University of Birmingham

Dr Keith Brain PhD, MB/BS

Senior Lecturer

Neurobiology

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About

Dr Brain graduated with a PhD in Physiology in 1998 and in Medicine in 1999 from the University of Sydney, Australia. After working as a medical officer at the Royal Prince Alfred Hospital in Sydney he joined the Department of Pharmacology, Oxford, in 2001.

While in Oxford, Dr Brain held a series of research fellowships, including a Nuffield Medical Fellowship, Wellcome Trust Career Development Research Fellowship (both based in the Department of Pharmacology), Staines Medical Research Fellowship (Exeter College) and the post of Research Fellow and Tutor (Keble College). In 2009 he moved to the post of Senior Lecturer (Neuropharmacology) at the University of Birmingham.

Qualifications

- MB/BS (Hons; Sydney)
- PhD (Physiology; Sydney)
- MA (Oxford)
- BSc (Mathematics and Physics; Sydney)

Biography

Dr Brain's undergraduate career commenced by combining medical (MB/BS) and science (Mathematics and Physics) degrees at the University of Sydney. His interest in Physics, developed through involvement with the International Physics Olympiad, led to research projects in physical optics investigating confocal microscopy. This interest led on to the applications of confocal microscopy in medicine, so Dr Brain chose to work with Prof Max Bennett (University of Sydney) investigating the regulation of Ca^{2+} in autonomic neurons using new confocal imaging techniques. During his PhD, Dr Brain developed the first technique to monitor Ca^{2+} in intact, mature autonomic nerve terminals, investigating its role in frequency facilitation and prejunctional autoinhibition.

He then returned to complete his medical degree, working for one year as an Intern (House Officer) at Royal Prince Alfred Hospital (Sydney). His research career then developed through the award of a Nuffield Medical Fellowship, allowing him to move to the Department of Pharmacology, Oxford, to work with Dr Tom Cunnane. There, he exploited the Ca^{2+} imaging techniques developed in Sydney to investigate the prejunctional effects of nicotinic receptors on sympathetic nerve terminals.

In 2002, he was elected to the Staines Medical Research Fellowship at Exeter College, Oxford; this post has previously been held by eminent scientists including Sir John Eccles. During the following few years he discovered and characterised a new optical method to detect neurotransmitter release from autonomic nerve terminals. This is technique is based on the principle that ATP, released from most autonomic terminals as a cotransmitter, acts on postjunctional P2X receptors to cause a local Ca^{2+} influx. This local Ca^{2+} influx can be detected and hence neurotransmitter release monitored with submicron spatial resolution.

Remaining based in the Department of Physiology, he moved on from Exeter to Keble College, Oxford, where we was elected as a Research Fellow and Tutor. His research work was supported through a Wellcome Trust Career Development Research Fellowship, during which he worked on a range of problems related to autonomic transmission in the anococcygeus, mesenteric artery, urinary bladder and vas deferens, working with talented students and postdoctoral researchers including James Kennard, Sabine Kobayter, Damian Williams, and John Young. In 2007 he was appointed as a University Research Lecturer in the University of Oxford. His latter work in Oxford involved the development of optical approaches to monitor neurotransmitter transporter function (norepinephrine and vesicular monoamine transporters).

Dr Brain took up his first substantive academic post in 2009 at the University of Birmingham, where he primarily works within the Neuropharmacology team of the Neuropharmacology and Neurobiology section. His active external research collaborations include those with Prof Hagan Bayley (Dept Chemistry, Oxford), Prof Stephen Faulkner (Dept Chemistry, Oxford), Dr Federica Pessina (University of Siena), Professor Rohit Manchanda (Indian Institute of Technology, Mumbai) and Professor Christian Aalkjær (University of Aarhus).

Teaching

Undergraduate teaching:

- Cellular Communication, Endocrinology and Pharmacology (BMedSc, 1st year)
- Pharmacology (BMedSc, 1st year).
- Neuromusculoskeletal System I (BDS, 1st year)
- Introduction to Respiratory Medicine (MBChB, 1st year)
- Systems Pharmacology (BMedSc, 2nd year)
- Cardiovascular System (MBChB, 2nd year)
- Renal System (MBChB, 2nd year)

- Molecular and Integrative Pharmacology: From Molecules to Man (BMedSc, 3rd year)
- Cardiovascular Science (Integrative Mechanisms) (BMedSc, 3rd year)
- Neuropharmacology (BMedSc, 3rd year)
- Basic and Applied Systemic Human Disease (BDS, 3rd year)

Postgraduate supervision

Current PhD student:

- James Kennard

Current Postdoctoral researcher:

- Dr Peter Sidaway

Dr Brain is happy to discuss project proposals in the fields of autonomic physiology, autonomic pharmacology, and urogenital pathophysiology (including detrusor instability).

Research

Dr Brain's laboratory aims to understand autonomic junctional transmission from fundamental principles through to therapeutic interventions

Current projects include:

- The development of new techniques for dynamically monitoring neurotransmitter release with single-molecule resolution failure (with H. Bayley, University of Oxford)
- Developing new optical and MRI-sensitive probes for sympathetic failure (with S. Faulkner, University of Oxford)
- The role of parasympathetic transmission in bladder overactivity
- Prostaglandin E2 and its role in bladder overactivity
- Prejunctional nicotinic receptors and the regulation of sympathetic transmission
- The effect of cannabinoids on sympathetic transmission

Other activities

- Membership and Awards Committee, British Pharmacological Society (2010-13)
- Lecturer (Pharmacology), Christ Church College, Oxford (2010-)
- European Representative, International Society for Autonomic Neuroscience (ISAN) executive (2009-)
- Council of the Doctoral School in "Physiology, pharmacology and toxicology", University of Siena (2009-)
- Editor, British Journal of Pharmacology (2011-2015)

Publications

Brain, K.L. (2010), Parasympathetic cholinergic transmission, minus the vesicles, **Experimental Physiology**, 95:263-264.

Parker, L.K., Shanks, J.A., Kennard, J.A.G. & Brain, K.L. (2010), Dynamic monitoring of NET activity in mature murine sympathetic terminals using a fluorescent substrate, **British Journal of Pharmacology**, 159:797-807.

Brain, K.L. (2009), Neuroeffector Ca^{2+} transients for the direct measurement of purine release and indirect measurement of co-transmitters, **Experimental Physiology**, 94:25-30.

Rahman, F., Manchanda, R. & Brain, K.L. (2009), Prejunctional and postjunctional actions of heptanol and 18β-glycyrretinic acid in the rodent vas deferens, **Autonomic Neuroscience**, 148:69–75.

Valeri, A., Brain, K.L., Young, J.S., Sgaragli, G. & Pessina, F. (2009), Effects of 17β-estradiol on rat detrusor smooth muscle contractility, **Experimental Physiology**, 94:834-846.

Young, J.S., Amos, R.J. & Brain, K.L. (2009), Focal Ca^{2+} transient detection in smooth muscle, **Journal of Visualized Experiments** 28, doi: 10.3791/1247.

Brain, K.L. & Cunnane, T.C. (2008). Bretylium abolishes neurotransmitter release without necessarily abolishing the nerve terminal action potential in sympathetic terminals, **British Journal of Pharmacology**, 153:831–839.

Young, J.S., Meng, E., Cunnane, T.C. & Brain, K.L. (2008), Efferent purinergic neurotransmission in the mouse urinary bladder, **Journal of Physiology**, 586:5743-5755