

Name: Stephen G Woodhams

Address: Lendület Laboratory of Molecular Neurobiology, Institute of Experimental Medicine, Hungarian Academy of Sciences, Budapest 1083, Szigony utca 43, Hungary

Email: woodhams.stephen@koki.mta.hu

Education

2002-2006: Master in Science: Upper Second Class (IIA) in Neuroscience, University of Nottingham

2008-2012: MRC CASE PhD Neuroscience University of Nottingham, School of Biomedical Sciences

Relevant Research Experience

2012-present: Post-Doctoral Researcher Lendület Laboratory of Molecular Neurobiology Institute of Experimental Medicine, Hungarian Academy of Sciences, Budapest.

2008: Scientific Officer Onclmmune Ltd., Nottingham

2006-2007: Research Technician Renasci Consultancy Ltd., Nottingham

2004-2005: Industrial Placement Year GlaxoSmithKline, Neurology & GI CEDD, Harlow, Essex

2002: Summer Placement Student GlaxoSmithKline, Neurology & GI CEDD, Harlow, Essex

Pre-Doctoral: Prior to attending University, I was awarded a summer student position at GSK, Harlow, performing *in vitro* research into Alzheimer's disease, acquiring basic research experience of cell culture and molecular biology assays, and invaluable experience of working with highly skilled and motivated colleagues with access to cutting edge technology. I returned to GSK for my Industrial Placement year for further research on an *in vitro* model of Alzheimer's disease, achieving a first class mark Industrial and an internal GSK Industrial Student prize. Prior to commencing doctoral studies I worked for a contract research organisation performing varied research on animal models of diabetes and obesity, and a University spin-out company developing an autoantibody blood screening assay for early detection of breast cancer in humans. These positions offered experience of producing high quality data to specific deadlines and of developing a commercial product from an academic idea.

Doctoral: I undertook a PhD titled "Modulation of Spinal Hyper-Excitability by the Cannabinoid and Vanilloid Systems", utilising a multi-disciplinary approach to study the endocannabinoid system and spinal cord dorsal horn circuitry in rodent models of nociception. During this time, I developed expertise in behavioural studies, *in vivo* electrophysiological recordings from spinal cord dorsal horn neurones, and measurements of endocannabinoid-related genes, proteins, & enzyme activity using molecular biology techniques. This work included the first published report of anti-nociceptive effects of spinal MGL blockade (Woodhams *et al.*, 2012), alongside significant contributions to several other publications.

Post-Doctoral: After completing my PhD, I moved to Budapest to continue researching the spinal endocannabinoid system, developing complementary expertise in anatomical techniques including *in situ* hybridization and immunohistochemistry, confocal microscopy, electron microscopy, and super-resolution microscopy (STORM). I applied these techniques to transgenic mouse lines to determine for the first time the cellular localization of the major endocannabinoid metabolizing enzyme MGL (Horvath & Woodhams *et al.*, 2014), and to explore alterations in the spinal expression of the CB₁ receptor in the absence of MGL. I was involved the development of a high-throughput application of STORM microscopy for quantifying protein expression in neural tissue (Dudok *et al.*, 2015), a novel 3D approach to colocalization analyses (Woodhams *et al.*, 2016 – submitted), and in investigating the localization and characterization of the orphan receptor GPR35 in mouse brain (Henstridge *et al.*, currently unpublished).

Other Relevant Skills: I have mentored students at undergraduate, Masters, and PhD level. A recent Masters student won first prize in the Hungarian regional biology competition, and was highly commended in the National Students Competition. I also co-chair a successful seminar series for students and young post-doctoral researchers within the institute, aimed at developing their confidence and presentation skills. Since completing my doctoral work, I have been an *ad hoc* reviewer for the British Journal of Pharmacology, the Journal of Neurochemistry, and Nature Scientific Reports, and have authored several invited review articles and a book chapter on the role of the endocannabinoid system in pain.

Publications

Woodhams SG, Pongor CI, Barti B, Dudok B, Kano M, Sakimura K, Watanabe M, Katona I Chronic elevation of endocannabinoids induces rewiring of the spinal nociceptive circuitry: Introducing the 3D Analysis of Co-Expression (3D-ACE) Plug-In, *Journal of Neuroscience*, 2016 (**Submitted**)

Woodhams SG, Sagar DR, Burston JJ, Chapman V, (2015) The role of the endocannabinoid system in pain, *Handbook of Experimental Pharmacol*, 2015, 227:119-43

Dudok B, Barna L, Ledri M, Szabo SI, Szabadits E, Pinter B, **Woodhams SG et al.** (2015). Cell-specific STORM super-resolution imaging reveals nanoscale organization of cannabinoid signaling. *Nature Neuroscience* **18** (1):75-86

Burston JJ & **Woodhams SG** (2014). Endocannabinoid system and pain: an introduction. *Proceedings of the Nutrition Society* **73**(01): 106-117

Horváth E & **Woodhams SG**, Nyilas R, Henstridge CM, Kano M, Sakimura K, et al. (2014). Heterogeneous presynaptic distribution of monoacylglycerol lipase, a multipotent regulator of nociceptive circuits in the mouse spinal cord. *European Journal of Neuroscience* **39**(3): 419-434

Kelly S, Chapman RJ, **Woodhams S**, Sagar DR, Turner J, Burston JJ, et al. (2013). Increased function of pronociceptive TRPV1 at the level of the joint in a rat model of osteoarthritis pain. *Annals of the Rheumatic Diseases* **74**(1): 252-259

Woodhams SG, Wong A, Barrett DA, Bennett AJ, Chapman V, Alexander SPH (2012). Spinal administration of the monoacylglycerol lipase inhibitor JZL184 produces robust inhibitory effects on nociceptive processing and the development of central sensitization in the rat. *British Journal of Pharmacology* **167**(8): 1609-1619

Sagar DR, Burston JJ, **Woodhams SG**, Chapman V (2012). Dynamic changes to the endocannabinoid system in models of chronic pain. *Philosophical Transactions of the Royal Society B: Biological Sciences* **367**(1607): 3300-3311

Okine BN, Norris LM, **Woodhams S**, Burston J, Patel A, Alexander SP, et al. (2012). Lack of effect of chronic pre-treatment with the FAAH inhibitor URB597 on inflammatory pain behaviour: evidence for plastic changes in the endocannabinoid system. *British Journal of Pharmacology* **167**(3): 627-640

Sagar DR, Burston JJ, Hathway GJ, **Woodhams SG**, Pearson RG, Bennett AJ, et al. (2011). The contribution of spinal glial cells to chronic pain behaviour in the monosodium iodoacetate model of osteoarthritic pain. *Molecular Pain* **7**(1): 88

Sagar DR, Staniaszek LE, Okine BN, **Woodhams S**, Norris LM, Pearson RG, et al. (2010). Tonic modulation of spinal hyperexcitability by the endocannabinoid receptor system in a rat model of osteoarthritis pain. *Arthritis & Rheumatism* **62**(12): 3666-3676.

Sagar D, Gaw AG, Okine B, **Woodhams S**, Wong A, Kendall D, et al. (2009). Dynamic regulation of the endocannabinoid system: implications for analgesia. *Molecular Pain* **5**(1): 59.

Selected Conference Presentations

Woodhams, SG, Barti, B, Dudok, B, Pongor, CI, Katona, I, "Chronic elevation of the endocannabinoid 2-AG induces alterations in mouse spinal cord nociceptive circuitry" *Poster presented at the Multinational Congress on Microscopy, Eger, Hungary (Aug 23-28, 2015)*

Woodhams SG, von Schoultz, C, Horváth, E, Nyilas, R, Watanabe, M, Sakimura, K, Kano, M, Zeilhofer, HU, Katona, I "Adaptive changes in spinal dorsal horn CB1 expression following genetic deletion of monoacylglycerol lipase (MGL)" *Poster presented at the Gordon Research Conference Cannabinoids in Synapses, Circuits and the Human Brain, NH, USA (Aug 4-9 2013)*

Woodhams, S, Okine, B, Kelly, S, Chapman, V, "Effects of Spinal Application of the TRPV1 Antagonist JNJ17203212 on Nociceptive Processing in the Rat MIA Model of Osteoarthritic Pain". *Poster presented at the European Federation of IASP Chapters 7th Pain in Europe Congress, Hamburg, Germany 2011 (Sept 20-14, 2011)*

Woodhams, S, Okine, B, Sagar, DR, Norris, LM, Bennett, AJ, Chapman, V, "Modulation of the Endocannabinoid Receptor System in Models of Acute and Chronic Pain". *Poster presented at the IASPs 13th World Congress on Pain, Montreal, Canada 2010 (Sept 2010)*