# Large-scale population imaging for understanding individual variation

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This lecture will review the application of advanced imaging methods in the context of large population studies for understanding the biological bases for individual variations in performance, behaviours and disease risk. Several mature initiatives provide illustrations of this approach and highlight how advances in automated quantitative image analyses can be coupled with traditional epidemiological analyses for open, collaborative science (e.g., the Alzheimer's Disease Neuroimaging Initiative, the Human Connectome Project, UK Biobank). I will highlight how these developments are creating a new "imaging epidemiology" for which samples are becoming large enough to support meaningful, data driven "discovery" science and its replication. As a neuroscientist, I will focus on the ways in which UK Biobank and related initiatives are catalysing a "step change" in the brain sciences. I also will explore some of the ways in which the nature of the questions that can be asked, the time scale of the observations and the depth of phenotyping demand that major research ethical challenges are re-addressed in more robust and creative ways. I am hopeful that, as the benefits of this approach to science become more clear, and as the ethical issues are addressed by increasingly inclusive groups, a broader social consensus for research may be achieved.
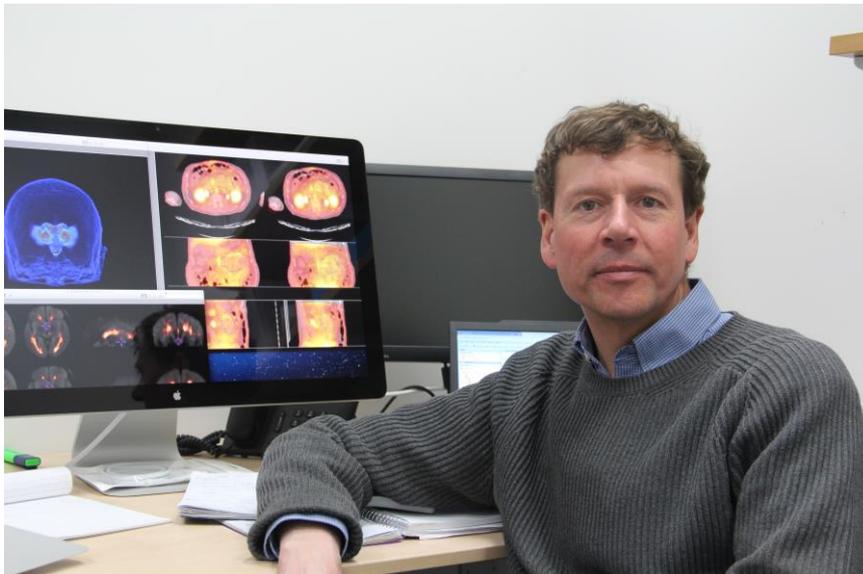
Professor Paul Matthews is the Edmond and Lily Safra Chair of Translational Neuroscience and Therapeutics and Head of the Division of Brain Sciences in the Department of Medicine of Imperial College, London. He was educated in Oxford and at Stanford and McGill. His research programme is directed towards large-scale population imaging and applications of novel medical technologies for personalised medicine. He was founding Director of the Oxford Centre for Functional Magnetic Resonance Imaging of the Brain and, after leaving Oxford, became a Vice President in Pharmaceuticals for GlaxoSmithKline, where he led a medicines development team leader before returning to academic medicine in Imperial College. He serves in several external clinical research leadership roles including Chair of the Imaging Work Group for the UK Biobank, membership on the Executive of Dementia Platforms UK and UK representative for the Interim Board of Euro-Bioimaging. Matthews is a Fellow by Special Election in St Edmund Hall, Oxford (1997) and was awarded an OBE for services to neuroscience (2008), elected as a Fellow of the Academy of Medical Sciences (2014) and to the Academia Europaea (2015). He received an NIHR Senior Investigator Award in 2015.