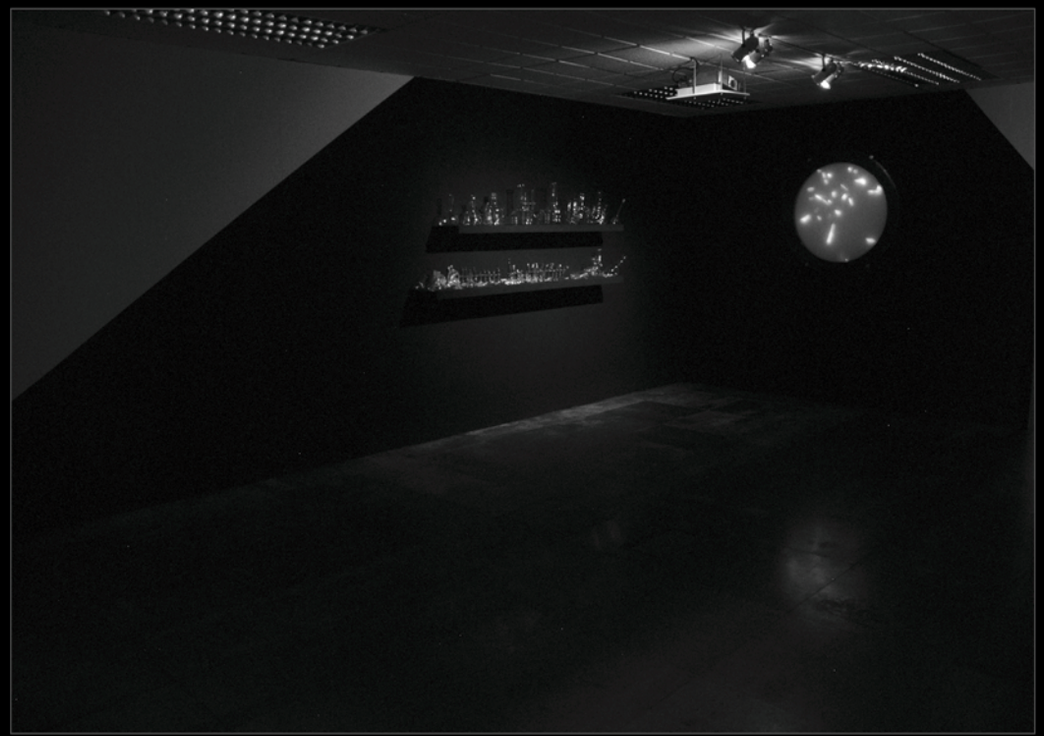
a. & b.

Towards A New Working Class:
A Wander Through The Nanoscene

Melanie Jackson 2012.

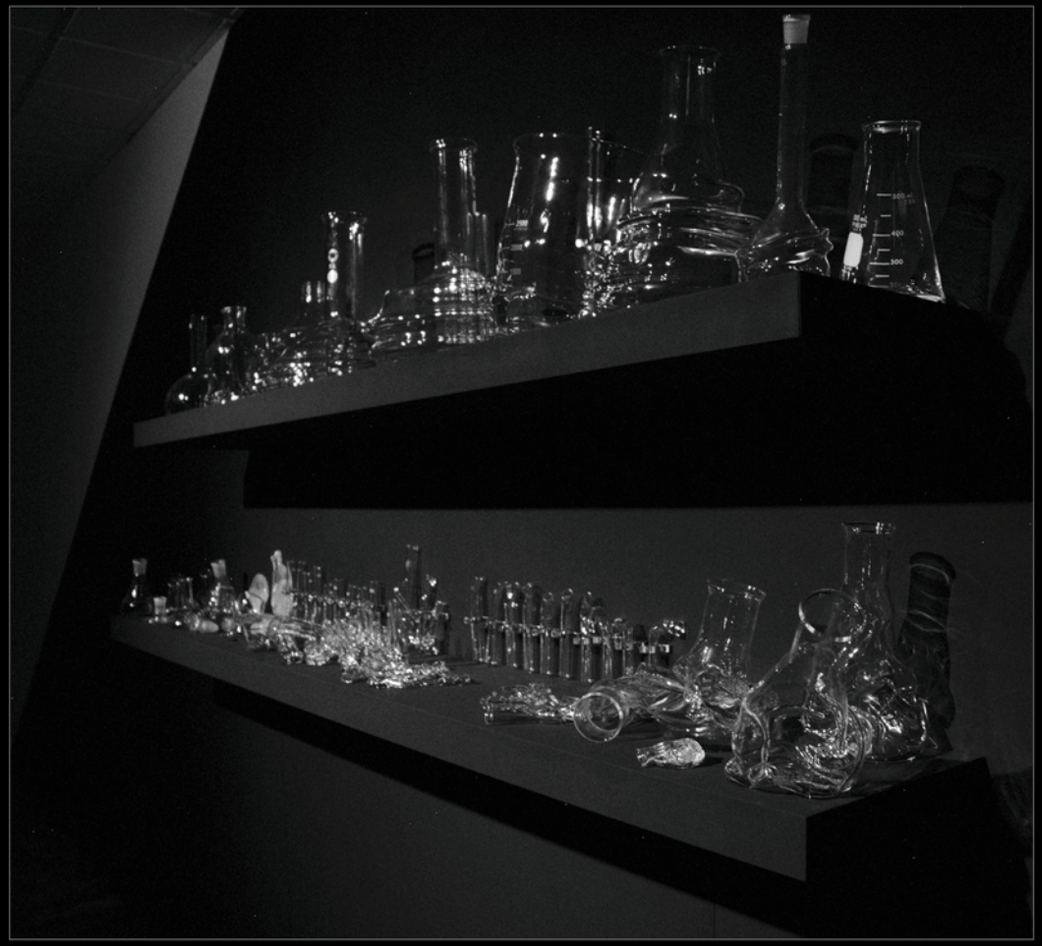
SUPER-NATURAL *pt.1*





25.

26.



27.

28.

29.

30.

PROTOCOLS & IMAGES

1. Tituba.
2. Transformation diagram.
3. SpaS plasmid insert *(i)* sequence of DNA fragment between NheI & EcoR1 restriction sites.
4. Restriction enzymes exponential phases. Diagram by Dr. Wendy Smith.
5. Synthetic Biology design of Tituba by Dr. Wendy Smith.
6. E-coli DH5α colonies with SpaS insert *(i)* on agar + kanamycin, grown at 37°c.
7. B.Subtilis colonies: pGFP-rrnB vector *(v)* on agar + spectinomycin, grown at 37°c.
8. Gel electrophoresis with plasmid vector *(v)* fragment against 100kb DNA ladder.
9. New plasmid *(v)* & *(i)* 'parts' on ice with annealing ratio's for ligation.

10. B.Subtilis 168 transformation protocol by Dr. Wendy Smith.
11. B.Subtilis 168 media preparation recipe for transformation protocol by Dr. Wendy Smith.
12. Spectrophotometer optical density measurements of nucleic acid DNA concentrations.
13. B.Subtilis amalyse gene transformation test on agar starch,

14. PCR (polymerase chain reaction) DNA amplification notes.

15. PCR protocol appropriation by Dr. Wendy Smith.

16. Preps, pellets and clones.

17. Digests, pellets, transformations, clones, gels and stores.

18. Clone 2b: re-suspended from -80°c on agar.

19. Clone 1c: re-suspended from -80°c on agar.

20. - 23. The construct Tituba animated under time-lapse ultra-violet microscophy post incubation at 37°c. Fed a broth of brain and heart.

31. Tituba in -80°c deep freeze awaiting further transformation.

EXHIBITION Images

24. Detail: hand-cast scrying mirror with Tituba projection.

25. Installation view: scrying mirror with projection, manipulated scientific glass on shelving and painted walls.

26. Detail: manipulated scientific glass and scrying mirror with projection.

27. Detail: shelving with manipulated scientific glass.

28. Detail: manipulated scientific glass on shelving.

29. Detail: manipulated scientific glass on shelving.

30. Detail: manipulated scientific glass on shelving.

INSTALLATION

Manipulated scientific borosilicate glass on shelving, hand-cast glass circular 'scrying mirror' with a circular projection constructed from 2,804 stills taken under ultra-violet blue light from time-lapse microscophy and walls painted with matt black theatre paint.

EXHIBITION

AV Festival, VANE Gallery, Newcastle-upon-Tyne, 2012.

Exhibition photography by Lindsay Duncanson, glass by Sarah Blood.

BIOGRAPHIES OF CONTRIBUTORS

Melanie Jackson

Melanie Jackson is an artist and a lecturer at Slade School of Fine. She is represented by Matts Gallery, London, UK.

Much of Melanies work has been concerned with localized practices that emerge around the flow of international capital. She is interested in experiences and ideas of corporeality, and their relation to the economies and technologies of the material. She utilizes material and immaterial modes of production such as storytelling alongside diverse tactics of art-making and construction. She is currently investigating the relationships between nature and technology through a series of experiments with fauna and flora, and the technologies available to her.

Melanie Jackson and writer Esther Leslie have been collaborating on an investigation into the impulse for transformation and novel forms. Contemporary science re-imagines biological and chemical function as an engineering substrate, a complex fully programmable animate object, opening up a potential for us to “grow” any form. Goethe's idea of the Urpflanze - a primordial plant that contains within itself an infinity of potential forms - recurs startlingly in the present moment when matter, from the molecule up, is coerced to adopt fantastical forms.

The Urpflanze (Part 2) is a new sculpture and film installation, the second and concluding part of an investigation into mutability and novel forms through speculations that begin with plant technology. (*The Urpflanze* Part 1 was staged at The Drawing Room in London in 2010). Recent solo exhibitions include *The Urpflanze* (Part 1), The Drawing Room, London (2010) Road Angel, Arnolfini, Bristol (2007), Made In China, Matt’s Gallery, London (2005). She won the Jerwood Drawing Prize in 2007. Jackson's *Urplanze* (Part 2), commissioned by The Arts Catalyst, will be presented at the John Hansard Gallery in 2013.

- Artists website - http://www.melaniejackson.net/
- Matts Gallery - www.mattsgallery.org/artists/jackson/home.php

Dr. Wendy Smith

Dr. Wendy Smith is a researcher specialising in molecular cell biology, particularly in bacteria cell biology working in specific area’s which include transcription and translation, chromosome replication and bacterium-host interactions. Currently Wendy works in Synthetic Biology with both 'gram positive' and 'gram negative' 'Escherichia-coli' (E-coli) and 'Bacilus Subtilis' bacterium at Newcastle University where she manages a research 'wet' laboratory with the 'Synthetic Biology Research Group'.

Her previous posts included working with Streptococcus Bacterium and Necrotizing Fasciitis. Wendys research was recently published with collaborators as an article in the Journal of 'Molecular Oral Microbiology- Streptococcus pyogenes infection of tonsil explants is associated with a human B-defensin 1 response from control but not recurrent acute tonsillitis patients', (2012).

The 'Synthetic Biology Research Group', is part of 'Integrative Bioinformatics' integrating bioinformatics, systems and synthetic biology. The group includes researchers and students from a wide variety of disciplines including Computing Science, Molecular Biology, Microbiology, Genetics and Engineering. In 1998 the group won a Gold Medal at iGEM (international Genetically Engineered Machines) competition, Cambridge, Massachusetts, USA and are one of the few groups undertaking research in this area. Led by Prof. Anil Wipat, the group work at the worlds first major research centre on the molecular and cellular biology of bacterial cells- the 'Centre for Bacterial Cell Biology', a category 3 laboratory at Newcastle University.

- Integrative Bioinformatics - http://bio-nexus.ncl.ac.uk/pages/projects.html
- Centre for Bacterial Cell Biology - http://www.ncl.ac.uk/cbcb/about/

Sneha Solanki

Sneha Solanki is an artist and repeatedly works with technology and science as a language, aesthetic and as a major influential agent in society. Her works and curatorial events aim to investigate and function in parallel to technological determinism by regularly employing methods of cultural agency, citizen science and surveillance. She has made works from the invisible signals from military bases, with plants and with computer viruses, extending to installation, sound, image, web and performance. Her practice often draws from specific historical periods in time, as a point of reference, and also as a marker questioning the neutrality and immateriality of technology.

For over ten years and until early 2012, Sneha also co-directed an artists led organisation- Polytechnic which emphasised open and distributed approaches to art an technology, producing a series of events and workshops.

After a long term interest in technology mediating and manipulating life Sneha created a synthetic life from data- 'Tituba' for Super-natural' at the 'Center for Bacterial Cell Biology', Newcastle University during an artists' residency with the 'Synthetic Biology Research Group'. Connecting the recondite modes of witchcraft and Synthetic Biology *Super-natual, pt.1* was shown in its' first incarnation during the AV Festival, VANE Gallery, Newcastle-upon-Tyne, 2012.

Sneha is currently a nominee for the 2013 Northern Arts Prize, Leeds, UK. Previous exhibitions include; *Test Tube Food*, Our Land is Your Land, CCA, Glasgow, UK; *Field Recordings*, Spectropia, Riga, LV; *Reclaiming the Nostalgia of Kitchen Science*, Open_Sauces, Brussels, BE; *The_Lovers*, Museum of Modern Art, Belgrade, CS and Brown University Watson Institute, Boston, USA.

- Artists website - http://www.electronicartist.net/solanki/
- Super-natural - http://super-naturalproject.org/