The ASCUS Lab: Scotland's First Publicly Accessible Interdisciplinary Laboratory for Art, Science and Everyone

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Whilst the status quo for decades has been to forge a career path that engenders deep skills in a single discipline, today the value of interdisciplinary practice is recognised as necessary to create solutions for a future that faces global challenges such as climate change, equality and health.[1] While interdisciplinary research can occur between different fields within the sciences, social sciences or humanities, increased value can be gained when taking this a step further and enabling collaboration across disciplines. In this paper, the authors set out the philosophy that drives the organisation ASCUS Art & Science, focusing specifically on the value of collaboration between the arts (including fine art and humanities, visual arts, choreography, poetry, architecture, design etc.) and the sciences.

The integration of art and science is not a new concept. During the Renaissance, the concept of the polymath, where creativity and learning were explored across disciplines was the norm. Renowned artist Leonardo da Vinci studied anatomy, physics and chemistry in order to create more realistic artworks and is likewise recognised in the scientific community as a pioneer for his engineering inventions, medical drawings that revolutionised our understanding of the human body and other research.[2] Similarly, scientists from Robert Hooke to Ernst Haeckel and D'Arcy Wentworth Thompson incorporated detailed anatomical drawings to aid their biological research.[3] Today, some artists remain interested in science, whether it be the field itself, the processes and methods used or the global challenge it aims to address and as a result have incorporated scientific principles, concepts, and techniques as part of, and as inspiration for their creative practice. Spaces that foster and nurture an exchange across disciplines are essential. In 2008, the non-profit organisation ASCUS Art & Science in Edinburgh pioneered this way of creating such spaces in Scotland through a hybrid approach to creative and critical engagement with the world. ASCUS was founded by Dr Paul Parrish and, then-PhD student, Dr James Howie. Its mission was (and remains) to provide a platform and build a community of artists, designers, scientists, anthropologists and others who are driven to explore how working across disciplinary lines can develop new collaborations, excite experimentation, reach wider audiences and provoke curiosity. ASCUS is neither an arts nor a scientific body, but an organisation dedicated to fostering artiscient* intersections at all stages, particularly early on in a collaboration by developing relationships between artists and scientists eager to connect with one another but not sure where or how to start.

*_Artiscience_ ar'tisiəns: _n._, 1. the theory and practice of integrating and harmonising (the) art(s) and (the) science(s); 2. the study and knowledge of relations between (the) art(s) and (the) science(s); between artists and scientists. Hence, _artiscient_: ar'tisiənt _adj_. exhibiting or practising artiscience.

The concept of artiscience is central to the ASCUS philosophy. ASCUS seeks not only to provide access to research and technologies that are often considered to be behind a privileged – and hence restricted – wall of scientific knowledge, but to offer the same courtesy to science through making accessible the theories and practices of the arts and humanities. Through sharing projects such as Marta de Menezes' *Immortality for Two* (2018), which explores the complexities in rejection and immunity through the lens of love, or Oron Catts and Ionat Zurr's public talk, *Contextualising Biotechnological Artifacts* (2018) which reflects upon the existence of and narratives surrounding living materials as biotechnological objects across disciplines, the concept of artiscience thus expounds the conceptual and ethical value of bringing the arts into

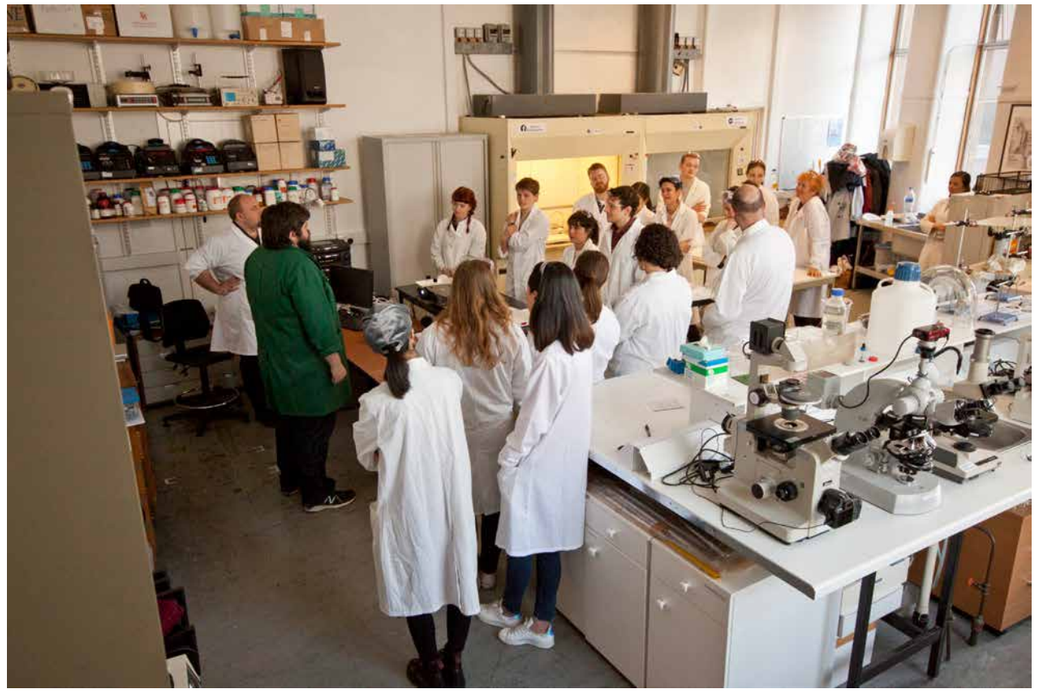

Fig.1 Molecular biologist Frank Machin and Lab technician Dr Jiří Jirout delivering a workshop, *Making Scents* (2017) to an interdisciplinary audience in the ASCUS Lab.

relationship with the sciences. The spaces in which innovation and insight occur often exist as ruptures or wrong-footings, exceptions to the normal place of work.[4] It is in ASCUS' unique location that individuals, free from the silos of institutional thinking, can meet, express and bring to fruition ideas and concepts that are difficult to manifest in either discipline alone.

The existence of dedicated funded arts facilities such as print studios, sculpture workshops and photography studios to foster the arts through the provision of specialist artistic equipment is culturally accepted, yet the provision of scientific resources and support for the same purpose is a newer concept that is yet to be widely accepted. One of the barriers for non-scientists is access to scientific research tools and equipment that would enable better understanding of scientific concepts and an expansion of one's creative practice. While a certain amount of science experimentation is possible in one's kitchen, back garden or art studio, there are limitations that eventually arise, especially when working with biological material. These limitations include access to a variety of expensive specialist equipment, which are particularly important when working with microorganisms where contamination and health concerns are one of the main challenges, as well as access to a knowledge of a particular subject. A key element of ASCUS' philosophy is taking the conversations between artists and scientists a step further and to challenge the misconception that 'a lab is somewhere you can't go unless you're a scientist' through the belief in the democratisation of science and removing some of the barriers present within more conventional research institutions. The impetus that led to this belief arose when Edinburgh University student Lucy Stewart was unable, as an undergraduate Physiology student, to access university science laboratory facilities. Knowing of international organisations with interdisciplinary lab space such as the Waag Society in Amsterdam and GenSpace in New York, the ASCUS team were compelled to open their own.[5] As such, after receiving a Wellcome Trust People award, the doors were opened to Scotland's first publicly accessible art-science laboratory, the ASCUS Lab, in the arts and cultural hub Summerhall in 2016.[6]

Once funding was secured the lab began to take shape when ASCUS brought together a group of like-minded individuals who recognized the need for a dedicated space where they could come together and share their knowledge and expertise.

Then ASCUS Assistant Manager (Managing Director from 2019-2022) Miriam Walsh and ASCUS Lab's first Lab Technician, Dr Ryan Lewis, played a crucial role alongside Dr Howie and a team of volunteers in setting up the lab and working out what facilities, workshops, events and training ASCUS could provide for the benefit of public and academic audiences. Through generous donations from the University of Edinburgh, the NHS, National Museums Scotland, other institutions and individuals of ex-research equipment such as microscopes, incubators, centrifuges, biosafety cabinets, PCR machines, 3D printers and more, that would otherwise have been disposed of, the ASCUS Lab became a publicly accessible biosafety level-1 (BSL-1) facility equipped to facilitate research and experimentation primarily in the fields of microbiology, microscopy and DNA analysis supported by a prodigious advisory board. (Fig.1). In later years ASCUS Lab Technicians included Dr Jiří Jirout and Marina Freijo, followed by Dr Keira Tucker, who went on to become General Manager of ASCUS.[7] As a small non-profit with limited funding, some focus of their resources is required but ASCUS offers training and support for any individuals or groups wanting to use scientific techniques who can access this equipment much in the same way that artists have done for years at the Edinburgh Printmakers for example and has built a large community of both artists and scientists with a wealth of knowledge.

In addition to ASCUS' rich history of artist residencies and 'Micro-Residencies' (residencies with limited, relatively short, contact time *in situ*) for artists and scientists within academic institutions, over the years ASCUS has organised and participated in a wide range of other events and projects that have brought together artists, scientists and the public. These have included exhibitions featuring international interdisciplinary artists, workshops, talks, courses and performances, as well as collaborations with schools and community groups such as Youth Vision Scotland.[8] Since the lab opened, a key aim has been to develop courses and workshops that introduce the skills and applications of microbiology, microscopy and other techniques to non-scientists as well as offering personalised one-to-one training, which has played an important role in supporting artists by giving them confidence to work across disciplines and empowering them to apply their new skills to their own creative practice through independent hands-on experimentation. G-Lands: An out of Body Experience is an example of a project where ASCUS supported artist Emily Fong with initial training in ASCUS Lab, during her residency at the Centre for Regenerative Medicine at the University of Edinburgh and through to exhibition for the 2022 Edinburgh Science Festival.[9]

At the core of the ASCUS Lab's ethos is making science accessible, tangible and breaking down barriers and hierarchies often found between art and science, enabling artists to bring their ideas to fruition. Artists across the UK and internationally make use of the lab space for various projects: making pigments from microorganisms; learning how to analyse DNA extracted from soil; experimenting with dyeing and printing textiles with bacteria and algae; using the ASCUS fume hoods to carry out work with resin and make magnetic nanoparticles; making sculptures from mycelium; getting a new perspective of the world through microscopy and so much more. The ASCUS Lab truly is a pioneering, one-of-a-kind facility that has been internationally recognised for its groundbreaking creative projects (Fig.2).

Also housed in Summerhall is the Artiscience Library, created by Colin Sanderson, who is a science graduate and a historian on relations between the arts and sciences. This unique collection is dedicated to promoting artiscience as a paradoxically specialised discipline in its own right.[10] Together with the ASCUS Lab this provision for independent research outside a traditional academic institution forms the concept of SEICA, the Scottish, European and International Centre for Artiscience. Through establishing further connections at Summerhall, with the Edinburgh Science Festival (ESF) and Summerhall Visual Arts, ASCUS has been involved in co-curating impactful and relevant event programmes consisting of talks, workshops and visual arts exhibitions with artists using the lab to explore the intersections of art, science, humanity, health and climate since 2015.[11] In addition to its long standing partnership with Summerhall Visual Arts, ASCUS Lab has had a pivotal role in the production of artwork that has been exhibited both nationally and internationally, in venues including LifeSpace Dundee, ISEA Montreal, Edinburgh College of Art and the Royal College of Art in London.[12] Between 2020 and 2022, ASCUS collaborated with India based artist Sonia Mehra Chawla on the interdisciplinary project *The Rooted Sea: Halophytic Futures* which was presented at the *Driving the Human* festival in Berlin in 2021.[13] The project explored endangered coastal ecosystems and wetland habitats of India and Scotland and their vital role in building resilience to climate change. This was an extension of their first collaboration together, Entanglements of Time and Tide (2019-2020)

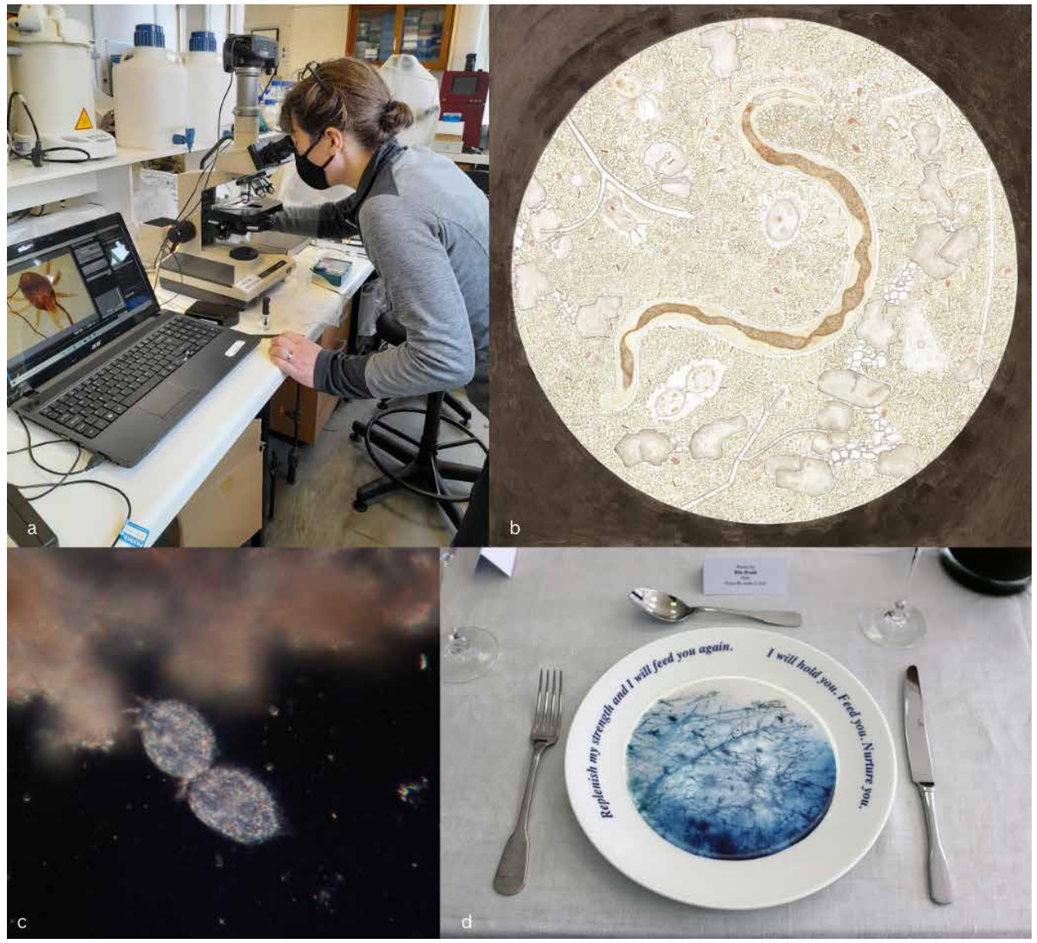

Fig.2 Natalie Taylor using ASCUS Lab microscopes to research microscopic organisms in soil. b) Natalie Taylor, *Intelligence of the Mycorrhizosphere*, 2022, soil pigments on paper. *Living Soil exhibition*, RBGE, 2023. c) Microscopic ciliates under the microscope. d) Natalie Taylor, *Replenish my strength and I will feed you again*, 2022. *Terra Infirma exhibition*, Dunbar.

with Edinburgh Printmakers and Marine Scotland. Together with The Rooted Sea, these projects were the foundation for further work on the topic by Sonia which has since been exhibited in various iterations at Summerhall, the National Institute of Design – Ahmedabad, ZKM Museum – Karlsruhe, Schloss Solitude – Stuttgart and more.[14]

In addition to being the first publicly accessible art-science laboratory in Scotland, ASCUS Lab is associated with other firsts: Artist Louise Mackenzie's doctoral research (*Evolution of the Subject – Synthetic Biology in Fine Art Practice, 2017*) on performing the act of genetic modification led ASCUS to work with Mackenzie to certify the lab as a Class 1 Genetic Modification (GM) lab – a first for a publicly accessible laboratory space in the UK. With this licence, ASCUS is also permitted to oversee the inclusion of GM organisms in other spaces and worked closely with Summerhall Visual Arts to show Mackenzie's GM work to the public within a gallery setting (Fig.3). With ASCUS' support, Mackenzie ran the first artist-led public GM workshop in Scotland (*Transformation: Thinking Through Making With Life*), where the questions raised through the work were explored with a public audience, leading to the short film, *Zone of Inhibition*, which premiered internationally in Montreal, 2020.[15]

With the world shifting to explore more sustainable futures, ASCUS has been approached by universities starting new modules that explore working with non-human organisms, to offer cultural reflections on working with non-humans and to give insight into the techniques and processes involved in working with these organisms from the perspective of art and

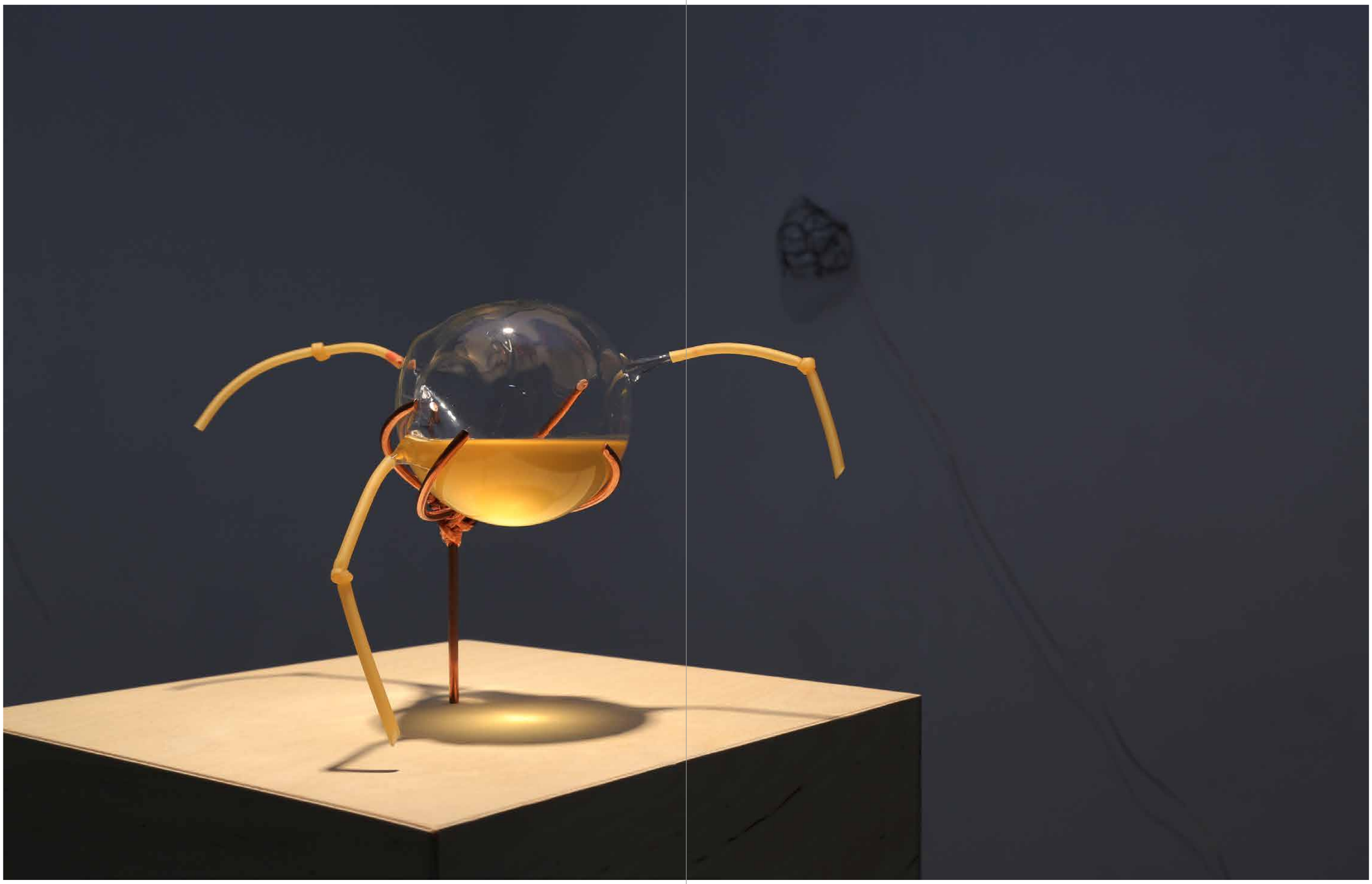

Fig.3 Louise Mackenzie, *Pithos ConsTrained*, 2018, live genetically modified *E. coli*, glass, latex, rubber bung, copper wire. Summerhall, Edinburgh, part of the 2019 Edinburgh Science Festival.

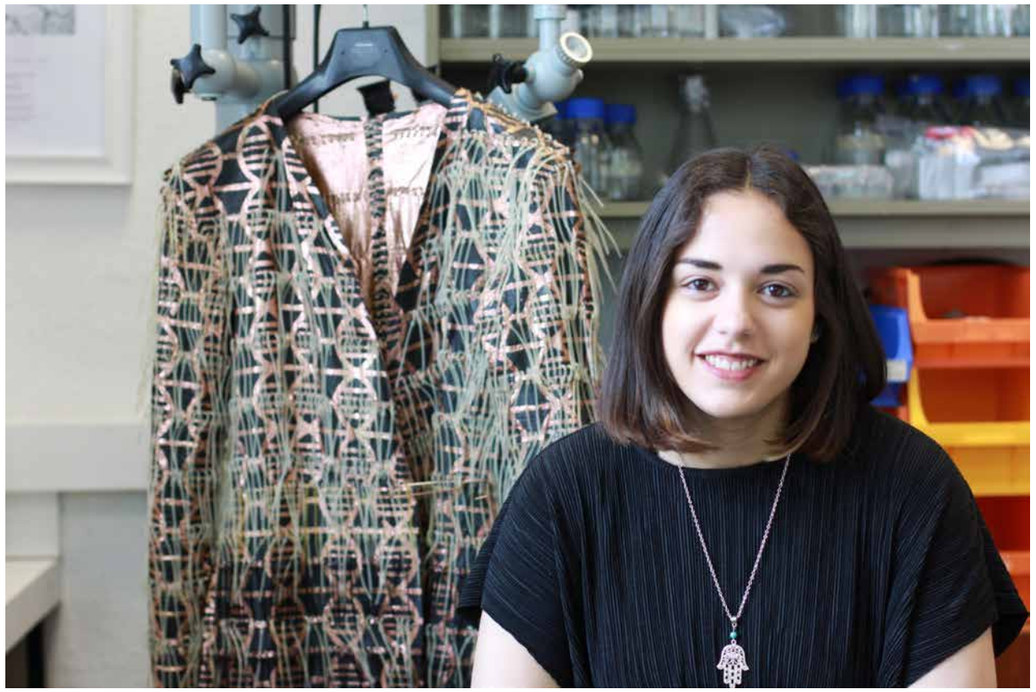

Fig.4 Aurélie Fontan with her dress fashioned from dried out Kombucha SCOBY made possible by the ASCUS Lab, 2018.

science hybrid practice, which is commonplace at ASCUS but not always within traditional institutions. These include inviting artists associated with ASCUS to share their creative projects, and offering advice on how to work with microorganisms for artistic purposes such as pigments for painting, dyeing textiles, creating new bio-materials and as inspiration for design. Students not only at local universities, but from across the UK have come to use the ASCUS Lab due to the lack of facilities to support interdisciplinary lab experimentation. In addition to Lucy Stewart who triggered the need for ASCUS Lab, there have been many other students who agree ASCUS played a pivotal role in their university success. Two such examples are Aurélie Fontan and Kexin Liu. In 2018, after not being able to gain access to her University's science labs, fashion design student Aurélie Fontan from Edinburgh College of Art approached ASCUS to assist with her idea: creating and experimenting with sustainable textiles using microorganisms. Experimentation in the ASCUS Lab led to kombucha SCOBY (Symbiotic Colony of Bacteria and Yeast) being dried out to make fruity-smelling, vegan leather. These samples were all sewn together to create a dress (Fig.4) and Fontan went on to win multiple awards at London Graduate Fashion Week.[16] Reflecting on her career development a few years after starting work with ASCUS, Fontan said; "My residency at the ASCUS Lab was a pivotal moment in my design practice and paved the way for my career as a biodesigner." In addition, Royal College of Art graduate Kexin Liu, who travelled regularly from London to the ASCUS Lab in 2022 during her studies, was assisted in her research experimenting with bacterial pigments to dye textiles in a more sustainable manner with less ecological impact than conventional textile dyes. This entailed training Kexin on how to grow specific strains of bacteria, how to harvest the bacteria safely and extract the pigments. This work was subsequently shown as part of the *Interlinked* exhibition at Summerhall during the 2023 Edinburgh Science Festival.[17] One institution, Central Saint Martins (CSM), University of the Arts London, recognised the need for a maker-space to facilitate the safe and creative exploration of biological materials and processes and approached ASCUS to act as lead consultants to set up their own laboratory for bioart and biodesign teaching and research. As lead consultants, ASCUS advised on equipment, setup and the hybrid design of a creative laboratory facility.[18] The 'Grow Lab' has enabled CSM to offer a brand new postgraduate 'Biodesign' course in addition to accommodating existing 'Art & Science' and 'Material Futures' masters courses and supporting doctoral study in biological art and design through the Living System Lab research group, all of which now make use of the lab to develop innovative and safe protocols for working with living systems and laboratory processes. While some institutions like CSM have acknowledged the gap in their facilities and are beginning to create their own interdisciplinary labs, they are still limited to certain departments and once their students graduate, graduates are once again left with limited access to lab facilities for cross-disciplinary experimentation. ASCUS plays a vital role in offering interdisciplinary lab-based learning programmes that are not offered elsewhere, can be accessed by anyone outside or within an existing institution and serves students, professionals and the public alike.

ASCUS is also experienced in public engagement and are often recruited to facilitate and collaborate on designing hands-on interdisciplinary workshops both in and out of the lab that demonstrate current research happening in a variety of fields to create awareness, build community, educate, inform future research and often provides an experience where researchers, who sometimes tend to focus on the technicalities of their research, remember the motivation for becoming a researcher in their particular field. ASCUS' commitment to accessibility and creative engagement across all walks of life includes pop-up exhibitions, workshops and activities in public spaces such as shopping centres, beach promenades and public parks.[19] Among the beginners courses offered, ASCUS developed a creative learning programme, designed for young adults who may be socially isolated, find traditional learning environments challenging, or don't have access to extracurricular programmes to enhance skill development. This programme offers an artiscient approach to creative curiosity. By introducing young people to interdisciplinary practices, ASCUS has equipped them with a variety of skills, combining both scientific and creative (arts) approaches to problem solving, experimentation and investigation. This helps challenge society's perception of what a lab should be, encouraging creative experimentation from the perspective of both the arts and sciences.

In addition to courses and workshops developed in-house, ASCUS has also hosted workshops facilitated by artists, anthropologists, and scientists from varying fields, including for example, Oron Catts & Ionat Zurr, pioneers of bioart and exploration between the arts, science and technology and co-founders of SymbioticA in Australia. Many artiscient workshops have been run with collaborators over the years, with the lab providing a shared space for researchers, students, artists and members of the public to creatively engage with each other and with science. Workshops have been developed with collaborators for members of the public affected by cancer, infertility, eczema and other health conditions.[20] For those members of the public, this was a unique opportunity to meet the people dedicating their lives and research to finding solutions to these health challenges and for the researchers it provided a meaningful interaction with the people that their research will eventually be providing for. These workshops prove to be a valuable exchange when so much scientific research is far removed from the human experience. This idea of re-humanising the scientists was also 'highlighted' in BAFTA award-winning filmmaker Anne Milne's work *Scientists Under the Microscope* (2015), which came from the ASCUS Micro-residency at the Centre for Immunity, Infection and Evolution at the University of Edinburgh.[21]

As well as providing space for artists, due to low access costs and availability of a variety of equipment, the ASCUS Lab has also been home to startup companies in the biotechnology industry: Algacraft who offer a service of automated algae growth optimisation for various applications, and Nexacath, a London-based startup that used ASCUS Lab to test their prototype of a cost-effective catheter that reduces the rate and intensity of catheter-associated urinary tract infections.[22] As the lab has grown, so has the ASCUS art-science community. Being a shared space, the ASCUS Lab provides artists, scientists, professionals and students the opportunity to meet and exchange ideas. This space of chance exposure to other disciplines is a vital component of the ASCUS philosophy.

Over the years, ASCUS Lab has grown to become well known as a facility for creative research that engages with scientific practices and technologies, offering a space that fosters curiosity and encourages its users to push the boundaries of what is possible at the intersection of art and science. By promoting dialogue and engagement between scientists, artists and the wider public through workshops, residencies and exhibitions, its unique approach has made it an invaluable resource for local and international communities. The ASCUS Lab continues to be a vital and inspiring hub for creativity, exploration and innovation with the aim of blurring the boundaries between art and science and rather nurturing polymaths and artiscients to hold a valued place in society.

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