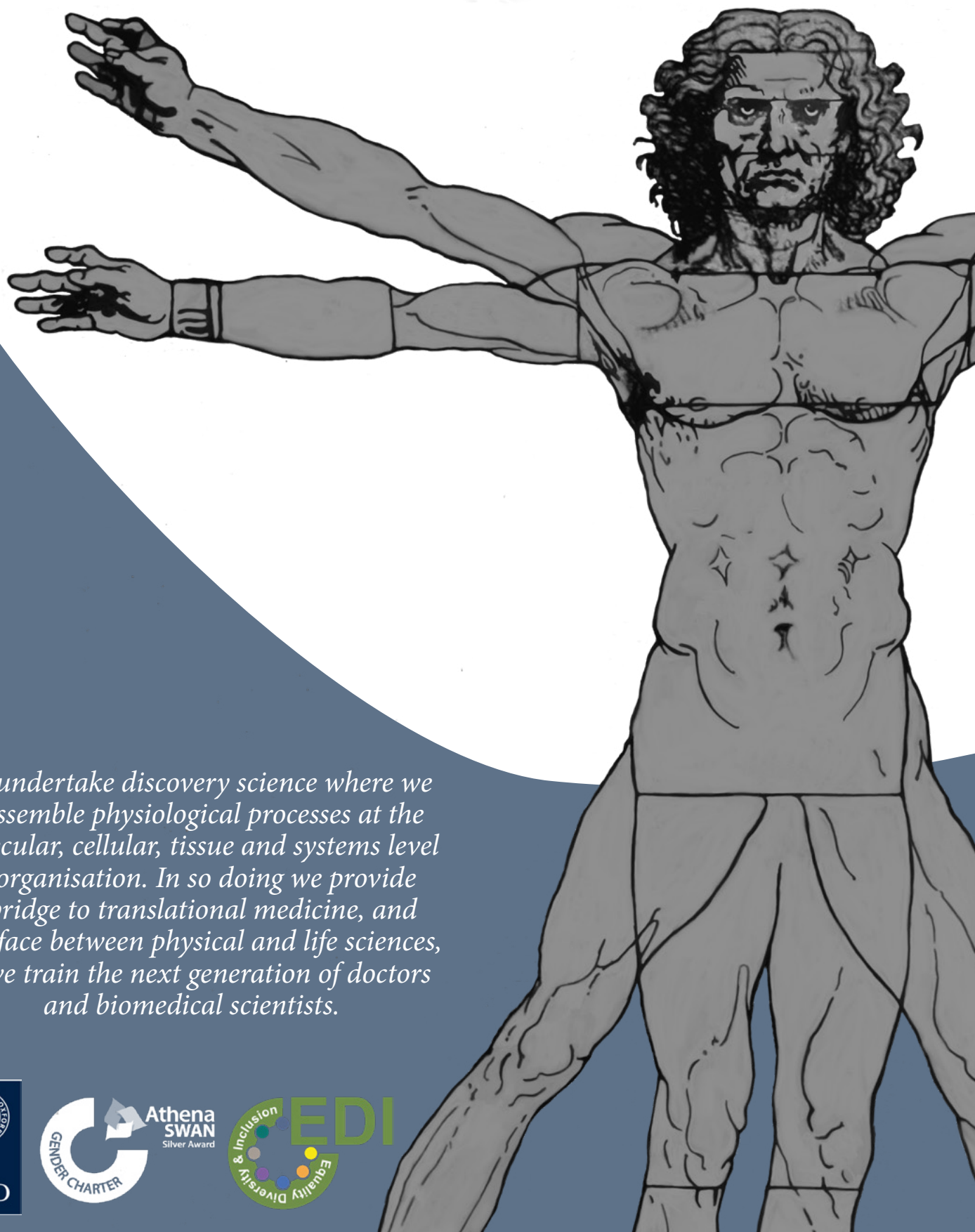




Annual Report 2021–2022



We undertake discovery science where we reassemble physiological processes at the molecular, cellular, tissue and systems level of organisation. In so doing we provide a bridge to translational medicine, and interface between physical and life sciences, as we train the next generation of doctors and biomedical scientists.

Defining Excellence

Oxford Anatomy and Physiology ranked #1 in the QS World University Rankings by subject 2017, 2018, 2020, 2021, 2022

From the Head of Department



The Department of Physiology, Anatomy and Genetics has emerged triumphantly from the challenges of the COVID-19 pandemic. Our research was submitted to Unit of Assessment 5 in the 2021 Research Excellence framework. Oxford had the largest national submission, in which 95% of the total profile was rated world-leading or internationally excellent. Our UoA achieved a 4* 100% rating for environment, outputs 91.8% 4*/3*, and impact 100% 4*/3*. Based on volume of world-leading research (4* x FTE) we continue to maintain our leading position on research power.

This year has also seen some fantastic new hires and personal successes. In January, we welcomed Professor of

Neuroscience Randy Bruno. In May, we congratulated Professor Irene Tracey CBE FMedSci who will become the next Vice-Chancellor of Oxford in 2023, and commence an honorary professorship at our department. In June, we congratulated Dr Nikita Ved as she received an MBE in the Queen's Birthday Honours.

Particular highlights for me have been the return of our named lectures. I hosted Professor Dame Kay Davies FRS for the inaugural Sir Wilfrid Le Gros Clark Prize Lecture, NASA Astronaut Dr Jessica Meir for the Sherrington Prize Lecture: Public Understanding of Science, Professor Molly Stevens FREng FRS for the Mabel FitzGerald Prize Lecture, Dr Sarah Teichmann FRS for the J.S. Haldane Prize Lecture, 2013 Nobel Laureate Thomas Südhof ForMemRS for the Sir Charles Sherrington Prize Lecture, and Professor Sir Stephen O'Rahilly FRS for the Sir Hans Krebs Prize Lecture.

This year has also been important for honouring our early pioneers. In November, Dr Meir unveiled The Physiological Society Mabel FitzGerald plaque outside the Burdon Sanderson Cardiac Science Centre. In April, I unveiled an Oxfordshire Blue Plaque commemorating Sir Charles Sherrington at 9 Chadlington Road, his long-time Oxford residence. In July, Professor Dame Frances Ashcroft FRS unveiled The Physiological Society Florence Buchanan plaque outside the Sherrington building main entrance. We have also renamed the Sherrington Small Lecture Theatre to the Florence Buchanan Lecture Theatre. The Large Lecture Theatre has also been renamed to the Blakemore Lecture Theatre in tribute to the longest serving Waynflete Professor of Physiology Sir Colin Blakemore FRS following a prestigious Festschrift event held in his honour. We were also delighted to host Patrick Hughes to unveil his artwork *Popsee*, donated in honour of Professor Blakemore and their shared interest in visual perception.

On a more sombre note, we were all saddened by the passing of our dear colleagues Dr Derek Bergel and Dr Piers Nye in December, and Heather MacKay, DPhil student, in April. Just this June, Professor Sir Colin Blakemore also passed, leaving an unsurpassed legacy in Visual Neuroscience. *In piam Memoriam*.

It has also been a truly difficult year for our friends and colleagues in Ukraine. We were deeply shocked at the barbaric unprovoked invasion, and I was pleased in my capacity as President of The Physiological Society to offer The Society's practical support for physiologists in Ukraine to come to the UK with our sponsorship. In solidarity, we have proudly displayed the Ukrainian flag on our website and video wall, and raised £1,500 at a bake sale led by Associate Professor Lisa Heather and the Cardiac Metabolism Research Group for the Ukraine Humanitarian Appeal.

Our community spirit continued at the end of year when we came together on Friday 1 July for a fantastic street party on Sherrington Road, where we celebrated its reopening with our colleagues in Biochemistry and the Kavli Institute for Nanoscience Discovery.

I conclude by thanking all our staff for their continued commitment to the Department. Many of them have now moved into the new Institute of Developmental and Regenerative Medicine where they are poised to make ground-breaking discoveries to help treat birth defects and acquired disease. Despite our increased distance, we remain unified by our common goal to empower discovery in the physiological sciences, and I could not be more proud of everyone for their unflinching hard work to achieve this.

David Paterson

A Year of



DPAG once more on top of the world

DPAG has been ranked world number one for Anatomy and Physiology in the 2022 QS World University Rankings by Subject for the third consecutive year. It is one of the highest rated departments globally in Oxford University, joining four other subject areas at the top position.

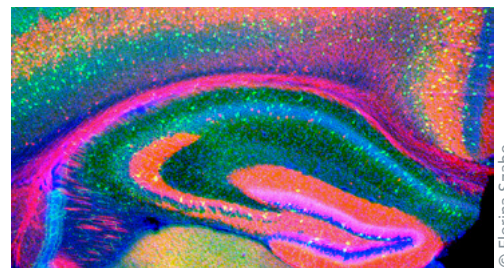
www.dpag.ox.ac.uk/news/dpag-tops-world-rankings-by-subject-for-third-consecutive-year



Nikita Ved recognised in 2022 Queen's Birthday Honours

Dr Nikita Ved MBE PhD FRSA was appointed a Member of the Most Excellent Order of the British Empire for her services during the COVID-19 pandemic. She was recognised for her vaccine outreach work as part of The 1928 Institute, an official Oxford spin out which she co-founded.

www.dpag.ox.ac.uk/news/nikita-ved-recognised-in-queens-birthday-honours



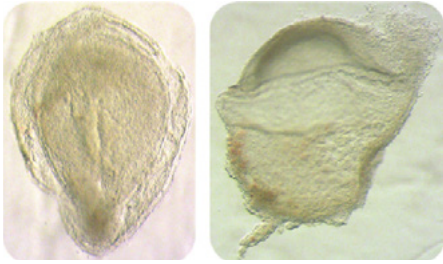
© Florina Szabo

DPAG Image Competition

The Head of Department ran a competition to refresh the science on the Sherrington building walls. First prize was awarded to DPhil student Florina Szabo of the Molnár Group for her epifluorescent image showing PV+ interneurons (green) in the mouse motor and somatosensory cortex and glutamatergic layer 5 cortical pyramidal neurons (red).

www.dpag.ox.ac.uk/news/winners-of-dpag-image-competition-announced

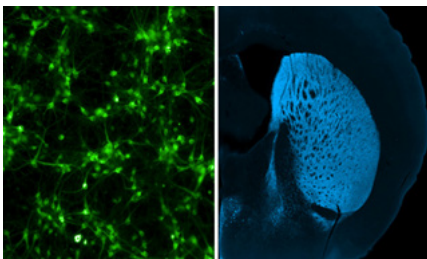
Progress



Milestone stage of human development mapped for the first time

New research published in the journal *Nature* led by Professor Shankar Srinivas and Dr Richard Tyser has analysed for the first time an ethically sourced rare embryo sample estimated to be from 16-19 days after fertilisation. The study has shed unique light on one of the most critical stages of human development – gastrulation – which has never been fully mapped out in humans before, and thus will contribute to the improvement of experimental stem cell models.

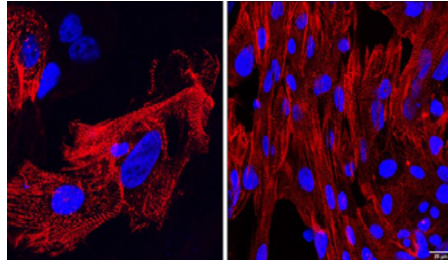
www.dpag.ox.ac.uk/news/oxford-led-research-maps-milestone-stage-of-human-development-for-the-first-time



Two major awards to progress critical Parkinson's research

Collaborative teams led by Professors Stephanie Cragg, Richard Wade-Martins and Peter Magill at the Oxford Parkinson's Disease Centre were awarded £6.6 million by Aligning Science Across Parkinson's to map the original brain circuits vulnerable to Parkinson's on an unprecedented scale, and a £3.8 million Wellcome Trust Collaborative Award to reveal the role of calcium in Parkinson's.

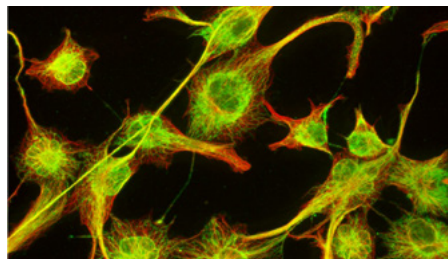
www.dpag.ox.ac.uk/news/mapping-uncharted-networks-in-the-progression-of-parkinsons / www.dpag.ox.ac.uk/news/opdc-awarded-3-8-million-to-reveal-the-role-of-calcium-in-parkinsons



Drugs could help diabetic hearts recover after heart attack

New research published in the journal *Diabetes* led by Associate Professor Lisa Heather has found that a drug known as molidustat could help improve heart function in people with diabetes who have heart attacks, ultimately reducing the risk of other complications such as heart failure. The drug, currently in clinical trials for treating anaemia in chronic kidney disease, increases levels of a protein called Hypoxia-Inducible Factor 1 (HIF), activating 'target' genes to help cells adapt and survive.

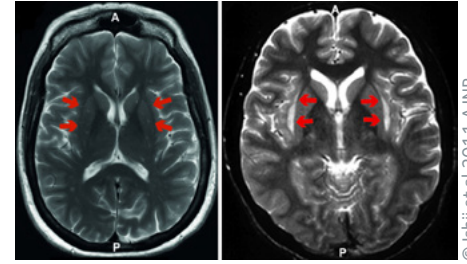
www.dpag.ox.ac.uk/news/drug-could-help-diabetic-hearts-recover-after-a-heart-attack



An unexpected role for the cell's largest membrane network

A new paper published in the journal *PNAS* led by Associate Professor Robin Klemm has uncovered a new mechanism involving the endoplasmic reticulum (ER) that is critical to the organisation and position of the microtubule (MT) cytoskeleton, which ultimately dictates the shape and function of our body's cells. Researchers discovered that inhibition of membrane fusion in the ER leads to dramatic changes in ER network dynamics, namely strong re-positioning of both the ER membranes and the MT cytoskeleton within cells.

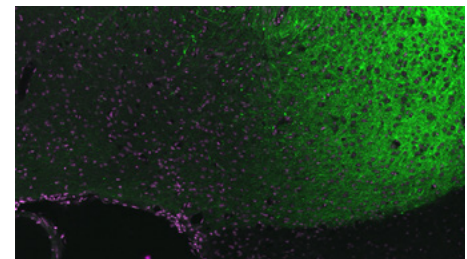
www.dpag.ox.ac.uk/news/an-unexpected-role-for-the-cells-largest-membrane-network



Little understood brain region linked to how we perceive pain

A new paper published in the journal *Brain* led by Dr Adam Packer, has shown for the first time that a poorly understood region of the brain called the claustrum may play an important role in how we experience pain. The research, in collaboration with Professor Irene Tracey and Associate Professor Sanjay Manohar, suggests that this densely interconnected, yet rarely studied, brain region may be the next frontier in improving outcomes for brain damage patients.

www.dpag.ox.ac.uk/news/little-understood-brain-region-linked-to-how-we-perceive-pain



Switch with a spring: a new model for sleep regulation

New research led by Professor Vladyslav Vyazovskiy found that the hypothalamus is responsible for regulating the qualitative dimension of wakefulness and sleep. Their findings, published in the journal *PNAS*, allowed the Vyazovskiy Lab to posit that it is not just time spent awake that determines the rates of build-up of homeostatic sleep pressure and propensity for state switching, i.e., 'sleep need', but rather wake 'intensity' or 'quality'. Thus, they have proposed a novel concept they call the 'switch with a spring' model.

www.dpag.ox.ac.uk/news/switch-with-a-spring-a-new-model-for-sleep-regulation



Dr Jessica Meir inspires the next generation of scientists and explorers

NASA Astronaut and Physiologist Dr Jessica Meir, Ph.D., who made history in 2019 by being part of the historic all-female spacewalk, delivered the Sherrington Prize Lecture: Public Understanding of Science on Tuesday 16 November. The lecture entitled *Experimenting in microgravity: Full circle for a scientist turned astronaut* followed her unveiling of The Physiological Society blue plaque in honour of fellow pioneering Physiologist and Scientific Explorer Mabel FitzGerald.

www.dpag.ox.ac.uk/news/dr-jessica-meir-inspires-the-next-generation-of-scientists-and-explorers

Sherrington Talks 2022



Third year DPhil students presented their research at the Department's premier annual event for graduate students, held in person this year for the first time since the onset of the COVID-19 pandemic.

This year's joint prize winners are David Oliver with *Sensory response properties of the mouse claustrum* and Dr Ni Li with *Human iPSC derived cardiac myocytes and sympathetic neurons in disease modelling*.



www.dpag.ox.ac.uk/news/sherrington-talks-2022-prize-winners

Honours, Fellowships and Prizes

The Department is proud to host a number of academic staff who have been honoured with fellowships and prestigious awards. The following list offers some highlights from the past year: **Associate Professor Ana Domingos**, 2023 Carl Ludwig Distinguished Lectureship; **Professor Anant Parekh FRS**, 2023 Annual Review Prize Lecture from The Physiological Society; **Associate Professor Neil Herring**, the Bayliss Starling Prize Lecture from The Physiological Society; **Professor Dame Frances Ashcroft FRS**, the Banting Medal; **Professor Randy Bruno**, Academy of Medical Sciences Professor, and alongside **Professor Scott Waddell**, Wellcome Trust Discovery Award; **Professor Damian Tyler**, Senior Fellow of the International Society for Magnetic Resonance in Medicine (ISMRM); **Dr Nikita Ved**, MBE; **Professor Peter Robbins**, Asma Alamoudi, **Dr Matthew Frise**, **Dr Chris Fullerton**, Snapper Magor-Elliott, **David O'Neill**, the late **Tim Pragnell**, **Dr Peter Santer**, **Dr Nick Talbot**, Royal Society of Chemistry Horizon Prize; **Emeritus Professor Gillian Morris-Kay**, 2021 Anatomical Society Prize Medal; **Professor Vladyslav Vyazovskiy**, conferral of title of Professor of Sleep Physiology; **Associate Professor Nicola Smart**, appointed to an established post as Associate Professor of Cellular and Integrative Physiology in association with Christ Church; **Emeritus Associate Professor Jeremy Taylor**, MSD Lifetime Achievement Award; **Associate Professor Helen Christian**, MSD Excellent Teacher Award; **Dr Filipa Simões**, BHF Intermediate Basic Science Research Fellowship; **Associate Professor Duncan Sparrow**, BHF Senior Fellowship renewal; **Dr Mootaz Salman**, Leverhulme Early Career Fellowship, and with **Dr Charmaine Lang**, conferral of title of Departmental Research Lecturer; **Dr Richard Tyser**, Bernard and Joan Marshall Early Career Investigator Prize; **Kaitlyn Dennis**, William C. Stanley Young Investigator Award; **Dr KC Park**, European Society of Cardiology Young Investigator Award; **Wade-Martins Group**, LEAF Bronze Award.



Sir Charles Sherrington Prize Lecture 2022

Professor Thomas Südhof received the Nobel Prize in Physiology or Medicine in 2013 with James E. Rothman and Randy W. Schekman for their discoveries of machinery regulating vesicle traffic, a major transport system in our cells. On Friday 29 April, Südhof delivered *The cell-adhesion code that underlies the molecular logic of synapse formation* in honour of the 1932 Nobel Laureate in Physiology or Medicine Sir Charles Sherrington, who first coined the term 'synapse'.

www.dpag.ox.ac.uk/news/nobel-laureate-professor-thomas-sudhof-delivers-2022-sherrington-prize-lecture



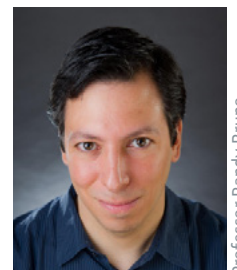
Renowned British artist Patrick Hughes unveils "Popsee" in honour of Sir Colin Blakemore FRS

On Tuesday 2 November, Patrick Hughes, pioneer of reverspective art, unveiled his 2020 masterpiece, *Popsee*. The awe inspiring hand painted, pop culture inspired, 3D piece was donated in honour of long-time friend and colleague Sir Colin Blakemore.

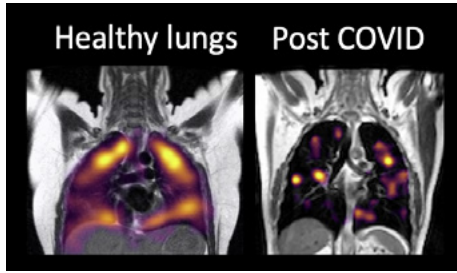
www.dpag.ox.ac.uk/news/pioneer-of-reverspective-art-unveils-celebrated-optical-illusion-piece-in-honour-of-sir-colin-blakemore-frs



Associate Professor Ana Domingos



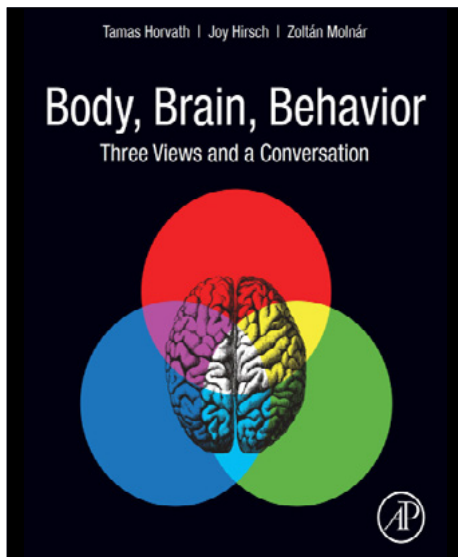
Professor Randy Bruno



Hidden lung damage found in Long Covid patients with breathlessness

A major study between Oxford, Sheffield, Cardiff and Manchester universities, in which Dr James Grist plays a key role, used novel hyperpolarised xenon MRI scans to identify abnormalities in the lungs of people who were not hospitalised with COVID-19 yet continue to experience breathlessness long after initial infection. The results showed 'significantly impaired gas transfer' from the lungs to the bloodstream, which could not be detected by standard Computed Tomography (CT) scans.

www.dpag.ox.ac.uk/news/hidden-lung-damage-found-in-long-covid-patients-with-breathlessness

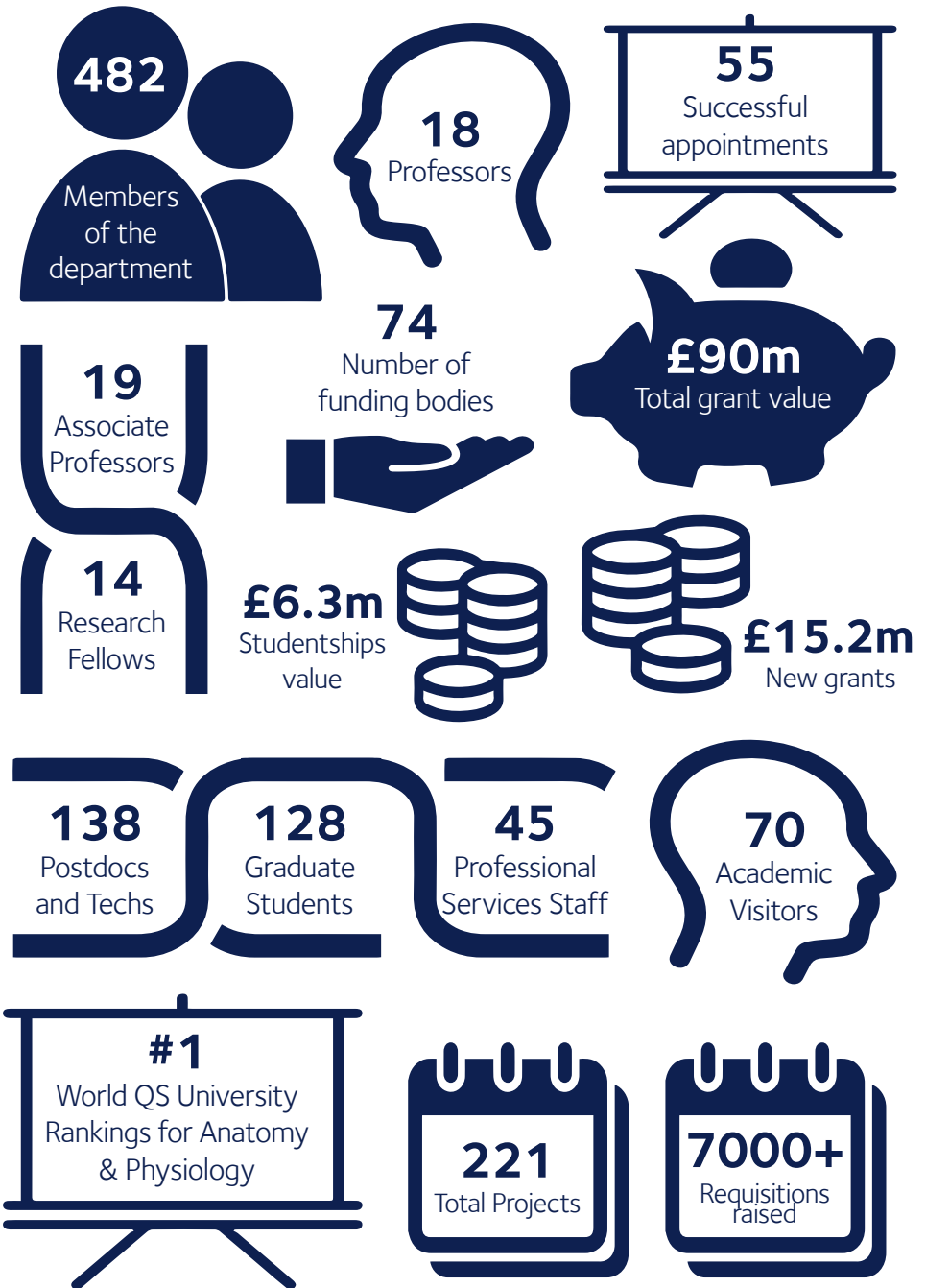


New Book expands the horizon of brain research

A pioneering book from Professor Zoltán Molnár and Yale Professors Tamas Horvath and Joy Hirsch entitled *Body, Brain, Behavior: Three views and Conversation* describes brain research on the frontiers, bringing together three very different perspectives to address this fundamental relationship. In a radical departure from conventional single topic publications, the book is published by Elsevier as three chapters alongside nineteen recorded conversations. DPAG hosted the Oxford Launch of the book on Thursday 7 April.

www.dpag.ox.ac.uk/news/new-book-expands-the-horizons-of-brain-research

Statistics for 2021–2022

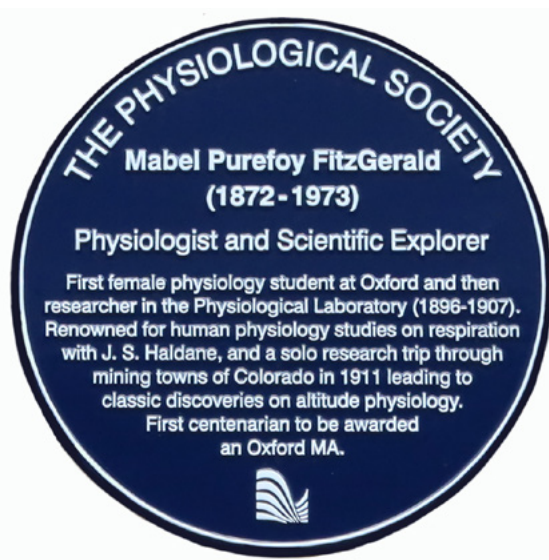
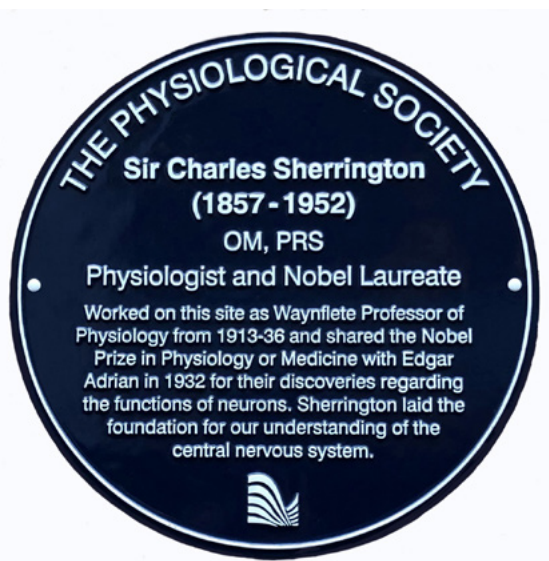


Blood bank storage can reduce ability of transfusions to treat anaemia

New research published in the journal *Haematologica* led by Professor Pawel Swietach in collaboration with NHS Blood and Transplant is the first demonstration that the process of storing blood in blood banks can profoundly reduce the rate of oxygen release from red cells, and potentially compromise the effectiveness of blood transfusions, a treatment commonly used to combat anaemia. The study also showed how rejuvenation with specially designed chemical additives can fully restore gas exchange kinetics.



www.dpag.ox.ac.uk/news/blood-bank-storage-can-reduce-ability-of-transfusions-to-treat-anaemia



The Physiological Society's blue plaques honour outstanding physiologists who have contributed to the advancement of the discipline through their discoveries while leaving a legacy beyond their lifetime. DPAG now has four such plaques erected on the Sherrington Building to honour the Department's early pioneers.

