

Defining excellence: Department of Physiology, Anatomy & Genetics ranked #1



Professor David Paterson, Head of Department, Professor of Cardiovascular Physiology and Hon. Director Burdon Sanderson Cardiac Science Centre.

Medicine has been taught and researched in Oxford for over 800 years, and involved many famous names and discoveries. In 2017 the present Department of Physiology, Anatomy & Genetics (DPAG) was ranked number one in the world for Anatomy and Physiology in the Top Universities QS rankings.

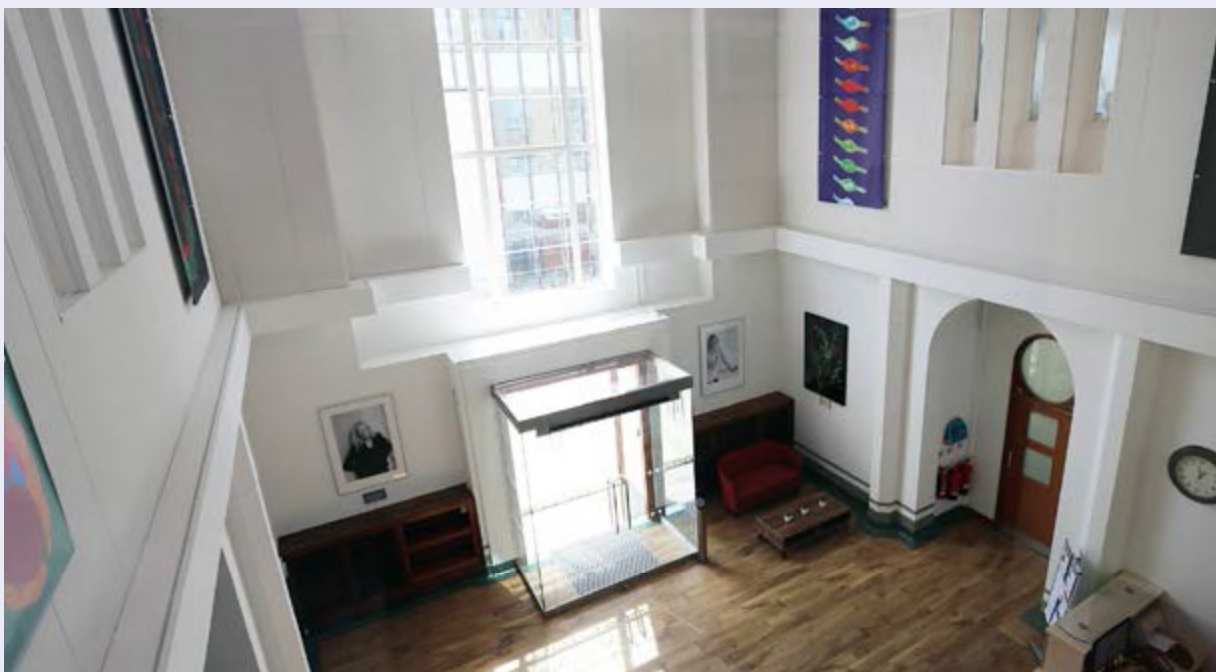
DPAG was formed when, in 2006, the Medical Sciences Division merged the University Laboratory of Physiology with the Department of Human Anatomy and Genetics (itself created from the Department of Human Anatomy when Professor Dame Kay Davies FRS became Dr Lee's Professor of Anatomy). The first Head of the merged Department was Professor Sir George Radda FRS. DPAG now comprises ca 500 FTE staff, has an operating budget of £20M pa and services £135M of research grants.

Teaching

Most alumni will remember anatomy being taught in the LeGros Clark building and physiology in the Sherrington building. Nowadays, most teaching including all gross anatomy is conducted in the Medical Sciences Teaching Centre (behind the Dunn School of Pathology) built to house the expanded intake of medical students in 2002. DPAG currently does ca 55% of all preclinical and FHS teaching. Oxford has retained the tripartite preclinical science, honours year and clinical years which have been a source of real strength. Both physiology and anatomy still use the well-tried combination of lectures and practicals, but clinical applications are increasingly stressed. In anatomy students no longer dissect for long periods but study professionally prepared prosections, surface and imaging anatomy guided by demonstrators. Since 2004 students also undertake a unique 3-week 'total immersion' clinical anatomy course between preclinical finals and the start of clinical studies.

Research

Research in DPAG involves six broad areas of study: Cardiac Science; Cell Physiology; Development and Cell Biology; Functional Genomics; Metabolism and Endocrinology; and Neuroscience. The work is necessarily multidisciplinary, so most researchers work across more than one theme and collaborate with colleagues in physical sciences, life sciences and clinical departments, in Oxford and internationally. The research strength has attracted many graduate students (currently 145) and postdoctoral workers. Concentration of animal studies in a new Biomedical Services Unit is allowing units in LeGros Clark progressively to move into space freed in Sherrington. Sherrington itself houses a Centre for Integrative Neuroscience, the new Burdon Sanderson Cardiac Sciences Centre, and a centre for Cellular and Molecular Neurobiology in the Henry Wellcome Building for Gene Function. A Centre for Neural Circuits and Behaviour headed by Professor Gero Miesenbock FRS,





OUIimages.com/John Cairns

has been established on Mansfield Road, and DPAG also shares a new joint Centre for Cellular and Molecular Imaging with the Sir William Dunn School of Pathology which houses a new state-of-the-art Titan Cryo EM for molecular and cellular structural imaging.

Cardiac Sciences researchers aim to develop innovative avenues of basic research using experimental and computational techniques ranging from molecule to myocardium. The vast array of experimental data derived from enhanced visualisation systems and molecular techniques, with massively enhanced computing power, is used to exploit the predictive power of integrative biology to tackle issues in cardiac medicine such as arrhythmias, cardiac hypertrophy and heart repair. Our 90 basic scientists have extensive links with disease-led programmes in the clinical departments. The Burdon-Sanderson Cardiac Science Centre is part of the British Heart Foundation Centre of Research Excellence in Oxford and has just been awarded a £7.6 million BHF grant to further these studies. This Centre is led by Professors Paterson and Zaccolo.

Cell Physiology researchers study ion channels, transporters and signalling. These very basic processes underpin our understanding of cellular activity, organ function and dysfunction, and can inspire the development of new treatments. Particular growth areas are how potassium channels affect insulin secretion, the role of nutrient transporters in cancer growth, the involvement of calcium channels in gene expression, and mechanisms of metabolic signalling in the heart. The

research on potassium channels has recently led to the adoption of sulphonylureas to treat neonatal diabetes, while that on calcium channels has led to a potential treatment for allergic asthma. Work in these areas is led by Professor Dame Frances Ashcroft FRS and Professor Anant Parekh.

Developmental and Cell Biology research aims to understand molecular and cellular mechanisms which underlie development and reproduction. This involves experiments *in vivo* using model organisms which, though complex, facilitate understanding of clinical relevance. The varied approaches include genetic dissection of sexual behaviour, patterning and morphogenesis in the early embryo, studies on neural development ranging from neural stem cells through optical probing of neural networks to cerebral cortical development and evolution, and exploration of exosome and extracellular vesicle signalling in reproductive physiology and tumour growth. The Cardiac Centre hosts a major programme on heart regeneration led by BHF Professor Paul Riley.

The Functional Genomics group aims to understand human disease through genetic analysis of patients and relevant animal models. Prof Kay Davies' group study single gene defects responsible for Duchenne muscular dystrophy; this has led to treatments for the disease in mice which are being translated for humans. Computational genomics analysis is particularly important. A training programme is equipping researchers from diverse backgrounds to interpret their results more efficiently and this approach is shedding light on

neurodevelopmental disorders to understand cerebellar disease, autism and ADHD.

Metabolism and endocrinology influence every aspect of our lives. Defects in endocrine and metabolic function underlie many common human diseases – especially the twin pandemics of obesity and type-2 diabetes – and understanding is critical to improve the performance of endurance athletes. Pioneering studies by Haldane and Douglas on human respiration and by Geoffrey Harris, the ‘founding father’ of neuroendocrinology laid the foundation for this joint theme. Studies in respiration concentrate on oxygen sensing and the effects of hypoxia and exercise and the pulmonary circulation; studies on obesity and diabetes explore details of insulin packaging and release and abnormalities of metabolism in type 2 diabetes.

In a building named after our Nobel laureate Sir Charles Sherrington, it is natural that Neuroscience is a major theme. Studies range from molecular, through cellular, to higher level neural processing. The increasing longevity of populations means that understanding the cellular basis of neurodegenerative diseases such as Parkinson’s, Alzheimer’s and motor neuron disease are major foci of research. At the start of life developmentalists study how cells of the nervous system are generated, how they migrate into position, and assemble in neural circuits and what can go wrong with these processes. At the cellular level optogenetic manipulations are probing neural circuits and effects on behaviour, and at the systems level research is focussed on perception, using multidisciplinary approaches to understand hearing, vision and decision making.

Many of these studies fit into a number of the overarching themes, and there is tremendous overlap in terms of techniques used and conceptual approaches. This overlap is a major strength in the overall effort of DPAG. Bringing the physiology, anatomy and genetics together into a coherent and interactive grouping augurs

well for the flourishing of research in the Department for many years to come.

Many of our academics have performed at the highest level on the world stage winning prizes and named lectures such as the Massry Prize, Heinrich Wieland Prize, Brain Prize to Professor Miesenbock; L’Oreal-UNESCO Women in Science Award to Professor Ashcroft; William Allan Award, American Society of Human Genetic to Professor Davies. For a full list see www.dpag.ox.ac.uk/about-us/honours-fellowships-and-prizes.



The Department has been ranked number one in the world for Anatomy & Physiology. This ranking is based on Academic Reputation, Citations per Paper, Employer Reputation and H Index of Faculty

