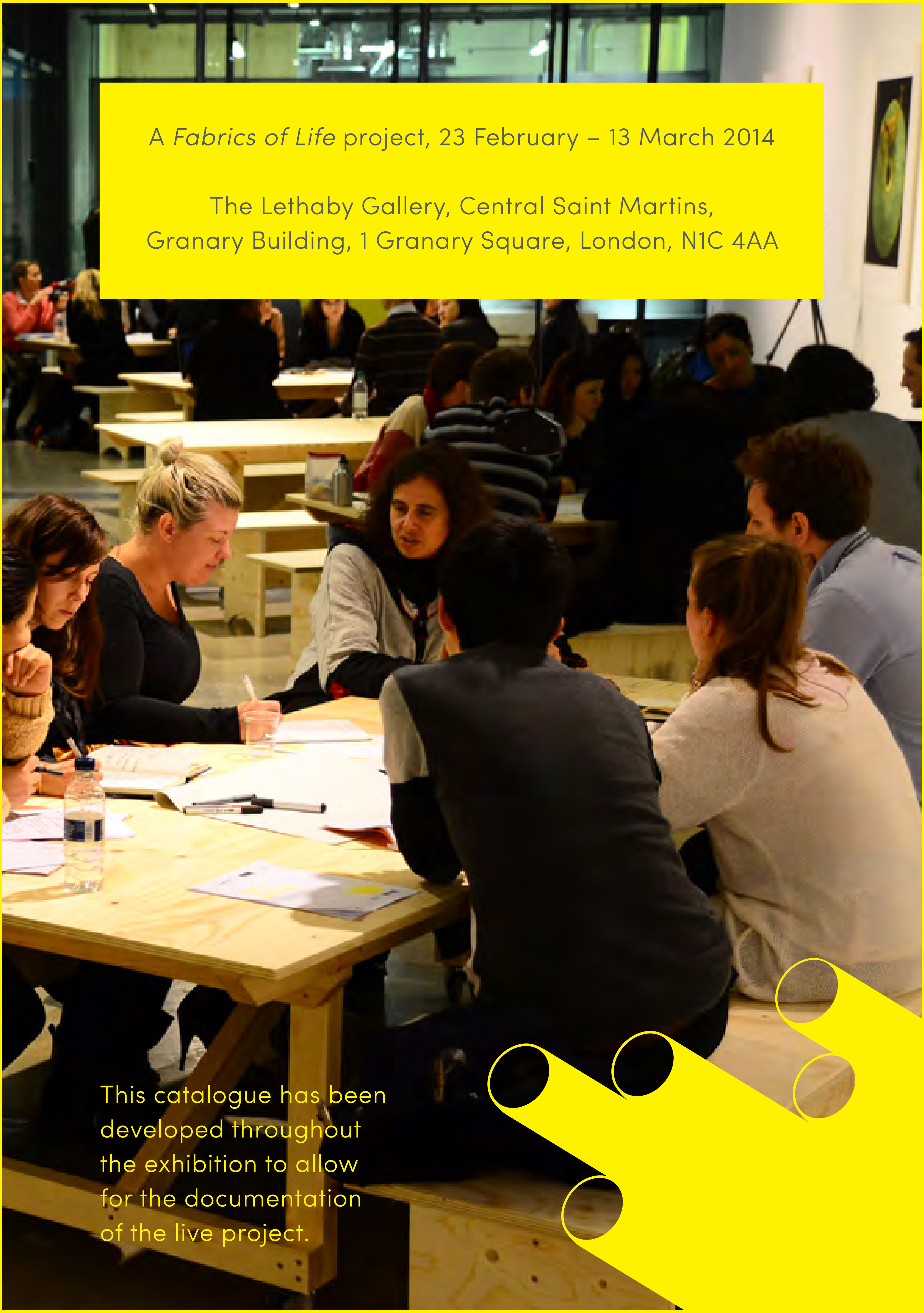
BIG DATA

Designing with the materials of life



A *Fabrics of Life* project, 23 February – 13 March 2014

The Lethaby Gallery, Central Saint Martins,
Granary Building, 1 Granary Square, London, N1C 4AA

This catalogue has been developed throughout the exhibition to allow for the documentation of the live project.

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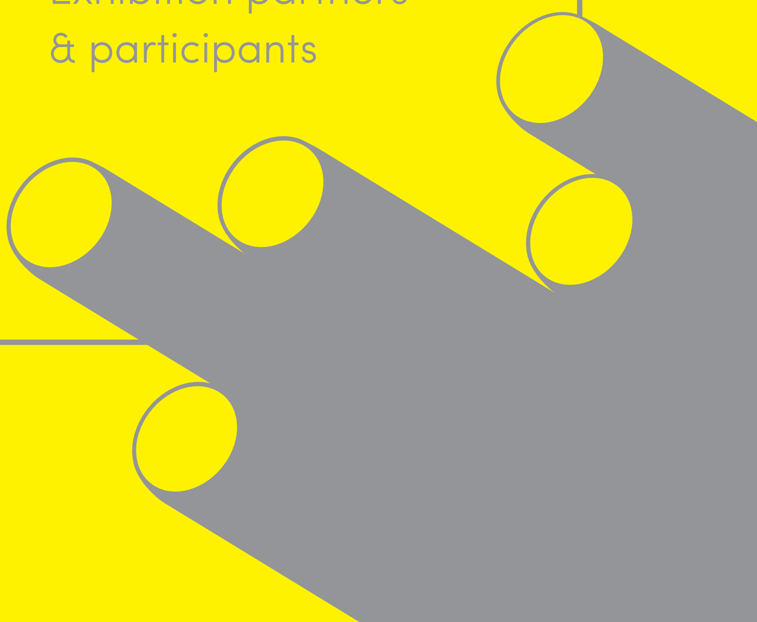


00 A DESIGN JOURNEY INTO BIOLOGICAL SCIENCES

What can designers learn from interacting with scientists? Can the study of biological systems generate new perspectives on design? These key questions encapsulate the premise of our on-going collaboration with the MRC Clinical Sciences Centre. Since the Nobel Textiles project at the ICA in 2008, we have been working on other cross-disciplinary initiatives such as Nobelini (Dana Centre, 2009), as well as running regular *Fabrics of Life* projects, which expose designers to contemporary biomedical research.

This catalogue showcases *Fabrics of Life* 2014, a project on the theme of big data which has taken place in its entirety within the Lethaby Gallery at Central Saint Martins in London. This year, for the first time we have invited the public to witness the secrets of design thinking and making throughout the three-week project. The 2014 project, entitled: Big Data: Designing with the Materials of life, explores the growing challenges of processing, editing and storing large amounts of digital data.

The exhibition is curated in two parallel formats:

01 A design exhibition featuring biologically-driven design narratives, including work from Ann-Kristin Abel, William Bondin, Natsai Chieza, Amy Congdon, Ruairi Glynn, Rob Kesseler and Ollie Palmer.

02 *Fabrics of Life* 2014, a live project created by designers from MA Textile Futures (Central Saint Martins, UAL) and architects from the Interactive Architecture Lab (RC3, the Bartlett School of Architecture, UCL). Groups of students have dedicated three weeks to transform ideas from big data biology into blueprints for design futures.

Their work has been documented over the duration of the project culminating in this publication.

Carole Collet, Reader Textile Futures, Deputy Director TFRC, Central Saint Martins UAL

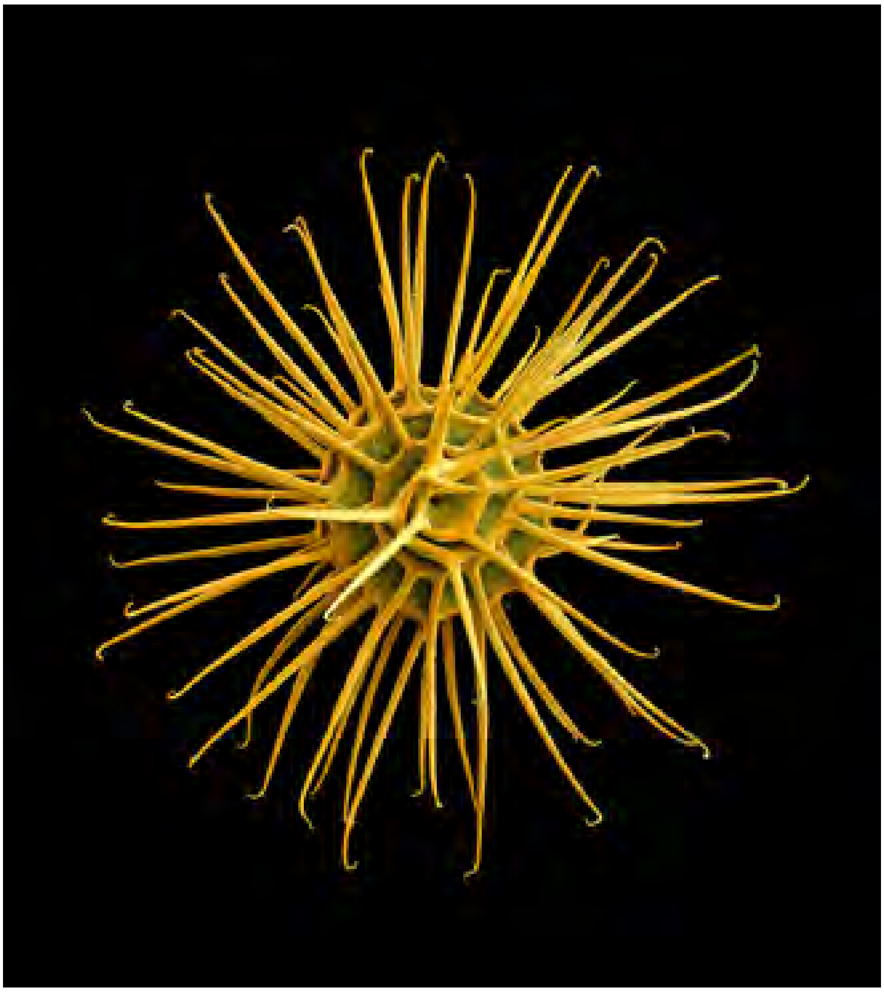
Brona Mcvittie, Head, Public Engagement, Media & Grants, MRC Clinical Sciences Centre

Ann-Kristin Abel
William Bondin
Natsai Chieza
Amy Congdon
Ruairi Glynn
Rob Kesseler
Ollie Palmer

01 BIG DATA: DESIGNING WITH THE MATERIALS OF LIFE: EXHIBITION

ROB KESSELER

Phytopia
2012



^ *Medicago arborea* - Tree medick
Hand coloured micrograph.

< *Medicago minima* - Bur medick
Hand coloured micrograph.

Seeds are the most complex organs plants ever produce and a major keystone in the evolution of land born species. The diversity of their shapes and sizes is seemingly endless, packed into which is the complete genetic information needed to give rise to a new plant. Using the exceptional resolution of Scanning Electron Microscopy, even the tiniest seeds reveal complex form and structural appendages to assist with their dispersal. Inherent in the research was the development and use of colour as both an informative and emotive tool beyond the limitations of the false colouration characteristic of most science imaging. Through a process of multiple layering, addition and erasure, the application of colour introduced an artistic sensibility intended to create a sense of awe, with the dual purpose of extending knowledge within the respective fields of art and science, thus revealing the hidden complexities of nature to new audiences.

Medicago minima

Typical of the genus *Medicago* (87 species) the carpel is coiled into a spiral of 4-6 turns. With its spherical shape and hooked spines it is well adapted to attach itself to furry or feathery animals as a means of dispersal. Original diameter 8mm.

Medicago arborea

Typical of the genus *Medicago* the carpel is coiled into a spiral of 1-2 turns. As a tall shrub it is unlike the other members of the family and its dispersal relies more on branch agitation from wind and animals. Original diameter 12mm.

With support from Central Saint Martins and the Royal Botanic Gardens Kew.

OLLIE PALMER

^ Testing Ant Ballet: Phase I in a forest near Barcelona, July 2011.

A colony of ants are tricked into following artificial trails they did not create, laid by a machine they cannot see.

Using synthesised pheromones– the chemicals through which ants communicate– the behaviour of a colony of ants is subverted and influenced beyond their control.

The Ant Ballet is literally a theatre of the absurd, a performance space in which the desires of an entire colony are manipulated and entangled with those of another– all without the knowledge of the players.

Ant Ballet is a project divided into four phases. Phase I (shown here) demonstrates that ants will follow artificial versions of their own trail pheromones. Phases II–IV will use this technology to explore issues of control and communication over a number of years.

This project asks viewers to reflect on their relationship to control systems, free will, and our mechanistic viewpoint of the world. The Ant Ballet machines directly hack into ant communication protocols, tricking ants into thinking that they are being passed trail messages by other ants. As humans, we can see that the machine is in control. If we could shift our perspective, could we ever tell if something larger were playing the same trick on us?

Developed in the Interactive Architecture Lab at the Bartlett School of Architecture. Project supervisors: Ruairi Glynn and Stephen Gage.

With the assistance of: The Zoological Society London, Pestival, UCL Organic Chemistry, DuPont® Corian®, Universita Autonoma Barcelona, FutureEverything.

Thanks to: Heechan Park, Helen Floate, Bridget Nicholls, Prof. Jim Anderson, Jack Bestwick, Dr. Seirian Sumner, Abi Palmer, familias Prieto-Botella y Colet-Castaño, Xavier Esplander.

ANN-KRISTIN ABEL

Thought Harvester

2013

^ Harvester on platform pre-connection.

^ Process of creation post-synchronisation between human and Harvester.

The human mind is a thought factory, producing around 70.000 thoughts per day. Imagine a device that could physically harness this boundless energy and the instantaneous nature of a thought to aid and innovate the process of creation.

Based on research into cerebral organoids– miniature brains grown in a spinning bio-reactor - the device is part artificial and part organic. It connects to the user via the central nervous system, sending and receiving impulses, essentially forming a symbiosis between two organisms.

Synchronisation is achieved when the device and the human brain merge. The Harvester, helping the mind to focus, feeds the designer with relevant research and allows him to explore material properties such as shape, colour, weight and other visual and haptic information. This virtual yet physical approach could lead to a more organic and intuitive process of making.

Photography by Robert Klebenow, special thanks to Amy Congdon and Anne-May Abel.

RUAIRI GLYNN

Fearful Symmetry – Tate Modern

2013

< Primitive in appearance, to avoid figuratively inferring life, a piercing glowing tetrahedron glides through the air, swooping down to play with visitors and fleeing up and away if too many get close.

What part of us, willingly projects life into things that in all common sense are not alive? In objects of all shapes and sizes, even the faintest expressions of purposeful behaviour can irresistibly bring them to life in the eye of the observer. In a world increasingly inhabited by artificially intelligent systems, contextually aware gadgets, sensory spaces and robotic agency, will our sense of our built environment as inert and lifeless change to one rich in synthetic personalities, and forms of artificial life? Bringing together Psychology research of the perception of animism, with Puppetry techniques, Interaction Design and Robotics, an interactive installation titled 'Fearful Symmetry' was exhibited at The Tanks gallery at Tate Modern in 2012.

Built with the Support of Bartlett School of Architecture, UCL Centre for Robotics Research, KCL Product Design Engineering, Middlesex University.

Lighting Sponsor: Lumitec AG. Team Robotics: Vahid Aminzadeh (KCL) & Alex Zivanovic (Middx Uni). Computer Vision: Paul Ferragut & George Profenza (UCL). Mechanical Engineering: Neil (Spike) Melton (Middx Uni). Sound Design: Emmett Glynn & Sam Conran. Light Engineering: Lianka Papakammenou (UCL).

AMY CONGDON

Biological Atelier: 2082

2011-2014

^ AW 2013 'Haute Bacon' collection (Bracelet) Decellularised back and streaky bacon, bone powder and pearls.

Biological Atelier: 2082 presents a vision of the imagined future fashion showroom.

The installation is composed of three seasonal collections from the A.C. Atelier: Spring Summer 2082 'Extinct' collection, Autumn Winter 2082 'Bio Nouveau' collection, and Autumn Winter 2013 'Haute Bacon' collection- taken from the archive.

The 'Haute Bacon' collection (pictured) is made using a technique called decellularisation; a process developed for regenerative medicine purposes that involves removing the cells from an organ, leaving behind the extracellular matrix. This material has been subsequently treated using various textile techniques such as dyeing, tanning and weaving.

All three collections suggest a new way of producing luxury fashion, combining textile techniques with tissue engineering. The project considers the shifting role of the designer, the craftsman and the scientist in our biotechnological future. At some point in the not-too-distant future, biotechnology will afford designers the biggest set of complex new materials and tools they have ever had the opportunity to work with. As a speculative design project, 'Biological Atelier' explores what these emerging living materials and tools will mean for design.

The project envisions a world where materials are not made, they are grown; where new luxury materials are fashioned from cells, not fabrics.

Photography by J.J. Hastings

This work is part of a practice based PhD being carried out at the Textile Futures Research Centre at Central Saint Martins, and is in collaboration with Kings College London.

WILLIAM BONDIN

Inherent Motives

2012-2013

^ Temporal geometries performed by a mobile tetrahedron.

Inherent Motives is a design research project addressing the inconsistencies between simulation and the performance of physical objects in the realm of dynamic architecture. A series of objects and performances were developed in relation to this subject, one of which is called MORPHs.

MORPHs, short for Mobile Reconfigurable Polyhedra, are autonomous architectural structures which can crawl and self- assemble in order to inspire social interaction through play. These playful robotic creatures encourage the public to choreograph them into dance routines, assemble them into complex sculptural geometries or else play music at them, which they will play back over time. Groups of people can interact at any one time and eventually develop a dialogue amongst participants, through the use of contemporary digital technology.

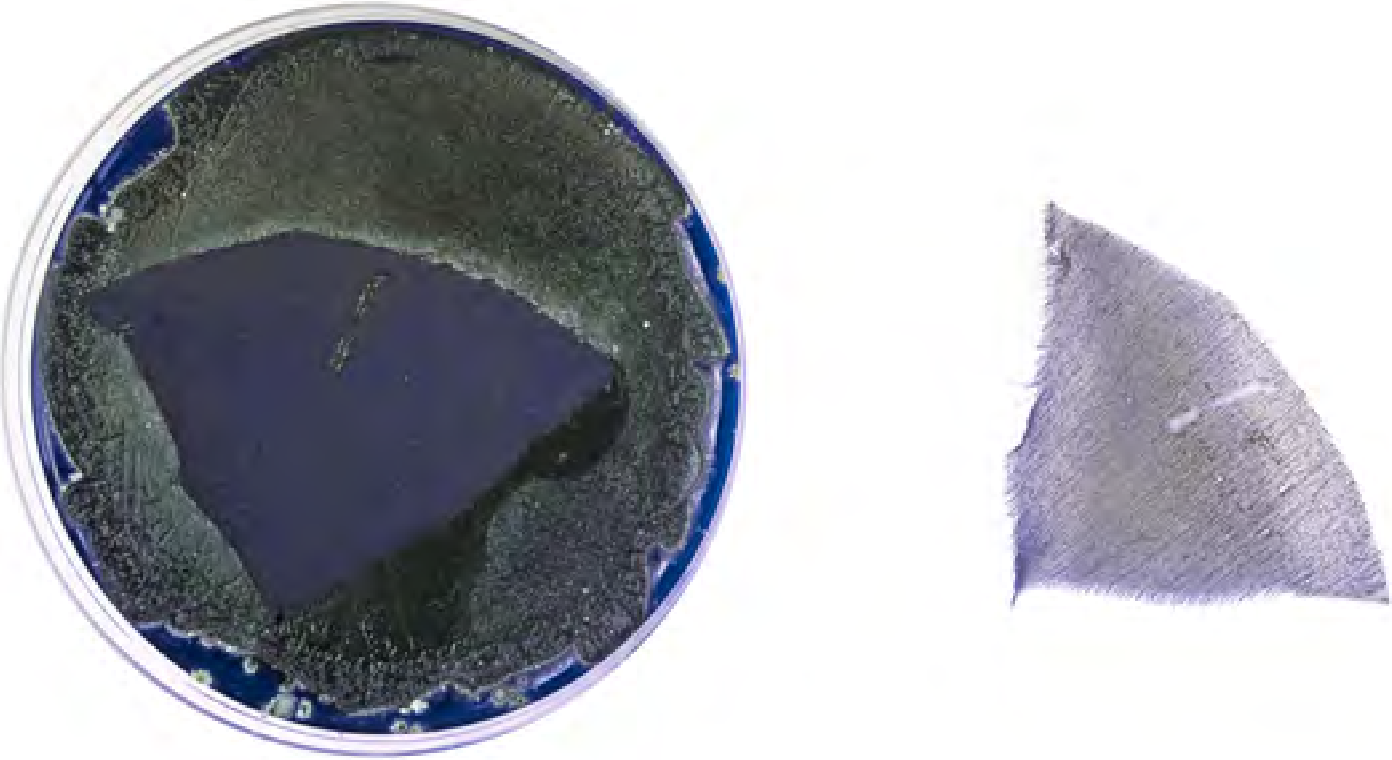
The behaviour is inspired by the slime mould *Physarum polycephalum* and its display of collective intelligence without representation. As architectural creatures, they are designed to operate on an architectural time scale, where events occur really slowly. Like contemporary nomads, they travel across landscapes and meet people and other structures with whom they develop dialogues. In turn, these experiences will teach them new information about their world, to which they will adapt or react.

With thanks to Ruairi Glynn, Sam McElhinney, Ollie Palmer, Paul Harkin, The Bartlett School of Architecture and The Malta Arts Scholarships.

NATSAI CHIEZA

Faber Futures: The Rhizosphere Pigment Lab

2013-2014



^ Silk organza is dyed navy blue by *Streptomyces coelicolor.*

The Rhizosphere Pigment Lab is the first of the Faber Futures series exploring the emerging protocol unique to the designer whose craft is developing in the science laboratory. This research project considers the potential of bacteria as a material for design, and is in collaboration with Professor John Ward, Structural Molecular Biology (UCL). Articulated in the installation is the novel process Natsai and John have established to determine what unique colours plants might provide within their micro-ecosystem, and how to train viable isolates to dye fabric.

Hosting millions of plant-specific microorganisms (often through symbiosis), the soil surrounding a plant's root system provides a rare opportunity to 'colour hunt' by botanical species. Now a living factory, these micro-ecologies transform pure silk fabrics with their programmable colour palettes and distinctive metabolic patterning.

Supported by: Heimtextil (Frankfurt), Department of Biochemical Engineering University College London (London), Textile Futures Research Centre (London).

EXHIBITION PRODUCTION TEAM

Curator: Carole Collet
Assistant Curator: Natsai Chieza
Graphic Design: Laura Gordon
Art Direction: Caroline Till

Gallery Manager: Peter Cleak
Production Team: Andrew Baker, Paul Murphy, Colin Buttimer, Arya Fathi, Annie Cooper.

With thanks to Kieren Jones and Nelly Ben Hayoun (MATF), Ruairi Glynn (IA Lab) and Louisa Bailey (Luminous Books).

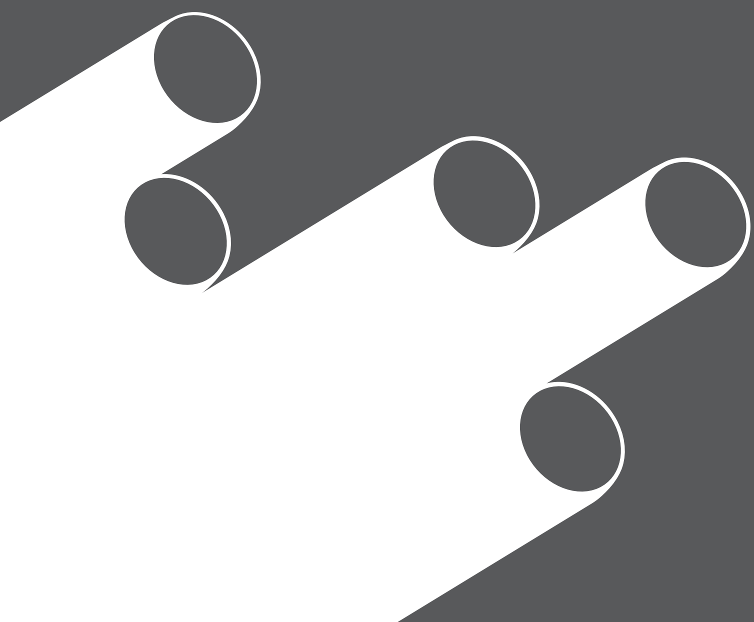
02 FABRICS OF LIFE 2014: THE WHY & THE HOW

“SHAKESPEARE’S SONNETS AS DNA LOOK LIKE A TINY SMUDGE OF DUST”

Ewan Birney,
European Bioinformatics Institute
(EMBL-EBI)

For the past six years the Medical Research Council’s Clinical Sciences Centre has worked with MA Textile Futures to devise a series of F*abrics of Life* projects that bridge the worlds of biology and design. Through these projects designers have developed an emergent practice to translate biological principles into blueprints for design futures. *Fabrics of Life* 2014 explores some of the big challenges presented by big data in the biomedical spectrum. Designers from MA Textile Futures, Central Saint Martins together with architects from the Interactive Architecture Lab, RC3 (the Bartlett School of Architecture, UCL) have spent three weeks in the Lethaby gallery at Central Saint Martins developing design proposals that explore issues related to big data within the context of sustainability.

This project enables young designers to engage with contemporary biomedical research to explore new directions for sustainable design. New design methodologies arise from the cross pollination of design, architecture and science. You are invited to witness this journey across the following pages.



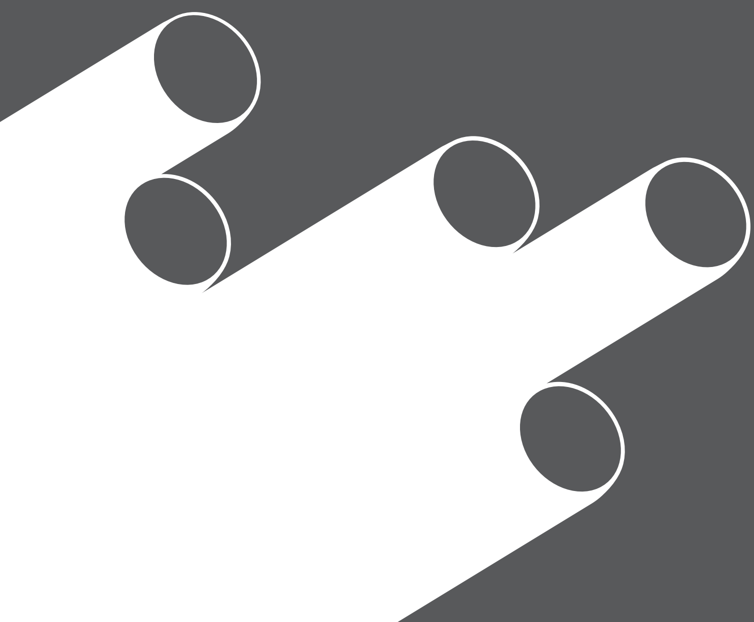
WHY BIG DATA?

> **"ONE GRAM OF DNA CAN STORE TWO PETABYTES OF INFORMATION"**
>
> Ewan Birney,
> European Bioinformatics Institute
> (EMBL-EBI)

Technological advance and increases in computational methods allow research scientists to probe ever larger datasets. Big data focuses on the exploration of patterns between datasets that can help to predict trends. Data storage is a prescient issue, not only for scientists, but professionals in every other industry.

All the digital data we produce requires an ever increasing number of data centres, packed with energy-hungry servers that contribute to large amounts of CO^2 emissions. This kind of digital storage is limited, but biology may provide a new solution. Recently scientists have stored all of Shakespeare's sonnets in DNA, along with 26 seconds of Martin Luther King's 'I have a dream' speech, and Watson and Crick's paper on the structure of DNA. Scientists are also considering a whole range of unlikely solutions such as storing data in live vectors like bacteria. But perhaps the idea is just too strange: Martin Luther King, more than forty-five years after his assassination, living on in a bacterial smear?

These kinds of scientific experiments are beginning to create a new bio-tech landscape for design. Yet few designers are able to understand how to work with biological systems. Here we explore big data as a key driver of new tools and methodologies for sustainable design fostered by the hybridization of design and biology.



SCIENCE SYMPOSIUM

The *Fabrics of Life* 2014 edition kicked off with a scientific symposium featuring a series of talks from leading research scientists. Each speaker then brainstormed with a team of designers to help them develop design concepts. A science demonstration day followed the symposium giving the designers a chance to carry out a series of hands-on experiments.

SYMPOSIUM PROGRAMME

Wednesday 22nd Jan
Lethaby Gallery
Central Saint Martins

Introduction
Carole Collet (Reader Textile Futures, Central Saint Martins) & Professor Amanda Fisher (Director, MRC Clinical Sciences Centre)

Colouring our chromosomes
Anne Ferguson-Smith: *Department of Physiology Development and Neuroscience, University of Cambridge*

The secret life of plants
Ueli Grossniklaus: *Plant Developmental Genetics, Institute of Plant Biology, University of Zurich, Switzerland*

Spying on slimemould genes
Jonathan Chubb: *MRC Laboratory for Molecular Cell Biology, University College London*

Fly food
Irene Miguel-Aliaga: *Gut Signalling and Metabolism, MRC Clinical Sciences Centre, Imperial College London*

Brainbase
Aldo Faisal: *Brain & Behaviour Lab, Department of Bioengineering, Imperial College London*

The big heart
Antonio de Marvao: *Cardiovascular Magnetic Resonance Imaging and Genetics, MRC Clinical Sciences Centre, Imperial College London*

Design brief
Carole Collet, Caroline Till and Ruairi Glynn

Workshop
Speakers brainstorm with small groups of design students. Professional designers facilitate groups to conceptualise science in design form.

SCIENCE DEMONSTRATIONS

Thursday 23rd Jan
Lethaby Gallery
Central Saint Martins

Fly demo
Dafni Hadjieconomou, Marion Hartl and Jake Jacobson *(Gut Signalling and Metabolism, MRC Clinical Sciences Centre, Imperial College London)* explain how the fruit fly *Drosophila melanogaster* can be used to study diet and nutrition.

DNA demo
Carole Collet demonstrates how easy it is to extract DNA.

Motion-capture demo
Pedro Rente Lourenco *(Brain & Behaviour Group, Imperial College London)* explains how his team uses motion capture body suits to study movement and the brain.

Worm demo
Esther White *(University College London)* explains how the worm, *Caeonorhabditis elegans*, moves around and responds to its environment.

Brain cell demo
Lucien West *(Neuroplasticity and Disease Group, MRC Clinical Sciences Centre)* helps students get an insight into brain research.

Slime mould demo
Brona McVittie *(Head, Public Engagement, Media & Grants, MRC Clinical Sciences Centre)* helps students find out more about *Dictyostelium* (sample courtesy of Jonathan Chubb's lab).

DESIGN BRIEF

Following the scientific contributions, we asked the following key questions:

> How will the ability to interrogate and manipulate big data and biology impact the future of design?

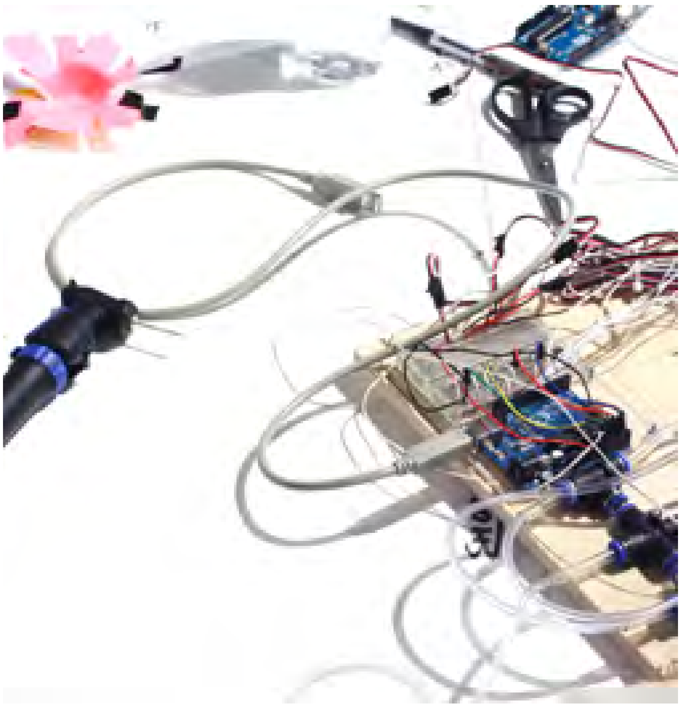
> Can designers embrace biological technologies to harness and exploit big data, while maintaining the pursuit of a sustainable design future?

> When living materials become carriers for our data, what systems do we design, what applications and interactions emerge?

Each design team was tasked with developing a future design scenario in response to one of the scientific presentations. For the first few days the teams worked on wall sketchbooks to articulate a specific design question. This was followed by an intense week of design prototyping and story-boarding to prepare an animated design scenario presented in a final design critique on Wednesday the 12th of February.

These projects are featured in section 3 of the catalogue.

DESIGN IN PROGRESS

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EXHIBITION

PRIVATE VIEW

Photography: Brendan Bell

FABRICS OF LIFE 2014 PROJECT TEAM

Fabrics of Life 2014 was coordinated by Brona McVittie, Head of Public Engagement at the MRC Clinical Sciences Centre and Carole Collet, Reader in Textile Futures at Central Saint Martins UAL

Science Facilitators

Madan Babu, PhD
Programme Leader,
MRC Laboratory of Molecular Biology, Cambridge, UK

Harry White
University of Exeter. Harry also completed the MA in Industrial Design at Central Saint Martins

Design Facilitators

TFRC, Central Saint Martins, UAL

Carole Collet
Reader in Textile Futures

Natsai Chieza
Designer, Research assistant

Amy Condgon
Designer and PhD candidate

MA Textile Futures, Central Saint Martins, UAL

Caroline Till
Course Leader

Kieren Jones
Academic Coordinator

Nelly Ben Hayoun
First Year Tutor

Interactive Architecture Lab, RC3, The Bartlett School of architecture, UCL

Ruairi Glynn
Lecturer, Head of IA Lab

Ollie Palmer
Tutor

William Bondin
Tutor

Bespoke Care
Brain Material
The Engineers
Living Maps
Meridian 12
Bespoke Memorializations

03
BIG DATA LIVE PROJECT: 6 DESIGN PROPOSALS

BESPOKE CARE

THE BIG HEART

Scientific Research
by Antonio de Marvao

Cardiovascular Magnetic Resonance Imaging and Genetics, MRC Clinical Sciences Centre, Imperial College London

Heart and cardiovascular diseases are the leading cause of death globally. The vast majority of these deaths are caused by coronary heart disease (heart attacks). But many of them are genetically inherited conditions called cardiomyopathies. In the UK alone, 12 apparently fit and healthy people under the age of 35 die every week from conditions such as Dilated Cardiomyopathy or Hypertrophic Cardiomyopathy.

Today scientists have more powerful tools to analyse the human heart than ever before. Antonio is working on a project to characterise the human heart by studying 1500 healthy volunteers. Using MRI scans of their hearts he is building a 3D model that enables the visualization and detailed analyses of different physical characteristics. Wall thickness and muscular movement in each heart is measured at 16,000 different points. These data are then linked up to genetic information to reveal more about how genes determine cardiac shape, size and function.

www.csc.mrc.ac.uk/Research/Groups/IB CMRGenetics

BESPOKE CARE

Design Response,
Scenario Year 2030

Will big data gathered from our own bodies allow future healthcare to be self-administered? What are the psychological and ethical implications of trusting big datasets?

The potential value of harnessing big data in healthcare is the ability to provide a personalised service featuring precise assessment of health risks, early diagnosis, and more effective drug prescriptions. We explore how this could affect the space between wellness and sickness in the form of self-administered preventative care.

The growing trend in people searching the internet to probe their symptoms, or tracking their own physiological data with an array of devices, demonstrates that people are looking for ways to manage their health before seeking local medical support. How might we interact with a system that gathers and analyses our big bio-data, and offer treatment with minimal effort at home?

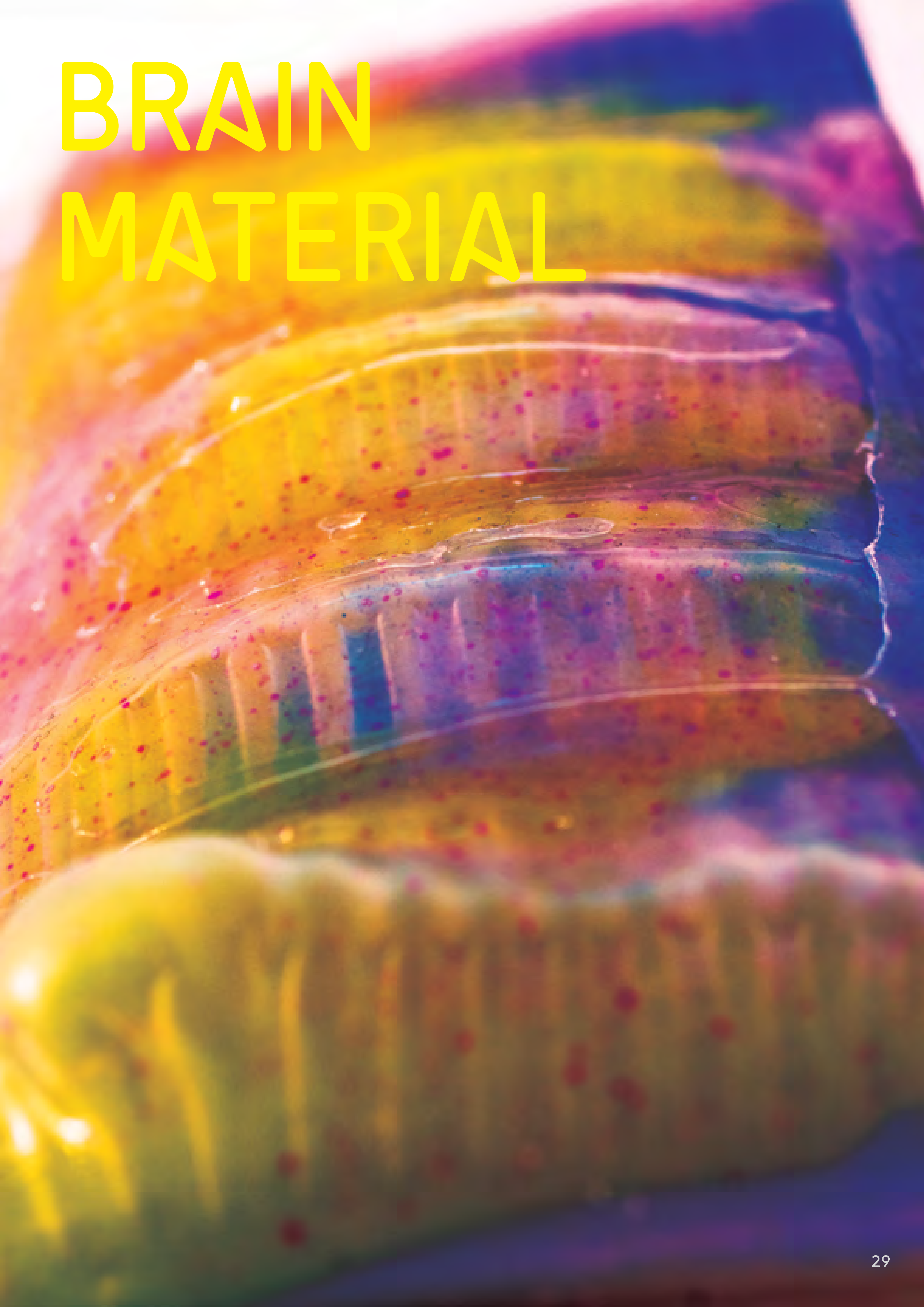
We have designed a system where data indicators from our bodies (hormone levels, blood sugar, blood pressure, nutrient levels, infections, etc.) could be stored along with our genetic information and analysed to provide early warnings of potential problems. The system includes a personalised care kit with medication and supplements that are acquired via subscription and self-administered for the prevention and treatment of conditions, which are not fully explained to the patient.

We are most interested in the experience and psychology of using such a system. We propose that access to these data could eventually become overwhelming and stressful, and that with growing trust in the system some users would choose to know less and less about what they consume. Would wellness be improved if we can self-medicate without having to know what ails us? If we place increasing levels of trust in the algorithms that analyse big data, then what is lost as we "upgrade"?

Students: Maritta Nemsadze, Zhixin Zhao, Ran Xie, Ran Lu, Elysia Evers Wilson

BESPOKE CARE

BRAIN MATERIAL



BRAINBASE

Scientific Research
by Aldo Faisal

Brain & Behaviour Lab, Department of Bioengineering, Imperial College London

Fusing neuroscience with technology, Faisal's research team uses computer science, physics and engineering to study how the brain works. In his own words, "We study both machine learning systems and biological brains: learning from the brain how to advance technology, and vice versa use advanced technology to reverse-engineer the brain – we call it 'Neurotechnology'."

Faisal's team works with huge datasets, generated for example by using a motion capture suit to measure the movement of our limbs. With almost 50 motion sensors, the suit traces body movements in incredible detail. They'd like to harness the variability in this form of big data to create solutions for patients with neurodegenerative disease.

Aldo's team studies movement, the only behavioural output from our brains that we can measure.

http://www.faisallab.com

BRAIN MATERIAL

Design Response,
Scenario Year 2020

How can we use brain activity to control material behavior?

Over the ages there have been many myths of people born with strange telekinetic powers. A psychic ability allowing a person to influence a physical system without physical interaction - to move objects, change shape, even levitate.

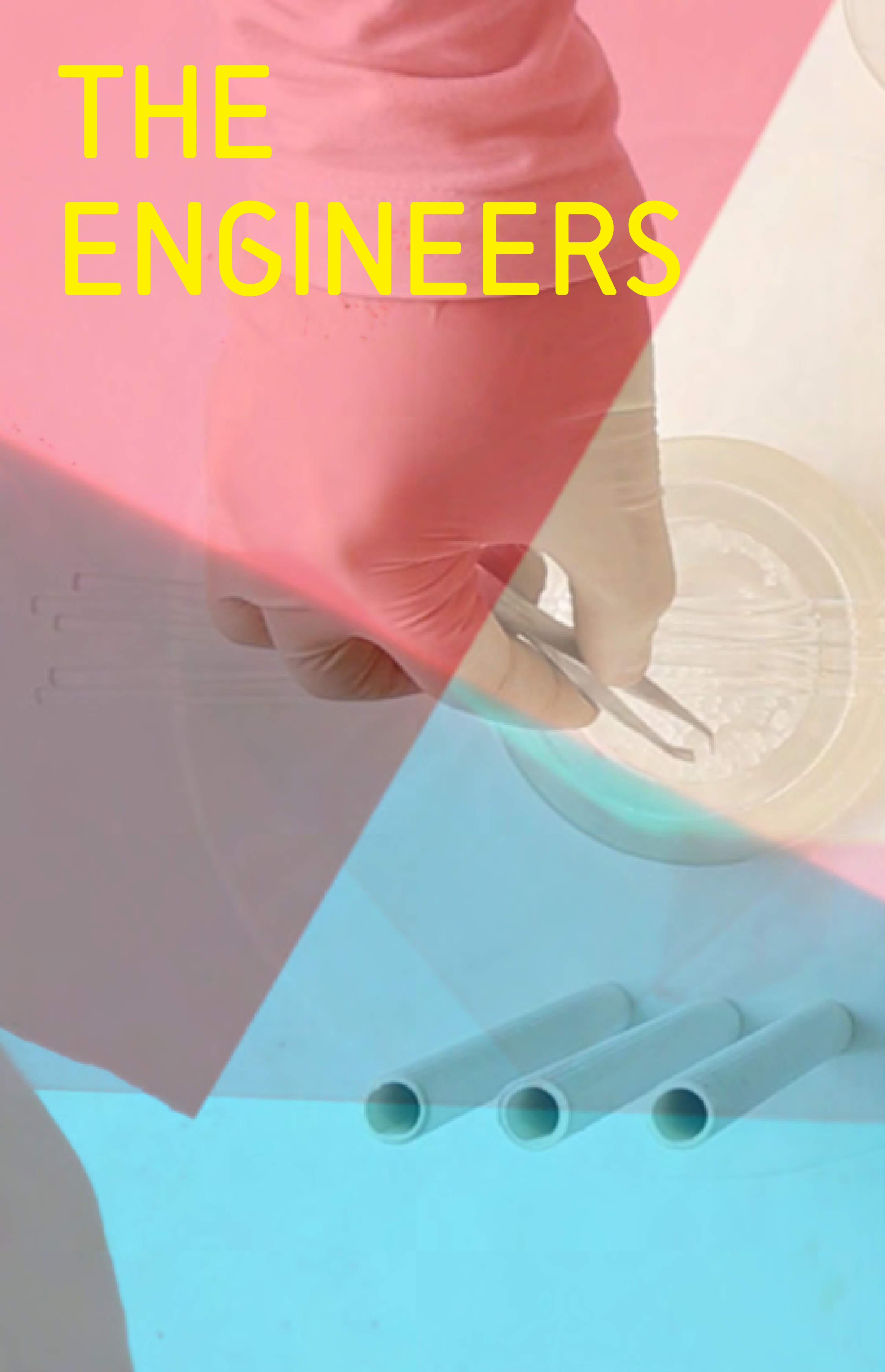
As robotic applications for the built environment bifurcate, space is becoming increasingly motive – from fine scale, micro-actuated composite materials, up to adaptive building facades. As the resolution with which buildings detect and interpret human behaviour increases, we can anticipate sophisticated reciprocal gestures from our built environment – as delicate and deliberate as those made by its inhabitants. Through the coupling of high definition sensing and actuation, space will become evermore animate – perceptively possessing a life of its own, populated with agency, in constant conversation with its surrounding.

The project examines the application of brain waves to the manipulation of material behaviour. Could we begin to control the world around us with just a thought? Could our materials anticipate and adapt to our needs? This speculative project of physical experiments suggests a softer more responsive future architecture.

Students: Rebecca Cooper, RU CHEN (Hailey), Caroline Angiulo, Lin Zhang (Charlie), Gejin Gao (Helen), Bijing ZHANG (Becky)


> PLAY

THE ENGINEERS



COLOURING OUR CHROMOSOMES

Scientific Research
by Anne Ferguson-Smith

Department of Physiology Development and Neuroscience, University of Cambridge

The Human Genome Project was a mammoth feat, yet the genome is only one dimension of our molecular identity. Despite being stored in almost every body cell, most of the genome remains blissfully silent. In our brain cells relatively small numbers of genes are switched on; and a whole different batch is active in our liver cells. The identity of our cells is wrapped up in another code, a layer ontop of our DNA that mediates which bits get made into the stuff of our cells (proteins). Scientists call this code the epigenome. Along with many researchers across the world, Anne's team is trying to crack the epigenetic code.

Resolving the epigenetic code against the already sizeable banks of genetic code presents a number of challenges. How should scientists interpret these data? Does our increasing power to generate huge datasets make us wiser? What do these data all mean? Anne's team uses what researchers call 'genomewide next generation sequencing technologies' to help characterise epigenomes.

Anne's team is also trying to uncover why some genes are inherited in a silent way depending on whether they come from our mother or father.

www.pdn.cam.ac.uk/staff/ferguson/index.shtml

THE ENGINEERS

Design Response,
Scenario Year 2100

To what extent does current epigenomics research give rise to opportunities for social control?

'Big data' provides us with an opportunity to meaningfully model environmental data – to understand where crisis points lie, to predict when we will reach them, and to propose viable interventions for averting or mediating threats to humanity.

In the absence of a single political force to monitor and control global challenges such as population growth, temperature levels, carbon emissions and freshwater availability, there existed an opportunity for a powerful consortium to assume this role.

In the year 2100, a secret society called 'The Engineers' formed to confront this global and political inertia. By capitalising on advances in epigenomics, they began to release engineered viruses designed to modify the human genome. Each virus was programmed and colour-coded according to a specific environmental issue. For instance the Year of the Blue meant that anyone who contracted the virus that year was allergic to animal proteins, thus reducing the impact of the meat industry on the environment.

This project speculates on the potential of epigenomics to be used as a mechanism for social control.

Students: Ipek Kuran, Sunny Han, Alison Taylor, Roisin Johns & Zuzana Lalikova

THE ENGINEERS

LIVING MAPS

SPYING ON SLIME MOULD GENES

Scientific Research
by Jonathan Chubb

MRC Laboratory for Molecular Cell Biology, University College London

Slime mould may not seem an obvious candidate for scientific research, but this single-celled organism has become a powerful tool for understanding the molecular underpinnings of life. Jonathan Chubb's team use a species of slime mould called *Dictyostelium* to investigate the molecular basis of their cells' ability to unite with their neighbours in times of need. When food is aplenty slime mould cells happily hang out by themselves reproducing as they please. But when food runs short, they congregate into a 'slug' and work together to search for food and reproduce.

In the run up to slug formation, the cells begin to 'pulse'. Their molecular signal spreads in waves. Jonathan's team is trying to understand what's happening inside of individual cells at this time. Scientists can generate huge datasets measuring bulk readouts from cells, but how can they see through these big data to understand what's going on in individual cells? And how does 'pulsing' spread from cell to cell to allow these individual cells to become social?

Jonathan's team studies RNA, an output from DNA that helps to 'translate' this information into proteins (which have different functions inside the cell).

www.ucl.ac.uk/cdb/academics/jonathan_chubb/

LIVING MAPS

Design Response,
Scenario Year 2025

What if an organism invisible to the naked eye could generate a global-scale map of soil contamination?

Intensive farming, deforestation, and industrial processes spread toxic chemicals that cause widespread soil contamination. Even with today's technologies, mapping and treating contaminated soil is expensive and time consuming. Companies failing to follow legal protocols around waste disposal suffer heavy fines, but the tools to assess whether they are acting within these parameters are ineffective. This ultimately leaves the environment vulnerable to long term degradation.

Slime mould is a type of single-celled amoeba that lives in the soil. Capable of moving individually or collectively as a swarm, they use pheromone trails to communicate. Individual cells release pheromones based on their environmental conditions. When the pheromone trail gets intense enough the slime mould cells pile together to form a larger being.

This project suggests that in 2025 the use of a genetically engineered slime mould specifically rendered to be responsive to a bespoke set of polluting chemicals will be released into the wild. Slime mould programmed to indicate particular pollutants will also be modified to exude specific colourings. On finding intensive areas of contamination they will produce a coloured "smoke" – an enhanced version of their natural behaviour of reproduction where they release spores.

These colour signals visible and recorded on satellites across the world will provide a massive self sustaining sensory network generating big datasets of soil pollution on a global scale. This future scenario raises some interesting questions on its implications. Could this data be commercially exploited, and what of the geopolitical consequences?

Students: Stefanie Powell, Jaimme Guan, Marta Santambrogio, Ansha Jin, Shiori Aiba


>
PLAY


MERIDIAN
12

FLY FOOD

Scientific Research
by Irene Miguel-Aliaga

Gut Signalling and Metabolism, MRC Clinical Sciences Centre, Imperial College London

The fruit fly, *Drosophila*, is one of the oldest used model systems in biology. First used over a hundred years ago, the species became popular in labs because it is easy to breed and keep, so scientists can easily analyse large populations of flies. In fact, much of what we know about how genes work in humans was first outlined in flies. Scientists can today readily access the huge databases of information about fly biology online, and have identified many genes in common between flies and mammals. They even have the power to 'switch off' each of the 15,000 fly genes one by one. Irene's team uses flies to understand signalling in the digestive system, and how appetite is managed.

While we continue to generate big data, we are also fashioning big bodies, to the extent that obesity has now been labelled an epidemic. The human gut has around 500 million nerve cells, although we've not really looked into the role they might play in obesity. But it's not straightforward for scientists to research the way our brain talks to our stomach. In flies, the system is much simplified, yet fundamentally similar to our own. One of the ways that Irene's team researches diet in flies is to analyse pictures of hundreds of thousands of poos.

http://miguel-aliagalab.csc.mrc.ac.uk/

MERIDIAN 12

Design Response,
Scenario Year 2035

Could a 'second brain' be engineered to council our wellbeing?

Stress experienced in the UK at work and at home has steadily increased, affecting worker performance, anxiety levels and overall physical wellbeing. In 2012 alone, according to the NHS, stress-related hospitalization rose by 7%.[1] Crucially, many individuals fail to fully recognize the signals their body generates to indicate unhealthy levels of stress.

Inspired by the stomach, arguably our second most 'intelligent organ', the project aims to explore a way in which 'gut instincts' could be communicated more clearly.

Meridian 12 is a speculative luxury living stress monitor grown from the user's own stem cells. It requires the user to perform a daily health-check routine. First the user collects sweat from their palm using bio-sensor beads. These beads are then fed to Meridian 12 which will decifer stress levels and inflate to indicate when levels are too high to be healthy. Once aware, the user is empowered to make lifestyle changes.

1 http://www.hscic.gov.uk/article/2233/Hospital-admissions-for-stress-rise-by-seven-per-cent-in-12-months (accessed February 2014).

Students: Ying Shen, Angelene Fenuta, Mariah Wright, Sandy Tsai, Feng Chen


>
PLAY

BESPOKE MEMORIALIZA-TIONS

THE SECRET LIFE OF PLANTS

Scientific Research by Ueli Grossniklaus

Ueli's team works on DNA, RNA and protein in the context of cells, organisms and ecosystems

Plant Developmental Genetics, Institute of Plant Biology, University of Zurich, Switzerland

When it comes to storing DNA, plants are perhaps the greatest of biological hoarders. Common wheat, for example, hides away not one or two, but three copies of the genome in every cell. The secrets within take us back thousands of years to the wild ancestor of this modern crop plant. Ueli's research group is fascinated by the secret life of plants: how they have sex; how they can reproduce without sex; and how they can change from one generation to the next when their DNA stays the same.

Plant seeds are an extremely viable storage solution. Recently a plant was regenerated from a 32,000 year-old seed. Could plants provide novel solutions to storing big data?

www.botinst.uzh.ch/research/development/grossnik.html

BESPOKE MEMORIALIZATIONS

Design Response, Scenario Year 2040

Can our living memories be stored in DNA?

The desire to carve out proof of one's existence is very much a human one, as people have long used a variety of approaches to leave behind personal artifacts as a way of immortalizing themselves in memory. Nature has often been utilized to achieve this means through the creation and naming of new plant hybrids, such as when David Austin created the Rosa 'Royal Jubilee' to celebrate the Queen's Diamond Jubilee, ensuring that this moment in time could remain recorded and represented.

SeedGem is a service that provides bespoke memory storage in the form of plant DNA.

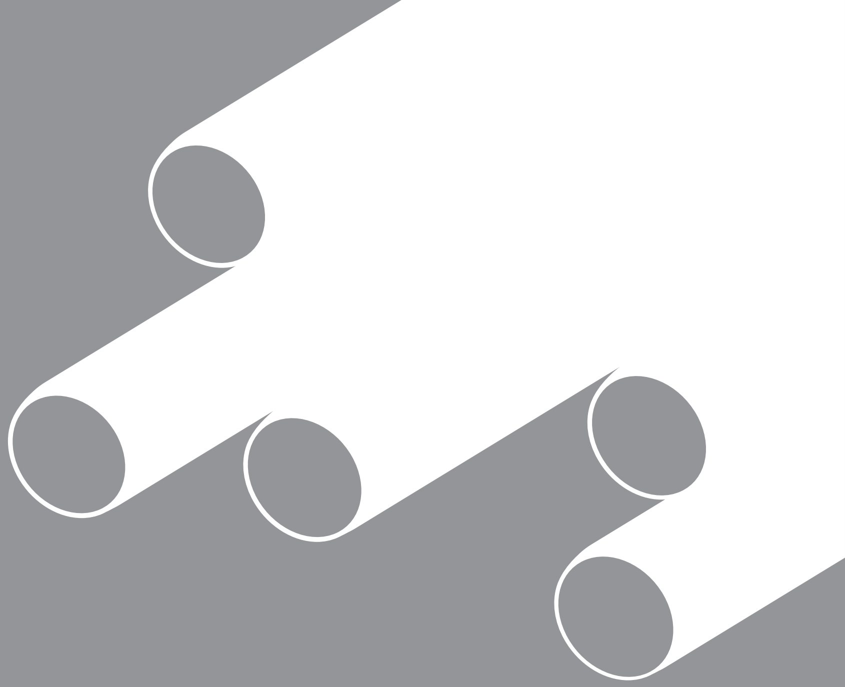
Through an online interface the user curates and uploads their life memories such as digital photographs and films. The user is then required to design a bespoke plant hybrid which will be engineered by SeedGem upon their death. This plant will contain their digital memories, converted and encoded in DNA form.

Their loved ones will inherit a memorial pod which contains the engineered seeds. The may choose to retrieve the data using the SeedGem decoder, or they may decide to sow the seeds and nurture the plant. This form of legacy enables a meaningful ritual for the remaining family members and friends, enriching the way a person is memorialised.

SeedGem also provides a further service whereby the seeds can be donated to a Seed Sanctuary which are located around the world in areas where reforestation efforts are essential. Hence, users are enabled to leave behind a legacy that is not only long-lasting but also sustainable.

Students: Jaime Tai, Abigail Summerfield, Tamon Sawangdee, Eizo Ishikawa, Yizhu Fang, Ting Ye

BESPOKE MEMORIALIZATIONS



04 EXHIBITION PARTNERS & PARTICIPANTS

MRC

^ Professor Amanda Fisher, Director MRC Clinical Sciences Centre

The MRC Clinical Sciences Centre is based on the Hammersmith campus of Imperial College London. It was established initially in 1994 by the Medical Research Council (MRC) to provide a focus of strength in basic science in a clinical environment. Its aims are: firstly, to undertake high quality basic science underpinning our understanding of human disease; secondly, to exploit our co-location with partners at Imperial College and at the Imperial College Healthcare NHS Trust to facilitate the translation of this understanding into improved diagnosis and treatment.

The MRC's mission, by Royal Charter, is to: encourage and support research to improve human health; to produce skilled researchers; to advance and disseminate knowledge and technology to improve the quality of life and economic competitiveness of the UK; and finally to promote dialogue with the public about medical research.

Fabrics of Life initiatives embody the MRC's mission to engage the wider public in contemporary biomedical research. Designers help to translate complex scientific ideas into a more accessible form, as well as helping researchers to reflect on their work from new perspectives.

MATF

MA Textile Futures is a two year masters course dedicated to designing the future of materiality.

MA Textile Futures explores the intersection of craft, science and technology encouraging students to look beyond existing boundaries to anticipate future needs, desires, and challenges. Taking materiality as the starting point of the design process we integrate high and low technological materials and processes, pursuing relevant applications across fashion, architecture, product design, and communication & critical design.

Observing and analysing how we live today allows us to consider how we can live better tomorrow. Considering the current and future context of design decisions is core to our ethos, combining social, political and economic inquiry to inform future, sustainable design applications.

Working with the MRC:
Interrogating the convergence of science and design is one of the core areas of our curriculum, therefore we highly value the opportunity to work with the Medical Research Council and the scientists involved. It is a real privilege for our students to hear first-hand about the scientists work, then further question their thinking on a more one-to-one level. As well as introducing highly pertinent scientific research, and encouraging collaborative practice, this project requires students to generate future-facing design proposals from a complex research starting point.

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TFRC

Textile Futures Research Centre, UAL

^ Strawberry Doily © Carole Collet 2012. Part of the Biolace Series

TFRC is one of the Research Centres established at the University of the Arts London, and is based across two of its eminent design colleges: Central Saint Martins and Chelsea College of Arts. TFRC hosts a community of practice-based researchers who explore how materials and textiles can enable a more sustainable future. Our research projects examine the future of textiles through several lenses – future materials, science and technology, sustainable strategy, well-being and social innovation. We work at local, national and international levels and are engaged with both fundamental and applied research. We also act as consultants for leading brands and manufacturers to help them implement design-driven sustainable strategies.

Carole Collet is leading the Science and Technology Platform for TFRC together with research assistant Natsai Chieza. By investigating disruptive technologies as well as emerging life sciences, the platform fosters design projects and events that speculate on our sustainable futures. To coincide with the 'Big Data, designing with the materials of life' project, The TFRC Science-Tech Platform organised 'The Living Factory' in partnership with InCrops: an evening of talks and discussion on the opportunities, risks and challenges associated with designing and manufacturing with synthetic biology horizon 2050. www.tfrc.org.uk

For further information please contact:
Carole Collet: c.collet@csm.arts.ac.uk

Interactive Architecture Lab, RC3, the Bartlett School of Architecture, UCL

How can the vast reservoirs of information gathered through sensory, social, biological and industrial data networks be used in architectural and urban design today, and what does it mean for the future of buildings and cities? By bringing big data together with planning and design we have the power to transform cities into places that are more responsive to the public's needs and aspirations while also strengthening social capital and engendering digital inclusion. The challenge is how to compute such complexity in Big Data?

The impact of bio-technologies such as genetic, genomic and transgenic engineering will undoubtedly be a powerful force in shaping the architectural imagination of this Century. Concepts of assembly and lifespan will be completely reconsidered with recombinant architecture and reprogrammable bio-materials fashioning unpredictable yet purposeful and site responsive shells, skins, interfaces, organs and other bodily morphologies. Body-architecture hybrids will break down notions of the organic and synthetic. The matter of the built environment will be alive, and inherently interactive. It will feature layers of complex inter-relationships of intelligent behaviour. Some perceivable but many imperceivable too - as living materials harness energy, filter nutrients and toxins from the environment, gather information, exchange signals, adapt and grow through interaction with their surroundings.

While as designers we continue to work in a speculative manner - an encyclopedia of genomically designed structural materials is already in use in industries such as chemistry and medicine. Architects and designers can see on the horizon real material applications in the built environment. Optimistic and consciously ignorant, we pick and choose like magpies the properties and behaviour of living systems, proposing the impossible (which may not be so impossible). Could these biological computers solve Big Data?

We have really enjoyed the opportunity to work both with MA Textile Futures and the Medical Research Council. To find synergy we could say that we see Medicine as an optimistic science applied to the body while architecture works at another scale offering the chance to improve health and wellbeing in society. Bringing these together to find relationships between scales has been a fascinating feature of this project.

The Interactive Architecture Lab are anti-disciplinary researchers interested in the behaviour & interaction of things, environments & their inhabitants. The group is directed by Ruairi Glynn and based at University College London's Bartlett Faculty of the Built Environment. The Bartlett is the UK's largest and leading multidisciplinary faculty of the built environment covering architecture, planning, construction and project management, development planning, environmental design as well as many other specialist fields.

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FABRICS OF LIFE 2014: THE FILM

Every year, Kiki von Glasow and her team follow the research scientists and designers, who participate in *Fabrics of Life*, from the workshop and design translation to the final showing of work. This has led to a series of short films about the project. Previous workshops have explored themes of Epigenetics (2007), Model Organisms (2008), Evolution (2009) and Synthetic & Systems Biology (2010)

Catalogue Design: Laura Gordon, www.laura-g.co.uk