

Art & Science

Merging Art & Science to Make a Revolutionary New Art Movement

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Susan Aldworth
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MERGING ART & SCIENCE

Arthur I. Miller

Science is changing our world and our lives at an ever-increasing rate. But today artists are bringing science out of the laboratory. Nowhere is this more evident than in biology-inspired art which, by its very nature, necessitates collaboration between an artist and a scientist. This is the theme of the exhibition *Merging Art & Science*.

Once art and science seemed diametrically opposite; but these days some of the most innovative artists are fusing art and science to create a brand new art movement inspired by science. Striving to visualise the invisible and what it will mean to be human in the future, they create images and objects of stunning beauty, redefining the notion of 'aesthetic' and of what is meant by art.

Artists and scientists have always tried to fathom the reality beyond appearances, but it was really only with Isaac Newton, and the onset of the Age of Rationalism in the 17th century, that a distinction was made between the two. In the centuries that followed, science and technology were seen as the real pursuit of truth, while art – which had the role of representing people and landscape – seemed like mere entertainment. With the onset of the avant-garde, and of modernity, the two began to merge with greater and greater intensity.

Albert Einstein and Pablo Picasso – inventors of the 20th century - were the catalysts. In the very first sentence of his 1905 relativity paper, Einstein wrote that physicists interpreted certain equations in ways that led to 'asymmetries that [were] not inherent in nature'. The relativity theory was in response to his aesthetic discontents. Picasso's 1907 painting, *Les Femmes d'Alger (O. J. R. Version O)*, which contains the seeds of Cubism, was strongly influenced by his interest in science (X-rays), technology (photography and cinematography) and mathematics (four-dimensional geometry).

As the century progressed, artists continued to look to breakthroughs in science for inspiration. Einstein's famous equation $E=mc^2$ was central to Kandinsky's creation of Abstract Expressionism; while in *Nude Descending a Staircase*, Duchamp reflected Einstein's notions of movements in space and time. Relativity also influenced the Futurists, a group of dapper young Italians who rejected the static nature of Picasso's Cubism, and evoked speed, violence and technology of modernity. Dali was inspired by relativity and then by quantum physics in his efforts to represent the passage of time. Mondrian reduced the world to lines at right angles, capturing what he saw as the dynamic nature of the cosmos in equilibrium, while Malevich concentrated on the end of the material world, as represented by the second law of thermodynamics, which states that the universe will eventually run down. In Malevich's white-on-white paintings, everything disappears.

Merging Art & Science focuses on biology-inspired art, an ancient art form. An early 20th century example, Picasso's *Standing Female Nude* (1910) was inspired by the power of X-rays to glimpse beyond the visible: what you see is not what you get. In this case, the inspiration was X-ray photographs taken to diagnose the illness of Picasso's mistress, Fernande Olivier. Superposed on a background of planes, her body lies open to reveal pelvic hip bones made up of geometrical shapes: forms reduced to geometry – the aesthetic of Cubism - inspired by modern science.

For some years, the wonders of the physical sciences enthralled artists, particularly relativity theory, with its spellbinding consequences for space and time, and quantum physics with ambiguities that shock the imagination, such as the wave and particle duality of light and matter. And then there was Jungian analysis – couched in mysterious archetypes, with more than a whiff of alchemy.

The 1953 discovery of the structure of DNA, with its potential to alter life forms through genetic engineering and to cure diseases, piqued everyone's attention. It was the greatest scientific discovery of the 20th century and more accessible than relativity theory and quantum physics. Metaphors abound for making the new biology understandable and biology is, of course, of more immediate relevance than exotic objects such as black holes, supernovae and Schrödinger's both dead and alive cat. Artists found they could work in a biological laboratory.

Biology-inspired artists have at their disposal objects that can actually be glimpsed by opening the body or using functional magnetic resonance imaging (fMRI) or with microscopes. This contrasts with physics, which depends on a visual imagery generated by mathematical models to provide a glimpse of objects such as black holes, whereas observing the heavens with the naked eye reveals only tiny dots of light twinkling as if on a heavenly canopy – a quiescent scene. In biology-inspired art, the object of study can actually be altered by artists who, along with scientists, explore the boundaries between humans, animals and robots. Artists genetically engineer new forms of life, creating them in bioreactors. Their startling experiments on objects that straddle the border between living and nonliving remind us that, in the long course of our evolutionary history, we come from, and are possessed of, organisms other than human.

These days the term 'art and science' is on everyone's lips - but no-one quite knows what it is or where it is going. Does it mark the rise of a new culture in which science and technology will be the driving forces and will even, perhaps, determine the future of culture? Are there similarities in the creative processes of artists and scientists? Can science benefit from art? And can considering these questions bring us any closer to understanding creativity? This exhibit is a step towards exploring these key issues of the 21st century.

The artists in this show collaborate with scientists, and the benefits run in both directions. Thus their creations have that sharp edge, the tension that accompanies creativity.

Susan Aldworth works on the border between philosophy of mind and neurophysiology. She studies the relationship of The Self to the physical brain: 'How to define one's personality and whether it can

be physically located'. Among her tools is fMRI.

Artists explore, interpret and reinterpret forms in nature, attempting to discern forms that are successful and find out why. Davide Angheluddu describes his investigations thus: 'My artistic production gets inspiration from nature, particularly from nature sublimely described in the book *Kunstformen der Nature (Art Forms in Nature)* of the German philosopher and biologist Ernst Haeckel'. To investigate further the essence of natural forms he turns to sculpture using digital technologies.

Whereas work in physics-inspired art often tends to be decorative, this is less the case in biology-inspired art. Artists in the laboratory can produce works of interest to scientists. Andrew Carnie states this emphatically: 'Art is too important to be left to artists - science too important to be left to scientists'. Carnie tracks the changing organisation of the brain, how it develops and how it is capable of holding memories.

Annie Cattrell attempts to make tangible seemingly intangible neurological experiences, such as pain and pleasure. Using what is essentially a sculptural photocopying, she examines 'subtle shifts and rhythms which ceaselessly occur in the natural world and within the body'.

Katharine Dowson has always been inspired by how science and technology can further inform us about the hidden world within the human body, even beyond what we see in anatomy museums. Among the transparent materials she employs in conjunction with laser technology, glass plays a major role because it 'is also a major component in scientific discovery, from test tubes to lens, revealing the microcosmic and macrocosmic universe and their visual similarities'.

David Marron has a different take on biology-inspired art. As a paramedic, he ponders the body in death resulting from violence, accident, or natural causes, sometimes in the loneliest of circumstances: 'Each work is approached differently but a generalised underlying subject is humanity. Scratching at our fragility and durability, violence and emotion. Our habit he explains.

Helen Pynor studies flora and fauna with a unique visual language linked sometimes with text. She writes: 'I'm fascinated by the mystery of our status as biological beings whose bodies are the repository for experience, language, and a consciousness in and beyond the central nervous system'.

Nina Sellars' artwork utilizes drawing, photography, installation and state-of-the-art technologies. 'In the 21st century, we have become increasingly captivated by technologies for realms that exist beyond what is normally visible,' she writes.

For Stelarc the body is obsolete. His aim is to 'deconstruct our evolutionary architecture and to integrate microminiaturised electronics inside the body. [The body is] an extended operational system'. He extends the concept of art onto his own body.

Ken and Julia Yonetani look to the environment for inspiration towards sculptures using ground water salt or sugar. "Our work tries to retrace lines of connections that have been broken or lost, particularly between acts of consumption and the environment," they explain.

As Ionat Zurr and Oron Catts write: 'Wet biology art practices are engaged in manipulation of living systems. [We are] exploring the manipulation of living tissues as a medium for artistic expression'. The *Pig Wings* project - part of their study of the production of semi-living organisms in which they muse that if pigs could be designed to fly, then what shape would their wings take - goes further. In growing cells for the purpose of exploring the shape of wings on pigs, they explore the aesthetic as well, because purpose-built forms in nature seem necessarily to be aesthetic. Forms having pleasing properties are naturally preferred, just as are beautiful theories in physics.

May we not say that these artists represent the extremes of science-inspired art - like in extreme sports, pushing the envelope of the possible?

Arthur I. Miller

May 2011

Susan Aldworth

Cogito Ergo Sum 3

What is a brain scan? Brain scans are precise scientific photographs but they are incomplete records of a person. I am fascinated by their ambiguity: the gap between what they do show (the physical structure and function of the brain) and what they don't - The Self. Brain scans have a specific meaning within a medical and scientific context, but this changes when we consider them as images of someone. For me, they are a signpost to the interior self.

I underwent an fMRI scan at Queen Square Imaging Centre in London for this series of 20 digital (giclee) prints which tile together to form *Cogito Ergo Sum 3* - I think therefore I am. It is a self-portrait located in a moment of time. A brain scan has a potency as it seems to suggest that we can see into our minds, that it might reveal something of the Self. I doctored the scans and changed scale. I scratched into the scan emulsion and added images and words into the fMRI sequence to try to connect these medical images to my daily experience. *Cogito Ergo Sum 3* visualizes what an MRI scan might look like if it could show what was going on in my imagination as well as the physical structure and function of my brain.

"I am both in my mind and out of my brain"

"You can look INTO my brain but you will never find me."



Susan Aldworth, *Cogito Ergo Sum 3*

Susan Aldworth lives and works in London. She took a degree in philosophy at Nottingham University prior to studying printmaking at Sir John Cass in London. Aldworth is Senior Research Associate at Swansea Metropolitan University and Research Fellow in Print at London Metropolitan University. Working on location as an artist-in-residence in a medical or scientific setting is central to Aldworth's practice. She weaves together personal, medical and scientific narratives in her experimental print and film works on human identity. She is Artist in Residence at the Institute of Neuroscience at Newcastle University working on a project exploring schizophrenia which will be shown as *Reassembling the Self* at the Hatton Gallery and Vane in Newcastle in 2012.

A solo exhibition of her portraits of people with epilepsy, *The Portrait Anatomised*, will be shown at the National Portrait Gallery in 2013. Aldworth regularly exhibits nationally and internationally and her work is in many public and private collections including the V&A and the British Museum. Future exhibitions include *Images of the Mind* at Deutsches Hygiene-Museum Dresden and Moravian Gallery Brno, in 2011 and 6th International Kyoto Hanga Print Exhibition Japan/UK in 2012.

Davide Anghelèddu

Kunstformen der Natur Series

Davide's artistic production is inspired by nature and science, particularly from nature sublimely described by the German philosopher and biologist Ernst Haeckel in his book *Kunstformen der Natur* (*Art Forms of Nature*), written at the end of the 19th century. It contains over 100 prints, followed by an accurate description of animals and marine creatures. Haeckel focused on marine microorganisms and how they illustrated Darwin's theory of evolution with images of an astonishing beauty that go beyond the organisms themselves.

Above all, I was impressed with the radiolarians' siliceous skeletons, a component of the marine plankton, a substance present in all oceans. Plankton, a Greek term meaning wandering, presents a peculiarity: it moves only vertically, what remains of its movement is determined by the wave motion. I found this image strongly evocative of a human life. We are partially the author of our own decisions and partially in the hands of uncontrollable and unfluencable forces.

Starting from primary forms, I submitted them to the action of external forces which destroyed them on the one hand while on the other gave them a new shape, a new life.

The surface of my works is corroded. You can guess their initial geometry, but then time devours and deforms them. The result is a fragile object, like a human life, but also a continuous becoming. The most important part of the objects I make is the missing one: their shapes resemble their skeletons; you feel that maybe the true work was the one which was before, or perhaps the one that will become later.

My artistic activity is tightly linked with the most modern of digital technologies. The bronze sculpture is made of the succession from two separate processes. The first process is the laser sintering. The second process is lost-wax casting: this technology is basically the same as the one used three thousand years ago. The forming system, cooking and evaporation remade the same as during the last thousand years. The model is used as wax, and it is lost during the casting.



Davide Angheluddu, *Shell*

Daide Angheleddu, born in Como, graduated from the Polytechnic of Milan Faculty of Architecture, where he studied in a programme that combined technique and aesthetics. He began his career working in an architecture studio that specialised in the design of luxury yachts. He studied both the external shape and the internal spaces/interiors. In doing this, he explored how digital representation went beyond being merely an instrument to show a client a finished product, but a means to create the actual shape, thus being a fundamental part for the realisation of the object. This idea is the basis of his exhibited work.

Andrew Carnie and Professor Margrit Shildrick

In Out

For some time in my practice I have been exploring how our view of the human body is mediated through science. What is a body? Where does it begin and end? How do we experience it and know it?

In Out developed out of a chance meeting with Prof Margrit Shildrick. It is a response to what happens to a sense of self when the bounded unique being is disrupted by the introduction of a large piece of another, a heart, and where the body is continually trying to reject the other, and would if it were not for immunosuppressants. How does knowledge of this sort of event change us and make us reflect on whom we are? This print was my first finished response to this project - other ideas wait to be carried out. Presently, we are further exploring a longitudinal study by scientists of the Heart Transplant Team at the Toronto General Hospital as they look at the psychic well being of heart transplant recipients pre and post operation, in a project called *Hybrid Bodies: An Artistic Investigation into the Affective Experience of Heart Transplantation*.

Andrew Carnie is an artist and academic. He is currently part of the teaching team in Fine Arts at Winchester School of Art, University of Southampton, England. He studied chemistry and painting at Warren Wilson College, North Carolina, then zoology and psychology at Durham University, before starting and finishing a degree in Fine Art at Goldsmiths College, London. He completed his Masters degree in the Painting School, at the Royal College of Art. In 2003 he was the Picker Fellow at Kingston University.

Carnie's artistic practice often involves a meaningful interaction with scientists in different fields as an early stage in the development of his work. There are also other works that are self-generated and develop from pertinent ideas outside science. The work is often time-based in nature, involving 35 mm slide projection using dissolve systems or video projection onto complex screen configurations. In a darkened space, layered images appear and disappear on suspended screens; the developing display absorbs the viewer into an expanded sense of space and time through the slowly unfolding narratives that evolve before them.

Margrit Shildrick is Professor of Gender and Knowledge Production in the Medical, Technical and Natural Sciences at Linköping University, Sweden. She completed a BA (Hons) English at Sussex University, an M.Sc Ethics of Health Care at Liverpool University and a PhD in Interdisciplinary Philosophy and Women's Studies at Warwick University.

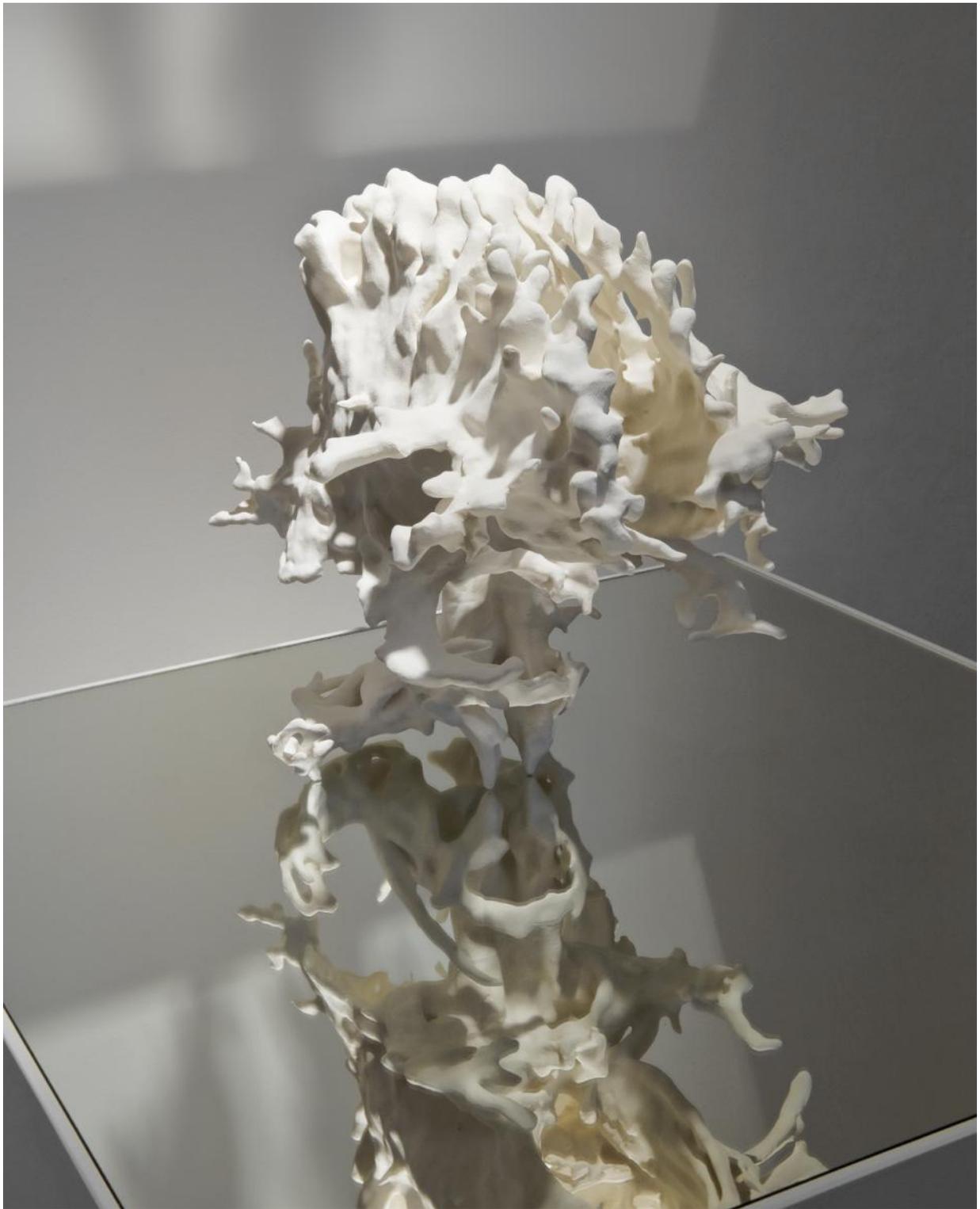
Her research interests lie in postmodern feminist and cultural theory, bioethics, critical disability studies and body theory. Her long-term research interests have focused on the body and particularly on the notion of the anomalous body, whether that relates to sex and gender, to disability, to ageing, or to cyborgs. Currently, she is working on an international project exploring the phenomenology of heart transplant recipients.

Annie Cattrell & Professor Morten L. Kringelbach, D.Phil.,

Pleasure/Pain

Pleasure/Pain models the structural connections of a small region in the brainstem, the periaqueductal grey, as revealed by a method of magnetic resonance imaging called diffusion tensor imaging. The piece explores the links that might be activated during sensations of pleasure and pain. The periaqueductal grey is a pivotal and primitive area of the brainstem that functions in ways that are incompletely understood. Low frequencies applied to the periaqueductal grey during deep-brain stimulation relieve chronic pain; higher frequencies enhance the pain. The region works with other areas of the brain through a reciprocal call-and-response mechanism. Oscillations of neural activity bounce back and forth, moving at different frequencies, some initiating pain, others moderating it.

As Kringelbach explains, 'What is key is that the sender and recipient neurons – like two girls rhythmically swinging a jump rope for a third to hop over – must be in sync'. Cattrell created the model of this oscillating connectivity using a rapid prototyping method called selective laser sintering. It is a kind of sculptural photocopying in which cross-sectional layers are fused to create a solid model. Delicate traces of the successive layers can be detected on the surface of the sculpture, like contour lines on a map. The resultant shape invites analogies – an incredibly complicated vertebra perhaps, or a wondrous fungal growth, or even a blossom flowering posthumously in the scalding water of a teapot.



Annie Cattrell & Professor Morten L. Kringelbach, D.Phil., *Pleasure/Pain*

Annie Cattrell was born in Glasgow and studied Fine Art at Glasgow School of Art, University of Ulster and at the Royal College of Art. She is Senior Research Fellow in Sculpture at De Montfort University in Leicester and has just completed a residency and solo exhibition based in Orkney hosted by the Pier Centre, working in part with scientists from Herriot Watt University who are involved with research into renewable energy using wave power. In 2011 she will participate in one of a series of sailing expeditions to the north west Scottish islands, organised by Cape Farewell.

Recent solo exhibitions include the Anne Faggionato Gallery (London), The Faraday Museum at the Royal Institution (London) and Berwick Gymnasium Gallery, Berwick upon Tweed. She has exhibited widely nationally and internationally. Cattrell's practice as a fine artist is at times informed by working with specialists in neuroscience, meteorology, engineering, psychiatry and the history of science etc. This cross-disciplinary approach has enabled her to learn about cutting edge research and in-depth information in these fields.

Professor Morten L. Kringelbach, D.Phil., is a prizewinning neuroscientist whose main focus is to understand the functional neuroanatomy of pleasure. He is the Director of Hedonia: Trygfonden Research Group, a unique transnational research collaboration between Oxford and Aarhus universities. Kringelbach has published widely on the topic of pleasure and reward, including his book *The Pleasure Center* (OUP, 2009), meant for the general public.

He is a fellow of the Association for Psychological Science, on the editorial board of the journal *Social Neuroscience* and member of the advisory board of *Scientific American*. In addition to his scientific research, Kringelbach has a keen interest in linking art and science in on-going collaborations with artists.

Katharine Dowson

Memory of a Brain Malformation

Memory of a Brain Malformation originated as a commission organised by Dr Anya Hurlbert for the Institute of Neuroscience, Newcastle University in 2006. My interest in the brain initially started in 2002 collaborating with Dr Piers Corneliesson and Dr Paul Hanson in their research into dyslexia and I had an fMRI scan at Oxford University to see how the brain of a dyslexic, processes words and which part of the cranium is used. Images of my brain subsequently inspired various works of mine and my cousin gave me her brain angiogram of her venous-arterial malformation, a benign tumour, which had been successfully treated with laser 10 years before.

Memory of a Brain Malformation is not a collaborative work with a scientist but a problem solving exercise of digital transfer from large angiogram films into modern 3D laser technology used in glass etching. I first manipulated the images digitally on my computer and then worked with a computer technician at the etching company who wrote a program especially for the work.

The sculpture shows my cousin's life size, delicate arterial, branch like scaffold, which fed her brain tissues and tumour. The laser etching in glass creates a delicate and ephemeral memory, like an echo of the real thing before the laser surgery.



Katharine Dowson, *Memory of a Brain Malformation*

Katharine Dowson studied sculpture at the Royal College of Art and exhibited in London, USA, Brazil, Europe and Asia. Collections include The Wellcome Trust, The Arts Council Collection, Cultura Englesa, Brazil, The Ulster Museum, Belfast Aberdeen Art Gallery, The Institute of Neuroscience Newcastle University and Private Collections. Her work was bought by Charles Saatchi and is included in *Shark Infested Water*, *Saatchi Collection of British Art in the 90s*.

Dowson was commissioned to create work for the groundbreaking shows, *Spectacular Bodies, A History of Anatomical Art from Leonardo to Now* at The Hayward Gallery and *Head On: Art with the Brain in Mind* at the Science Museum for the Wellcome Trust.

More recently, her work has been in *Gregor Mendel, Planting the Seeds of Genetics*, USA touring Exhibition, *The Glass Delusion*, UK National Glass Centre *Seeing Heads* Hatton Gallery Newcastle, Solo show *Mitosis*, Newcastle, and GV Art London exhibitions *Experiments, Brainstorm* and her 2010 solo show *Relics of the Mind*.

In 2011-2012, her work will be in *Images of the Mind/The Mind in Images*, Dresden and Brno.

David Marron

The Physician

The Physician is a life-sized sculpture configured from a skeletal armature of wood and plaster that embodies certain objects. It has the conflicting demeanour of shared representations of what a doctor is. The unnerving apparel of a plague doctor – with herb filled beak, eye glass, black apron and prodding stick (here fashioned to recall Asclepius's snake-entwined staff – still brandished as a medical emblem). A shamanic headdress sprouting outward is countered with a modern surgical gown and stethoscope. The torso is modelled into a historic medicinal snapshot, with a background that references the Hippocratic Oath, surgical instrumentation and anatomical maps. The case is segmented into three parts – the top implicating analgesia – electric fish, laudanum, paracetamol. The middle encompassing the cleansing aspects of larvae and leeches (itself an archaic word for physician). The lower half drawing upon the inherent remedial properties of honey – suturing and bacterial resistance, a hypertonic.

A bird cage at the Physician's feet recalls Magritte's works upon *The Healer* and a cluster of objects recognise the foxglove flower found within Van Gogh's portrait of Dr Gachet. The extractions of the foxglove being used in the formation of cardiac glycosides – prescribed to combat cardiac arrhythmias. The medical dictionary upon the figures head cites the Bosch painting - *Stone Operation*. Deriding the medical charlatans who desired the acquisition of knowledge without study, in balancing a book upon the head and willing the information to pass down via osmosis.



David Marron, *The Physician*

David Marron trained in fine art at Chelsea College of Art and Design and currently divides time between his art practice and his work as a paramedic. His art incorporates visual symbols that infiltrate the past to share and shape within the present. He exercises drawing, sculpture, language, object, substance and film, to consider relations within subjects and entice some kind of response: a silent dialogue.

'The scientific aspect of my art work is influenced by my work as a paramedic, consequently the medical aspects which afflict and assist in our daily lives. Touching upon the progress of treatment and technology, societal damage, basic pathology and physiology, anatomy, the trite but constant balance of life and death. Observed and worked from the personal viewpoint, the human aspect. Basking in these failed attempts at conveying the emotive response'.

Helen Pynor

Liquid Ground 6

The *Liquid Ground* series addresses our relationship with the interior body, seeking a language that is at once anatomically explicit, but which avoids either the sensationalism of gore or the clinical neutrality sought by medical discourse.

My aim is to 'personalise' the interior body, reinstating and hinting at the histories and narratives in which the body's interior is entangled. In contemporary debates and research, the corporeal body is not given the same scrutiny as the brain in explorations of consciousness. One of my interests lies in exploring the ways in which 'mind' functions throughout the body's structures and spaces - within, between and beyond the nervous system.

The status of the organs in the *Liquid Ground* series lies somewhere between the uncanny spectre of organs rendered out-of-place, and the apparent seamless habitation of organs within their watery milieu.

The early starting point for this series was research I undertook into incidents of accidental drowning in the Thames, fuelled by interests in the habitation of the human body in water and the notion of drowning as an extended process over time, rather than a moment. However, more broadly the work considers ongoing themes around the entwined nature of our bodies as 'cultural' beings and our visceral selves.



Helen Pynor, *Liquid Ground 6*

Helen Pynor gained a BSc (Hons) in Biology at Macquarie University majoring in cellular and molecular biology, a BVA at Sydney College of the Arts, The University of Sydney majoring in photography, sculpture and installation, and a PhD at Sydney College of the Arts, The University of Sydney. In her doctoral thesis, she sought the reconciliation of materialist understandings of the human body with understandings of the body as a culturally-constructed entity, a theme she continues to explore.

Pynor's practice has included exhibitions, residencies and public art commissions in Australia, Europe and Asia. She has been the recipient of a number of prestigious national awards in Australia such as the 2009 RBS Emerging Artist Award and the 2008 Josephine Ulrick and Win Schubert Photography Award, and has recently been awarded a number of Australia Council for the Arts grants. Her work is held in public and corporate collections in Australia as well as private collections in Europe, Asia and Australia. Pynor is currently undertaking a major project exploring organ transplantation in collaboration with artist Peta Clancy.

Pynor draws extensively from the writings of scientists as well as philosophers of biology, in addition to working with scientists in both collaborative and consultative roles. Her practice is integrally tied to a questioning of the philosophical and material status of human and non-human organisms.

Nina Sellars

Lumen

In the 21st century, we have become increasingly captivated with scientific images of our bodily interior. Technologies that enable the virtual unfolding of the corporeal body i.e. computerised tomography (CT) and magnetic resonance imaging (MRI) provide coordinates for realms that exist beyond what is normally visible. CT and MRI use light from the extremes of the electromagnetic spectrum to penetrate, map and ultimately image the anatomical body. Thereby unveiling a subcutaneous spectacle that is only attainable for the human eye through the mediation of technology.

Lumen is a kinetic installation that presents real time scans of a fictional interior that are realised as projected shadows. The title of the installation is a play on the double meaning of the term *lumen*, as a unit of luminous flux, and alternatively, the central cavity of a tubular or other hollow structure in an organism or cell. The work probes the question: how do we phenomenologically engage with this view into an intangible interior, which has only been made possible through the intensification of light and the magnification of sight?

Lumen was initiated during a Professional Artist's Residency at the Pilchuck Glass School, Seattle, USA. It was then developed in collaboration with the Laser Physics Centre, Research School of Physics and Engineering, Australian National University. Craig MacLeod (technician/mechanical engineer) assisted with fabrication and Dr Matthew J. Sellars (quantum physicist) was the advising scientist.



Nina Sellars, *Lumen* (installation detail - shadow image in rotation)

Nina Sellars

Oblique: images from Stelarc's Extra Ear surgery

In *Oblique*, the oversized photographic images of the surgical scene possess an inescapable presence, bearing down on the viewer with a visceral intensity. The fascination is not merely with a preternatural act of corporeal construction – a surgical creation of an ear on an arm – but also with the man-made hole, which appears to be a seemingly arbitrary entry point into the body – an artificial aperture – that provides us with a visual portal into the ‘sticky’ anatomy that lies beneath the skin’s surface. Our expectations are that a surgical incision is made as part of a ‘purposeful’ operation – a utilitarian cut – not for the seemingly expedient realisation of an artistic concept. The close up confounds any visual escape and also denies us the identity of the patient. The *almost* present patient – faceless and unidentifiable – is merely a fragment of a body; thus a larger than life, visually dismembered forearm is transformed into an anthropomorphic whole. But the identity of the patient is not lost only transferred, as it soon emerges attached to a scaffold of an ear, that is to say the *Extra Ear* project has become synonymous with Stelarc.

The *Extra Ear* surgery was performed in a private practice in Encino, Los Angeles, USA. *Oblique* is an interpretation of the surgery and presents just one possible perspective taken from the real time experience of viewing the *Ear on Arm* operation.



Nina Sellars, *Oblique: images from Stelarc's Extra Ear surgery - Surgeon*

Nina Sellars is an artist and PhD student in Drawing at the Faculty of Art, Design & Architecture at Monash University, where she also lectures in Anatomical Drawing for both the Medical and Art faculties. She has trained and worked as a prosector (dissector of cadavers for medical display) and often works collaboratively with scientists and artists on cross-disciplinary projects. Her artwork utilizes drawing, photography and installation, and has been exhibited nationally and internationally.

Craig MacLeod is a mechanical engineer and technician at the Laser Physics Centre, Research School of Physical Sciences and Engineering, Australian National University.

Dr Matthew Sellars is senior research fellow and head of the Solid-State Spectroscopy group at the Laser Physics Centre, Research School of Physical Sciences and Engineering, Australian National University and program manager for the Centre of Excellence for Quantum Computing and Communication Technology. His research interests centre on quantum measurement and quantum information processing using optically active ions in crystals. He has published in numerous journals including *Nature*, *Physical Review Letters* and *Journal of the Optical Society of America*. His work on stopping light for over a second was voted by the Chinese Academy of Science as one of the top 10 international scientific achievements in 2005.

Stelarc

Stretched Skin

The *Stretched Skin* installation is a digital portrait of the artist. Printed on three separate panels, its original size is 3 m x 4 m. It is exhibited not on the wall of the gallery, but rather 40 cm horizontal to the floor. Illuminated from above, it appears as a flattened and floating face, a landscape of stretched skin. This was inspired by the digital skin made for the *Prosthetic Head* project – an embodied conversational agent that speaks to the person who interrogates it. Wrapped around a 3,000 polygon mesh, it resulted in an agent that somewhat resembles the artist. The *Prosthetic Head* has an extended data-base, a conversational strategy and real-time lip syncing. As well as being able to converse with a human user, it can also generate its own poetry and song-like sounds – different every time it is asked to recite a poem or sing a song. Another project that the *Prosthetic Head* skin inspired was the *Partial Head* project. With the *Partial Head*, the artist's face was scanned, as well as a hominid skull. A digital transplant was done of the face over the skull producing a 'third face', a composite construct that was 3D printed and used as a scaffold to grow a layer of living skin over it.

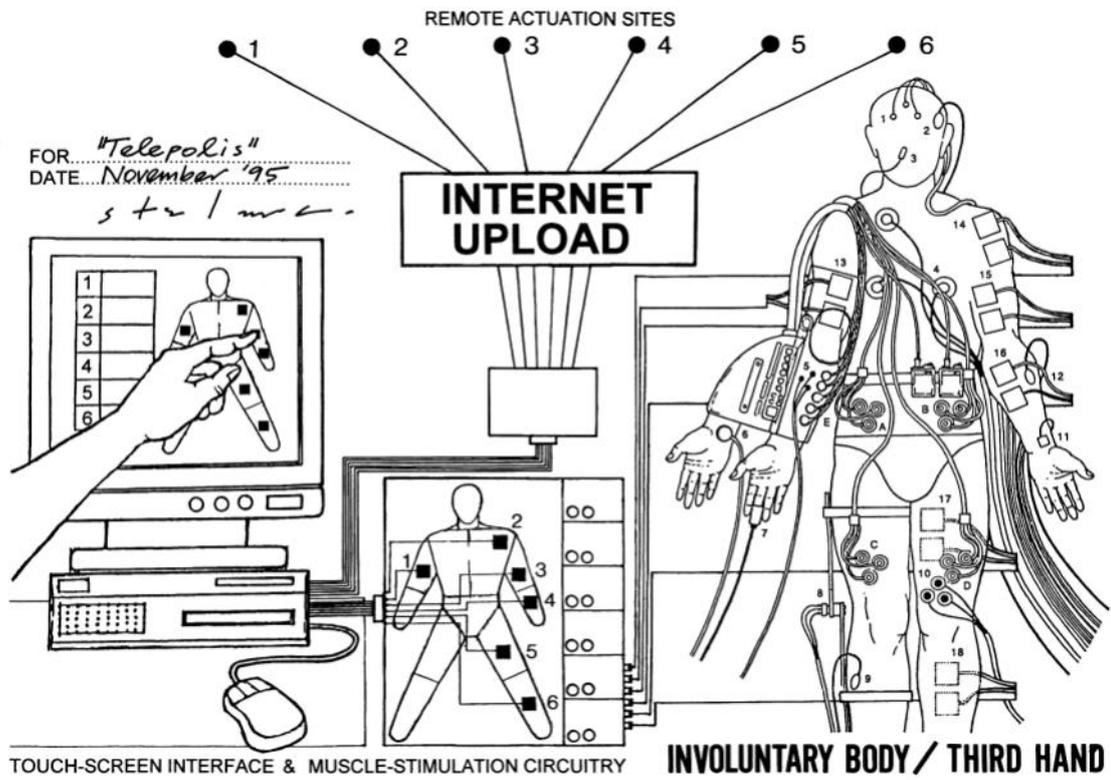


Stelarc, *Stretched Skin*

Stelarc

Postcard Installation

The images and texts inform, elaborate and contextualise the performances and projects, exploring alternate anatomical architectures. The earlier body suspensions expose the body as obsolete, empty, often absent from its own agency and performing largely involuntarily. This realisation generates a series of events augmenting and inserting technology into the body. The Third Hand is an EMG actuated prosthesis that has a tactile feedback system for a sense of touch. Initially a visual attachment to the body, the Handwriting performance involved writing one word, Evolution, simultaneously with three hands. The Third Hand performances also involved amplifying body signals and sounds such as brainwaves, heartbeat, bloodflow and muscle signals. The Stomach Sculpture becomes an artwork not for a public space but a private, physiological space. A machine choreography inside a soft and wet organ of the body. Walking machines like Exoskeleton and Muscle Machine translate human bipedal gait into a 6-legged insect-like locomotion. Fractal Flesh initiated a series of performances that experimented with remote and online actuation of the body using a muscle stimulation control system. The Ear On Arm project is a soft prosthesis that is surgically constructed and cell grown. The aim is to electronically augment and internet enable the ear. This extra ear would become an accessible, mobile and acoustical organ for people in other places.



Stelarc, *Postcard Installation* (image of one postcard *Fractal Flesh-DR*)

Stelarc has used medical instruments, prosthetics, robotics, virtual reality systems, the Internet and biotechnology to explore alternate, intimate and involuntary interfaces with the body. He has performed with a *Third Hand*, a *Virtual Arm*, a *Stomach Sculpture* and *Exoskeleton*, a six-legged walking robot. His *Prosthetic Head* is an embodied conversational agent that speaks to the person who interrogates it. He is surgically constructing an *Ear on Arm* that will be internet enabled. In 1997 he was appointed Honorary Professor of Art and Robotics at Carnegie Mellon University, Pittsburgh. In 2003 he was awarded an Honorary Degree of Laws by Monash University. He received a New Projects grant from the Australia Council in 2010 to develop a micro-robot. Last year he was also awarded the Prix Ars Electronica Hybrid Arts Prize. He is currently Chair in Performance Art, School of Arts, Brunel University London, Uxbridge, UK. He is also Senior Research Fellow and Visiting Artist at the MARCS Auditory Labs at the University of Western Sydney, Australia.

Stelarc's artwork is represented by the Scott Livesey Galleries in Melbourne.

Ken + Julia Yonetani and Dr. Ian Kaplin

Imagine Tree

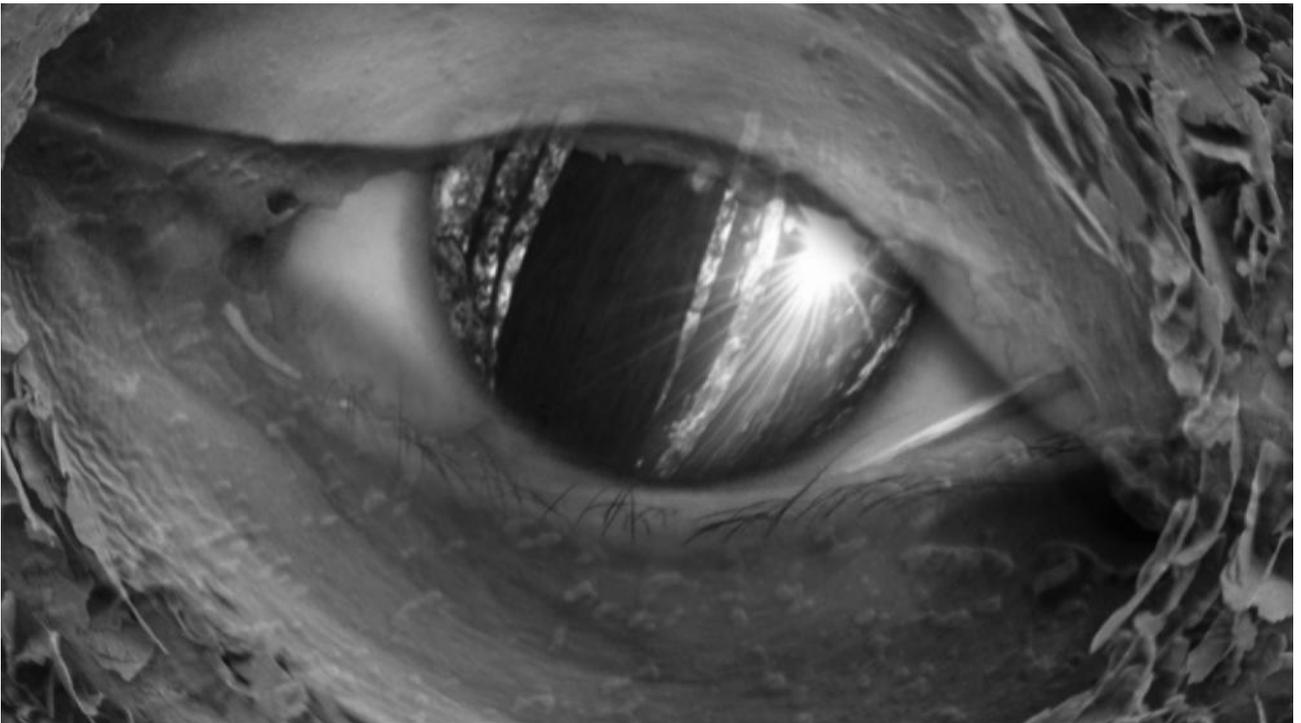
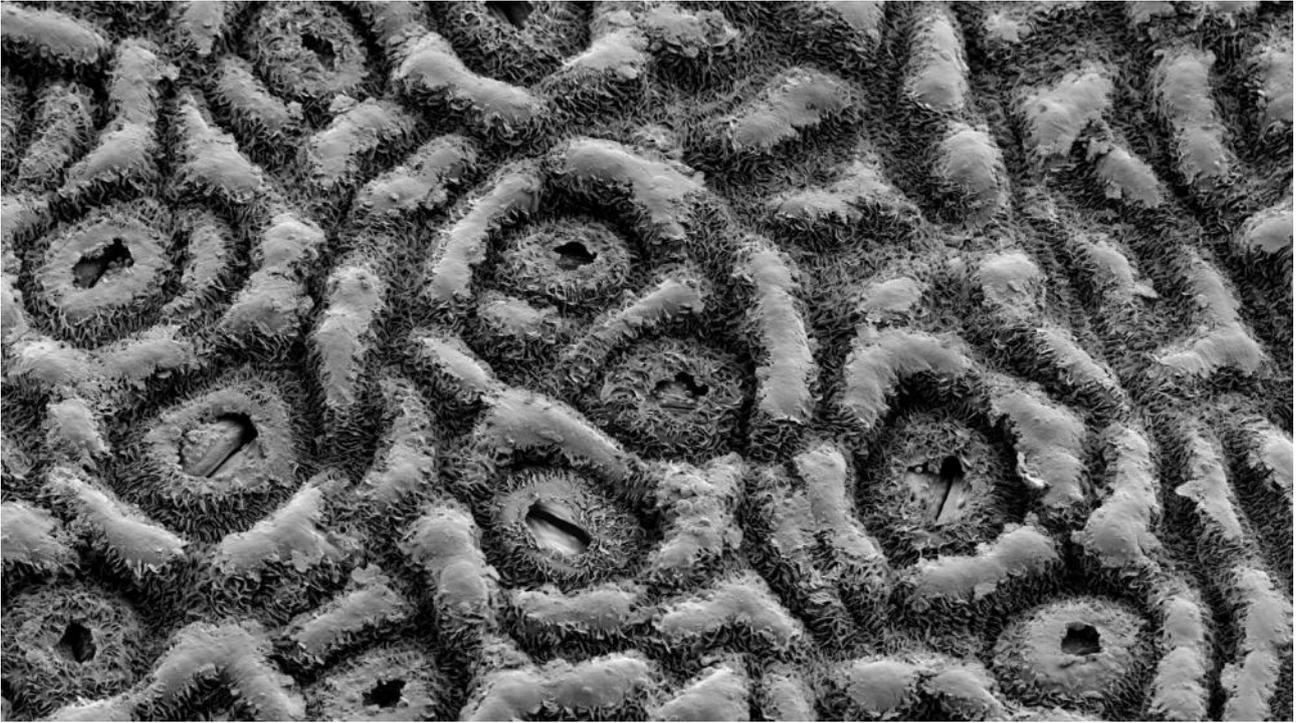
Imagine there's no forest.

Imagine there's no trees.

Imagine no trees breathing.

Imagine all the people speaking of the soul of the tree.

A multimedia work inspired by micro images of stomata from the leaves of trees near the Blue Mountains National Park, NSW, acquired using electron microscopic technology from the Australian Microscopy & Microanalysis Research Facility, the University of Sydney. The work reveals the hidden process of photosynthesis and respiration of plant life to the naked human eye, asking us to once again begin a lost conversation with trees as living and breathing spirit.



Ken + Julia Yonetani, *Imagine Tree* (still images from video installation)

Ken and Julia Yonetani are collaborative artists who work in the field of sculptural installation, video, and performance art. They have exhibited together at *Arterial Gallery*, *Campbelltown Arts Centre*, *La Trobe University Museum of Art*, *Object Gallery*, *Gold Coast City Gallery*, *Jan Manton Art*, and *Sydney College of the Arts*. In 2010, they staged a bed-in performance in Federation Square, Melbourne, and conducted a *Synapse Residency* in Mildura in collaboration with the Murray Darling Freshwater Research Centre and Sunrise 21. Ken was born in Tokyo, Japan. He received a Bachelor of Economics in Japan and worked in the Foreign Exchange Market in Tokyo for three years. Following this, he was an assistant for pottery master, Toshio Kinjo, oldest son of Jiro Kinjo, National Living Treasure of Japan. He completed his M.A. at The Australian National University School of Art in 2005. He has held numerous solo and group exhibitions, including the 2008 Adelaide Biennial of Australian Art, and was selected for the Australian contingent at The 53rd Venice Biennale in 2009.

Julia holds a PhD from the Australian National University, and has held positions lecturing and researching in History, Cultural Studies, and Art Theory at the University of New South Wales, Western Sydney University and the University of the Ryukyus, Japan. She has also published work in *Cultural Studies Review*, *Artlink*, *Art and Perception*, *Asian Studies Review*, *Japanese Studies*, and *Critical Asian Studies*. She has been involved in various environmental movements and represented Okinawan environmental groups at the International Union for the Conservation of Nature in Amman, Jordan in 2000. Ken and Julia live together with their two daughters in the Blue Mountains, Australia.

Dr Ian Kaplin holds a BSc (CE) from the University of Sydney, a MSc from University of NSW, 1972, and a PhD from the University of NSW. He works as the professional officer, Australian Centre for Microscopy and Microanalysis, University of Sydney, a title he has held since 1982. He also worked at Deutsches Wollforschungsinstitut, Aachen, Germany, 1979 to 1982. With over 30 years experience in electron microscopy, Ian's current main focus is the support of users on both scanning and transmission electron microscopes. This includes a leading role in microscope training courses and also in the teaching of microanalysis.

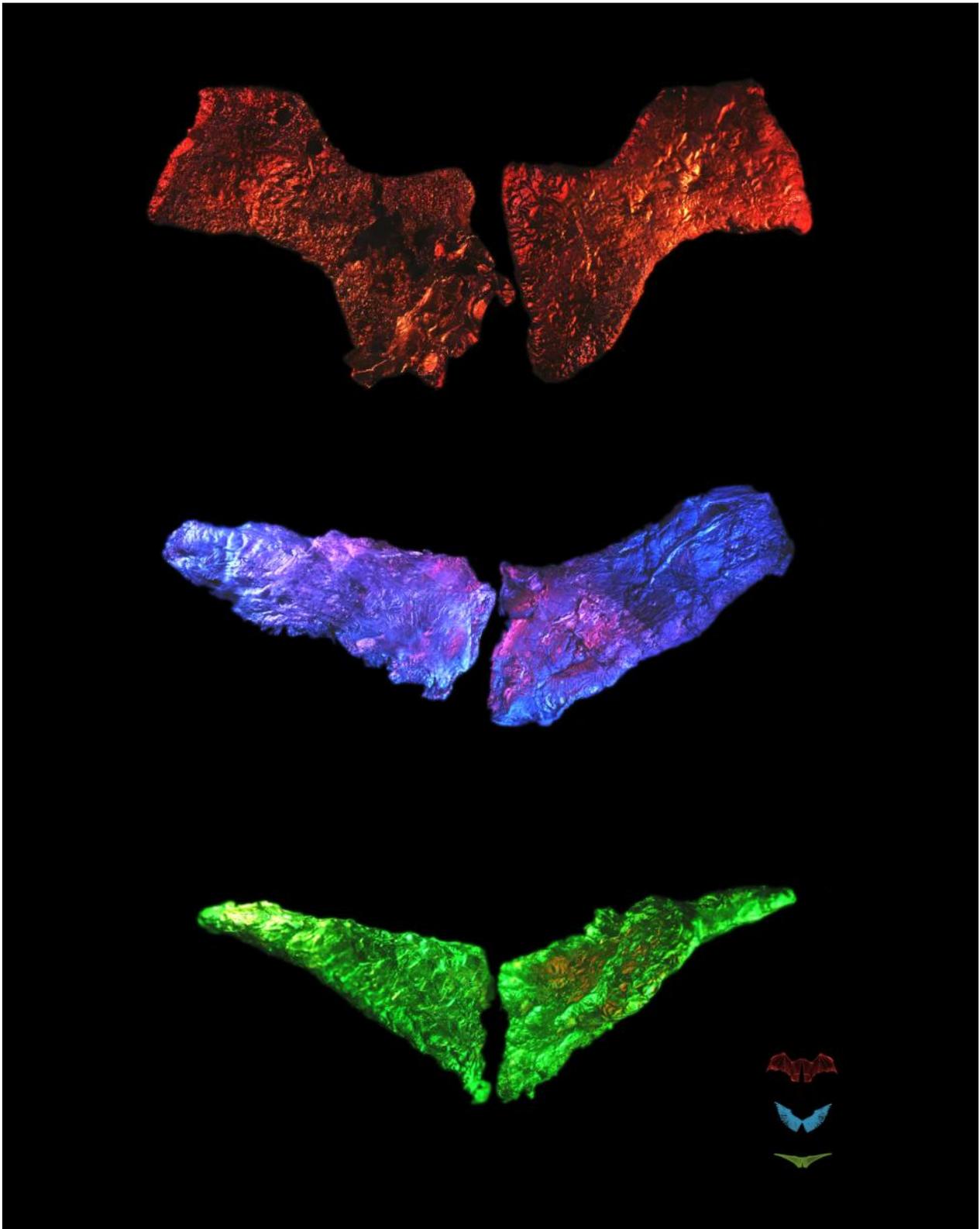
He is also heavily involved with the undergraduate and schools outreach visits. His basic research interest is in the development, ultrastructure, and composition of keratin fibres. During Ian's time in the ACMM, this has extended to collaborations ranging from the biological sciences, veterinary science and medicine to the physical and earth sciences including chemistry, physics, aeromechanical and mechatronic engineering and geoscience, as well as to the arts.

Oron Catts and Ionat Zurr

The Pig Wings project

Advances in bio-medical technologies such as tissue engineering, xenotransplantation, and genomics promise to render the living body as a malleable mass. The rhetoric used by private and public developers as well as the media have created public anticipation for less than realistic outcomes. The full effects of these powerful technologies on the body and society have been, in most cases, only superficially discussed. Winged bodies (both animal and human) have been used in most cultures and throughout history. Usually, the kind of wings represented the creature (chimeras) as either good/angelic (bird-wing) or evil/satanic (bat-wing). There is yet another solution to flight in vertebrates which seems to be mostly free of cultural values - that of the pterosaurs. We have used tissue engineering and stem cell technologies in order to grow pig bone tissue in the shape of these three sets of wings. The *Pig Wings* installation presents the first ever wing shaped objects grown using living pig tissue.

The *Pig Wings* project was developed in 2000-2001 during a residency in Doctor Joseph Vacanti's Tissue Engineering and Organ Fabrication Laboratory, Massachusetts General Hospital, Harvard Medical School. Three sets of wings made out of pig mesenchymal cells (bone marrow stem cells) were grown over/into biodegradable/bioabsorbable polymers (PGA, P4HB). The wings size is 4 cm x 2 cm x 0.5 cm each, and they were grown for approximately nine months inside a rotary cell culture bioreactor. The original wings are coated with gold and kept in jewellery boxes.



Oron Catts and Ionat Zurr, *Pig Wings*

Oron Catt is Director of SymbioticA, The Centre of Excellence in Biological Arts School of Anatomy and Human Biology The University of Western Australia. Oron Catts is an artist, researcher and a curator at the forefront of the emerging field of Biological-arts, whose work addresses shifting perceptions of life.

In 1996, he founded the Tissue Culture and Art Project to explore the use of tissue technologies as a medium for artistic expression. In 2000, he co-founded SymbioticA, an artistic research laboratory within a biological science department. SymbioticA became a Centre of Excellence in 2008 and has a thriving residency, academic and workshops programme.

In April 2009 he was acknowledged by Icon Magazine (UK) as one of the top 20 Designers "making the future and transforming the way we work". His work received international awards and recognition including the inaugural Prix Ars Electronica Golden Nica in Hybrid Art in 2007, the 2008 WA Premier Award and The Second Prize in the VIDA10. His work is in New York's MoMA design collection and has been exhibited internationally. Catts has published 13 book chapters and numerous articles.

Dr. Ionat Zurr is an Artist, researcher and a curator as well as the Academic Coordinator of SymbioticA – The Centre of Excellence in Biological Arts, School of Anatomy and Human Biology, the University of Western Australia.

Ionat together with Oron Catts formed the internationally renowned Tissue Culture and Art Project. She has been an artist in residence in the School of Anatomy and Human Biology since 1996 and was central to the establishment of SymbioticA in 2000. Ionat is considered a pioneer in the field of biological arts and her research has been published widely, exhibited internationally and her artwork has been collected by MoMA New York. In 2009, Ionat was listed by the Icon Magazine (UK) as one of the 'Top 20 Designers making the future and transforming the way we work'.

Ionat have been a fellow in the InStem Institute, NCBS, Bangalore (2010) and a visiting scholar at The Experimental Art Centre, Stanford University (2007) and The Tissue Engineering & Organ Fabrication Laboratory, Massachusetts General Hospital, Harvard Medical School (2000-2001). She exhibited in places such as the MoMA, New York, Mori Museum, Tokyo, Ars Electronica, Linz, GOMA Brisbane and more.

ARTHUR I. MILLER

Arthur I. Miller is emeritus professor of history and philosophy of science at University College London. Although the theory of elementary particles was his interest – he has a PhD in physics – his passion was always the ‘What is the nature of ...’ questions. He is fascinated by the nature of creative thinking - creativity in art on the one hand and science on the other. What are the similarities, what are the differences? He is the author of *Einstein, Picasso*, nominated for the Pulitzer Prize, and *Empire of the Stars*, shortlisted for the 2006 Aventis Prize for Science Books. His most recent book is *Deciphering the Cosmic Number: The Strange Friendship of Wolfgang Pauli and Carl Jung* (paperback title, *137: Jung, Pauli and the Pursuit of a Scientific Obsession*). Presently he is working on a book, tentatively titled *The Creative Revolution*, looking into the exciting new field of science-inspired art.

GV Art

GV Art is a contemporary art gallery which aims to explore and acknowledge the inter-relationship between art and science, and how the areas cross over and inform one another. The gallery produces exhibitions and events that create a dialogue focused on how modern man interprets and understands the advances in both areas and how an overlap in the technological and the creative, the medical and the historical are paving the way for new aesthetic sensibilities to develop.

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GALLERY OPENING HOURS:

Tuesday to Friday 11am – 6pm

Saturdays 11am – 4pm or by appointment

Admission Free

