

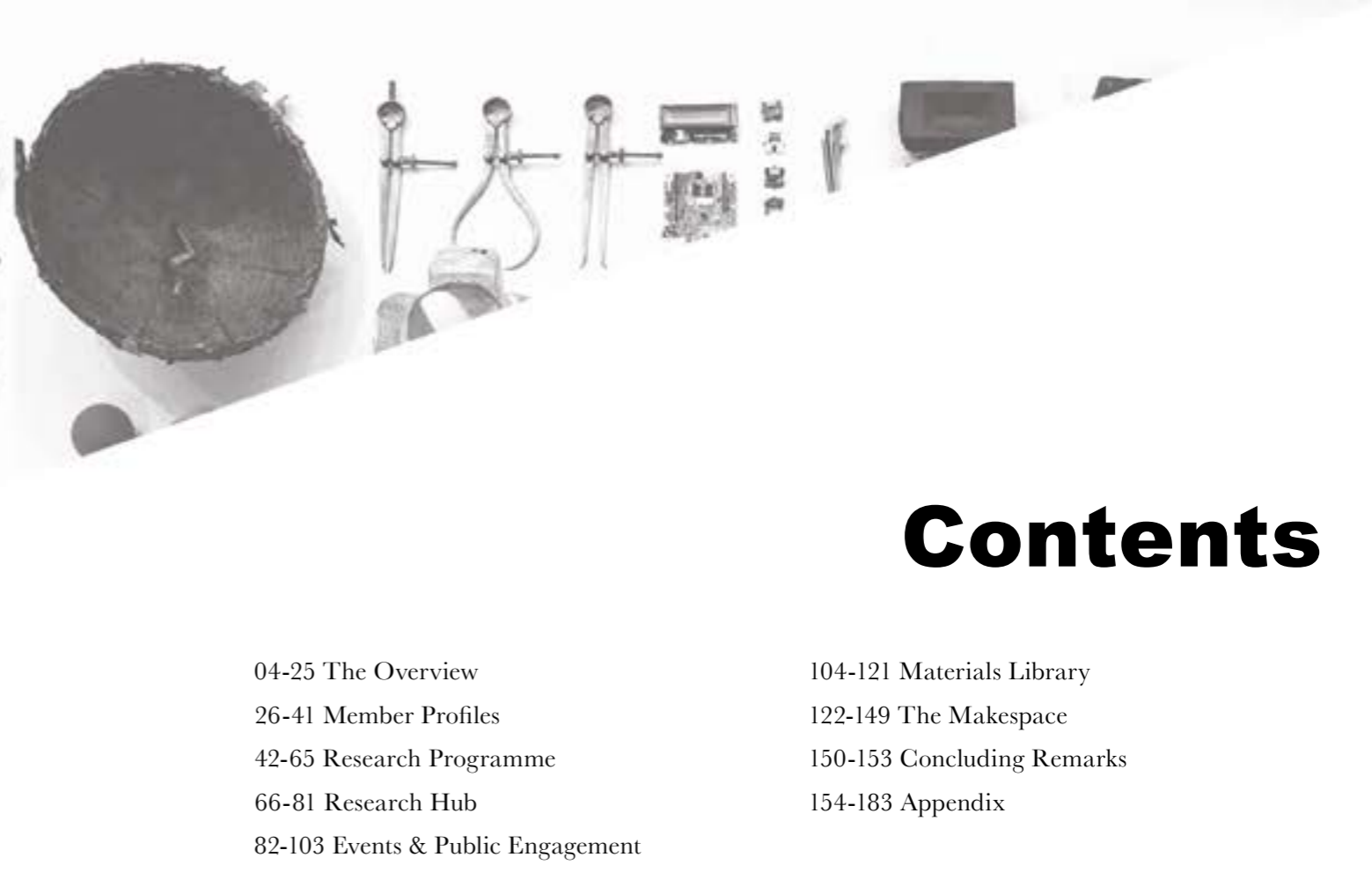


Institute of Making



Third Year Report

Institute of Making, UCL 2015-16



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The Overview

Why we do what we do...

“One of the things that makes UCL so appealing for me is having access to the Institute of Making facilities with all the creative learning that it fosters in terms of skills, but also cross-disciplinary connections that I would never have the opportunity to make otherwise. I was approached by another university (for a position) and realised that the Institute of Making is unique and I would really miss it if it wasn't there.”

(Suzanne Ruddy, Faculty of Life Sciences)



We are a very unusual research club...

The Institute of Making is a place that encourages play, research and development through making. We have created a vibrant multidisciplinary community whose activities support teaching and research at UCL, as well as anyone who is curious about stuff. We provide a fully equipped workshop, technical training, a library of materials and most importantly, inspiration and support.



Membership is open to anyone at UCL...

We currently have 2656 active members, of whom 34% are staff and 66% are students. A further breakdown of the member demographic is as follows: female (37%), male (50%), no gender declaration (13%); undergraduates (34%), postgraduates (32%), academic staff (21%), professional services staff (11%) and other (2%). The membership encompasses a wide range of specialisms and interests, from Art to Anthropology, Chemistry to Architecture, and Engineering to English Literature.



Doing is a different way of thinking...

A typical snapshot of activity at the Institute is as follows: an undergrad from the Arts and Sciences BSc degree programme attends the Materials Library clinic to do research on materials for her project; a Civil Engineering lecturer uses the workshop to make a demo for his course on aeronautics; a Medical Physics post-doc uses the laser cutter to build a medical device for her research; a Chemistry PhD student comes to an induction on throwing clay; our staff help the BBC make a film about materials research; a one day research workshop on design-led materials science gathers together researchers from across UCL and around the UK.



We specialise in multidisciplinary materials research...

The Institute of Making acts as a research hub, bringing together and supporting interdisciplinary teams of researchers both at UCL and beyond. We also actively conduct our own research: this year we were successful in winning two EPSRC collaborative grants (EP/N01006X/1, EP/N010523/1), an EPSRC Institutional Award (EP/N508731/1) for Design-Led Materials Science, and our Research Manager Sarah Wilkes won a Wellcome Trust Fellowship. We also have on-going funded collaborative research projects: Scrambled Messages, a project led by Professor Caroline Arscott at the Courtauld (AHRC EP/K038656/1); the Wearable Assistive Materials project led by Professor Nick Tyler (EPSRC EP/K020323/1); the Centre for Nature Inspired Engineering led by Professor Marc-Olivier Coppens (EPSRC EP/K038656/1); and Light Touch Matters (EU FP7-NMP-2012-SME-6/310311) led by Professor Erik Tempelman.



Our events often get fully booked in seconds...

Our events programme aims to do several things. Firstly, it aims to inspire the public with regard to all things materials and making and to place us at the heart of the international making community. The programme also exists to introduce our members to new areas of interest help them acquire new skills, encourage them to engage with experts in various fields of materials and making research and allow them gather together research collaborators. Last year we held 47 events, 24 of which were member events and 26 of which were public (see pages 158-161 of the Appendix for the full list of events). These included 24 masterclasses (Enamelling and Glass as a Material, for example), 6 research events, 2 Materials Library evenings, 3 corporate events, 3 outreach events, 4 public open days (Light and Clay, for example), 2 factory visits (London Glassblowing Studios and Airbus) and 1 talk. Over the past year all of our events have attracted a total audience of more than 6000 including a high representation from families and young people.



We have one of the most wondrous collections of stuff...

The Materials Library is a collection of some of the most wondrous materials on earth, gathered from sheds, labs, grottoes and repositories around the world. It is a resource, laboratory, studio, and playground for the curious and material-minded to conduct hands-on research through interdisciplinary enquiry and innovation. The Materials Library Collection currently has over 2000 materials. Last year we launched the Materials Library App, designed to enable library users to navigate the physical collection whilst also providing a virtual repository of material knowledge.



We have a public profile...

The Institute of Making and its team have gained a public profile as champions of making and materials, promoting them through social media (Twitter, Facebook, Instagram, Tumblr), many newspaper articles (The Observer, The Telegraph, The Times, etc.), and TV and radio programmes (BBC4 TV Documentaries, BBC Radio 4's Kitchen Cabinet, Start The Week and ITV News).



We are international...

The Institute of Making has an international reputation; we have given invited talks all around the world from Washington to Milan on our interdisciplinary materials research and our other activities, including building a multidisciplinary research environment centered on making. This year we produced a Massively Open Online Course (MOOC) called An Introduction to Steel which had more than 16,000 participants from 139 countries and a completion rate of 29%.



We do commercial & policy stuff...

Our profile has allowed us to influence policy makers and the national academies, attract industrial collaborators (TENARIS, ATKINS, US National Academies, American Association for Advancement of Science), and inspire both current and future students and staff. We have had numerous visits from other institutions that wish to collaborate and many of these relationships are being actively developed.





Member Profiles

“I love all the ideas you get here just by talking to people, the positive attitude towards future technologies and creativity - making the world a bit better - it’s exciting”

(Emilia McLaughlin, Biochemistry MSci student)

In this section we profile the people whose imagination and diverse research activities are the lifeblood of the Institute: our members. This year, as news of our facilities and accessibility filters through into the wider university, our membership grows ever more broad and cross-disciplinary. The number of new members and their appetite for learning new skills continues to exceed the amount of staff time we have for introductory and workshop inductions, which are always booked out immediately.

Despite the continued stream of members coming and going, the friendly, engaged and inquisitive Makespace spirit continues to be strong. The community communicates and shares opportunities and ideas through our online noticeboard and member Facebook group. They also share their own work and experiments via our Instagram feed and member projects blog, as well as through informal member-to-member advice and chat in the space

For a full list of member social media feeds, see pages 166 - 167 of the Appendix.



“Being a PhD can be isolating. Knowing that this is a social space makes it important - you’re not locked in a lab - the community is as important as the machinery.”

(Rhys Williams, UCLIC PhD student)

Team and individual projects have sprung up side by side. Some people arrive with a very clear idea of what they want to achieve, and others are drawn by a particular tool or process (3D printing or pottery for example) and stay, getting involved in masterclasses, materials exploration or research projects that they didn’t anticipate. One thing we often hear from members is that their Makespace and Materials Library experiences have led them to take a more creative approach to their own work, research or studies at UCL.

Member competitions this year have included an invitation to design a scrambled messaging machine for the AHRC-funded project Scrambled Messages. The winning entry by Alexandra Bridarolli will be installed in the Victorians Decoded: Art and Telegraphy exhibition at the Guildhall Art Gallery London, from September 2016 to February 2017.

“I get very sentimental when I talk about the Institute of Making, because to me it’s the only place I have encountered in the whole world that truly combines art and science. It is so inclusive: the fact that any member of staff or student can come here to work and learn new skills.”

(Laura Dempsey, Medical Physics PhD student)

Agostino Nickl Architecture MArch student

I have been researching American suburbia, informed in particular by The Sims video game. Many hours of playing Sims revealed that communal living, working from home and creating and crafting objects to sell are the best ways to keep Sims happy. To understand how this translated from a digital environment to the physical environment I created a series of Gnomes: the most lucrative craft items in the Sims.

First I tried carving by hand, just as my Sims had done in the game, initially using a chisel and a hammer. I then switched to using the Swiss carving chisels, which I found better suited to my task. It was also important to choose the right wood, and after a discussion with the technicians I choose limewood for its texture and fibre density. After the hand carved version I moved to digital tools, creating a 3D model in CAD that I then 3D printed and CNC milled. I found the digital Gnomes weren't as satisfying to make. I also noticed that it wasn't much faster than doing it by hand, as I had to create the 3D model and set up the machines first. I also preferred the finish I was able to achieve by hand carving.

My next step is to implement these findings in my work by designing architectural plans with a focus on shared spaces, optimised for happy suburban living. I plan to reinvent suburbia by embracing concepts of crafting, making and skill sharing. I love the Makespace and see it as a necessary response to the decline of Homo Faber, as described by Hannah Arendt, that society as a whole is experiencing.



Adam Azhari

Arts and Sciences BAsc

In my second year I was walking past and I saw the Institute being made. I have a similar but much smaller workspace back home in Malaysia so I was naturally drawn to it. When it was done and I saw all that equipment and sawdust through those big glass doors I couldn't resist.

I have been a member for a few years now. I started making pottery and spoons with wood and clay before moving on to a multitude of other things including a laptop stand and laser engraved chopsticks. I was so excited by the Makespace that I kept trying to think of more things to make. I was particularly impressed with the precision I was able to achieve using digital tools.

I'm a keen musician so this term I've focused on making custom IEMs (in ear monitor headphones). This has involved working across lots of disciplines. I started by creating a silicone mould of the inside of my ear, which I 3D scanned and made adjustments to using CAD software. Once I had modified my scan I 3D printed it using one of the SLA printers, hollowed out the print, and rigged up and soldered the internal electronics. I also built a special lightbox to speed up the curing time of my 3D prints. Finally, I braided and assembled form-fitting cables to complete the set up.

It was fantastic to make everything start to finish in the Makespace. Being exposed to professional tools has really changed my approach to making. Armed with this making knowledge I now want to start a company producing affordable custom IEMs for other people.



Thore Bücking **Medical Physics PhD student**

My favourite thing about the Institute of Making is the freedom to use the tools without strict supervision. I was amazed to find a space dedicated to love for materials and the making process, where you are encouraged to let creativity roam free and are given the facilities to let this happen.

I'm a PhD student working on photoacoustic imaging. I am also a long standing member of the Makerspace and part of LEGO2NANO (now open AFM) research project (see pages 70 - 71). I joined the Institute of Making along with lots of my colleagues, and initially made custom parts and tools for my research using the metal lathe, the drill press and the 3D printer. After meeting Jonathan Keep and discovering a digital approach to clay (see pages 92 - 93), I was inspired to start a new project based on one of my passions: data visualisation.

The idea was to create a vase from seismographic data. First I wrote a program in Python to generate a 3D model. The vase was printed in PLA plastic and then used to create a multi-part plaster mould for slip casting. From the mould I created porcelain casts. I found I could make multiple copies of the vase relatively quickly, experimenting with different glazing and firing techniques to achieve the best finish possible. Now that I've finished experimenting I will pick the best vase and destroy the inferior copies along with the mould to ensure the final product is unique.

As a scientist I always enjoy it when people in the Makerspace mistake me for an artist! I've learnt a lot about materials by getting hands on and following my instincts.



Prash Ganeswaran

Medical Physics & Biomedical Engineering

I've been a member of the Makerspace for nearly as long as it has been open. I first noticed it while walking past during the opening ceremony and joined up soon after. At the time I was still studying and often found myself running across London after finishing an exam to attend a masterclass. I studied Mechanical Engineering and was drawn to the Institute of Making as a place where I could take the theory I'd learnt and apply it in a practical way.

Since graduating I've taken up a position in Medical Physics, designing and building medical imaging devices. I got my job through being a member supervisor at the Institute. I had graduated and a big plus point of accepting a job within UCL was that I could keep using the Makerspace. The employer also needed someone with making skills. We have some tools in our lab but not as great a range as the Makerspace. I've found a range of making skills I've picked up invaluable. For example, on top of laser cutting, milling or turning parts for the machines I build, I've made custom wooden tools using techniques I remembered from a workshop with Barn the Spoon.

I've also met some of my best friends at the Institute of Making. As a member supervisor I run laser cutter and 3D printing inductions and help other members with their projects by suggesting tools and processes. In the future I'd like to develop my skills on the potter's wheel and do more milling, both conventional and CNC. My favourite thing about the Makerspace is the culture. Everyone is really friendly and wants to help each other out.



Eamon Hassan Biomedical Sciences Undergraduate

What I like about the Makerspace is that everyone can come into the shared space and swap ideas: it doesn't matter if you are doing a PhD or undergraduate degree, everyone is equal. I joined recently and after trying out a number of making processes I decided I prefer working with compliant materials. I enjoy realising my imagined designs and can do this more quickly with textiles than with wood or other resistant materials.

After my sewing machine induction in the first term I researched other techniques like needle felting using roving (loose hanks of pure merino wool). This term I created a fashion range in hot pink wool that celebrates the material's raw properties, which featured in the Modo Fashion Society show. I learnt that roving can be manipulated very easily without looking damaged: the long fibres can give strength, flexibility and flair which allowed me to make hats that were angled rather than straight. I used an unprocessed version of the material for the jacket: this meant I could utilize the innate properties of the material.

One of the pieces in the collection is a pleather bag that twinkles with fairy lights. I'd like to follow this up by further combining textiles and electronics. I'd also like to revisit 3D printing after being inspired by the work of other members I've spoken to in the Makerspace.

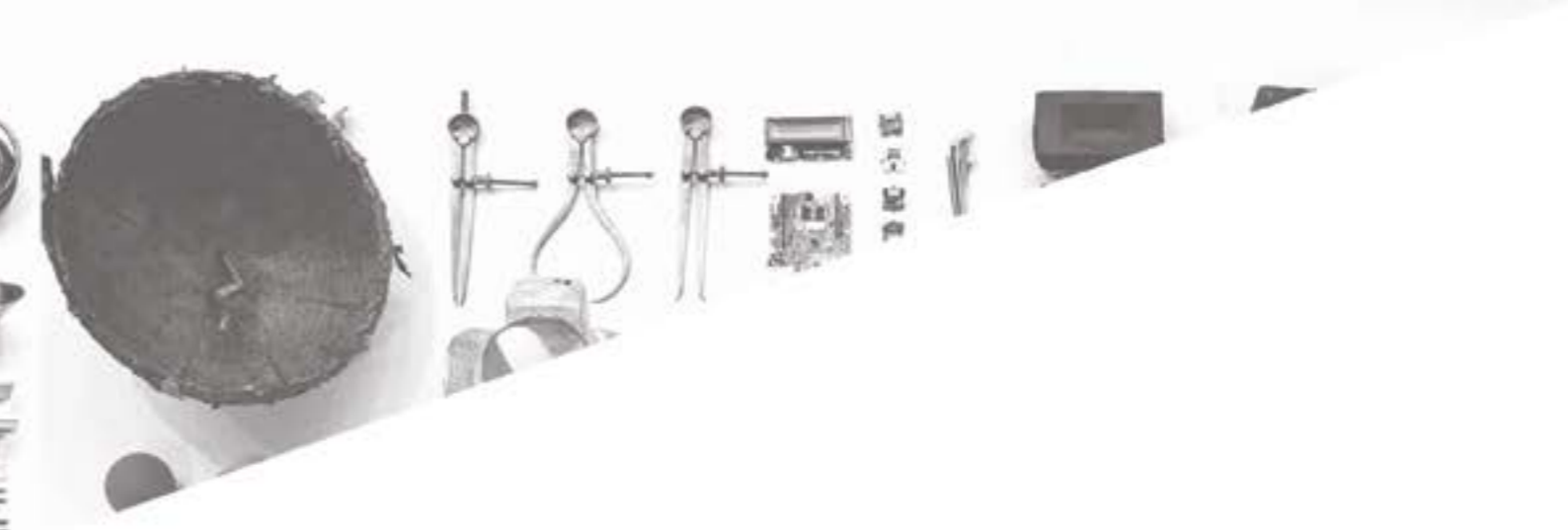


Laura Dempsey **Medical Physics PhD student**

To me it's obvious that everywhere should have an Institute of Making. There are lots of other makespaces but none of them are as accessible and welcoming! Having both an engineering and an art degree, I quickly found myself at home here. Since joining I've used the space to help further my research in biomedical optics, specifically focusing on non-invasive imaging of the infant brain using time-resolved diffuse optical imaging. To aid this research I've 3D printed heads of various sizes to test my head-gear designs. Alongside my research I've particularly enjoyed throwing pots, using the metal lathe, basket weaving, luted-crucible bronze casting and fabric dying. Experimenting with different materials and processes has taught me about the merits and limitations of the various tools and machines in the Makerspace. I spent quite a bit of time trying and failing to print detailed components on the Ultimaker before swapping to an SLA resin-based printer. Investigating the specific optical qualities of different materials made a huge difference to the final result.

In my role as member supervisor I help with inductions and open days. I helped put together the screen printing kit and run weekly inductions to teach members how to use it. I'm also a keen gardener and undertook a project with technician Rich to bring some greenery into the Makerspace by installing hanging indoor flower beds with UV lights. By inducting other members I hope to have the same effect Lenore Thomas, my printmaking instructor, had on me. She taught me etching and screen printing and gave me the inspiration for DIY working. Next I would like develop my skills in woodturning, stone lithography and hydroponics.





Research Programme

At the Institute of Making we actively conduct our own multidisciplinary research to better understand the human – material interface, whilst also bringing together and supporting teams of materials researchers and makers from different disciplines around UCL and beyond. This year we were successful in winning two new EPSRC collaborative grants; Self-Healing Cities with the University of Leeds, University of Birmingham and University of Southampton (EP/N010523/1; £5,247,017); and Hands of X led by Dr Graham Pullin at DJCAD (EP/N01006X/1; £287,813). Our Research Manager Dr Sarah Wilkes won a Wellcome Trust Medical Humanities Fellowship for her project Material Anxieties (200354/Z/15/Z, £200,556). We were also awarded an EPSRC Institutional Award to encourage Design-Led Materials Research in the UK (EP/N508731/1, £49,743), and a UCL Grand Challenges for Human Wellbeing grant for our collaborative project PhysFeel, led by Dr Andy Fugard in UCL Psychology and in collaboration with Dr Praveetha Patalay from the Institute of Education. We won the opportunity to put together the latest UCL Octagon Gallery exhibition, Dangerous Diaries, curated by Research Manager Sarah and Dr Emma Richardson from UCL History of Art.

Our ongoing funded collaborative research has been going from strength to strength: the Centre for Nature Inspired Engineering led by Prof Marc-Olivier Coppens (EPSRC EP/K038656/1, £4,980,773) is in its second year and the team of researchers is growing, with numerous new publications, conference papers and collaborative projects. Scrambled Messages, a project led by Prof Caroline Arscott at the Courtauld (AHRC EP/K038656/1, £731,190) is now in its third year, with a forthcoming exhibition. The Wearable Assistive Materials project led by Prof Nick Tyler (EPSRC EP/K020323/1, £994,066) and Light.Touch.Matters (EU FP7-NMP-2012-SME-6/310311, €3,984,150) led by Prof Erik Tempelman are both coming to a close, with some very exciting results.



Self-Healing Cities

EPSRC EP/N010523/1 (£5,247,017)

This EPSRC Grand Challenge project is led by the University of Leeds and involves academics at the University of Birmingham and University of Southampton, as well as local councils and industrial partners. The project takes its inspiration from a vision of a city where the infrastructure is autonomously and dynamically diagnosed, maintained and repaired by robotic systems.

The team aim to tackle the Grand Challenge of zero disruption from street works in UK cities by 2050 by developing robots that will identify, diagnose and repair street works through minimally invasive techniques, starting with three case studies:

- “Perch and Repair” drones that can perform repairs tasks like remote maintenance and modernisation of street lights.
- “Perceive and Patch” flying vehicles for autonomous inspection, diagnostics, repair and prevention of highway defects (e.g. potholes).
- “Fire and Forget” hybrid robots designed to operate indefinitely within live utility pipes, performing inspection, repair, metering and reporting tasks.

Mark Miodownik will be leading research into materials for this project, including 3D printing technologies for repair of city infrastructure. This includes assessing non-conventional materials for additive manufacturing for suitability in 3D repair of infrastructure, and mechanical testing of a range of materials for 3D printing, scaffolds and inserts to assess their suitability and reliability for the task. The ultimate aim of this project is to improve the health, wellbeing, happiness and economic prosperity of those living in future cities through materials research and engineering.



Hands of X EPSRC EP/N01006X/1 (£287,813)

This project is an eighteen month collaboration between the Duncan and Jordanstone College of Art and Design, the Scottish charity and public access makespace MAKLab and the Institute of Making. It aims to expand the palette of materials available to wearers of prosthetic hands. Nowhere is the selection of materials more profound than for a prosthetic hand, which becomes part of its wearer's identity. Currently amputees can choose between hands in skin-coloured silicone gloves or cyborg-like carbon-fibre. Hands of X explores a more nuanced choice of materials, chosen by the wearer, exploiting the possibilities of digital fabrication techniques whilst also drawing on a deeper cultural history of familiar materials; worn and handled.

In a series of participatory workshops, amputees, designers, prosthetists, makers, artists, engineers and materials scientists will work together to explore materials that can be combined in simplified, speculative hands. The stories of the people and processes behind these hands will be recorded and exhibited as a collection. We will then work with a few amputees, applying their material choices to their chosen type of prosthesis (passive, mechanical, electric or bionic), to conceive a small collection of simple hand designs. We will also scope out the infrastructure needed for this kind of affordable and bespoke prosthetics service, and prototype the user's experience of it.

This project is supported by the EPSRC; Finding Your Feet, a charity founded by amputees for amputees; the Royal National Orthopaedic Hospital, Stanmore and Steeper, makers of mechanical, electric and bionic hands.



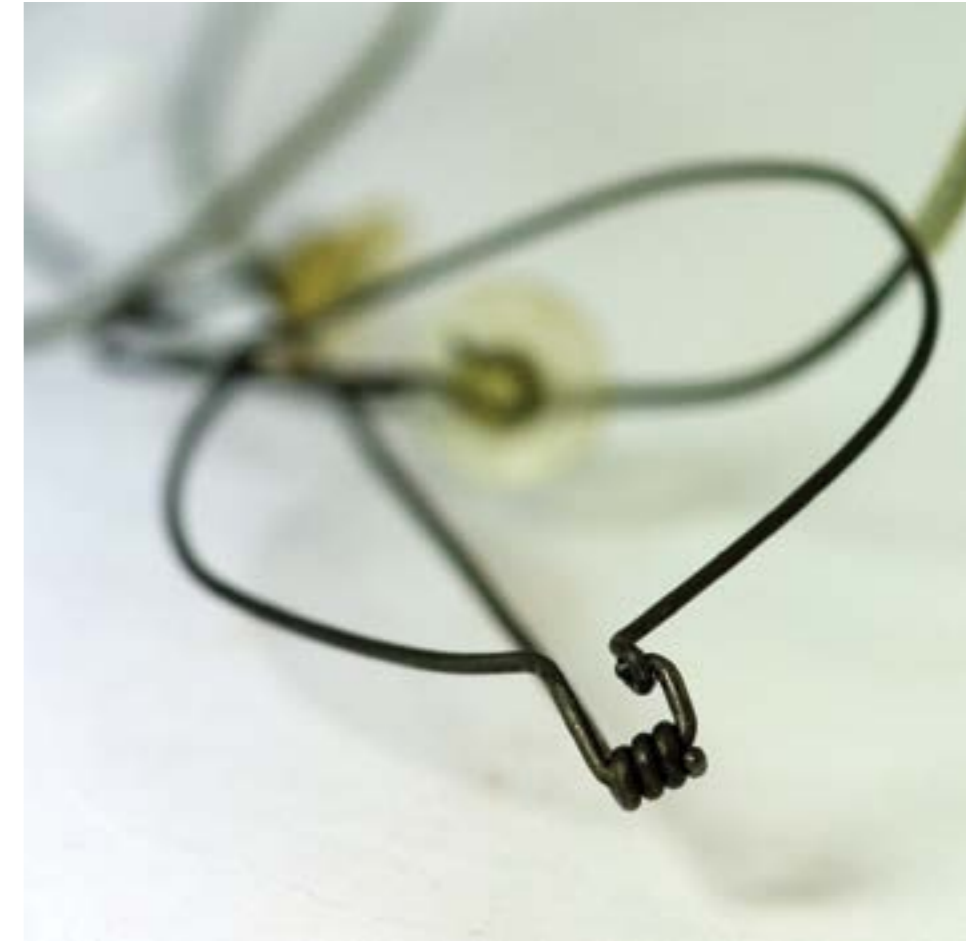
Material Anxieties

Wellcome Trust 200354/Z/15/Z (£200,556)

Research Manager Sarah Wilkes was recently awarded a three year Wellcome Trust Medical Humanities fellowship for *Material Anxieties: The Perceived Health of Materials in Medical Products*. This project follows new and familiar materials being developed for healthcare applications from their inception in labs and manufacturing facilities to their selection in design studios and finally to their everyday use in formal and informal healthcare environments. The ultimate aim of this project is to better understand how materials like steel and silicone rubber mediate people's experiences of health and wellbeing in positive and negative ways. This understanding will be used to influence design practice, inform research directions in materials science and identify and develop materials that better suit the needs of clinicians and patients.

Through a series of project workshops, materials producers, healthcare designers & architects, clinicians and users will be brought together in a dialogue about health and materials. In order to ensure this dialogue between disciplines is effective, the project uses a novel, multidisciplinary approach to gain a holistic understanding of human experiences of materials. This tripartite method combines ethnographic research, design research and psychophysical experiments, allowing for a simultaneous focus on the physical, sensory, aesthetic and cultural affordances of materials.

The project begins this September with eighteen months of ethnographic research to identify applications (e.g. prostheses or architectural hardware) where materials have the potential to enrich healthcare experiences.



PhysFeel UCL Grand Challenge for Human Wellbeing (£2318)

This UCL Grand Challenge of Human Wellbeing project is led by Dr Andy Fugard (UCL Psychology) along with investigators at the Institute of Making (Dr Sarah Wilkes and Prof Mark Miodownik) and Dr Praveetha Patalay (Institute of Education). This pilot aims to explore how physical props and material stimuli can enable a different kind of conversation about emotions than that made available through verbal communication. This work has potential to impact on a clinical setting, augmenting current understandings of the ways in which people communicate their emotions with psychological therapists. An understanding of people's emotional responses to materials and their physical properties could also help those from materials science or design communities to better understand the implications of the materials they make and use.

The project team are currently running a series of focus groups to investigate whether emotions may be consistently communicated non-verbally using sets of physical objects that vary along one physical dimension such as density, elastic modulus, thermal emissivity, surface roughness or transparency. The results from these focus groups will be analysed to see what dimensions of emotions these material-object sets might map onto. Starting next month, the physical sets will also be validated against standard measures of emotions traditionally used by psychologists. PhysFeel culminates this summer with a research event that brings together researchers from numerous disciplines to examine the role of materials, objects and co-design activities in wellbeing-related research.



Dangerous Diaries: Exploring Risks and Rewards in Fabrication

“I have just returned from visiting your wonderful exhibition ‘Dangerous Diaries’. I have to rank it as one of the best exhibitions I have visited in London. I live in Eastbourne and I make regular trips to see exhibitions on a wide range of subjects. I guess there is no chance of extending it, as I would love to take my wife as well?”

(Michael Saxby, exhibition visitor)

Research Manager Sarah and Dr Emma Richardson (History of Art) curated the latest UCL Octagon Gallery exhibition, exploring the dangers and rewards of engaging with materials and making processes. An interdisciplinary group of researchers, makers and materials enthusiasts contributed to the exhibition by keeping diaries that explored the risks and pleasures they encountered in their daily acts of fabrication (for full list see Appendix). This interdisciplinary team recorded and reflected on their experiences of materials as varied as sellotape, polyurethane foam and asbestos.

These contemporary diaries were brought into conversation with artefacts from ten different UCL Collections, including: a taxidermied woolly monkey from the Grant Museum, the lungs of a coal miner from the Pathology Collections, a collection of ancient Egyptian votives to ward off disease from the Petrie Museum and Sir William Ramsay’s mildly radioactive laboratory notebooks from Special Collections. These objects were drawn together in a narrative that charted changing attitudes to the dangers of materials and approaches to risk in scientific and artistic making, and reflected on the historical development of contemporary Health and Safety.



Light.Touch.Matters

EU FP7-NMP-2012-SME-6/310311 (€3,984,150)

The Light.Touch.Matters project is now in its final year, and is reaching its conclusion with some significant and interesting outcomes. The materials researchers have succeeded in producing novel, smart and lead-free materials that allow “the product to become the interface”. These LTM materials consist of four distinct technological components: piezo plastics for touch sensitivity, OLEDs for luminescent response, a conversion layer for modifying the colour of light emitted and control electronics.

The materials have been developed with essential input from the eight design SMEs. These design practitioners have also developed a series of technology demonstrators, ranging from physiotherapy aids to pain management toys, which have tested, advanced and highlighted the unique potential of the LTM materials. As part of the design research stream of the project, we have also explored how people respond to these new materials and product concepts.

Alongside the materials R&D and design objectives, one of the central aims of this research project has been to develop and refine a method for doing successful design-led materials science. The Institute of Making are currently developing an online course, available later this year, that reflects on and shares our experiences of doing this kind of interdisciplinary development of new materials.

For more information: www.light-touch-matters-project.eu



Scrambled Messages AHRC EP/K038656/1 (£731,190)

Now in its third year, the Scrambled Messages project brings together researchers from fields as diverse as Engineering, Art History, English and Archaeology to examine why the telegraph had such a profound impact on the Victorian imagination. Through a combination of primary research, dialogue, research events and exhibitions, the team look at the way in which popular understandings of the trans-Atlantic submarine telegraph fed the Victorian imagination and made certain themes, metaphors and paradigms urgent and relevant for artists, writers, scientists and other cultural producers.

This year, notable project events have included Failure, a day celebrating the failed first attempt to lay the transatlantic cable. This workshop at the Institute of Making brought together music theorists, naval architects, archaeologists and literature scholars to explore failures of materials, technologies and communication between disciplines. Amongst other activities, participants used basic prototyping materials



and the vast array of resources in the Materials Library to communicate difficult concepts from their discipline (e.g. narrativity, seriality, electrical fields) to each other. Scrambled Messages Co-Investigator and Professor of English Literature at King's College London Clare Pettitt wrote this about the day:

“What I learnt was that it is true...that you learn differently by making stuff with your hands and objects can give you an entirely new way of thinking through concepts. This was one of my favourite days - possibly ever!”

This September, the Scrambled Messages project culminates with Victorians Decoded: Art and Telegraphy, an exhibition at the Guildhall Art Gallery. One of our members Alexandra Bridarolli won a competition to design an imaginative interactive messaging machine for the exhibition, and is currently making a machine that displays the connections between the history of telegraphy and the art and literature of the Victorian period for visitors.

For more information: www.scrambledmessages.ac.uk

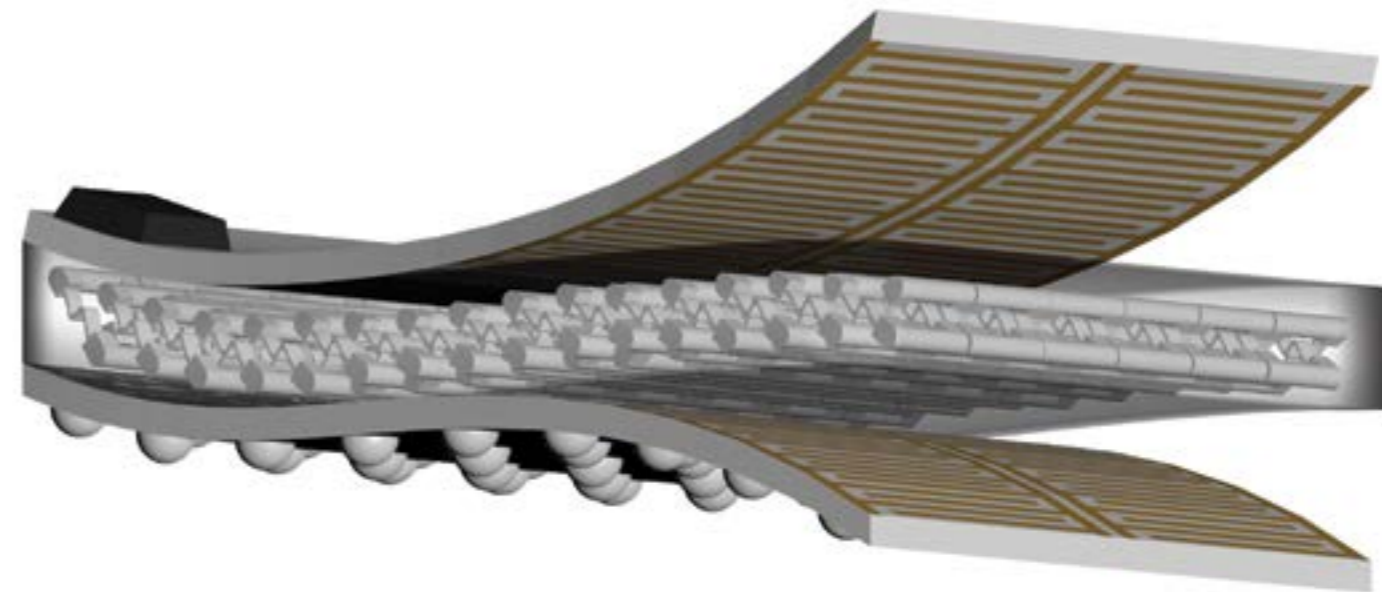
Wearable Assistive Materials

EPSRC EP/K020323/1 (£994,066)

The WAM project, led by Prof Nick Tyler, brings together civil, biomedical and mechanical engineers, chemists and clinicians to develop a shape-changing smart material designed to alleviate movement-related disabilities. Now in its third year, the project has focussed on developing two technologies to enable this wearable assistive material. WAM chemists Prof Ivan Parkin, Dr Richard Jackson and Dr Kristopher Page have been exploring vanadium oxide (V_2O_5): a substance that is able to flex when exposed to an electrostatic potential and can exhibit strength about ten times the strength found in skeletal muscle. The V_2O_5 is being developed as an actuator to be used separately or in combination with interlockable ceramic tiles, which are being designed and prototyped by WAM PhD student Mark Ransley, whose image features opposite. These tiles provide the stiffness needed to support the human skeleton, but once unlocked allow the structure to bend flexibly. Mark has produced a number of conference papers, delivered at the Orthopaedics Research Society's Annual Meeting and Materials Research Society's Spring Meeting 2016.

Researchers Dr Dafne Morgado Ramirez, Dr Catherine Holloway and Mr Peter Smitham have worked with patient groups and clinicians to understand the human impact of these materials, including the forces they exert on wearers, what end users might be looking for in assistive technology, and how this particular type of support might be useful. The WAM team have also disseminated their research to the wider public at events such as the Science Museum Late.

For more information: www.instituteofmaking.org.uk/research/wearable-assistive-materials



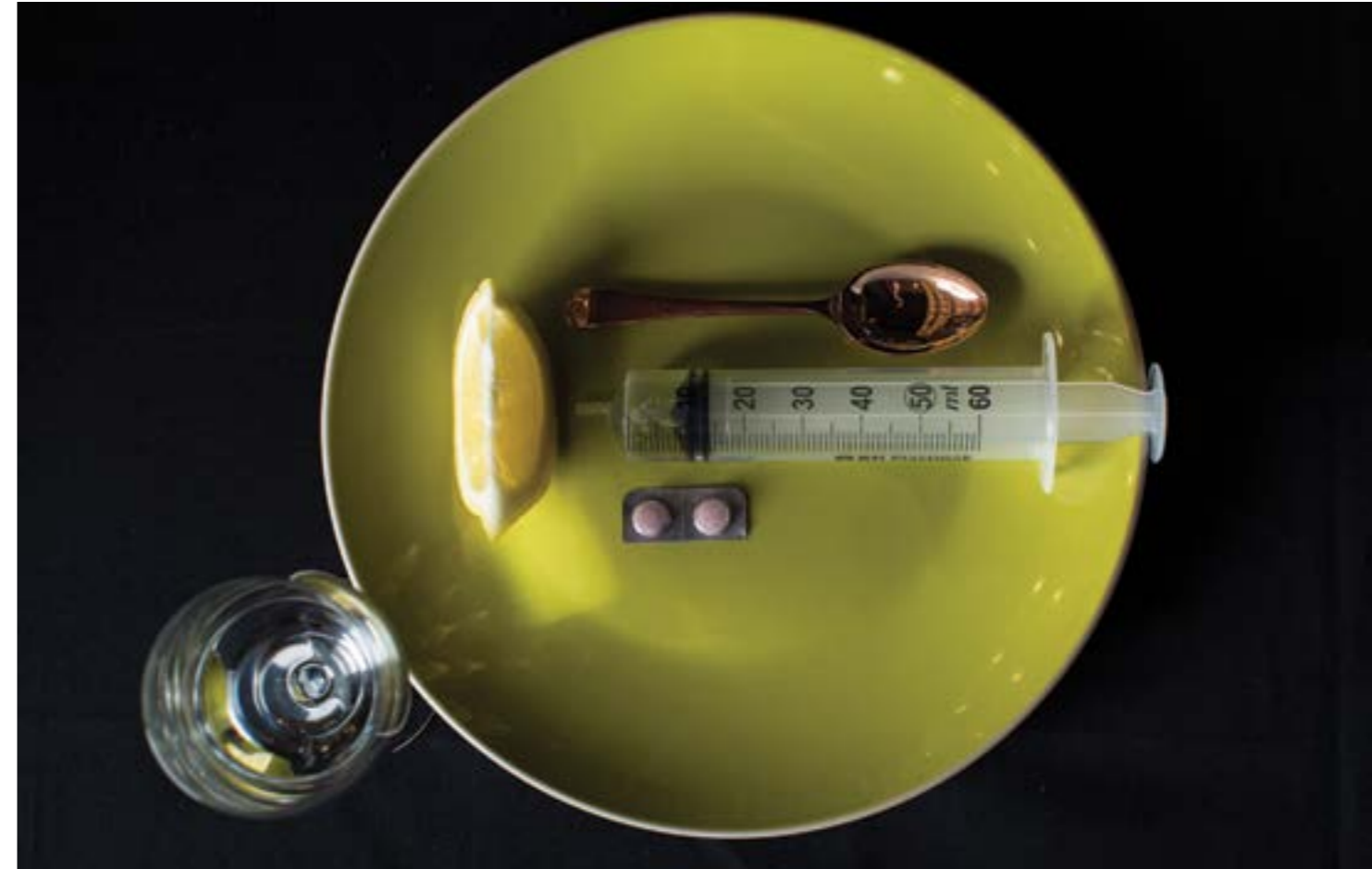
Centre for Nature Inspired Engineering EPSRC EP/K038656/1 (£4,980,773)

The Centre for Nature Inspired Engineering is now in its second year, and the team is growing. Researchers span disciplines as varied as genetics and computer science, chemical engineering and architecture, and draw lessons from nature to engineer innovative solutions to our grand challenges in energy, water, materials, health, and living space.

Rather than imitating nature out of context or succumbing to superficial analogies, research at CNIE takes a scientific approach to uncovering fundamental mechanisms underlying desirable traits, applying these mechanisms to design and synthesise artificial systems that borrow the traits of the natural model. These systems, which include desalination membranes, fuel cells, catalysts, adaptive materials or built environments, thus become endowed with the same desirable characteristic as their models in nature – cell membranes, lungs, trees and bacterial communities – with associated extraordinary performance, such as scalability, robustness, material and energy efficiency.

Mark Miodownik leads the research theme of Dynamic Self-Organisation: studying self-organising and self-healing materials that are able to adapt their structure and associated properties in response to a changing environment. A new collaborative PhD project on this theme is with Richard Beckett (Bartlett School of Architecture) entitled Designing Bioreceptivity – Architectural Biofilms.

For more information: www.natureinspiredengineering.org.uk



The Open Workshop Network

The Open Workshop Network (OWN) is the ongoing research project of Liz Corbin, our doctoral researcher. This project is an in-depth study of the London maker community: research is being carried out over the course of three years in collaboration with over 40 London-based Makerspaces, Hackspaces and Fab Labs.

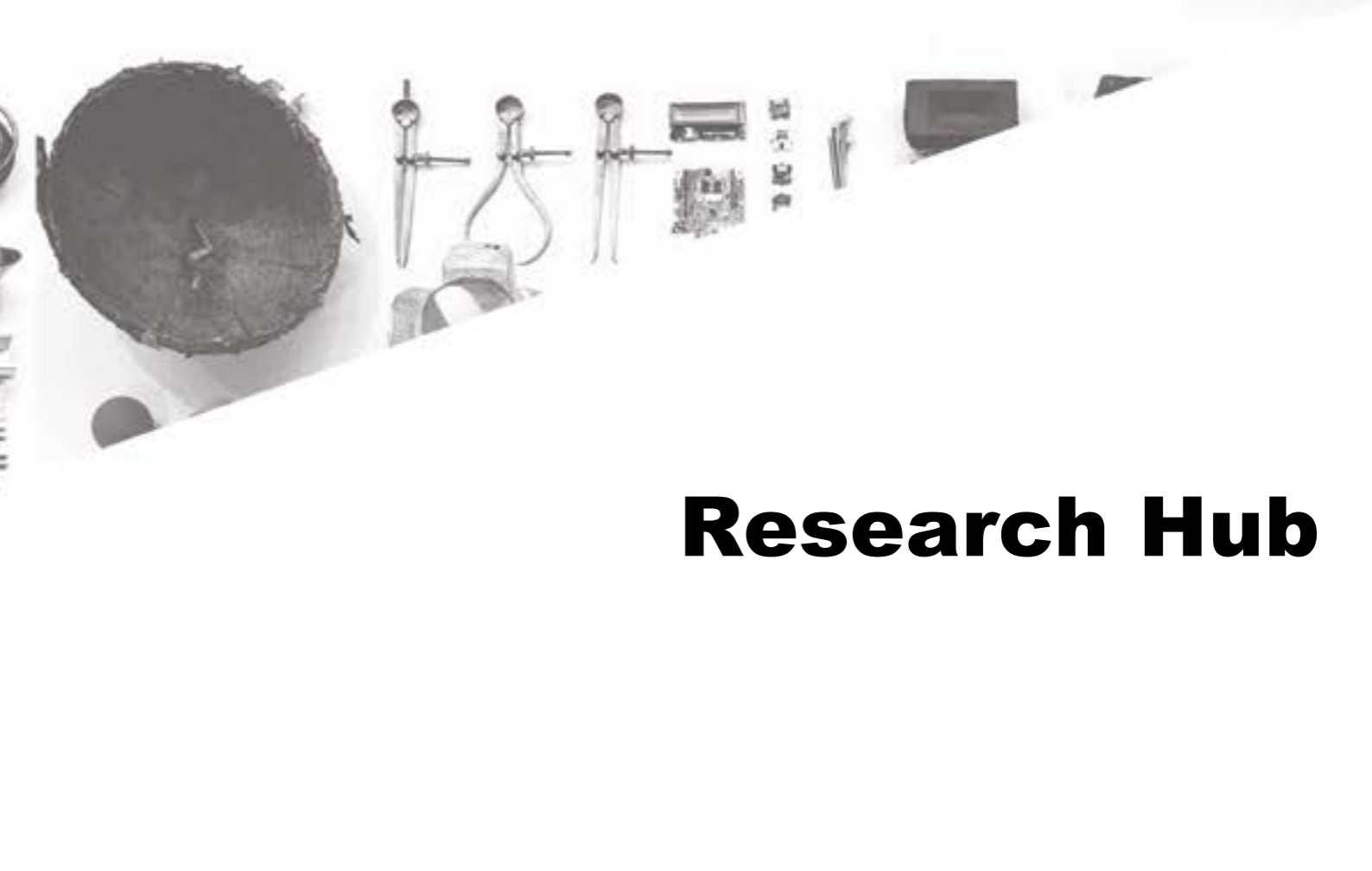
At a time of increased interest and speculation in the broader maker movement, this project extends beyond anecdotal enquiry and responds to the needs of participating organisations with a thorough analysis of the variety, reality, triumphs and challenges of running open-access, community-centered makespaces. It therefore both contributes to academic debate and provides a useful tool for the individuals, workshop collectives and maker communities of London and further afield.

A key aim of the project is to develop a method of research whereby respondents and participants play a more active role in plotting the course of inquiry. By adhering to this adaptable and responsive methodological approach, the project is bridging the gap between academic research and those communities that are the focus of study.

An initial outcome of the research is a digital platform that maps the open workshops in London. From printmaking to welding, 3D scanning to plaster casting, the OWN digital platform provides a place for people to learn about and connect with the many London-based organisations that are dedicating themselves to providing publicly accessible means for making.

For more information: www.openworkshopnetwork.com





Research Hub

In addition to our own research activities, The Institute of Making acts as a hub to support making and design-led materials research and teaching at UCL and beyond, encouraging play, understanding and development through making. We support the teaching and research communities at UCL by providing a fully equipped workshop, technical training, a library of materials and most importantly, inspiration and support from our vibrant and multidisciplinary community of staff and members. The Hub is curated and run by our research manager Sarah Wilkes, and its success is largely due to her ability to intelligently understand, manage, accommodate and administrate the complex needs of multidisciplinary teams. For part of this year we also had the help of Joni Browne, our wonderful and very capable temporary Research Administrator.

The longest-running research hub project this year is the successor to the LEGO2NANO project, Open AFM. In its third year, this international citizen science project has resulted in a not-for-profit start up and presentations at a number of science festivals. Having been awarded an EPSRC Institutional Award (EP/N508731/1) for Design-Led Materials Science, we have also been able to support five interdisciplinary teams of researchers working between UK academic institutions



on design-led approaches to materials. The funded projects focus on research areas where the sensory, aesthetic and socio-technical properties of materials strongly impact on the popularity and success of products. Being able to distribute these small grants has been fantastic, and we have found they are particularly important for undergraduates who want to get a taste of research; postgraduate students who want to gain experience of managing their own research project; and early career researchers who want to develop a new research direction. These grants have even proven useful for more established academics wanting to seed a novel, interdisciplinary project that may be less likely to gain support from mainstream funding schemes without proof of concept.

Demand for involvement in our own research projects far outstrips our capacity to collaborate and take on researchers in-house. In acting as a hub to enable other people's research, we are able to match-make and bring together teams of researchers who are interested in similar areas, growing the UK materials research community. These Research Hub activities also give our UCL members a chance to access an exciting international, multi-institutional materials and making research community, with opportunities to collaborate with practitioners and researchers from the creative industries, social sciences and materials science and engineering communities outside UCL and around the world.

Open AFM

This year the LEGO2NANO project got serious. Over the last three years this international student project's aims were to make real science accessible to young people by developing low cost scientific equipment for schools and beyond. An Atomic Force Microscope (AFM) is an instrument capable of seeing objects a millionth of a millimetre in size. LEGO2NANO is an AFM design, assembled from cheap, off-the-shelf electronic components; including Arduino, Lego and 3D printable or laser cut parts.

In its third year the team have made it work. The result is OpenAFM, a not-for-profit start-up aimed at sharing the open source microscope for use in schools and wherever it's needed. The project kicked off with a robot build and race in the Makerspace, to integrate the teams. The time spent in China this year was longer and more involved, with one week at the Lifelong Learning Lab at Tsinghua University Beijing, and the second week in Shenzhen, China's home of mass-manufacturing. Partnerships and visits involved iCentre (Tsinghua's massive industrial prototyping facility) and OWL (Tsinghua's Open Wisdom Lab). In Shenzhen they spent time developing the project at SZOIL (Shenzhen Open Innovation Lab) and visited a multitude of spaces including HAX hardware accelerator.

The team presented their work at Mozilla Festival and Pint of Science Festival in London, and GOSH! 2016 in Geneva (the Gathering for Open Science Hardware). The team also hopes to work with UCL advances to develop the company further.

For more information: www.openafm.com



Design, Modelling and Characterisation of Porous Materials for Bio-Receptive Buildings

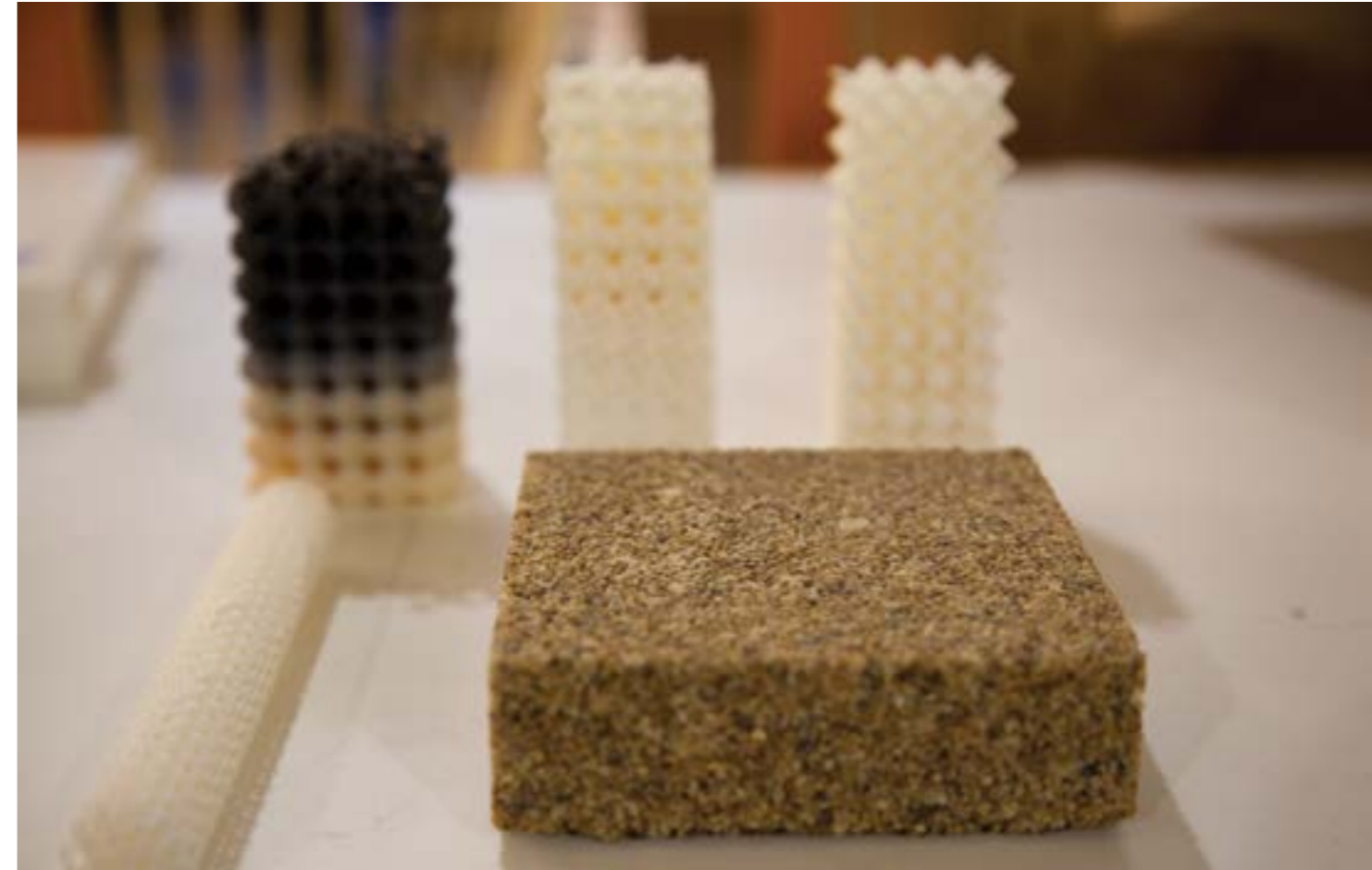
Principle Investigator: Richard Beckett, Bartlett School of Architecture, UCL.

Co-Investigators: Mina Bergstad, & Dr.Nima Shokri, School of Chemical Engineering and Analytical Sciences, University of Manchester.

In designing 3D printed building materials that act as a protective host for growth for cryptogams (algae, mosses, lichens and ferns), this interdisciplinary team of architects and chemical engineers aimed to challenge society's neophilic obsession with 'clean' buildings. They designed bio-receptive building materials that encourage the growth of biological organisms, turning them into an intentional, aesthetic design feature.

The first step was to create materials optimised for cryptogam growth, so the project team began working on 3D printed structures that could be suitably pH neutral, porous and moisture-absorbent. They made an initial series of designs in various lattice types and pore size arrays using SLS and objet technologies at the Bartlett School of Architecture. They then analysed the materials at the University of Manchester, assessing their feasibility in terms of pore size achievement, strength and practicality of fabrication methods and examining how their capillary structure affected fluid transfer through the material.

Next steps for the project team involve assessing the materials as viable architectural elements, investigating how the growth of microorganisms affects their material structure, and experimenting with creating 'patterns' using microorganisms by channelling water through the materials.



High-Res Printed Electrical Interconnects for Biomedical Devices

Principle-Investigator: Dr Manish Tiwari, Mechanical Engineering, UCL.

Co-Investigator: Prof Shervanthi Homer-Vanniasinkam, Consultant Vascular Surgeon, Leeds General Infirmary.

This project brings together engineers and surgeons with the long-term goal of developing high-resolution 3D printed pressure sensors for cardiovascular applications. This project began as an experimental demonstration to show that copper can be used for metallic interconnects in 3D printing as a low cost alternative to silver and gold printed interconnects. The benefits of copper include its low cost and high conductivity, but the project team faced numerous obstacles including controlling the flow of the copper inks and the reactivity of the printed metal, which readily oxidises when heated.

Having overcome these obstacles to achieve a series of workable printed interconnects, the team are now developing these sensor materials, with the constraints of biomedical, robotic and haptic applications strongly influencing their research agenda. The findings from this experimental demonstration are an important step towards securing future funding from other programmes to develop miniaturised sensors that meet clinical needs.



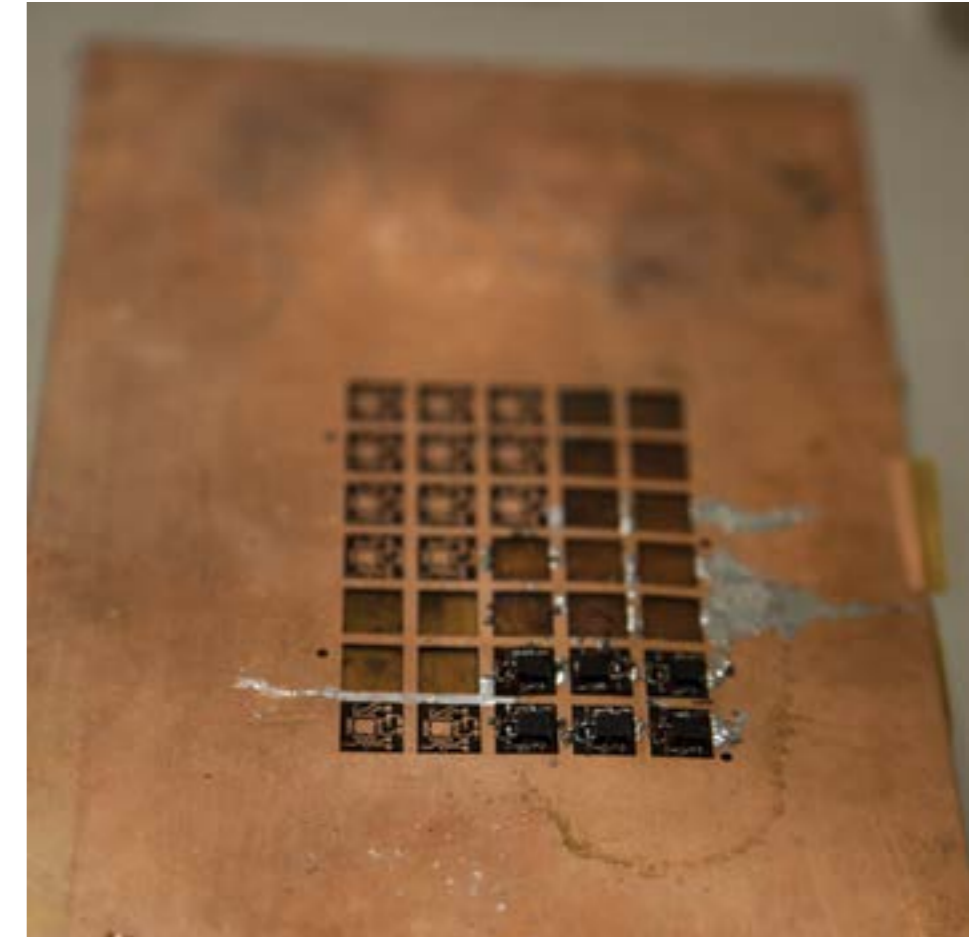
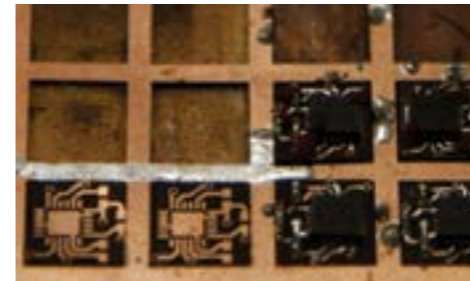
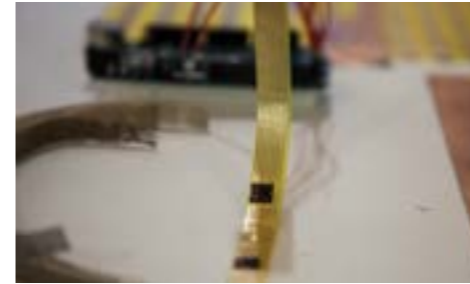
Printable, Stretchable, Conductive Sensors for Performance and Physiotherapy

Principle Investigator: Dr Sally Day, Electronic and Electrical Engineering, UCL.

Co-Investigator: Prof Sandy Black, London College of Fashion; Thomas Gilbert, PhD student Electronic and Electrical Engineering, UCL.

This collaboration between electrical engineering and fashion design investigates the best screen-printable conductors to use in sensors systems for different types of stretchable textiles. The sensors produced by this collaboration are intended for applications from performance-tracking and -enhancing dance costumes to wearable monitors for general physiotherapy and the measurement of movement disorders such as Parkinson's. The sensors therefore have to be comfortable to wear and unobtrusive, and the team also have a particular interest in making the sensors as sustainable as possible by examining the whole product lifecycle.

As part of this project, the team have fabricated a series of demonstrators that incorporate gyroscopes, accelerometers, printable conductors and a power supply into a movement-tracking glove. The glove aims to fully capture the movement of the individual joints of the fingers whilst remaining as cloth-like and comfortable as possible. The next step is to use these sensor network demonstrators to initiate discussions with a number of potential stakeholders, including those in the fields of dance and healthcare. The team are also in discussion with other research groups, including another team funded by this EPSRC Design-Led Materials grant, to share knowledge gained as part of this project.



Affordable Printed Metals for Prosthetic Hands

*Principle Investigator: Elliott Magee, MPhil Medical Physics and Biomedical Engineering, UCL.
Co-Investigator: Dr Graham Pullin, Duncan of Jordanstone College of Art and Design, Dundee University.*

This pilot study, instigated by a postgraduate student at the Aspire CREATE Centre for Rehabilitation Engineering and Technology, aimed to test the feasibility of using existing, affordable stereolithography printers to 3D print metals in a cheaper way than is currently possible. If successful, this would be hugely beneficial in the making of prostheses and orthoses as it would expand the palette of metals and alloys available, which will allow for more accessible bespoke fabrication.

The first stage of the project sought to demonstrate that metal and resin structures can be printed using the alternative printer. The second stage demonstrates that these objects can be sintered to produce a finished, lightweight porous metal object. The next stage for this project, in collaboration with Dundee University, will be to experiment with various metal and resin combinations to find optimal print outcomes for the production of speculative prosthetic hands. These abstract hands will be used as a focus for participatory workshops that give amputees, clinicians and designers a chance to input into the selection of materials for prosthetic hands.



Co-Lab Biomaterials

Principle Investigator: Dr Brenda Parker, Biochemical Engineering, UCL.

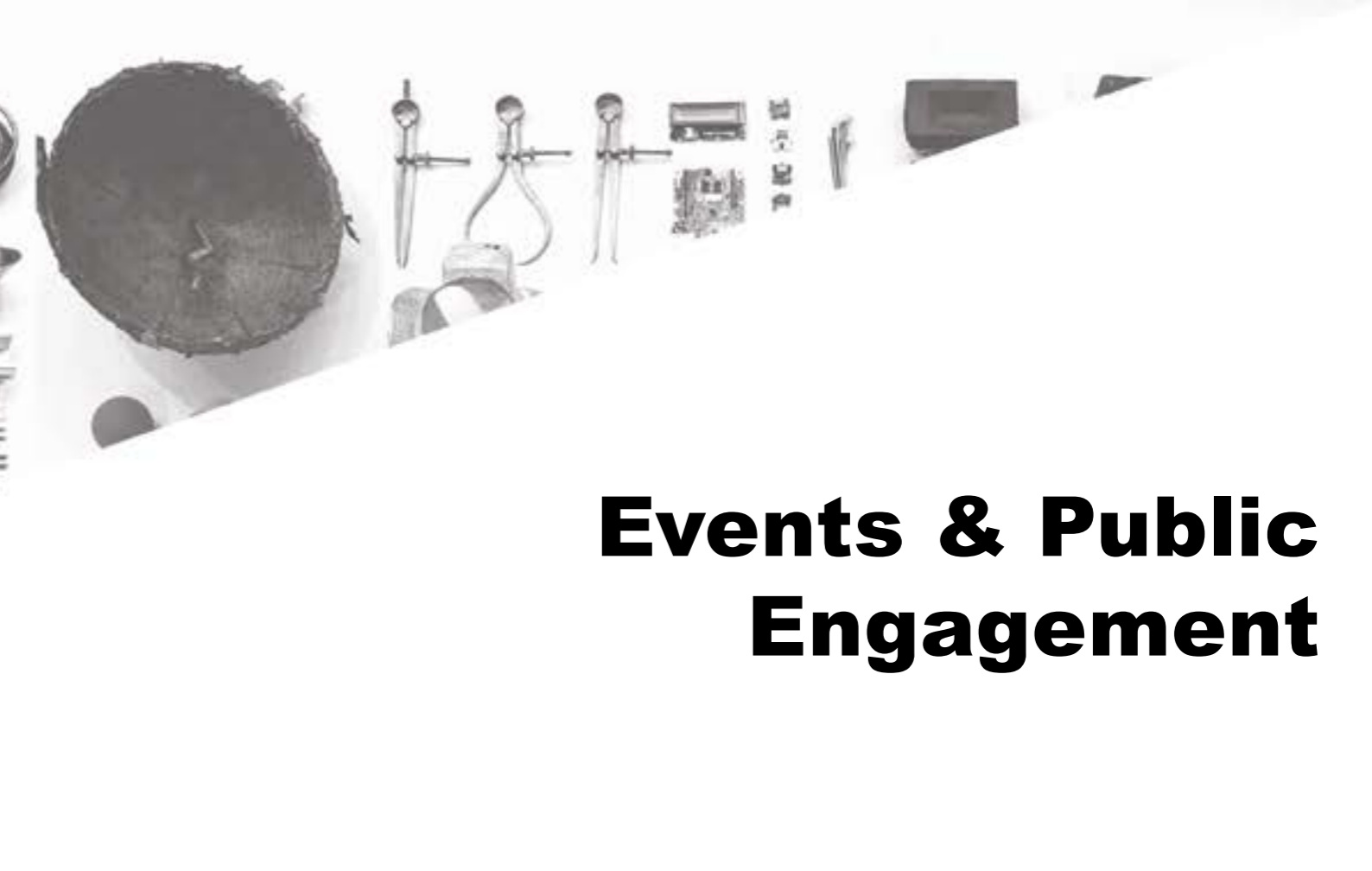
Co-investigators: Prof Buzz B. Baum, Crick Institute; Paloma Portela Torres, Molecular Biology BA, UCL; Lena Asai Design BA, Goldsmiths; Juan Manuel Garcia Arcos, MSc, CRI, Paris; Ke Fang, PhD, CRI, Paris.

This collaboration brought designers and biologists together to examine how new synthetic biology technologies can impact on society. Inspired by Bauhaus principles of learning by teaching, their aim was to bring together these different practitioners to collectively explore the design possibilities of biomaterials. They organised a series of three-day hands-on workshops to introduce each discipline to the others' ways of working, to create new ideas around the use of biological materials and to foster future collaborations.

The workshops were structured to allow plenty of space for informal one-to-one exchanges, as well as short talks by experts and an introduction to the UCL bioengineering plant and biochemistry wet labs. They culminated in a day at the Institute of Making, where participants prototyped biological design ideas as varied as a glowing watch using bioluminescent dinoflagellates, packaging that detects when milk has gone bad and turns it into cheese and a plastic material that incorporates a mycelium that degrades polyurethane. A few of the teams from the workshops are still working on their designs, and the Co-Lab group are currently applying for follow-on funding from Open Plant at the University of Cambridge.

For more information: www.openscienceschool.com/co-lab-biomaterial-2016





Events & Public Engagement

“Thanks for organising such a cracking event! Pleasure to help. Always up for volunteering with you guys!”

(Puja Bharadia, Centre for Sustainable Heritage PhD student)

Our events and public engagement programme is designed to inspire our members and the public to explore new areas of interest, acquire new skills and engage with experts in diverse fields of materials research and making. We organise several different types of event ranging from masterclasses run by expert makers for small groups of members to large scale public extravaganzas, talks, seminars and workshops. Each type of event enables those attending to gain an insight into the art and science of expert makers and a chance to discuss broader issues around materials and making. The research workshops are focused on specific research themes. They gather together experts and enthusiasts working in related areas to share their ideas and discuss the issues surrounding their topic, with the explicit aim of creating new interdisciplinary research collaborations.

From March 2015 - March 2016 we held 47 events, 24 of which were member events and 26 of which were public (see pages 158 - 161 of the Appendix for the full list of events). These included 24 masterclasses (Enamelling and Glass as a Material, for example), 6 research events (including Glass Sponges and Stone as a Material), 2 Materials Library evenings, 3 corporate events, 3 outreach events, 4 big public open days (including Light and Clay), 2 factory visits (to London Glassblowing Studios and Airbus) and 1 talk by perfumer Roja Dove. All of our events are extremely popular, with many being booked up in less than 2 minutes of being released and with extensive waiting lists forming.



These events do not happen on their own, of course. The events programme is developed and expertly managed by our Events Co-ordinator Olivia, with help from her trusty team of volunteers. Only with Olivia’s energy, enthusiasm and determination are we able to offer such a jam-packed, exciting and inclusive array of events that cater to people from all disciplines, age groups and from all over the world. The jewel in her crown is undoubtedly the 5 day Festival of Stuff, which is dedicated to our public audience. This is what one visitor said about it:

“Being on that street at Malet Place was electric. It’s fascinating what can be learnt from the littlest of “stuff”. It was an incredible afternoon indeed, and yes, I did make myself a copper spork and I’m contemplating tasting a variety of Indian foods with it. To be at the Festival of Stuff was indeed one of the best parts of my first trip to the UK. So, THANK YOU and whenever the Institute of Making community does go global I would love to be a part of it! Until then, an avid twitter follower I shall be.”

(Elizabeth Yorke)

Over the past year our events have attracted a total audience of more than 6000 people. The demand for our events far outstrips supply, and to cope with the large volume of people who attend, we regularly recruit both staff and students as volunteers to help; for the Saturday extravaganza during the Festival of Stuff we worked with 40 volunteers. Through these events our wonderful and knowledgeable community of staff and members get experience and training of interacting and talking to the public.

Festival of Stuff (Masterclasses)

This was a 5 day festival of materials and making, aimed at a public audience of adults and children, bringing back the most popular masterclasses from throughout the year. Each day we held a series of masterclasses on different themes including weaving, shaker box making, material explorations and lampworking. All 15 masterclasses sold out within minutes.

The first day involved morning and afternoon masterclasses that focused on weaving, including weaving with willow, wire, steel tape measures and paper cord. On the second day we had an all day masterclass: making a shaker box. In the evening everything was illuminated with a pyrotechnics display. On the third day we led two Materials Exploration workshops inspired by our Materials Library and an alternative stone lithography workshop. The day culminated in a Materials Library evening. On the fourth day there were three lampworking masterclasses where participants learnt the basics of glassblowing and made a whistle.



Festival of Stuff (Open Day)

More than 1300 people came to the Saturday finale of the Festival of Stuff, where we took over Malet Place, filling it with demo stalls and making stations. The extravaganza brought back some old favourites such as cyanotype photography with Angela Easterling, carbonated drinks, science demos with experimental chemist Andres Tretiakov, sugar glass with Fernando Laposse, copper spoon forming and copper bowl hammering. Alongside this we had some new discoveries including printmaking on a massive scale using a road roller with Hilary Powell, spectacle making to explore optics with Shelley James, alka-seltzer rocket making and electronic badge making with Codasign. We also showcased a range of research projects. These included large funded projects like the EU Light.Touch.Matters project as well as members' initiatives like Tom Catling's work with 3D knitting machine company KnitterBot, Hirsh Pithadia's app that detects radioactivity, and Mark Ransley's work on the WAM project, making smart materials that are capable of morphing between a rigid and flexible state.



Luted Crucible Bronze Casting and Furnace Making (Members Masterclass)

Luted or sealed crucible casting is a low-cost, low-tech method of casting, relatively unknown outside India and West Africa. Artist Piers Watson has become an expert in this type of casting, teaching it all over the world. Piers led a week-long masterclass where members were able to explore the fundamentals of the lost-wax technique by creating small solid bronze objects using a portable, propane-fired furnace.

Participants were involved in every step of the process and began the week making a small beeswax object. Over the course of the week they surrounded it with cumulative layers of sand, clay and rice husks to make their 'luted crucibles'. These were then put into the furnace with the raw metals that make up bronze (copper and tin) in one end, and the beeswax object in the other. Once the metals were fully melted, the crucibles were up-ended: molten bronze flowed into the cavity left by the melted wax. When cool, the crucibles were cracked open and the bronze pieces were finished with hand tools.

Alongside the bronze casting sessions, members made their own furnaces from oil barrels and a mixture of rice husks and clay. They also had the chance to fabricate a set of tongs for getting the crucibles in and out of the furnace.



Jonathan Keep - Ceramic 3D Printer (Maker in Residence)

In October we welcomed potter and artist Jonathan Keep as our first maker in residence. Jonathan has an interest in the hidden numerical code that underpins forms in nature, and he has developed a working process to convert pot shapes into computer code. This digital information is sent to a DIY 3D printer that Jonathan has adapted to print in clay.

During his week-long residency with us Jonathan built a large scale clay 3D printer. His design is based on the Delta type of 3D printer and aims to use parts that can be sourced or made easily with basic tools and skills. Throughout the week members were able to drop in to see how Jonathan was getting on, and even help build the 3D printer. From 12 - 2pm every day we threw open our doors for everyone to watch the progress he made throughout the week, providing a chance for non-members to see what goes on at the Institute. This week generated a lot of interest, and drew in new members from all over UCL, with overlapping interests in robotics, instrumentation, art, design, archaeology and material science.

Jonathan's 3D Printer has been donated to Institute for our members to experiment with. His machine is designed is for printing with clay, but it can be adapted to work with other materials too.



Interview with Roja Dove and drinks by Bompas & Parr (Talk)

Master perfumer Roja Dove describes himself as “a world renowned authority, philanthropist and collaborative innovator, who transforms sensory experiences”. Roja is regarded as one of the most complete and provocative voices on perfumery, delivering the secrets of scent and the risqué anecdotes that only he knows, in his inimitable way.

This talk offered a rare glimpse into the world of this master perfumer. Roja began the evening with a sensory delight, inviting visitors to smell the most rare and prestigious perfumery materials in the world – like the uniquely rich oil of the alpine rose which is only grown on one side of a single mountain in France. Roja then gave a rare and intimate interview with Zoe Laughlin, for the very first of our series “The Stuff that Makes Us”, talking through some of his most treasured objects, gathered at important times in his life.

During the break, jellymongers Bompas & Parr engulfed visitors in a gin-infused cloud, and they were invited to sip a spectacular cocktail of vodka infused with frankincense, rose and vanilla, topped with seltzer and garnished with a vanilla pod and 24-carat gold leaf. Bompas & Parr lead the way in flavour-based experience design, culinary research, architectural installations and contemporary food design.



Enamelling (Public Masterclass)

This masterclass was led by maker and artist Helen Carnac who introduced the process of applying enamel to metal; techniques which participants then used to make copper plates or badges. During this masterclass Helen situated the process of enamelling in its historical context. Through a series of short demonstrations, participants were taken through the basic principles and methods of fusing vitreous enamel to metal, before trying the process themselves to create a small panel.

Helen Carnac is an artist, maker and curator who lives and works in London. Having set up her studio in the early 1990s, Helen develops projects using design methodologies that are rooted in an acute awareness of physical location, place and working practices.



Third Birthday Celebrations (Open Day)

To celebrate our third birthday we threw a big public party, with delights such as musical jelly made by our technical staff and microwave rainbow cake made by pastry chef Terri Mercieca. Every birthday party needs candles, and we had the most spectacular candle ever: chemistry student Anna Ploszajski demonstrated her homemade Rubens' Tube – playing her trumpet to create waves of small flames to visualise sound waves. In our Materials Library visitors learned about the science of chocolate with our director Mark Miodownik. They got a chance to taste a 'miracle berry' that turns sour tastes to sweet, and to test if they were a 'supertaster'. Printall Studios taught visitors to screen print a canvas bags using a variety of brilliant pigments, metallic, flocking and foiling effects. In collaboration with Art on the Underground and inspired by London Underground signs, Helen Carnac introduced visitors to the process of enamelling. Materials scientist Jessica Wade wowed visitors with levitating bubbles, the magnetism of cornflakes and a demonstration of how to float seven different liquids on top of each other without them mixing.



Exploring Curious Materials (Research Event)

This afternoon event, organized in collaboration with Brunel's Human Centred Design Institute, offered design practitioners, architects, biomedical engineers and other makers a chance to experiment and prototype with a range of unusual but commercially available materials.

Participants got hands-on with conductive and thermochromic inks, low-melt and impact-protection polymers and shape-memory metals. Visitors were also introduced to the material at the heart of the Light.Touch.Matters research project: a flexible OLED and piezoelectric combination of materials that responds to touch with luminescence.

In a group discussion, the participants learnt more about the behaviour, potential and limitations of these materials and explored how they might incorporate them into their practice.



Materials Library Evening (Public Event)

A few times a year we open up the Materials Library to the public for an evening of exploration, experimentation and play. These evenings are curated so that attendees feel inspired and encouraged to explore the Materials Library collection and to see, touch, discuss and learn more about the extraordinary material world that surrounds us.

The central theme for the November event was ceramics. The evening included guided tours of the Materials Library, and materials that showcased the diverse world of ceramics were pulled out for closer inspection. Visitors also got to take part in an experimental workshop session led by master ceramist Nam Tran. Participants shaped, moulded, poured and sculpted their way towards learning more about the science, craft and culture of plaster of Paris. The evening also included opportunities for one-on-one materials consultancy with the Institute of Making team.





Materials Library

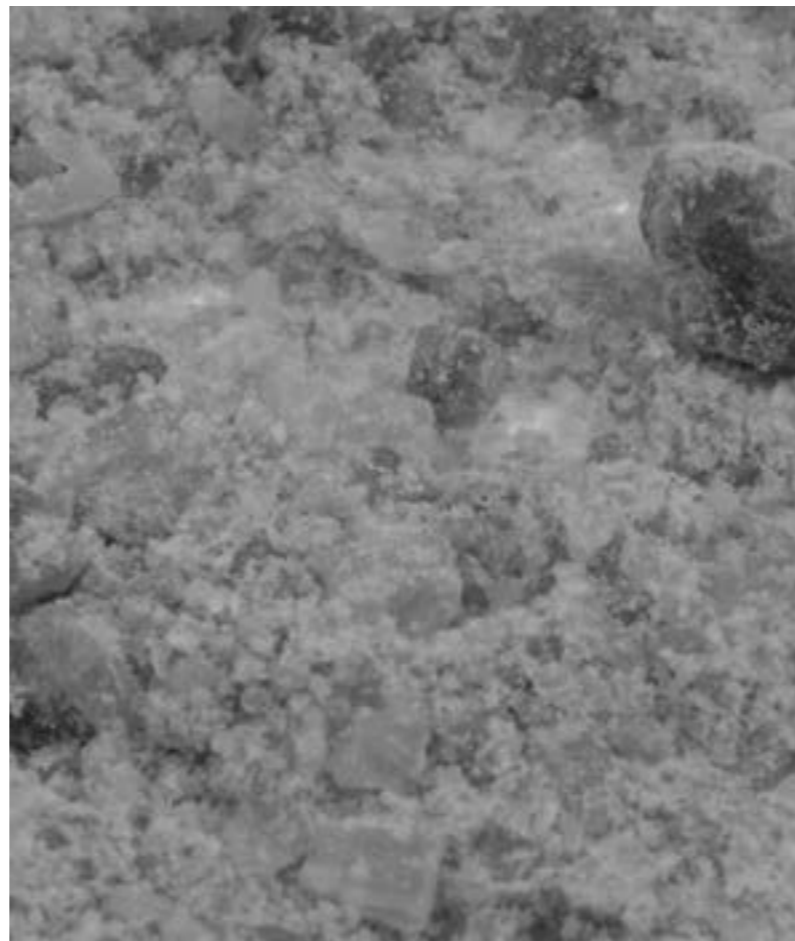
“For me the joy of the Materials Library is in how it facilitates hands-on, serendipitous searching. Exploring the Library’s collection is a quick-fire way to spark or enhance a new project. The Materials Library has been a place where I am able to network with other members while generating new skills and insights that can, in turn, inform and expand my own creative practice. Most recently, I’ve drawn inspiration from a large, rustic chunk of elm with some characteristic grain alongside a pressed titanium plate with a fluid matte patina. In my own work I hope to achieve an aesthetic balance between the natural, rustic, irregularities of the wood grain and the consistent matte appearance of the machined metal.”

(Ahilan Sooriasegaram, Library & Information Studies MA student)

The Materials Library provides a home for some of the most wondrous materials on earth, gathered from sheds, labs, grottoes and repositories around the world. It is a resource, laboratory, studio, and playground for the curious and material-minded to get inspiration, conduct hands-on research, and get involved in interdisciplinary inquiry and innovation.

This year the collection has grown to over 2000 material samples, providing a materials snapshot of the world that surrounds us. From baby teeth and toenails, pewter tankards and bronze WWII warden bells to shape-shifting polymers and ‘smart’ memory alloys: the collection celebrates the materiality of mundane, everyday life as well as those material innovations that have the potential to change the world we live in.

The Materials Library is open to all Institute of Making members on a daily basis. We also run events, workshops and consultancy sessions to provide members with a variety of ways to engage with the collection.



This year marked the introduction of a new series of Materials Library Consultancy sessions. These sessions are open to our members on a bookable basis, giving them a chance to explore the collection in greater detail and to seek material advice and inspiration from the Institute of Making team. The sessions have proved particularly popular with students and staff from the Bartlett School of Architecture, the Slade School of Fine Art, UCL Engineering and UCL Arts and Humanities, serving as a successful example of teaching-research interaction.

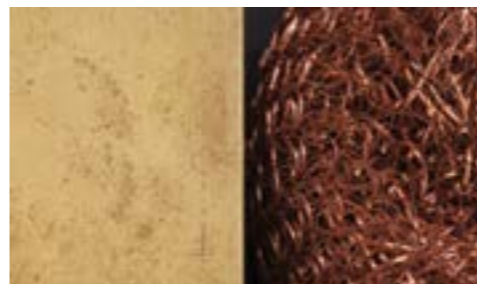
The Library is also open to the public on monthly open days and quarterly Materials Library evenings. All of this would not be possible without Liz Corbin, who manages to fit in curating the Materials Library collection, masterminding events and managing our amazing volunteers Ahilan and Valerie alongside her full time PhD.

Materials Library Volunteer Ahilan Sooriasegaram

“For me, volunteering at the Institute of Making is a microcosm of what studying at UCL is all about; it attracts students, tutors and practitioners from across the academic spectrum and spurs new conversations and multi-disciplinary thinking.”

Ahilan is a second year MA student in Library & Information Studies. He has been an integral part of the Materials Library team and has led our cataloguing efforts this year. Drawing on research for his dissertation, Ahilan has helped us explore innovative ways to generate greater impact in higher education and academic research institutions through public engagement initiatives and collection curation.

Volunteering at the Materials Library has given Ahilan the opportunity to handle, identify and research the vast array of materials and objects within the Collection. In particular, Ahilan has been able to gain first-hand insight into how students and practitioners from various disciplines approach materials and engage with objects through different processes. This has provided him with valuable hands-on experience in collection management, which will be invaluable as he goes forward in his career as an art & design/materials librarian.



Materials Library Volunteer Valerie Yingli Ngow

“Since volunteering at the Materials Library my lectures have become a lot more interesting as I am able to explore hands-on the materials and processes I learn about in class.”

Valerie is a second year Mechanical Engineering student. She has been an integral part of the team this year and has coordinated the development of the Materials Library Health and Safety Plan, a policy that has advanced a great deal this year. Volunteering with the Materials Library has been a great outlet for Valerie and has helped her to better connect with the Institute of Making community and become more involved at UCL.

“There is always something exciting happening in the Institute of Making each day I’m in. It has been inspiring to be see first-hand how projects unfold. Volunteering has also been a great way for me to get to know the staff and members here. Everyone I have met is working on really interesting projects and seems to love what they do.”

Most recently, Valerie has taken up screen printing. Before her induction in the Makespace, Valerie felt the medium to be ‘untouchable’ and the barriers to practicing the art form were too high. Seeded with a new sense of confidence, she is now looking forward to experimenting more with the process and materials once her course assignments are complete.



Polymorph (Polycaprolactone)

These small, milky white, bead-like pellets are more than meets the eye. When submerged in boiling water, the granules soften and fuse together forming a mass of clear material with endless possibilities and applications.

Polycaprolactone (PCL) is a biodegradable thermoplastic. Thermoplastics are polymers that become pliable above a specific temperature – in the case of PCL, the relatively low melting point of 60°C. The polymer chains that form PCL are linked to each other by weak bonds, which weaken further with increased temperature, eventually yielding a viscous liquid. From solid to liquid and back again, the amorphous nature of its polymer chains means the properties of PCL can change drastically without its structure becoming brittle or damaged.

The biocompatibility and degradation rate when placed in physiological conditions has made PCL an ideal candidate for use in an array of medical applications including: long-term implantable devices, controlled release drug delivery, suturing and bio-scaffolding. In addition to its medical applications, the seemingly effortless transition from tough plastic to mouldable putty makes PCL ideal for small-scale modelling, repair, rapid prototyping and as feedstock for FDM 3D printing.

Particularities

State: Solid

Category: Polymer

Relationships: Biocompatible, Thermosoft, Biodegradable, Prototyping, 3D Printing.



Crying Tin

Tin is most commonly used today in combination with other metals like lead to produce solders for electronic circuitry and copper to produce the alloy bronze. It has a very low melting temperature and is a pure metallic element. This particular item is a favourite of Creative Director Zoe Laughlin. Here is her take on it:

“This is one of my all-time favourite items within the Materials Library collection. It is at first glance unremarkable, yet it has the ability to reveal something of the extraordinary internal micro-world of material structure and how this produces macro-effects that we can see, hear and feel. If you take this bar in both hands and sharply bend it, something extraordinary happens; the movement of the internal crystal structure produces vibrations that can be felt and heard. The crackling sound is officially termed the cry of tin. Despite being malleable and ductile, it feels like it is shattering or splintering like a stick of wood or glass.”

Particularities

State: Solid

Category: Metal

Relationships: Acoustic, Bend, Element, Corrosion-Resistant, Low Toxicity, Pure Element, Crystal Structure.



Nitinol Stent

This stent is made of Nitinol, an alloy of nickel and titanium commonly termed a shape memory alloy. Shape memory alloys do exactly as their name would suggest: they're metallic materials that are able to remember, and return to, their original shape under the right stimuli. At high temperatures, the material is able to expand 4% or more from its original shape. When cooled, the material's atomic arrangement reverts to its original formation and, in so doing, miraculously returns to its previous shape.

Half of all stents (artificial tubes used in the human body to allow fluid to flow through a constriction) are made from shape memory alloys.

Particularities

State: Solid, Object

Category: Metal

Relationships: Alloy, Nitinol, Nickel, Titanium, Heat, Transformation, Memory.



Aluminium Nitride Wafer

This thin, fragile tile of ceramic material conducts the heat from your hand efficiently enough to cut through ice as if it were butter. Heat generated by the fingers is gathered from the two sides of the tile and conducted towards its edges, meaning that when an edge is placed against ice, the concentrated body heat rapidly melts the ice away. It is the speed of the conduction of heat that marks this ceramic out as a high performance material. If you hold it carefully between thumb and forefinger and then touch the edge to your lip, you will feel the rapid conduction of heat.

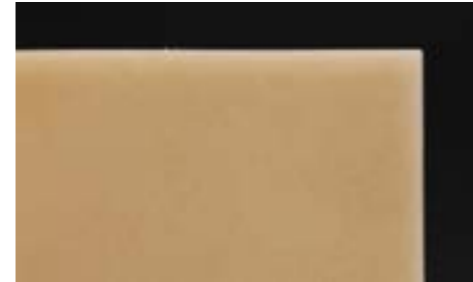
Although the existence of this substance has been known about since 1862, it was not developed as a commercial product until the 1980s when its potential for use as a heat conductor in electronics was recognised. Even then, early versions of this material were inconsistent. Although its performance has been greatly improved by technologists, its uses have thus far been fairly limited, largely in electronic and military applications, perhaps as a result of its high cost.

Particularities

State: Solid, Object

Category: Ceramic

Relationships: Conductive, Thermal, Wafer, Tile, Ice, Edges, Aluminium Nitride, Ceramic.



Single Crystal Jet Engine Turbine Blade

This jet engine turbine blade has two distinguishing material features. Firstly, it is made of a super-alloy, which has superior mechanical strength and creep resistance at high temperatures, good corrosion and oxidation resistance compared to normal metals and alloys. Secondly, it is formed out of a single metal crystal, a structure that gives the blade outstanding creep strength at high temperatures.

Most bulk metals are not one big crystal: they are composed of many tiny crystallites called grains. The boundaries between these grains generally increase the strength of a metal, however at high temperatures they provide a way for the metal to deform over time (called creep). Creating a turbine blade as a single crystal means it does not have any grain boundaries, and it is therefore intrinsically less prone to creep at high temperatures than polycrystalline metals. It is this property that has allowed turbine jet engines to be operated reliably at very high temperatures which increases the efficiency and safety of the engine. Modern turbine jet engines are the most efficient engines on the planet.

Particularities

State: Solid, Object

Category: Metal

Relationships: Ultra-Strong, Single Crystal, Aviation, Super-Alloy.





The Makespace

“My students, who range from first to fourth and fifth year Architecture students, find the Makespace an indispensable resource. Not only is it a great space, filled with wonderful stuff, but the thing that they mention most is how fabulous the staff are. Always willing to help and facilitate their ideas.”

(Abigail Ashton, Bartlett School of Architecture Design Tutor)

Over the past year the space has continued to grow and evolve. New tools and innovations in the layout of our physical space, coupled with ideas and expertise from new staff and member supervisors, have meant increased access to materials, techniques and processes. We are increasingly able to provide much-needed space and time to experiment and explore. Masterclasses and events have also inspired new activities in the space. Glassblowing, textile dyeing and metal enamelling have seen us stocked up with new materials and tools, and resulted in members getting together to perfect their own technique after having attended a masterclass. Access to the space, tools, materials, masterclasses and specialist technical advice continue to be free of charge for members and public, but we encourage members to bring in their own materials and to understand the real-world cost of the things we provide.

Ellie, our Makespace Manager, has been with us since we arrived at UCL. Since then she has set up from scratch and continuously improved the workshop and its systems, masterminded the member opportunities that make the workshop so vibrant, and even personally inducted most of the members herself! With her endless patience, inquisitiveness and willingness to help, she sustains the friendly and supportive spirit of the Makespace.

Our diverse team of technical staff are the beating heart of the Makespace. Their approachability, broad range of expertise, imaginative skills and can-do attitude are



what keep people coming here.

This year our wonderful technician of 3 years, Richard Gamester, decided to move on and focus on his own silversmithing practice. Since January we've been joined by two new technicians, who bring new skills and an inclusive spirit to the workshop. Darren Ellis is an artist and potter, who brings unrivalled clay and glaze knowledge as well as expertise in kiln-building and throwing, and machining knowledge from his experiences working in his family's traditional Yorkshire textile mill. Romain Meunier is an artist, designer and creative technologist, who specialises in interactive installations and mixing digital and analogue technologies; his technical skills have already made him indispensable. Long-standing technician Zachary Eastwood-Bloom, who has been with us since 2014, is an artist, maker and craftsperson who brings expertise in sculpture that explores the blurring space between materiality and digitisation. He has inspired our members and further broadened the scope of what we can do with our tools.

We've also been supported by fantastic temporary technician and artist Noga Inbar, who instituted and led Materials Library life drawing. Creative technologist and sound engineer George Walker has brought his flair for programming, robotics and digital tools, and his knack for making members feel confident in using new technology. He has made himself indispensable in the temporary role of Makespace Assistant.

Clay 3D Printer

October's maker in residence, Jonathan Keep, built a large-scale clay 3D printer with our technicians. The design uses parts that can be made and repaired fairly easily with basic tools and skills, and generic parts that can be ordered online such as arduino, stepper motors, syringes and flexible drive belts.

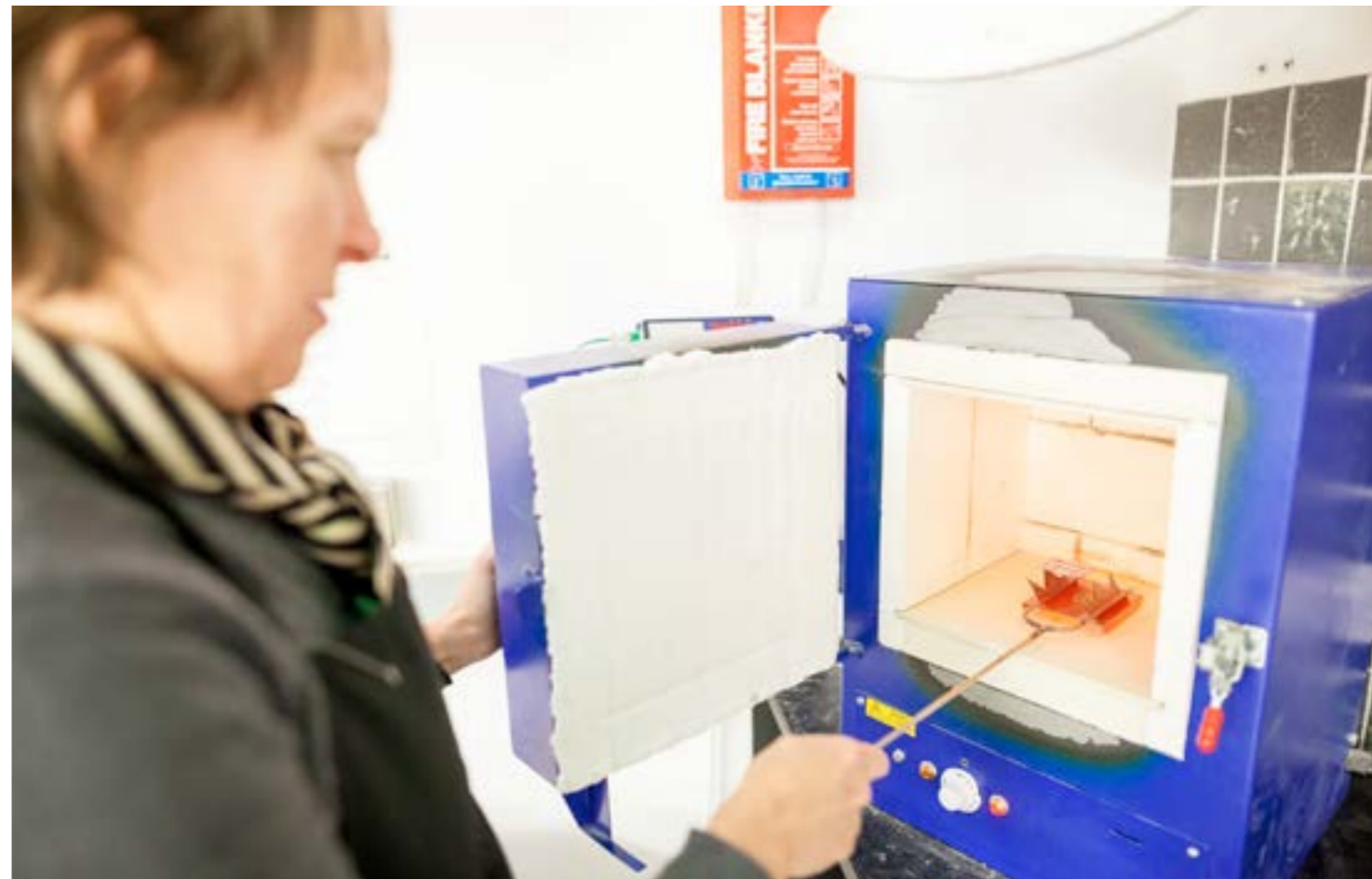
This design is optimised for printing with clay but it could be adapted to work with other paste materials too. The objects are built up layer by layer through material extrusion: a form of mechanical pottery coil building. After printing, the clay needs the usual post-processing of firing and glazing. This new tool is now open to our members to use.



Enamelling Kiln

During our series of enamelling masterclasses led by Helen Carnac, with Art on the Underground, we kitted the space out with an enamelling kiln and its associated tools like tongs, enamel glazes and glasses, tiny sieves and firing supports.

Enamelled pieces take minutes to fire once the kiln is set up, which makes the process gratifyingly instant and open to rapid experimentation. Members absolutely love it, and we will be experimenting with different metals and enamelling onto 3D objects over the next year.



Screen Print Facility

One of our member supervisors Laura Dempsey was keen to screen print in the space, and rightly guessed that other members would also be interested in the technique. We costed out all the kit with the help of James Keith, the friendly printmaking technician at the Slade School of Fine Art, and built a cabinet to house it all. We now run termly inductions on how to get started.

One of the nice things about screen printing is that it can be used in conjunction with other techniques: UV photoresist to make screen designs, laser cut stencils or even 'painting' with your fingers directly through the screen onto your surface. Materials, too, can be diverse, including textile inks, etching masks, enamel, ceramic glaze or conductive inks to make printed circuits.



Form 1 3D Printers

We initially bought a resin printer to have some provision for high-resolution 3D printing with complex geometries, which our thermoplastic FDM (Fused deposition modelling) could not provide. After two years we found the printer's material costs to be prohibitively expensive and we were having to charge for materials, with the cost generally being too high for members without research grants. We have since passed the printer on to our colleagues up in Medical Physics, who use it extensively.

As a replacement, we have invested in two Form 1 SLA (stereolithography) printers, which work by laser curing liquid resin in layers to form an object. The printers have the advantage of using material tanks which can be swapped out, allowing us to print with opaque, transparent, flexible or burn-out castable material.



Member Supervisors

Our voluntary student team of trusted member supervisors regularly lead tool and new member inductions, providing valuable peer-to-peer learning opportunities, which help to break down hierarchies between students, staff and researchers. They are generally self-selecting: we identify the people who are the most dedicated to the spirit of the place, and who spend the most time here.

Other members have also been generous with their time and expertise, and we hope to celebrate the breadth of making activity within UCL by encouraging our members to lead more masterclasses next year.

Here we interview them about what being part of the team here has meant for them and how it's influenced what they do at UCL and beyond.



Laura Dempsey **Medical Physics & Biomedical Engineering PhD student**

Laura is a multi-skilled, creative and engaged member supervisor, leading inductions in 3D print, laser cutter and screen printing. She also created our little hanging gardens on the mezzanine.

“Working as a member supervisor and having access to the Makerspace has had a huge positive impact on my experience at UCL. It’s given me valuable teaching experience and more confidence in instructing small groups. I really enjoy engaging with the members, getting them to talk about their ideas, and featuring the incredible work that people are making on the member blog.”

The Institute of Making has also brought to my attention so many cool opportunities, for example I found out about the biodiversity gardening project at the Institute of Education through the online member noticeboard.

Being able to pursue my own ideas has been very beneficial to making progress in my PhD. Instead of having to pay someone else to make a part and then wait weeks for it to be completed, I can pop down to the Makerspace and create a prototype in a few hours. The ability to keep my artistic side alive has definitely been beneficial to my mental health and general happiness during the tough slog that is the PhD years.”



Prash Ganeswaran Medical Physics & Biomedical Engineering

Prash has been with us from the start and has learnt to use and teach many of our tools. His inventive and can-do attitude make him a valuable team member.

“My main aim when I started was to learn to use all the tools. I studied Mechanical Engineering but we didn’t ever get to make anything during my course. The Institute was a place I could take the theory I had learned during my degree and apply it in a practical way. My favourite non-digital tool is the lathe; I was taught to use it in the Makespace.

Blacksmithing was incredible, probably the best master class I have done. You don’t often get the opportunity to work with metal in a raw form, shaping it and working it using traditional methods. I’m also fascinated by plastic welding: using a brush to ‘paint’ on the chemical at the joins, as the liquid moves through via capillary action and melts the two surfaces together, creating a very strong bond.”



Emilia McLaughlin **Biochemistry MSci student**

Emilia assists with the running of events, masterclasses and leads New Member Inductions. She takes part in hands on research, is an experimental maker and has won the member award for public engagement twice!

“People at the Institute take the time to get to know you and remember your name, that you’ve got a dog, what you’re up to.

I love to talk to other people in the space. Hearing from PhD students has really helped me see how it is at different levels of university, opening up the possibilities of research - what it can be - not just old men in offices like I thought. People like Brenda Parker (Biochemical Engineering Lecturer) have really opened my eyes. It is inspiring what people in different departments can do together. In the Makerspace I might come across senior staff like Andrea Sella, Suzanne Ruddy and Michael Baron in an entirely different context, which is exciting and unusual. Your teachers are peers here.”

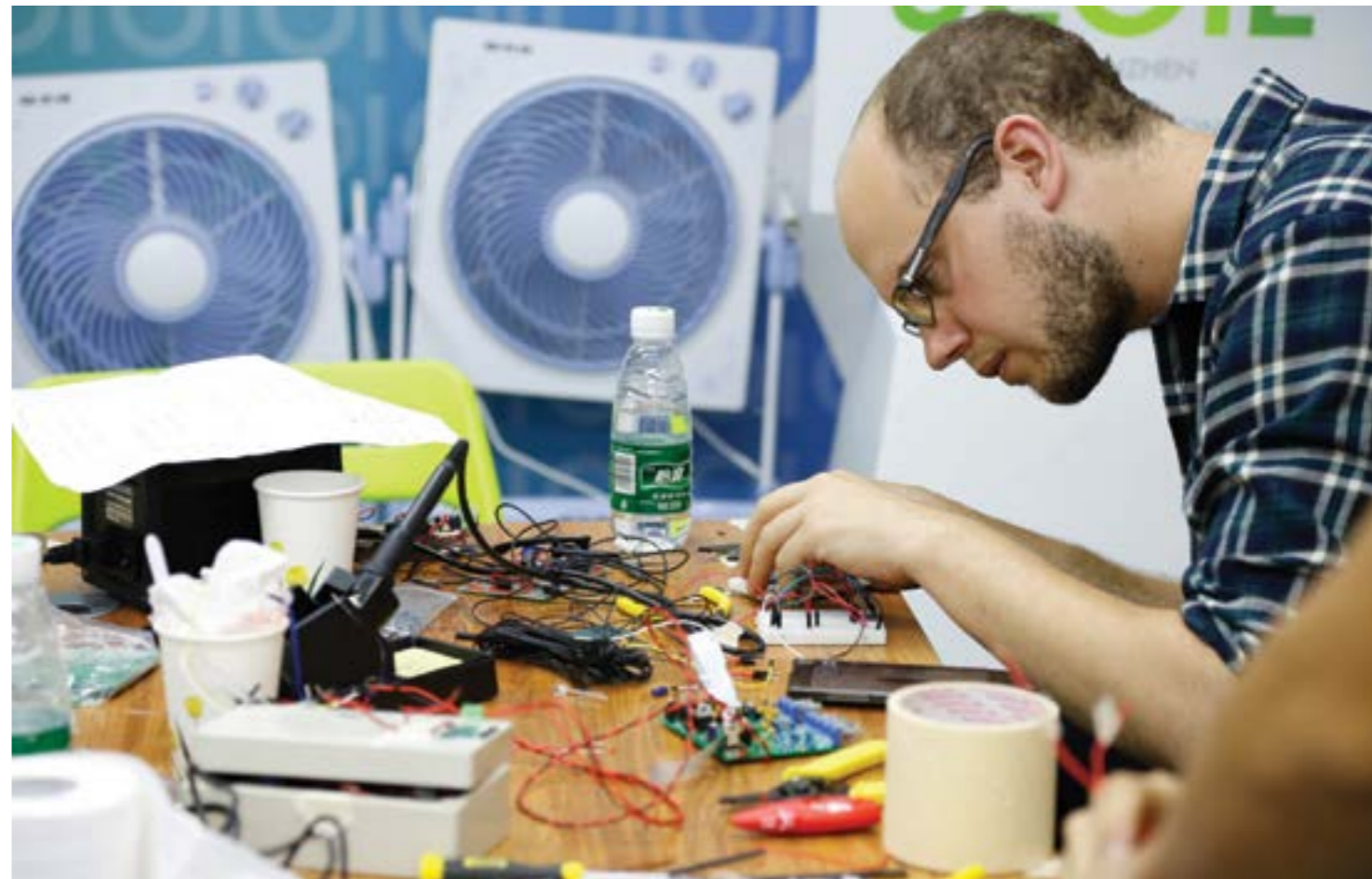


Tom Catling Astrophysics PhD student

Tom has made instrumentation his specialism, building and modifying the 3D printers and other tools in the space. He is a natural teacher and collaborator and is often to be found making musical instruments and chatting to other members about making.

“Being part of the Institute is a major part of my experience at UCL. I’ve made really good friends, met lots of interesting people and learned some really cool skills. I would not have enjoyed my time at UCL so much without it, and the people in it, and my prospects and career goals would now be very different.”

I really liked using the metal lathe and mill in the Makerspace. It’s pretty hard to get an opportunity to learn how to use these properly outside of expensive classes, so having Rich around to teach me was super amazing. It excites me because you can make anything, and if you plan carefully and do stuff meticulously you can come out with ‘real’ parts. I think it’s cool to hold a piece of metal you just machined and know that all the surfaces are flat and square, and you did it mostly by hand and by setting up angles. There’s a whole world of manufacturing that most people never get introduced to, and this was like dipping my toe in the water.”



Becky Lee **Geography Undergraduate student**

Becky regularly gets stuck in helping Darren with clay processing and inductions, and is always to be found elbow deep in some clay. She is looking to specialise in geomorphology and ecology.

“I really enjoy the process of making. Sometimes this is more important than creating something, so I often recycle pots after I throw them. The process of squeezing the clay and watching it transform under my hands is what I enjoy most. The feeling of the clay interacting with my hands: its texture and sliminess.”

Clay is from nature, from the earth, and whenever we take anything from the earth we need to appreciate it fully. In this consumerist world I really enjoy using clay as it is so easily recyclable. The desire to touch clay has influenced what I do at UCL. I really like the textures in rock; it is representative of the rock’s history. When you see granite exposed you have to imagine it being formed from molten magma and being revealed as a result of tectonic movements.”



Rhys Williams UCLIC PhD student

Rhys is a trusted member of the team and is very focused on using the space for research purposes. In his work he's exploring advanced 3D print methods to create biofeedback devices whilst also exploring the concept of comfort in wearables. He's enthusiastic and always on hand to give advice and friendly training on our 3D printers and laser cutter.

“The ability to explain 3D printing and laser cutting, and what they can be useful for, has really helped me in my academic path so far. It helps to practice talking to people, sharing research and my own ideas, advising others about their own projects. It's a very creative part of what I do.”

I like being a part of the Institute because of the people you interact with. One second you can be standing next to a professor of Engineering, then a student from the Bartlett doing something really crazy and out there with materials. It's a level playing field - a really important part of the place.”

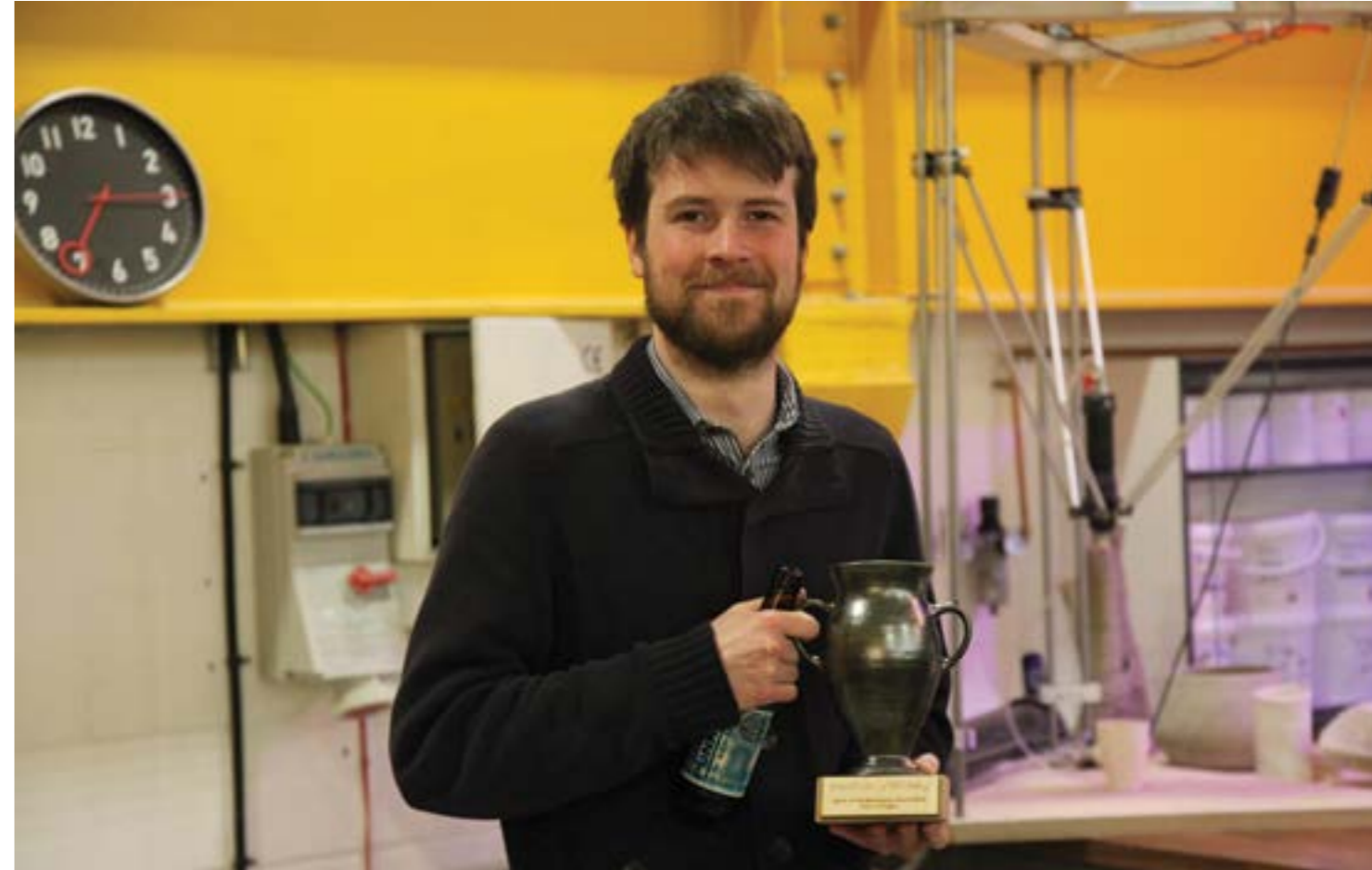


Elliott Magee **Biochemical Engineering PhD student**

Elliott's research goal is to design a minimally-invasive brain computer interface. He teaches digital skills and is most often found in the Makerspace wood turning, or making realistic accessories for his latest fancy dress costume.

"I have ended up using a lot of the techniques I've learnt here in my own work. In my own lab I'm the head of 3D print because of my experience here; I now hold an advisory role in the department and lead on maintenance.

My experience here informs my research in terms of new techniques. Now, when I'm faced with a new problem I have a much broader range of options to solve it; more opportunity to be creative, which in turn enhances creativity in my field."





Concluding Remarks

“The great success of the logical analytical reductionist approach to understanding over the last four centuries and the utility of the application of its principles has not negated the evidence of history that the sensual-emotional-aesthetic capabilities of the human being also have validity. The problem is to find the proper nonexclusive role for each.”

(Cyril Stanley Smith, 1981)

As the materials scientist Cyril Stanley Smith observed in the ‘80s, the development of new materials requires both theoretical knowledge and an understanding of human behaviours of making and using them. This is why, at the Institute of Making, we emphasize the iterative nature of materials design and development, as well as the importance of human insight and knowledge about materials.

Take the example of the development of new wound dressings, which are crucial for treating many chronic diseases. The functionality of a wound dressing is distributed across many scales; from the nanoscale of their antibacterial function, to the micro-scale of the membrane layers controlling humidity, to the meso-scale of their fluid-handing properties, to the macro-scale of their form-fitting attachment to the body. Moreover, aesthetic properties, such as smell and colour, can dramatically affect how patients feel about their treatment and condition. This affects recovery rates, which then has a huge impact on both the costs incurred by hospitals and the patients’ wellbeing. Thus, developing new wound healing systems not only involves solving physical and biological problems, as well as issues of disposal and recycling, but also requires an understanding of the look and feel of materials and their context in a healthcare or domestic setting. As our materials needs in every area of our lives grow more sophisticated, the solutions also become more complex.

Materials are fundamentally multi-scale, and this is why there is as much to be



learned about materials design through the production and trial of full-scale prototypes as through the application of theory. To assemble multidisciplinary teams with experts in each different scale requires laboratories that facilitate analysis, microscopy, and equipment to build and test physical prototypes.

Materials libraries have a significant part to play too, as physical catalogues of potential materials solutions. This approach to materials design relies on practical materials knowledge: not because theory is irrelevant to tackling complex problems, but because in making stuff such as bandages, exoskeletons, or solar roof tiles, materials scientists and engineers need to better understand the design factors that are important at the human scale. This is why we place so much importance on our Materials Library and why we continue to develop it as research tool.

“The Institute of Making is unique and unlike anything else I have witnessed on my travels around the world. Every time I visit I never leave without feeling inspired and excited about the diverse range of activities taking place here at UCL.”

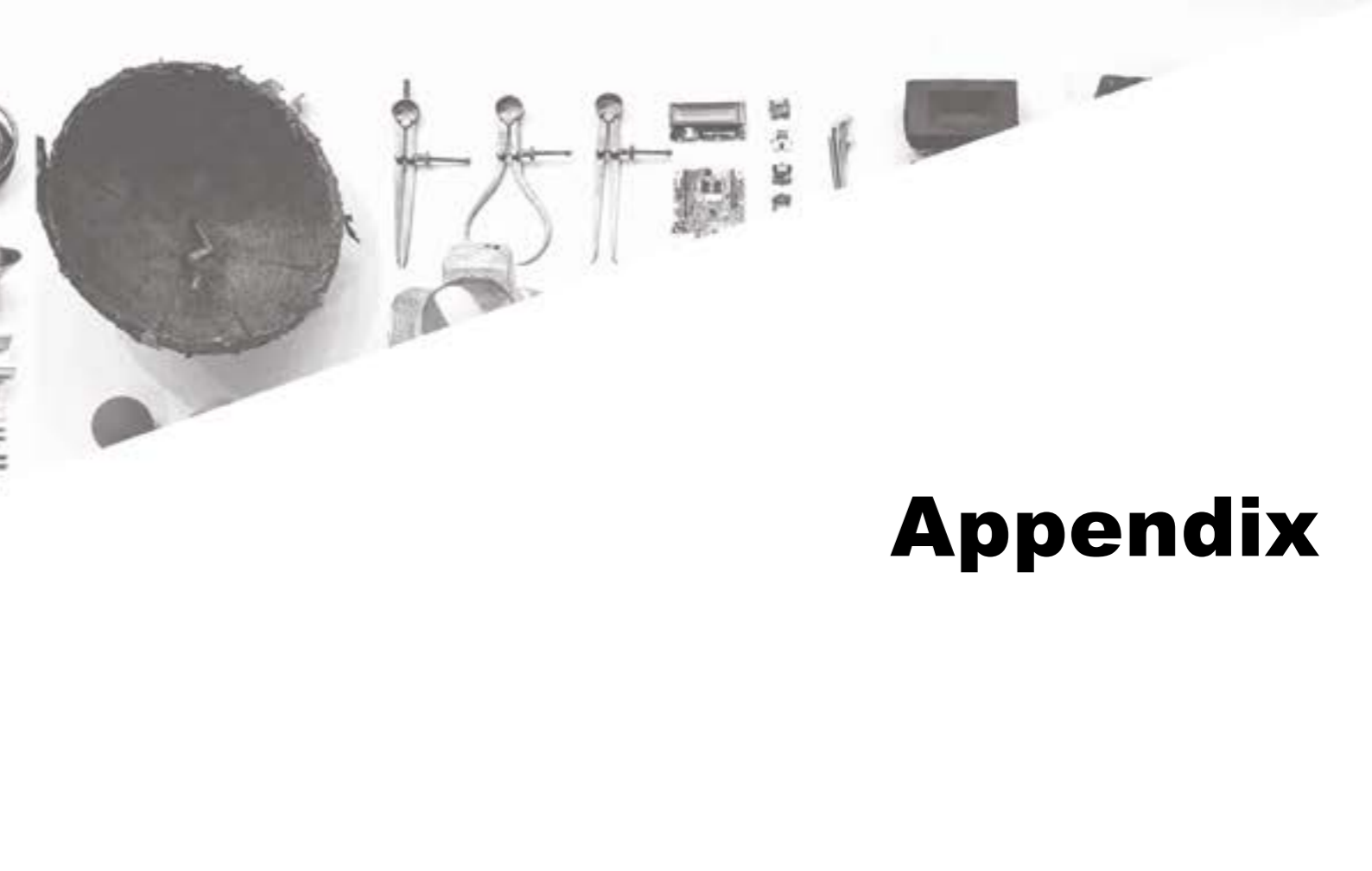
(Martin Conreen, Institute of Making, 2016)

“Three years on and our institute is still growing: we are bigger in terms of our numbers of members, our research activities, our events, our materials library, and our ambition. We are flying and I love it.”

(Mark Miodownik, Institute of Making, 2016)

“I’m so proud of all the team at the Institute of Making—they work incredibly hard and bring such joy and creativity to all they do. It is wonderful to see the breadth and depth of engagement we provide in materials and processes bearing fruit for the community of UCL and beyond.”

(Zoe Laughlin, Institute of Making, 2016)



Appendix

Full Statistics of Membership

Total number of registered members 5077

Active inducted members 2656

Gender

Female (37%)

Male (50%)

No gender declaration (13%)

Member type

Staff 34%

Academic staff (21%)

Professional services staff (11%)

Students 66%

Undergraduates (34%)

Postgraduates (32%)

Other (2%)



Full List of Events

Total number of events: 47 (24 member events and 26 public events)

Breakdown: 24 masterclasses, 7 research events, 2 Materials Library evenings, 2 corporate events, 3 outreach events, 4 public open days, 3 week-long events, 2 factory visits and 1 talk.

19th March, 2015. *London Glassblowing Studio*. (Factory Tour) Members event.

23rd March, 2015. *Glass as a Material*. (Masterclass) Members event.

2nd May, 2015. *Light*. (Open day) Public event.

12th May, 2015. *Stone as a Material*. (Research event)

23rd June, 2015. *Morning session - Basket Weaving*. (Festival of Stuff) Public and member event.

23rd June, 2015. *Morning session - Weaving with Wire*. (Festival of Stuff) Public and member event.

23rd June, 2015. *Morning session - Paper Cord Weaving*. (Festival of Stuff) Public and member event.

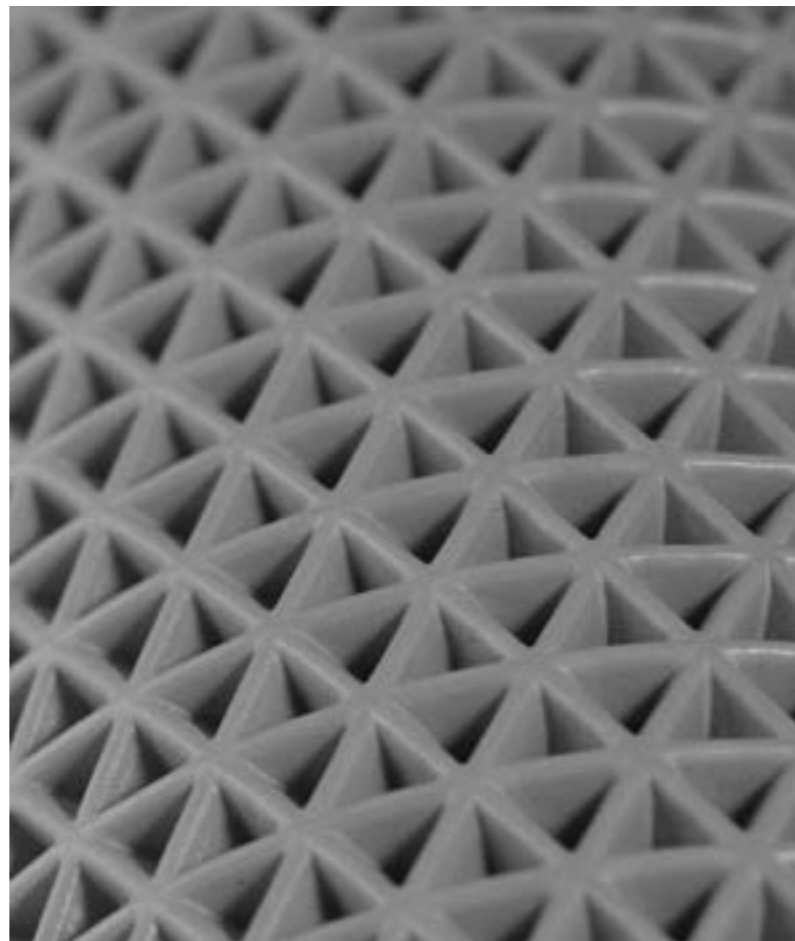
23rd June, 2015. *Afternoon session - Basket Weaving*. (Festival of Stuff) Public and member event.

23rd June, 2015. *Afternoon session - Weaving with Wire*. (Festival of Stuff) Public and member event.

23rd June, 2015. *Afternoon session - Paper Cord Weaving*. (Festival of Stuff) Public and member event.

24th June, 2015. *Shaker Box Making*. (Festival of Stuff) Public and member event.

24th June, 2015. *Pyrotechnics with Matthew Tosh*. (Festival of Stuff) Public and member



event.

25th June, 2015. *Alternative Stone Lithography*. (Festival of Stuff) Public and member event.

25th June, 2015. *Morning session - Material Explorations*. (Festival of Stuff) Public and member event.

25th June, 2015. *Afternoon session - Material Explorations*. (Festival of Stuff) Public and member event.

25th June, 2015. *Materials Library Evening*. (Festival of Stuff) Public and member event.

26th June, 2015. *Morning session - Lampworking a Whistle*. (Festival of Stuff) Public and member event.

26th June, 2015. *Lunchtime session - Lampworking a Whistle*. (Festival of Stuff) Public and member event.

26th June, 2015. *Afternoon session - Lampworking a Whistle*. (Festival of Stuff) Public and member event.

27th June, 2015. *Festival of Stuff*. (Open day) Public event.

20th July - 24th July, 2015. *Luted Crucible Bronze Casting*. (Masterclass) Members event.

20th July - 24th July, 2015. *Furnace Making for the Luted Crucible Bronze Casting*. (Masterclass) Members event.

22nd July, 2015. *Animatronics*. (Outreach)

27th July, 2015. *Lego2Nano Workshop with Children*. (Outreach)

14th September, 2015. *Making Day*. (Corporate)

5th October - 9th October, 2015. *Jonathan Keep - Ceramic 3D Printer*. (Maker in Residence)

5th October - 9th October, 2015. *Lunchtime Looks*. (Open to all UCL).

15th October, 2015. *Lampworking*. (Masterclass) Public event.

24th October, 2015. *Clay & Ceramics*. (Open day) Public event.

12th November, 2015. *Materials Library Evening*. (Library) Public event.

16th November, 2015. *Glass Sponges*. (Research event) Public and members event.
19th November, 2015. *Interview with Roja Dove and Drinks by Bompas & Parr*. (Talk) Public event.
23rd November, 2015. *Morning session - Enamelling*. (Masterclass) Public event.
23rd November, 2015. *Afternoon session - Enamelling*. (Masterclass) Public event.
30th November, 2015. *Making Matters*. (Corporate event)
7th December, 2015. *Exploring Curious Materials*. (Research event)
10th December, 2015. *Fish Printing*. (Masterclass) Public event.
25th January, 2016. *Morning session - Enamelling*. (Masterclass) Members event.
25th January, 2016. *Afternoon session - Enamelling*. (Masterclass) Members event.
30th January, 2016. *Engineers Save Lives*. (Outreach)
1st February, 2016. *Hands-on Learning*. (Research Hub event)
15th February, 2016. *Co-Lab Biomaterials*. (Research Hub event)
22nd February, 2016. *Co-Lab Biomaterials*. (Research Hub event)
22nd February, 2016. *Airbus*. (Factory Tour) Members event.
29th February, 2016. *Fabric Colour Adding and Subtracting*. (Masterclass) Members event.
12th March, 2016. *Birthday Celebrations*. (Open day) Public event.
14th March, 2016. *Design-Led Materials Finale*. (Research event).



Research Papers

Hashimdeen, S. H., Thorogate, R., Miodownik, M., & Edirisinghe, M. J. (2016). Fabrication of bespoke nasal septal scaffolds. *Materials and Design*, 90, 403-409. doi:10.1016/j.matdes.2015.10.120

Miodownik, M. (2015) Towards designing new sensoaesthetic materials: the role of materials libraries. In *The Social Life of Materials*, Editor(s): Adam Drazin, Susanne Küchler, Bloomsbury, ISBN 9781472592668

Miodownik, M. (2015). Materials for the 21st century: what will we dream up next? *MRS Bulletin*, 40 (12), 1188-1197. doi:10.1557/mrs.2015.267

Wilkes, S (2015). Sustainability and the co-constitution of substances and subjects. In *The Social Life of Materials*, Editor(s): Adam Drazin, Susanne Küchler, Bloomsbury, ISBN 9781472592668

Wilkes, S., Wongsriruksa, S., Howes, P., Gamester, R., Witchel, H., Conreen, M., Laughlin, Z. and Miodownik, M. (2016). Design tools for interdisciplinary translation of material experiences. *Materials and Design*, 90, 1228-1237. doi:10.1016/j.matdes.2015.04.013



Media Coverage

Newspapers

Soft robots for hospitals. *The Observer*, October 2015.

How laboratory-grown organs will transform our lives. *The Observer*, July 2015.

Wood 2.0 – a very modern material. *The Observer*, June 2015.

Steel – it is the material we are most intimately acquainted – after all we put it in our mouths every day. *The Observer*, May 2015.

Chocolate is as sophisticated as wine in igniting senses & giving pleasure. *The Observer*, April 2015.

Future fabric. *The Observer*, March 2015.

Dangerous diaries: exploring risks and rewards in fabrication. *Chemistry World*, February 2016.

So, who's the best chef: the one with the Michelin stars or the geek? *The Times*, 17th March 2016.



Television & Radio

Putting Science to Work, Infuriating Packaging. BBC Radio 4, 28th December 2015.

Start The Week. BBC Radio 4, 21st September 2015.

Everyday Miracles: The Genius Of Sofas, Stockings And Scanners. TV series (repeat), BBC4, June 2015.

How It Works. TV series (repeat), BBC4, November 2015.

My Perfect Country. BBC World Service, 4th February 2016.

ITV London News. ITV, 11th March 2016.

Chef vs. Science, The Ultimate Kitchen Challenge. BBC4, 23rd March 2016.

The One Show. BBC1, 23rd March 2016.

The Kitchen Cabinet. BBC Radio 4, September 2015 and January 2016.

Exhibitions

Cravings (featuring the spoons). The Science Museum, January 2015 - May 2016.

Social Media Feeds

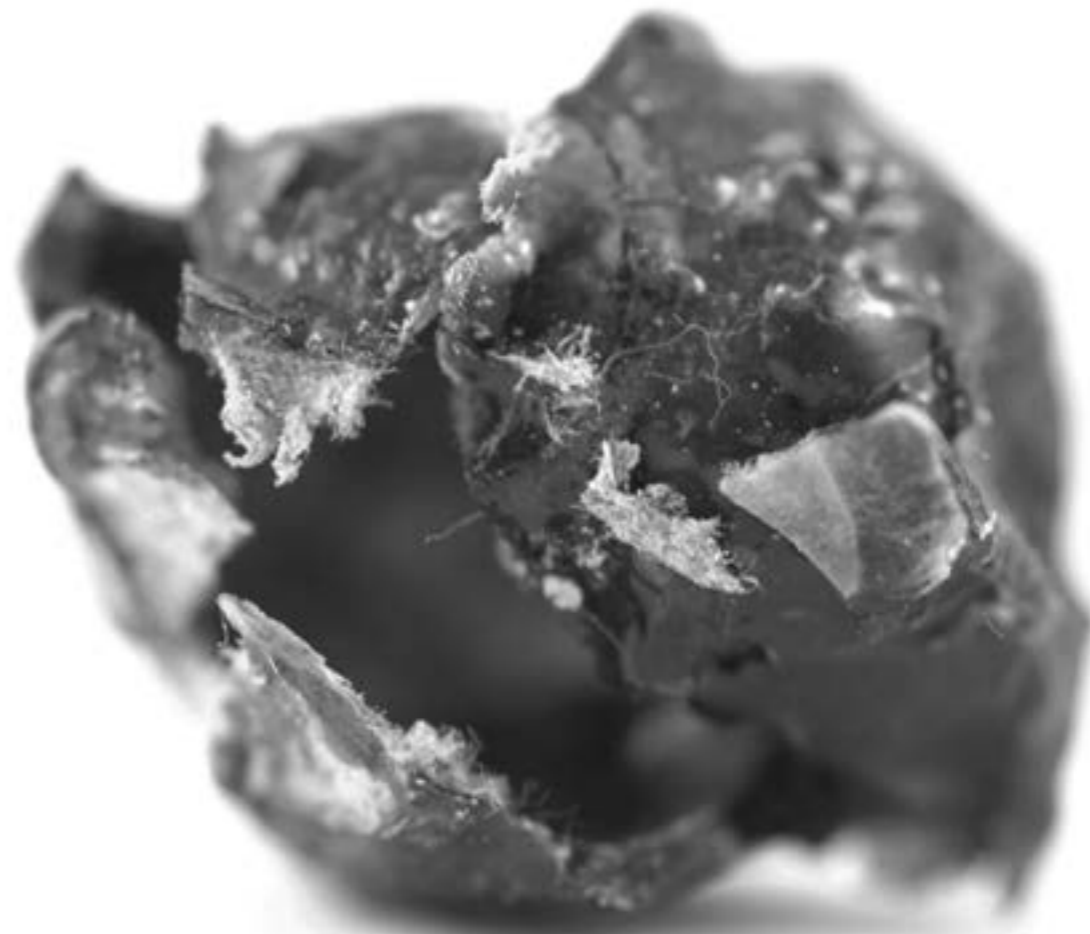
www.facebook.com/Institute-of-Making-173558692663820

www.facebook.com/groups/197250337040270/

www.instagram.com/of_making/

[ww.twitter.com/of_making](https://www.twitter.com/of_making)

ww.instituteofmaking.tumblr.com/



Institute of Making Member Supervisors

Becky Lee

Elliott Magee

Emilia McLaughlin

Laura Dempsey

Laure Durand

Rhys Williams

Tom Catling

Prashanthan Ganeswaran



Birthday Award Winners

Attention to Detail: Cristine Brache

Spirit of the Makerspace: Elliott Magee

Outstanding Maker: Dafne Morgado

Development Award: Bella Millon

Persistence Award: Adam Azhari

Materials Library Award: Ahilan Sooriasegaram

Most Helpful Staff Member: James Lawrence

Public Engagement Award: Emilia McLaughlin

Research Through Making Award: Rhys Williams



The Institute of Making Current Team

Darren Ellis – Makerspace Technician

Ellie Doney – Makerspace Manager

Elizabeth Corbin – Materials Library Assistant and PhD Student

George Walker – Makerspace Assistant

Mark Miodownik – Director

Martin Conreen – Director

Olivia Alice Clemence – Events Coordinator

Romain Meunier – Makerspace Technician

Sarah Wilkes – Research Manager

Zachary Eastwood-Bloom – Makerspace Technician

Zoe Laughlin – Director



Steering Committee

Andrea Sella – Professor of Inorganic Chemistry, UCL

Anthony Finkelstein – Dean of Engineering Sciences and Professor of Software Systems Engineering, UCL (Chair)

Bob Sheil – Professor of Architecture and Design through Production, and Head of the Bartlett School of Architecture, UCL

Chris Wise – Expedition Engineering and Professor of Civil Engineering Design, UCL

Mark Handley – Professor of Networked Systems, Computer Science, UCL

Susan Collins – Director, Slade School of Fine Art, UCL

Susanne Kuechler – Head of Anthropology, Professor of Material Culture, UCL



Funding, Donations & Commercial Support

- Alan Brener
- AHRC
- Atkins
- Chris Nolan
- Emma Thomas
- EPSRC
- European Union
- Jeremy Anderson
- Leverhulme Trust
- Robert Nichols
- UCL Engineering
- UCL Grand Challenges
- UCL PACE
- Wellcome Trust



Lego2Nano / Open AFM Team

Alan Bannon - EE
Alexander Robert Yon - Life Sciences
Alice Pyne - LCN
Angus Whitehead - Faculty of the Built Environment
Ellie Doney - Institute of Making
Hide Kurebayashi - LCN
Isabel Bennett - LCN / Division of Medicine
Jeroen Elzerman- LCN
Joe Bailey - LCN
Jose Michel - Management Science and Innovation
Komal Karir - Institute of Education
Marianna Pittokopiti - Engineering
Marios Hadjimichael - Department of Physics
Olivia Clemence - Institute of Making
Oscar Kennedy - EE (LCN)
Pavlo Zubko - LCN
Talfan Evans - CoMPLEx / Institute of Cognitive Neuroscience
Tom Catling - Astrophysics
Tongjun Liu - Medical Physics and Biomedical Engineering
Thore Mainart Bucking - Engineering
Funding: UCL Engineering, UCL MAPS, UCL Office for International Affairs,
LEGO Foundation, Tsinghua University
Partners: MIT Medialab, Academia Sinica Taiwan, and Xin Che Jian Hackerspace



Dangerous Diaries Team

Carla Flack

Daryl Ballard

Eleanor Morgan

Ellie Doney

Emilia Kingham

Hilary Powell

Puja Bharadia

Ruth Siddall

Simon Werrett



Thanks

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Andy Minnis
Angela Clemo
Angharad Milenkovic
Anna Clark
Anthony Finkelstein
Bob Sheil
Brenda Parker
Brendan Bryne
Caitlin O'Grady
Chris Wise
Christine Simms
Christopher Nolan
Diane Davis
Elaine Briggs
Eleanor Morgan
Elpida Makrygianni
Emma Thomas
Emma Richardson

Gaurav Sharma
Giles Corby
Graeme McPhillips
Gwen Mott
Hassan Osman
Hayley Midwinter
Hilary Powell
James Keith
James Lawrence
Janic Nielsen
Jeremy Anderson
John Stewart
Katherine Fletcher
Laura Dempsey
Lee Wilkinson
Liz Walker
Lori Manders
Marina Stephanides
Mark Handley
Michael Arthur
Mike Dawe
Miranda Laughlin
Neil Moscrop

Nick Booth
Peter Kelly and team
Phil Howes
Prashanthan Ganeswaran
Praveetha Patalay
Puja Bharadia
Rob Nichols
Rosie Meredith
Ruth Siddall
Saffron Hutt
Sam Green
Sara Collins
Sarah Mackay
Sarah Richey
Sarah Wishart
Simon Werrett
Subhadra Das
Susan Collins
Susanne Kuechler
Thea Sherer
Tom Hamer
Tom Kile Hartshorn
Tony Lawler

“It was fascinating to understand the thought process behind scents and really intriguing to hear how people work outside the physical world when creating a fragrance. With most making, you have matter in front of you that you can visibly change. From this I understood how a physical manifestation of an idea doesn’t need to be visible.”

(Eamonn Hassan, Biomedical Sciences undergraduate)



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Change the world