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Education

- **D.Phil. Auditory Neuroscience** (2001–2006: Corpus Christi College, Oxford.)
  Title: *The Role of Monaural and Binaural Level Cues in Sound Localisation: A Behavioural and Physiological Investigation*
  This research was funded by a 4 year Wellcome trust studentship.
- **M.Sc. Neuroscience** (2000–2001: Corpus Christi College, Oxford.)
- **B.Sc.(Hons.) 1^{st} Neuroscience** (1997–2000: University College London.)
  Awarded finalists' neuroscience B.Sc. prize (2000).
  Finals courses on which the degree was based:
  Research project: 1^{st}; neural computation: 1^{st}; advanced neurophysiology: 1^{st}; advanced neuroanatomy: 1^{st}; neurobiology of vision: 2:1

Papers [published]

- **Campbell RAA**, Schulz A, King AJ, Schnupp JWH. (2010) 'Brief sounds evoke prolonged responses in anesthetized ferret auditory cortex.' J Neurophysiol. 103:2783-93
- Campbell RAA and Turner GC. 'The Mushroom Body (Quick Guide)' (2010) Curr Biol.20:R11-12
- Kumpik D, Ting J, **Campbell RAA**, Schnupp JWH, King AJ. (2009) 'Specificity of binaural perceptual learning for amplitude modulated tones: A comparison of two training methods' JASA 125:2221-32
- **Campbell RAA**, King AJ, Nodal FR, Schnupp JWH, Carlile S, Doubell TP. (2008) 'Virtual adult ears reveal the roles of acoustical factors and experience in auditory space map development.' J Neurosci. 28:11557-70.
- King AJ, Bajo VM, Bizley JK, **Campbell RAA**, Nodal FR, Schulz AL, Schnupp JWH. (2007) 'Physiological and behavioral studies of spatial coding in the auditory cortex.' Hear Res. 229:106-15.
- **Campbell RAA**, Schnupp JWH, Shial A, King AJ (2006) 'Binaural level functions in ferret auditory cortex: evidence for a continuous distribution of response properties. 'J. Neurophysiol. 95:3742-55.
- **Campbell RAA**, Doubell TP, Nodal FR, Schnupp JWH, King AJ (2006) 'Interaural timing cues do not contribute to the map of space in the ferret superior colliculus' J. Neurophysiol. 95:242-54.
- King AJ, **Campbell RAA** (2005) 'Cortical processing of sound-source location'. Acta Acustica 91:399-408.
- **Campbell RAA**, King AJ (2004) 'Auditory neuroscience: a time for coincidence?' Current Biol. 14:R886-8.

Papers [submitted/in preparation]

- King AJ, **Campbell RAA**, Parsons C, Carlile S. (J. Neurosci. In preparation) 'Binaural plasticity in sound localization'

- **Campbell RAA**, Bajo VM, King AJ (JASA. In preparation) 'Sound localization accuracy in monaurally deafened ferrets'

Selected Poster Abstracts

- **Campbell RAA**, Schulz A, King AJ (2005) 'Sound Localization in Monaurally Deafened Ferrets: Comparing Behavioural and Cortical Responses'. ARO Abstracts. No. 995.
- **Campbell RAA**, Moore DR, King AJ (2004) 'Monaural and binaural contributions to developmental adaptation to altered localization-cue values'. ARO Abstracts. Vol 27. Page 57.
- Doubell TP, Nodal FR, **Campbell RAA**, Schnupp JWH, King AJ (2003) 'Development of auditory spatial tuning in the deep layers of the ferret superior colliculus'. IBRO Abstracts P2207.
- **Campbell RAA**, Bizley JK, King AJ, Shial A, Thomas PSW, Schnupp JWH (2003) 'Modeling binaural responses in ferret auditory cortex'. IBRO Abstracts P2186.
- **Campbell RAA**, Parsons CH, Moore DR, King AJ (2002) 'Relative and absolute localisation by monaurally deafened ferrets'. BSA Abstracts.
- Glennerster A, **Campbell RAA**, Parker AJ (2002) 'Dipper function' within, but not between, cues for depth and lateral motion. Perception, 31, S56.

Skills

- **Physiology**: acute extra-cellular electrophysiology in mammals. *in vivo* patching in insects. 2-photon and confocal microscopy.
- **Psychophysics**: animal and human.
- **Computing skills**: I make extensive use of Matlab and R in my daily work but am also familiar with Python, Perl, and Qt 4. In addition: PHP, Javascript, HTML & CSS, and LaTeX. Comfortable in any OS.
- **Statistics**: Experienced with exploratory, modelling, and computational stats in Matlab, R, and S-Plus. Attended the Insightful courses '*Statistical Modelling in S-PLUS*' by Bill Venables, and '*Bootstrap Methods and Permutation Tests*' by Tim Hesterberg. Took '*Statistics for Biosciences*' module at the Oxford Stats Dept. in March–April '07. Attended '*Neural Signal Processing: Quantitative Analysis of Neural Activity*' (SfN short course), organised by Partha Mitra.

In Addition

- *Teaching experience*: College lecturer (2003-2004) in systems neuroscience at St. Catherine's College, Oxford. Supervising both undergraduate and PhD students. Demonstrator in practical classes.
- Neuroscience 'expert' for Science Line from 1997 until the closure of the service in 2003. Science Line was an organisation which answered science-related questions posed by the public. I obtained experience in conveying scientific ideas in a way which is accessible to those without specialist knowledge.
- Captain of the Oxford University cycling team from 2002-2003 and Social Secretary of the Club from 2001-2002. Organised bike races, club trips away, re-designed club racing kit, raced for the University on a National level.
- Qualified skydiver (40 jumps) and parachute packer. I was an active skydiver from 1997-1999 but no longer jump because of a shoulder injury.

Summary of Previous Research

- **Sound localisation in ferrets** D.Phil. Thesis
  In my Thesis I studied the mechanisms underlying sound localisation. In particular how inputs from the two ears are processed. A sound arising to one side of the head will be louder at the near ear than at the far ear, and will reach the near ear first. *(i)* Using extracellular recordings in ferret auditory cortex I obtained neural response functions to sounds with a range of inter-aural intensity differences. Previous studies have partitioned such responses into a set of discrete classes. However, the functional significance of these classes is unclear. Using statistical techniques my work demonstrated that the binaural properties of cortical neurons form a continuum of response types rather than discrete classes. This argues that coding strategies based on such classes are unlikely. *(ii)* The relative time of arrival of a sound a the two ears dominates our perception of sound source location in azimuth. I recorded from the ferret superior colliculus (SC), a midbrain nucleus involved in orienting responses, to investigate whether this perceptual dominance extends to the response properties of SC auditory neurons. Using a sophisticated virtual acoustic space technique I showed that SC neurons ignore timing information and base their tuning functions on relative sound intensity at the two ears. Remarkably, the response properties of SC neurons are at odds with our perception of the sound. *(iii)* One way of studying a sensory system is to explore how it adapts when it is perturbed. I undertook an extensive series of behavioural experiments studying the localisation accuracy of ferrets reared with various peripheral manipulations. For instance, monaural animals, animals reared with a binaural imbalance by partially occluding one ear, and animals reared with the external ear structures on one side removed. The pattern of deficits observed elegantly delineated the range of conditions under which the auditory system can adapt.

- **3-D motion perception** M.Sc. project–Oxford
  Does the human visual system process lateral (fronto-parallel) motion in the same neural pathways as motion in depth? Lateral motion was found to have a lower detection threshold than motion in depth. This is surprising because the only difference in the two conditions is that for motion in depth the inputs to the two eyes are 180 degrees out of phase. In other words, the visual system should in theory have the same amount of information in each condition. The relationship between lateral and depth motion was investigated further by leveraging a stochastic resonance effect I found in the data. Stochastic resonance is a phenomenon which improves the detection of weak signals when they are presented against a noisy background. Noise in one motion dimension (depth or lateral) did not aid the detection of motion in the other dimension. This fact suggests that depth and lateral motion information are handled by separate underlying neural processes.

- **Retinal & pineal photoreceptors in fish** B.Sc. project–UCL
  The fish pineal gland is located on the top of the brain, beneath a thin piece of bone, and contains photoreceptive neurons involved in circadian rhythms and phototaxis. Using *in-situ* hybridisation these photoreceptors have been shown to express opsin-based photopigments. My work involved measuring the absorbance spectra of isolated retinal and pineal photorecptors in Orfe, a previously unstudied teleost fish. Photoreceptor structure and arrangement were explored using light and electron microscopy. This was some of the first work to accurately measure the absorbance spectra of extra-retinal photoreceptors and therefore provide evidence that these novel opsin proteins form functional photopigments.