Bright Brains Newsletter

Issue No. 3
Summer 2016

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Welcome to the summer edition of our 'Bright Brains' newsletter! We are pleased to present you with an impressive variety of thought-provoking articles that have been composed and edited by BNA students, postdocs and early-career researchers from a diverse array of neuroscientific disciplines throughout the UK.

Since our last edition, 'Bright Brains' has expanded its presence by establishing itself on the new BNA website. This online section, which can be found under the tab 'Publications', represents the online extension of the 'Bright Brains' newsletter in print. The online section covers exciting meeting reports, articles on research and public outreach, as well as reviews about topics that matter to you!

As scientists we all know that the human brain is an astonishing subject of study: it gives life to our thoughts and dreams through its parts ranging from molecules to genes and proteins that communicate to create cells to form specific pathways as parts of circuits to create large-scale cortical networks that through interaction and oscillatory synchronisation seem to ultimately give rise to our thoughts and perception. By the same token, thoughts and behaviour can affect operations at the genetic, molecular, cellular and systems level. Thus, all parts of the brain work together in a dynamic equilibrium, which can be shaped by an array of psychological conditions and behaviour that in turn can be affected by environmental influences.

In that regard neuroscience is special as it presents an amalgamation of different sciences that allow the brain to study itself. No matter through what discipline you are studying the brain, or in what form you are pondering the mind, in this edition 'Bright Brains' has provided you with a list of neuroscience documentaries that can give you an idea of research of the past and that can inspire you to think about where your research is heading regardless of whether you have just started thinking about how the brain works or whether you have been studying the brain for the past 50 years.

This list of classic and recent documentaries can help you review critical neuroscientific concepts, or inspire you to specialise in a certain direction, or introduce you to new developments from other neuroscientific disciplines. Also, 'Bright Brains' has many more exciting features in store for you in this edition! Our 'Nuntia' section reviews the remarkable Cambridge Neuroscience Seminar 2016, and the highly successful neuroscience event at this year's Edinburgh International Science Festival. Our 'Socialia' section introduces you to the brilliant 'Native Scientist', and highlights the critical significance of vacation lab placements for students. In the 'Varietas' section you can read about the excellent getPROTECTED initiative, and the epigenetic control of social behaviour in ants. 'Numquid sciebat…?' offers you insightful information on brain-computer-spinal cord interfaces, while 'Quid novi?' invites you to take part in the fantastic 'MindYerBrain' project. Last but not least, we are challenging you to the first BNA cryptic crossword on neurodegenerative diseases.

Finally, we sincerely hope that you will have as much joy in reading our third 'Bright Brains' newsletter as we had in producing it! On that note, we would like to encourage you to get involved in science communication by joining our newsletter team. Please direct enquiries to jayanthinykangatharan@gmail.com.

Jayanthiny Kangatharan, 'Bright Brains' newsletter coordinator

Documentaries about the brain and the mind	
The Mind Machine with Colin Blakemore (1988)	The Big Question: Why am I me? (2005)
Discovering Psychology (1990, 2001)	The Brain that changes itself (2008)
Brain Story (2000)	God and the Scientists (2009)
Secrets of the Mind (2001)	Horizon: Is seeing believing? (2010)
Brain: The Last Enigma (2003)	The Brain: a secret history (2011)
The Phantoms in the Brain (2003)	The Brain with David Eagleman (2016)

Julia Gottwald and Sally Jennings
PhD students in Psychiatry,
University of Cambridge

Cambridge Neuroscience Seminar 2016

On 17 March 2016, Cambridge Neuroscience organised the 28th Cambridge Neuroscience Seminar. Hosted by the Downing site campus, this meeting saw more than 300 delegates gather to attend a highly interactive symposium that showcased cutting-edge research on the theme of 'New Directions'. This meeting was opened by Bill Harris who thanked the seminar organisers, especially Dervila Glynn, for their hard work, and promised an exciting day of talks and posters.

In the spirit of 'New Directions' every session spanned a wide range of topics. The first session encompassed dementia, obesity and networks, with talks from Rick Livesey, Lucy Cheke and Tiago Branco. The second session covered computational modelling, neurocriminology and impulsive-compulsive disorders, with presentations from Timothy O'Leary, Kyle Treiber and Sam Chamberlain.

The morning talks were followed by a lunch break and an extended poster session, in which more than 60 scientists presented their research. The poster prizes went to Matilde Vaghi for her poster on brain connectivity in OCD and to Naotake Horiguchi for his poster on the neural basis of contingency learning. Many delegates were also active on twitter, with tweets under the hashtag #CNS2016 allowing people from anywhere in the world to follow the symposium.

The afternoon session continued with a highly varied programme with talks covering predation, pain and psychosis from Paloma Gonzalez-Bellido, Ewan St John Smith and Paul Fletcher, respectively. The Plenary Lecture was given by Sarah Tabrizi from UCL, who discussed the great strides her team has been making in meeting the therapeutic challenge for Huntington's disease. They have started work on the first 'gene silencing' trial in Huntington's disease, a technique in which the expression of a gene is prevented.

The event was then opened to the public for a talk from Giovanna Mallucci, in association with the Cambridge Science Festival, about novel dementia treatments. Professor Mallucci's new approach is to stave off neuronal loss, and associated worsening of dementia symptoms, by reducing the rate at which synapses are lost. The event concluded with a drinks reception and conference dinner at Downing College and was widely considered successful in having brought together neuroscientists from Cambridge and beyond.

Vikoria-Eleni Gountouna and Ksenia Kuznetsova
Postdoctoral researchers,
University of Edinburgh

Meeting your social brain at the Edinburgh International Science Festival

During 5-9 April 2016, the Nicodemus research group from the Institute for Genetics and Molecular Medicine at the University of Edinburgh organised a drop-in event entitled 'Meet Your Social Brain' as part of the Edinburgh International Science Festival 2016.

The two-week festival, one of Europe's largest science festivals and the first science festival to be founded (in 1989), hosted a large number of scientists from different disciplines ranging from biomedical sciences to chemistry and engineering to educate visitors about the recent developments in science and to raise social awareness of the importance of science and its application to real life. The aim of the neuroscience drop-in event was to teach both adults and children about the social function of our brains, emotional intelligence and the role of social skills in mental health.


Douglas Robertson Photography

Visitors at the neuroscience drop-in event.

The drop-in event welcomed visitors of all ages. Members of the Nicodemus group and neuroscience student helpers chatted to children about brain anatomy and brain functions. While the youngest visitors got involved in creating anatomical brain hats, or emotional clocks that indicate one's emotional state, older children, along with their parents and caregivers, enjoyed live neuroeconomic games and learned about the benefits of cultivating trust and cooperation in relationships. All games involved a reward of candy, proportional to the players' winnings.

Adults and older children were also invited to an informal chat about ongoing research involving neuroimaging techniques, genomics and their role in mental health. Over the course of the festival, data were collected as part of a pilot study to investigate developmental trajectories of socio-economic traits and the effect of family relationships on game play strategies. All in all, an estimated 2988 people visited the drop-in event during the 5 days, averaging almost 100 people per hour! Many thanks therefore go to everyone who helped make this event a success, with a special thanks to the mental health charity MQ, Edinburgh Neuroscience and its scientific coordinator Jane Haley, and to all volunteers.

Inês Barreiros
Postgraduate Research Assistant, University of Oxford

'Native Scientist': science outreach session in your native language

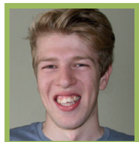
'To empower immigrant communities through science outreach' – this is the motto of the 'Native Scientist', a non-profit organisation, which promotes science and language-integrated learning. Collaborating with international scientists, the Native Scientist organises science outreach sessions for bilingual school children with immigrant backgrounds.

In these sessions children have the opportunity to develop their multilingual skills by practising a language that is not spoken in the country they currently live in. At the same time, pupils get to learn about science from real scientists and to know more about STEM-related careers. This gives voluntary scientists the opportunity to develop their communication skills while increasing the impact of their work through science outreach that is aimed at better social integration.

When it was first founded in 2013, 'Native Scientist' promoted sessions in London exclusively but it has now expanded. It is now organising UK-wide science outreach sessions in Portuguese, Spanish, French, Italian, Greek and German. It is reaching out to Europe as well by organising initiatives in Germany and France. Its aim is to increase both the number of school sessions and the range of languages covered.

I had the chance to participate in one of these wonderful sessions, held at the City of London Academy in Islington. During this Portuguese class, led by Sara Marques, Delfim Duarte, Sara Trabulo and myself, the pupils learned about a range of scientific subjects including cancer, cell migration, disease-causing parasites and the workings of the brain. Despite their varying personal interests or hobbies, the children showed abundant amounts of curiosity and were interested in learning about the aforementioned scientific topics. They were also curious about what it is like to be a scientist and what motivates scientists to pursue their fascinating scientific endeavours. The opportunity to talk to children about my research and my passion for neuroscience turned out to be an incredibly rewarding and memorable experience, one that I can truly recommend.

With a number of sessions that are being planned for the next months, the Native Scientist is currently looking for more voluntary bilingual scientists. To get involved and have the opportunity to talk about your work and passion for science while inspiring young children, get in touch with the Native Scientist at **nativescientist.com**.



William Monteith
Undergraduate student in Biomedical Science, University of Southampton

The importance of vacation lab placements

During the summer vacation period of 2015 I was fortunate to work in the Deinhardt lab, University of Southampton, thanks to the John W Caddick Scholarship. My supervisor Grace, a PhD student in Dr Deinhardt's lab, taught me all of the techniques that I would use, and the routine of working in the lab. Therefore, the aim of my studentship was to complete a piece of work that would benefit Grace's PhD that investigated how tau pathology is spreading between neurons in neurodegenerative disease.

This entire placement was unlike anything I have experienced on my degree course. In addition to it being my first experience of spending an extended amount of time in a lab, and the engaging work that I conducted, the studentship introduced me to a completely unfamiliar environment. Having been used to working in teaching labs where I would complete an experiment in 3 hours and then spend a few hours over the following week writing a report, I was instead working 8-hour days, attending weekly lab meetings and presenting my work or reading to a group of colleagues. The entire experience made me feel like part of an actual research group and provided me with a much clearer understanding of how a lab functions.

It taught me lots of skills that I had previously not required such as the need to be proactive, or the importance of discussing work with a team in order to find a way around a problem, skills I am certain will benefit me greatly in any future PhD position/career. But, perhaps more importantly, I enjoyed the work. I enjoyed the 9 to 5 hours, the evening trips to the pub and discussing work with other students in a similar position to myself, like a 'real' adult, and I now feel confident in my decision to study for a PhD in a similar subject.

Choice of career is the most important decision I have made since starting university, and extra lab experience has provided me with an opportunity to sample an environment unlike one that I had previously experienced. This experience has instilled in me the confidence of making an informed decision to study for a PhD. I hope that Southampton and other universities realise the benefits of vacation lab experiences, both for students and the research groups involved, and continue to provide these opportunities to students with a passion for science and research.

Alessandra Dillenburg and Owen Gwydion James
PhD students in Neuroscience, University of Edinburgh

Edinburgh PhD students create workshop aimed at brain injury awareness in children

Primary school children become more active by playing team sports and learning to ride a bike. Appropriate instruction alleviates the risk of injury in these sports; however, as exposure to injury increases, so too should an awareness of the type of damage individuals are susceptible to. While most adults understand that hurting your head is different to hurting your body, children may not yet be familiar with this concept. This is where getPROTECTED comes in.

Under the guidance of Jane Haley at Edinburgh Neuroscience, we recently set up a novel workshop on both brain function and head protection. This workshop is the newest addition to the getBRAINY series (get Busy Running Activities Inspiring Neuroscience in the Young) hosted by Edinburgh Neuroscience. This workshop teaches 10–11-year-olds about the brain, how it works, and why it is important to keep it safe.

By explaining the brain's functions in everyday life and the consequences of damaging specific brain areas, the getPROTECTED workshop aims to convey the reduced healing capacity of the brain compared to the rest of the body, and highlight helmet safety as a preventative action to injury.

The inspiration for getPROTECTED came from a previous workshop headed by Alessandra at the University of Toronto, and a mutual interest in cycling and public outreach. We run a fun activity where the kids 'pin the tail on the donkey' by matching different senses to specific lobes. The kids also learn how helmets work by running an experiment to test how well different materials absorb the energy of a moving object. Overall, we hope getPROTECTED will be a fun, interactive workshop where children get to know their brains and understand why they need to protect them.

We began the getPROTECTED workshop in spring this year, and are planning to expand and reach more schools next year. Our hope is to develop a nationwide initiative for injury prevention in children. If you are interested in getPROTECTED or would like to set up something similar, please contact Alessandra at a.dillenburg@ed.ac.uk.

Sophie Williams
Postdoctoral researcher, University College London

Epigenetic control of ants' social behavior

Does our environment and lifestyle influence our social behaviour? Until recently, it was believed that our physiology and behaviours were defined from birth by our genes; so lifestyle choices would not have any effect at the level of our DNA. However, we now know this view is too simplistic. In fact, external influences, including stress, can affect gene expression to enable lifelong behaviour changes through the process of epigenetic regulation.

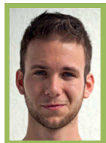
Research in this area has explored the fascinating social ranking system seen in social ants – which is driven largely by epigenetics. Depending on environmental influences, genetically sister-like ants develop neuroanatomical differences, which determine ranking and behaviour. Some ants can grow physically larger and enter into the major caste, while others become smaller, minor ants. Minor ants forage earlier in life and with greater intensity, whereas major ants become soldiers. The underlying process is influenced by chromatin regulators, which through acetylation restrict how tightly histones wrap portions of DNA and thereby control gene expression.

A recent study explored the molecular regulation of caste-specific behaviour in these ants (1). Pharmacological and molecular biology tools were used to manipulate the level of histone acetylation, revealing changes in genes involved in synaptic transmission and olfactory learning. Specifically, inhibiting histone deacetylase (HDAC) activity with valproic acid or targeted RNAi caused enhanced foraging in the major caste, mimicking the foraging behaviour normally found in the minor caste. This effect was prevented in the presence of a histone acetyltransferase (HAT) inhibitor, which blocked acetylation of histones. Furthermore, it was found that younger brains were the most vulnerable during this type of gene expression manipulation. When 1-day-old majors were injected with HDAC inhibitors, they began foraging regardless of the identity of their nest mates. This change in behaviour was sustained for up to 50 days, considerably after the modifier has left the system.

This study illustrates a mechanism underlying epigenetic control of behaviour. Epigenetic control allows dynamic adaptation within an individual's lifetime, for example, to maintain an even division of labour in response to changes in predators or food availability. How much this particular study relates to humans is as yet unknown, but it does raise important questions about the complexity of our relationship with the environment.

1. **Simola DF *et al.*** (2016) Epigenetic (re)programming of caste-specific behaviour in the ant *Camponotus floridanus*. *Science* 351(6268): aac6633.

VARIETAS NUMQUID SCIEBAS...?



Stefano Vrizzi
Undergraduate student in Neuroscience, University of Leeds

Connecting neurobiology and rehabilitation with mathematics and engineering

Hundreds of thousands of people suffer from spinal cord injury (SCI) worldwide, facing sensory, motor and autonomic function impairment. People whose injury occurred on their cervical segments ranked hand and arm movement as their highest recovery priority (1). There have been several attempts employing applied technology to restore motor output by targeting the disrupted corticospinal tract. However, the few promising results reported are still not widely applicable.

Brain–computer interface (BCI) devices make up a family of devices that essentially record brain activity to perform a desired output. Brain–computer–spinal cord interfaces (BCSIs) can, for instance, record firing rates of movement direction-tuned neurons from motor cortex, to then stimulate the spinal cord below the injury.

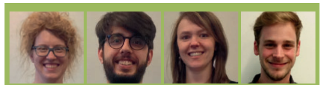
This can either reanimate a limb (2) or promote rehabilitation (3). Reanimating the relevant motor neuron pools has the advantage of physiological motor unit recruitment. On the other hand, rehabilitation not only directs regrowth of injured motor fibres, but it can strengthen synaptic connections. When the recorded neurons spike, BCSI exploits spike-timing-dependent plasticity rules by applying an optimal stimulation delay.

BCSI-induced neural plasticity can be simulated by computational models, which offer a powerful way to test different combinations of parameters. Despite simplifying some important biological features, some results have matched experimental findings (4). More importantly, they can accelerate BCI development by causing experimentalists to focus on more specific questions.

Despite BCI research being in its infancy, it is growing within a large extended family: engineers build efficient electrodes, neuroscientists investigate nervous system response, computer scientists come up with clever algorithms, and medical doctors optimise the benefits for patients against the risks. Collaboration is indeed the key to tackle some of the main current challenges, which range from improving signal decoding, to addressing inflammation responses to invasive electrodes, to discussing ethical implications.

1. **Anderson KD** (2004) Targeting recovery: priorities of the spinal cord-injured population. *J Neurotrauma* 21(10):1371–1383.
2. **Zimmermann JB & Jackson A** (2014) Closed-loop control of spinal cord stimulation to restore hand function after paralysis. *Front Neurosci* 8:87.
3. **Nishimura Y, Perlmutter SI, Eaton RW & Fetz EE** (2013) Spike-timing-dependent plasticity in primate corticospinal connections induced during free behavior. *Neuron* 80(5):1301–1309.
4. **Lajoie G, *et al.*** (2016, under review) Correlation-based model of artificially induced plasticity in motor cortex by a bidirectional Brain-Machine Interface.

VARIETAS QUID NOVI?



Lisa Genzel (postdoc)
Antonis Asiminas (PhD student)
Marie Bechel (postdoc)
Matt Swire (PhD student)
University of Edinburgh

MindYerBrain: Breaking down communication barriers

MindYerBrain is a project that we set up in 2012 to generate curiosity and inspire interest in individuals who are not likely to seek out information on brain-related research. With MindYerBrain we therefore aimed to showcase neuroscience in a much more accessible manner. In that context, we decided to develop social media sites to encourage discussions and sharing between the public and neuroscience researchers.

Shortly after receiving Wellcome Trust funding, we collaborated with Freddie Yauner at Shift.ms and artists Toby Melville-Brown, Billy Steel and Michel Lafrance to create a cinema advert for the MindYerBrain Facebook page. The advert showcased an analogy of neuroplasticity as an ever-changing city. We also led informal discussions at the Edinburgh International Science Festival, hosted a film night with discussion at the Midlothian Science Festival, and conducted informal interviews in the high street to gauge public interests.

Throughout the project we stumbled upon preset notions scientists and non-scientists have about each other. We discovered the challenge of bringing scientists' excitement in research to a conversational level, a challenge that often deters people from engaging in these discussions. We were surprised to find mixed public perspectives, from feelings of distance and even intimidation by neuroscience to an active interest in health-specific issues. The general population seems to think of researchers as aloof and 'special', not realising that the daily life of a scientist is just as repetitive and uneventful as any other. These surprises emphasised the importance of scientists themselves communicating research in a less formal way to break down notions that science is unapproachable. As the brain-related topics crop up more in the media and everyday lives (e.g. neuro-consultancy), it is important for scientists to promote the excitement about neuroscience in a realistic way to keep the balance between hype and truth.

We are keen to create and share more accessible videos featuring researchers. MindYerBrain is creating an image and video series documenting what life in laboratories is really like (#TrueLifeNeuroScience). This series will include 'sneak peeks' into the research world while providing accessible explanations of ongoing research to demonstrate the importance and excitement of neuroscience. Interested in joining the conversation? Then just snap up your phone, make a video and share on MindYerBrain!

VARIETAS THE BNA CROSSWORD

How well versed are you in neurodegenerative diseases?

Test your knowledge by completing the first BNA cryptic crossword! Answers will be revealed in the next edition. Answers to last edition's crossword are provided at the bottom of the page.

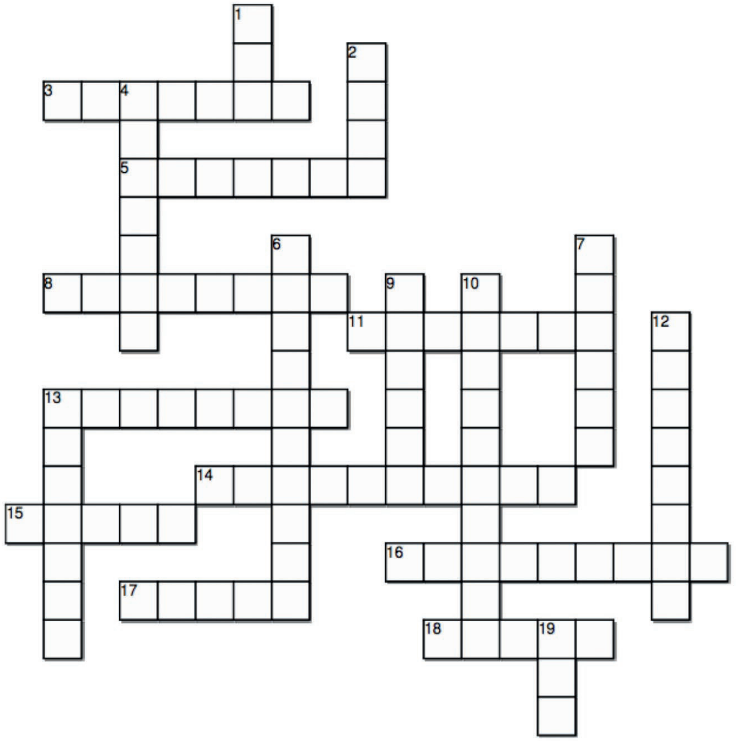
Enter this edition's competition by sending your answers to jayanthinykangatharan@gmail.com. Entries received before 1 September 2016 will be entered into a prize draw to win a unique contribution towards the 'Bright Brains' autumn edition.

VERTICAL

1. Protein found returning at university
2. Mostly agile, unusually, these cells are often involved
4. Burn baby's bed says famous neurologist
6. Banned sport? Can produce expanding repeat protein
7. Social worker follows silent without energy, causing disease
9. Neurofibrillary substance is in a knot
10. A gamble and statement, or having a higher chance?
12. Toxic species, missing a brain tumour and metal source somehow
13. Death of tissue is a prize?
19. A very quiet Alzheimer's protein

HORIZONTAL

3. Confused hint within reversed light source produces central component
5. Men confused in eastern continent exhibit forgetfulness
8. Genetic model – end of the fight, most likely?
11. Affected person also willing to wait
13. I can fly with kite – but feeling rigid?
14. Immoral person shows decline
15. Research creature; Emo used some?
16. Actor's delayed arrival; as with these diseases?
17. To spy on, we hear, reveals to infectious agent
18. Almost brake around article gives stages



Congratulations to Sophie Williams from UCL who won the first BNA crossword competition from the 'Bright Brains' spring edition.

Answers to the crossword from Issue 2: Spring 2016 – HORIZONTAL: 1. putamen, 3. lentiform nucleus, 4.thalamus, 6. trigeminal nerve, 9. septal nuclei, 15. genu VERTICAL: 1 pons, 2. amygdala, 4. tegmentum, 5. macula lutea, 7. synaptic cleft, 8. hypothalamus, 10. parahippocampal gyrus, 11. habenular, 12. peduncles, 13. crus cerebri, 14. circle of Willis, 16. pineal gland.