Brunel Brain Awareness Week 2011: Summary of Presentations

Dr. Daniel Bishop
Watching You, Watching Me: Systems in the Brain for Identifying and Responding to Others' Actions

The mirror neuron system (MNS), first identified a decade ago, is a network of cells in the brain that are active not only when we perform a task (e.g., kicking a ball), but also when we watch someone else perform that same action. Using brain imaging technology, we have shown that MNS areas are active when expert and novice footballers are required to watch video clips of an oncoming attacker and then predict the direction in which he will move. Additionally, experts exhibit greater activation of areas involved in the conscious allocation of attention when the video clips are truncated prematurely (i.e., when the clip ends before the oncoming attacker changes direction); this supports our earlier findings in badminton players (Wright et al., 2010) and suggests that experts possess greater ability to attend to early visual cues when required to do so. We also noted activation in a group of neurons responsible for initiating the allocation of attention and consequent eye movements; this activation, too, was stronger in experts. In an ongoing follow-up study, we have employed eye-tracking technology to examine the eye movement patterns resulting from these expert-novice differences in brain activation.

Dr. Liory Fern-Pollak
Bilinguals have one brain... So how do they read in two languages?

The ability to understand, speak, read and write in more than one language is extremely prevalent. This is known as multilingualism.
How are multiple languages processed by just one brain? There is more and more evidence to show that common brain regions work to process different languages, whether it be speaking, hearing or reading.
However, there are cases where following brain injury, people may start having problems with speaking, understanding or reading in only one of their languages, and not in another. In some cases, children who are diagnosed with dyslexia may only show reading problems in one of their languages, but not in another. Why is that?
In this talk, I will show data from a study looking at different groups of bilinguals, showing that although similar brain regions are at work when they read in each language, there are subtle differences in the way they do this, which depends to a great extent on the specific languages that they know.

Dr. Gustav Kuhn
The Science of magic: What does magic tell us about the way we see the world?

Have you ever wondered how magicians are able to make things disappear in front of your eyes? It may come as little surprise that these feats are carried out without supernatural powers. Instead magicians use a wide range of powerful psychological techniques to manipulate what you see. In this presentation I will demonstrate how magicians can distort your perception using several magic tricks as examples, and illustrate how these tricks provide insights into the inner workings of our mind. For example we will look at how magicians can misdirect your attention and prevent you from seeing things happening right in front of your eyes.

Dr. Tony Elliman
DIADEM: Using artificial intelligence to assist people with mild cognitive impairment (MCI) fill in online computer forms

DIADEM aims to help someone fill in an online form to get a rail ticket, buy something or get services from the local council. As more and more goods and services become available on-line their availability in the shops and by telephone or post is decreasing. Many new services are only available online. This is increasing the digital divide and placing people who have difficulty using the internet at a disadvantage in today's society. The DIADEM project set about redressing the balance by using artificial intelligence (the technology that enables computers to play games). DIADEM clears away a lot of the "visual clutter" and presents all forms in a consistent style tailored to the individual user. It then monitors the interaction as the user fills in the form. If the user appears to be having difficulty it offer verbal help to overcome the problem. DIADEM can also help by adapting the presentation of form as it learns what someone can cope with and by remembering information the user may need to put in repeatedly. Our DIADEM research (funded by the EU) has shown that we can detect the effects of MCI and offer constructive ways to help users.

Dr. Tom Balchin
A successful stroke survivor and an innovative approach to recovery

Dr Balchin, a stroke survivor himself, set up Action for Rehabilitation from Neurological Injury in 2001. ARNI is a national charity which locates and trains professional fitness instructors through their Functional Training After Stroke Accreditation module, and then matches them up with stroke survivors in their areas who apply for help. ARNI has 85 active trainers. Dr Balchin's publications concern high ability, gifted behaviour and stroke. He has worked at Goldsmiths College, University of London and Brunel, Reading and Middlesex Universities. He is a Director of the United Kingdom Rehabilitation Council and sits on the Technology in Medicine Section Council at the Royal Society of Medicine and the Steering Group of the United Kingdom Stroke Conference Forum. Dr Balchin's presentation is a fascinating personal story of a successful recovery from the limitations left by stroke combined with a glimpse into the implementation of an approach to action control re-training that has allowed his group to assist thousands of people worldwide of all ages and times from discharge to achieve better outcomes from acquired brain injury and stroke.

Neil O'Connell
Pain - It's all in your head.

Pain is an almost universal aspect of the human experience. Both protector and torturer it is arguably the most important perceptual experience that we encounter in our lives. We feel pain in areas of the body and interpret this as potential or actual damage, yet simply injuring a body part is not always sufficient to cause pain. Conversely there are many examples of severe and disabling pain occurring in body parts that do not appear to be damaged, and even in body parts that are not actually present! At the heart of this mystery is the only part of the body truly capable of giving us the experience of pain: The brain. This talk will take a stroll around the bizarre reality of pain perception, touching on clinical examples and current brain research to demonstrate the one fundamental thing that we know about pain: "No brain, No Pain".

Dr. Mark Pook
Research into the inherited neurological disorder Friedreich's ataxia.

Friedreich's ataxia (FRDA) is a lethal inherited neurological disorder that primarily involves loss of nerve cells in parts of the brain and spinal cord, although other parts of the body such as the heart and pancreas are also affected in some cases. Symptoms of FRDA usually develop in early childhood as uncoordinated movement and difficulty in walking, getting progressively worse throughout life so that FRDA sufferers typically become wheelchair-bound in early adulthood and die prematurely usually from heart failure. FRDA is a genetic disorder caused by mutation of the gene that is responsible for making a protein called 'frataxin' which is essential for life. My presentation will discuss the current FRDA research, which is focused on understanding more about the disease mechanisms, pathology, function of frataxin protein and developing therapies that aim to cure this disease.

Dr. Emmanouil Karteris
Involvement of novel signalling pathways in the pathogenesis of Alzheimer's Disease

Dementia is a brain disorder that seriously affects a person's ability to carry out daily activities. The number of people with dementia is steadily increasing. In UK, dementia currently affects over 750,000 people in the UK, and it is estimated that by 2010 there will be about 870,000 people with dementia. Always fatal, Alzheimer's Disease (AD) is the most common form of irreversible dementia. AD is a progressive neurodegenerative disease characterized by gradual and increasing loss of cognitive function and behavioural abnormalities. Symptoms include memory loss, personality changes, confusion, loss of language skills, and severe sleep disturbances. A number of recent studies provided a strong link between the mammalian Target of Rapamycin (mTOR) and AD. For example, mTOR is critical for long-lasting forms of synaptic plasticity and long-term memory (LTM) formation, which is impaired in mouse models of AD. In our laboratory we will: a) use of an animal-free 3D in vitro model to mimic neuronal circuits *in vivo*; b) map key gene differences from human brains of AD patients; and c) use an *in* silico approach to study complex mTOR protein interactions AD.

Professor Mary Gilhooly
"Use it or lose it": Does engaging in mental activities prevent dementia or cognitive decline in old age?

It is frequently argued that keeping mentally active will slow down cognitive decline in old age. Some even argue that keeping mentally active can ward off Alzheimer's disease, the most feared of all the diseases of old age. Is there any evidence for the notion of 'use it or lose it' in relation to cognitive functioning? Findings from my own research on mid-life risk factors for cognitive functioning in old age will be used to both demonstrate the role of serendipity in research, as well as address this intriguing topic. These findings will also be considered in relation to recent arguments that Alzheimer's disease is *not* a neurodegenerative disorder but is a vascular disease. It may be that the old adage, 'use it or lose it', is more about using your body rather than your mind to prevent dementia and cognitive decline in old age. In other words, "healthy body, healthy mind" may be the key to warding off Alzheimer's disease.

Dr. Noam Sagiv
Do we all see things differently?

We all have our different opinions and preferences but we usually assume that when we look at the same object we pretty much see the same thing. But do we? Is it possible that some people literally see things differently? Synaesthesia - a phenomenon in which what we perceive through one sense also triggers an experience in another sense - is perhaps one of the best examples of individual differences in the most basic aspects of perception. I will introduce the phenomenon and briefly explain what researchers have understood about the brain basis of such individual differences.

KEYNOTE
Professor Brian Butterworth
Dyscalculia – The science of failing to learn arithmetic

Professor Brian Butterworth is a world-leading expert in mathematical cognition. As Emeritus Professor at the Institute of Cognitive Neuroscience at UCL, his current research interest is dyscalculia – or the science of failing to learn arithmetic. Since 2004, his seminal book 'The Mathematical Brain' has been translated into four languages.
He also regularly contributes to advancing the public understanding of science, currently serving on the management committee of the Centre for Educational Neuroscience, as well as appearing regularly on BBC radio and television. Elected a fellow of the British Academy in 2002, Professor Butterworth has held teaching posts at Cambridge, MIT and the Max Planck Institute.