Bright Brains Newsletter

Issue No. 6
Summer 2017

Welcome to the summer edition of our 'Bright Brains' Newsletter! This edition is the second of the three-part series, in which the last 'Varietas' page is dedicated to the artistic exploration of the brain, thereby allowing you to creatively express neuroscientific phenomena. This edition's 'Varietas' features 'Picturae', showing a range of creative close-ups of different brain structures as chosen by 'Bright Brains' members.

What do painters and neuroscientists have in common? As the painters and artists among us know, both painters and neuroscientists have a strong interest in uncovering the laws by which the brain paints a picture of reality. Though painters' techniques clearly differ from the scientific method, by understanding and playing with neurologic and perceptual rules, painters have intuitively revealed secrets of the visual brain.

Engaging in art can allow you to gain insights into how visual perception arises. Leonardo da Vinci is one prime example of a painter and scientist who studied gradual changes in light to understand the visual perception of form and depth. In fact, Helmholtz emphasised during his lecture in 1871 how artists should be viewed as investigators who, through numerous observations and experiments, create work that due to its vividness and accuracy manifests a series of pertinent facts that physiologists cannot ignore. According to Harvard psychologist Patrick Cavanagh, artists are indeed neuroscientists in that they understand how the visual brain uses a basic approach to see the world, which can be reflected onto the canvas in ways that are invisible to the viewer.

These observations struck a chord with me, as I believe painting is essentially seeing, mentally and physically playing with colours, contours and contrasts. When I was standing in front of one of the many Stilleben in the Borghese Gallery in Rome, the artist in me mentally decomposed the painting and recreated it to meaningfully understand the painter's use of perspective, colours and light.

It is clear that art is a truly unique way of viewing the world that is distinct from the scientific method. By understanding how art engages us at different levels such as emotion, cognition and intellect, any information revealed can help us, when integrated with the scientific perspective, to create a better understanding of reality. Thus, by training your eye to dissect reality via engaging in art, the creative process will give you insights into the construction of visual perception. To help you pick up your painting brush to get you started on your first artwork, 'Bright Brains' has provided you with various close-ups depicting different structures of the nervous system in 'Picturae' to inspire you to focus your eye on the true beauty of the brain.

In addition, this special 'Bright Brains' summer edition has many more magnificent features in store for you! The 'Nuntia' section presents a student report on the BNA Festival of Neuroscience 2017, as well as a report on a symposium on neural circuits organised by the European Molecular Biology Laboratory. The 'Socialia' section brings you the highlights of the BNA Student Quiz held on 12 April. It also paints a picture of the exciting 'Brain Diaries' exhibition organised by Oxford Neuroscience, which runs until the end of this year. The 'Varietas' section presents you with the final parts of the inspiring 'Journey to the Centre of Scandinavia' series and the thought-provoking 'Research heading to the East' series. 'Numquid sciebat' advocates the use of creativity in science, while 'Quid novi' introduces you to the first BNA Special Interest Group on Neuroinformatics, which was launched at the BNA Festival of Neuroscience.

Finally, we sincerely hope that you will have as much joy reading our sixth '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

Yuhua Guo
PhD student in Neuroscience, University of Cambridge

BNA Festival of Neuroscience 2017

The BNA's biennial Festival of Neuroscience was held at the Birmingham International Convention Centre on 10–13 April 2017. The conference featured six plenary lectures, 45 symposia and discussions, over 750 posters, 60 exhibitors, and numerous social events, as well as career events for junior researchers.

The Festival included talks and posters on a wide range of neuroscience topics encompassing vastly different methods and techniques. Researchers presented novel findings ranging from the molecular/cellular mechanisms of the nervous system to system-level investigations of human cognition using neuroimaging and computational modelling. I found it particularly eye-opening to learn that fMRI has been successfully implemented on mice, revealing that it is more rewarding for mice mothers to feed their pups than to indulge in cocaine – although the fondness for cocaine does return once lactation is no longer needed.

'An evening with British Brain Prize Winners' was especially enlightening. Tim Bliss and Graham Collingridge (2016 winners) and Karen Steel (2012 winner) joined the discussion. Tracing their footsteps backwards chronologically, all three winners recognised the importance of opportunity and luck, in addition to hard work. On the one hand, it is essential to have a worthwhile research question to commit to, throughout one's scientific career. On the other hand, it is also critical to be in the right place with the right people at the right time. They encouraged young researchers to find a question they are passionate about and to strive solving it.

On the last day of the conference, one discussion forum focused on the prospect of research funding after Brexit. According to the Wellcome Trust alone, around 20% of their funding supports researchers from the EU. Despite the EU being an integral part of neuroscience research in the UK (both in terms of funding and talents), there is still enormous uncertainty regarding immigration and funding policies. In light of this, the funding bodies that were present at the forum promised to raise these concerns with the government.

All in all, the BNA Festival was both inspiring and informative. Let us hope that in two years' time – when the next BNA Festival takes place in Dublin – research in the UK will not be as uncertain as it is now, and that there will be a lot more science to be excited about.

Vinodh Ilangovan
Research Fellow, Max Planck Institute for Biophysical Chemistry, Germany

EMBO EMBL Symposium on Neural Circuits in the Past, Present and Future

The EMBO EMBL Symposium on 'Neural Circuits in the Past, Present and Future', held in Heidelberg, Germany, on 14–17 May 2017, served as an excellent platform for over 100 neuroscientists across the globe to understand the structure and function of neural circuits from a new perspective. The purpose of this symposium was to enhance the exchange of novel ideas and methodologies among scientists who work on diverse model systems from the molecular to the psychological level to unravel the complexity of neural circuits.

The symposium was structured into eight sessions ranging from the origin and evolution of the nervous system, emerging new model organisms to study neural circuits, innovation in neuroscience technologies, neural mechanisms of motivation and action to neurogenetics, and computational approaches to decipher neural circuits. Some of the highlights of the opening session included discussions on the role of neuromodulation in persistent individual behaviours of invertebrates and the genetic basis of parental care evolution in mammals. The second day of the symposium focused on the beauty and elegance of neural circuits through discussions on the origins, commonalities and differences of animal nervous systems. Jean-François Brunet (École normale supérieure, France) emphasised the need to revise and revive the past understanding of the autonomic nervous system, which remained elusive for centuries.

An exciting session on neurotechnologies opened up the possibility to evaluate techniques such as two-photon holographic optogenetics, dynamic mapping of neural circuits and functional ultrasound imaging in awake animals. Standard genetic model organisms such as the fruit fly *Drosophila* and laboratory mouse dominated discussions on the understanding of circuits involved in decision-making, action planning and the emergence of complex behaviours. Special emphasis was put on the neural mechanisms of bodily self-consciousness and models of sensorimotor decision-making in humans. Computational approaches to understand how brains make complex decision with deterministic simple rules emerged as a leitmotif of the circuit computations session.

During the poster sessions participants had an opportunity to discuss swift scientific communication methods like preprints and open research platforms. A speed networking session helped participants to foster interdisciplinary dialogues. A 'Meet the Speakers' session during lunch break allowed early-career researchers to discuss ideas and collaborations with eminent speakers. The evenings provided ample networking opportunities amid an extravaganza of music and a picturesque backdrop to the conference centre. Organisers and participants alike have renewed enthusiasm and motivation, and are looking forward to the next symposium.

Whaj Lee
Junior Doctor, NHS

The BNA Student Quiz 2017

On 12 April 2017, the BNA Festival of Neuroscience in Birmingham was celebrated by students and presenters with a friendly quiz on the wonderful world of neuroscience. Quiz hosts included students Stefano Vrizzi and Tyra Haywood from Leeds, myself and fellow junior doctor Joshua Au-Yeung. We helped the project assistant Mollie Neason and her team to manage the quiz event, which was attended by 120 students.

A total of 15 teams competed in the quiz. One thing we can be certain of is that they all faced up to our challenge of making neurology gag-related team names. On that night it was proven that a profession in stand-up comedy would not go amiss. Certain favourites such as 'Axons speak louder than words', 'Dope and mean glutaMates' and the classic 'Are you BNA helicase? Because I want to unzip your genes' are just a few that come to mind and deserve a shout out.

It is not surprising that an event such as the one held in the Pitcher and Piano basement, packed with 15 teams of neuroscientists being quizzed on their own subject, was not without its challenges. The lack of a microphone was the major one. The hosts attempted to solve this situation by either shouting the questions out loudly (my throat has not healed yet!) or having a few question announcers going around the room repeating them. We ended up going for both options. The timing of the questions was regulated by the bell and Mollie's voice, which actually worked very efficiently.

Overall, the vibe of the night was fun and relaxed, though the free drink coupons may have contributed to this. The standards of questions were high and the teams matched them with their expertise – I am sure their supervisors would have been proud. At the end of the quiz, the team 'Dope and mean glutaMates' won a closely contested event, securing the coveted prize of small notebooks, pens and paper pads, and most importantly more free drink coupons. Special thanks go to Mollie Neason and her brilliant team for helping to organise the event. A special shout out has to go out to fellow host Stefano for appearing in crisp attire topped off with a hand-made Italian bow tie. And, of course, a big thank you to everyone who participated and made the event a huge success.

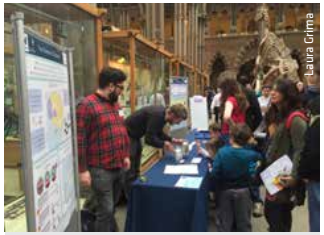
Caroline Jahn
PhD student in Cognitive Neuroscience, Centre de Recherches Interdisciplinaires, France

Brain Diaries

From 9 March 2017 until 1 January 2018, the Brain Diaries exhibition is running at the University of Oxford Museum of Natural History, charting research into the development of the brain throughout life. On the first floor of the glass roof, visitors can learn about how the brain learns and how it ages. Created in collaboration with neuroscientists from Oxford, this educational exhibition aims to captivate both adults and children by using a variety of media, from posters to fine-detailed 3D-printed brains. Even if you are unable to visit the museum in person, the online version will ensure the legacy of this project (**braindiaries.org**).

However, the scope of the Brain Diaries project goes beyond this single exhibition. Numerous satellite events are being held across Oxford, encompassing talks, film screenings, science fairs, and even discussions within some of Oxford boisterous pubs. Regardless of your interest or background, there is certainly an event for you. The goal is to show people modern neuroscience in action by understanding current insights, and how research methods can be effectively applied to explore the unknown.

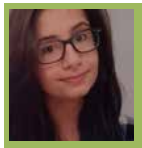
On 18 March my lab (**www.waltonlab.org**) participated in the 'Brain Diaries Demos'. In our day-to-day research, we study brain chemicals such as dopamine. Dopamine often features in the media, but is frequently wrongly associated with pleasure and happiness (1). We therefore wanted to assess the degree to which this influences what people know about dopamine, and find entertaining ways of demonstrating what it really does. Under the attentive eyes of parents, children played our 'Dopamine Dipper' marbles game and tried to discover which jar contained more red marbles to illustrate that dopamine provides a key learning signal in the brain. They also had a go at our 'Heavy Feet Challenge' and decided if they wanted to put in extra effort to gain better rewards to show that dopamine is important for motivation and decision-making.



Walton lab's stall at the Brain Diaries Demos.

Overall, we all felt that the event provided a fun opportunity to remind ourselves that our research can and should be relevant and understandable to everyone. The very positive feedback from attendees gave us a great sense of accomplishment. The exhibition as a whole is already a triumph, with more than 15,000 visitors so far having enjoyed the chance to expand their scientific knowledge.

1. **Bramley, E** (2017) Dopamine Dressing – Can You Dress Yourself Happy? Available at theguardian.com/fashion/2017/feb/03/dopamine-dressing-can-you-dress-yourself-happy [Accessed 24 April 2017].



Elene Nicola
Undergraduate student in Neuroscience and Psychology, University of Keele

Restoring hippocampal neurogenesis can improve cognitive processes in brain tumour survivors

For the past 8 months, I have been living in vibrant Stockholm undertaking a placement year at Karolinska Institutet. During my time here, I have had the privilege of contributing to thriving new research surrounding brain radiotherapy, with a particular focus on the juvenile brain.

Past research has shown that cranial radiation can cause adverse side effects including cognitive and intellectual impairments (1). The formation of new hippocampal neurons in the postnatal brain has been widely accepted to play a role in learning and memory; therefore, it is thought that these cognitive impairments seen after cranial radiation are due to a depletion of hippocampal neurogenesis (2). Thus, it is in turn strongly supported that promoting neurogenesis and the proliferation of neural progenitor cells in the hippocampus will help ameliorate these side effects.

Many approaches have been tested and seen to be successful in supporting this idea, including the administration of lithium, which inhibited radiation-induced apoptosis of hippocampal neurons and improved cognitive learning processes (3). The discovery of such treatment will not only vastly improve the understanding of mechanisms surrounding radiotherapy

The Karolinska Institutet.

but will also contribute to developing new rehabilitation strategies/treatments and improving the lives of brain tumour survivors. I feel very lucky and proud to have played a role in this field of research.

1. **Roughton K *et al.*** (2013) Irradiation to the young mouse brain impaired white matter growth more in females than in males. *Cell Death Dis.* 4(10): e897.
2. **Raber J *et al.*** (2004) Radiation-induced cognitive impairments are associated with changes in indicators of hippocampal neurogenesis. *Radiat Res.* 162(1): 39–47.
3. **Huo K *et al.*** (2012) Lithium reduced neural progenitor apoptosis in the hippocampus and ameliorated functional deficits after irradiation to the immature mouse brain. *Mol Cell Neurosci.* 51(1-2): 32–42.

Joshua Au Yeung
Foundation Doctor, Pennine Acute Trust

A Trip to Kolkata: Global Research (part III of III)

Several years have passed since research took me to the city of Kolkata, India. The experience highlighted the strength in research collaboration: how sharing knowledge, exchanging ideas and resources can help propel research forward. Since then, there have been many changes to the political and scientific climate in the UK. We are going to take a detour away from the East and examine the role that the UK plays on the global scientific stage. Political leanings aside, we ought to examine the likely impact of Brexit and what that means for researchers.

Statistically, the European Union is home to one fifth of researchers worldwide, yet generates over a third of all academic papers – an impressive 20% higher output than the USA. Talented UK academics are free to collaborate with our neighbouring colleagues, with a reported 15–20% of staff in top academic UK universities originating from EU countries. These key collaborations have achieved some impressive feats including the Large Hadron Collider and the European Space Agency.

The UK receives an extraordinary amount of funding from the EU. The recent EU Horizon 2020 is an innovative research programme with around €80bn of funding available over 7 years. There has already been €1.1bn allocated to neuroscience research alone, with the UK being the top beneficiary. The aim of Horizon 2020 is to help fund research projects and reduce regulatory restrictions to help launch projects securely and quickly. Post-Brexit, it is highly unlikely the UK will receive this level of funding.

The prevalence of neurological conditions and cost to the NHS are ever-increasing given our ageing population. Dementia alone is estimated to cost the UK £26.3bn pounds per annum. The EU Joint Programme in Neurodegenerative Disease Research (JPND) is an organisation that attempts to improve our understanding and treatment of neurodegenerative conditions, such as Alzheimer's and Parkinson's disease, by funding large-scale studies, for example the cognitive function and ageing study (CFAS I and II). Other large research organisations include international collaborations such as the international initiative for traumatic brain injury research, allowing researchers all over the world to make breakthroughs and optimise the management of traumatic brain injuries.

The enormity of neurological disorders represents one of the greatest challenges we face in the 21st century. To tackle this problem, our collective focus should be to advance our cause by enriching our shared passion of research and maintaining our strong global collaborations. After all, we will achieve more together than we will by working alone.

What are your thoughts on the recent political climate and how has it affected your institution? We would love to hear your opinion! Please email any comments to j.auyeung@doctors.org.uk.

VARIETAS NUMQUID SCIEBAS...?

Tamsin Nicholson
MSc student in Brain Sciences,
Glasgow University

Creativity in science

My transition from the arts to neuroscience was signalled by the diminishing value given to creativity. Creativity is synonymous with inventiveness, innovation, artistry, ingenuity and vision. Scientists prioritise a systematic approach, critical analysis and following protocol, leaving creativity significantly undervalued. But why is creativity so neglected in the sciences? Why do we not teach creativity to science students like we teach lab skills, scientific writing and experimental design? A brief exploration of famous neuroscientists and neurologists demonstrates their common tendency towards creativity, highlighting the importance of creativity in science.

The first figure that comes to my mind is the neurologist and author Oliver Sacks. Embracing the arts and sciences, he produced an extensive body of literature. But perhaps the strongest demonstration of his creativity was the decision to prescribe L-dopa to post-encephalitic patients. The drug was effective in treating Parkinson's disease and given the similar symptoms, he envisioned this new application. Whilst the effects were sometimes short-lived and had various complications, Sacks nevertheless made a lasting impression not only on his patients' lives, but also on his field of research.

But creativity comes in many forms. Nobel laureate Rita Levi-Montalcini was prohibited from working at a university in Italy under Mussolini's rule. But instead of accepting this, she created a laboratory in her bedroom. Being able to work freely, but with limited tools, she innovatively crafted surgical instruments from sewing needles. Her study of nerve fibre growth during this time led to a research fellowship and associate position at Washington University with Viktor Hamburger. It was here that she inventively adapted her previous experiments, leading her to isolate the nerve growth factor for which she won the 1986 Nobel Prize in Physiology or Medicine.

Unlike Levi-Montalcini, Alois Alzheimer was able to work with total freedom under the progressive psychiatrist Emil Sioli. This freedom may have fostered his creativity, enabling him to connect the psychological symptoms of dementia with the distinctive plaques and tangles of the pathology.

And without his artistic skills, Santiago Ramón y Cajal would not have left us with his beautiful and informative records of the microscopic brain, providing evidence for the neuron doctrine.

Although not a neuroscientist, Einstein famously stated, "Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand." With these words and legacies in mind, we should encourage more creativity in science as others have done before.

VARIETAS QUID NOVI?

Leslie Smith
Professor of Computing,
University of Stirling

First Neuroinformatics Symposium at BNA Festival

Neuroinformatics combines neuroscience and informatics, aiming to develop and apply advanced tools and informatics-based approaches to interpreting neuroscience data, and enabling major advances in understanding brain structure and function.

Neuroinformatics has a long history in the UK. The UK Neuroinformatics Network was set up in 2004, becoming the UK Node (1) of the International Neuroinformatics Coordinating Forum (INCF) (2) in 2008. The UK Neuroinformatics London meeting in May 2016 (3) resulted in the first Neuroinformatics Symposium at the BNA Festival (4), which I organised, and the BNA Neuroinformatics Special Interest Group (SIG) proposed by Marcus Kaiser and myself (5).

The Neuroinformatics Symposium started with Marcus Kaiser introducing the SIG, showing how neuroinformatics could aid clinical, experimental and engineering-based approaches to understanding and even re-engineering the brain (https://tinyurl.com/BNAneuroinfSIG). I discussed why neuroinformatics is critical. Sharing datasets (metadata and data), analysis tools and modelling techniques enables re-analysis of experiments, as well as comparisons across different tools and modelling techniques. Equally importantly, they enhance reproducibility, a major issue for neuroscience.

Claudia Clopath (UCL) discussed the onset and offset response in the auditory cortex. Interested in the causes and effects of long-term potentiation, and influences from environmental signals, she mixed experimental work with model-based data analysis. Tim Vogels (Oxford) discussed what makes the 'perfect synapse'. Interested in the effects of strengthening pre- and post-synaptic mechanisms in the synapse, and in using models to examine the differences in these effects, he re-used data from 15 to 25 years ago, giving a real example of the importance of keeping data in a re-usable form. Finally, Angus Silver (UCL) discussed why modelling synapses matters. Synapse types in neural systems have very varied pre-synaptic spike rates. How does synaptic structure relate to function? He developed a repository for models of these and other neural circuitry, Open Source Brain (6).

With over 100 delegates from different neuroscience areas attending, this reflects a strong and growing neuroinformatics community within the BNA.

1. http://neuroinformatics.org.uk
2. https://www.incf.org
3. http://neuroinformatics.org.uk/Network2016/meeting03052016.html
4. https://www.bna.org.uk/media/resources/files/S26_Why_Neuroinformatics_and_Computational_Modelling_matters_for_Neurosc_IXjC0ZQ.pdf
5. https://www.bna.org.uk/members/sigs/neuroinformatics/
6. http://www.opensourcebrain.org

PICTURAE

How well can you visualise structures in your brain?

In this edition we zoomed in on certain parts of your brain, with each photo focusing on a different structure. Can you guess what each photo is about? Then have a go at the following eight pictures. Answers will be revealed in the next edition. Answers to last edition's neuropoetic riddles are provided at the bottom of the page.

Please send your answers to each picture to **jayanthinykangatharan@gmail.com**. Entries received before 1 September 2017 will be entered into a prize draw to win a unique contribution towards the 'Bright Brains' autumn edition.

Photo 1

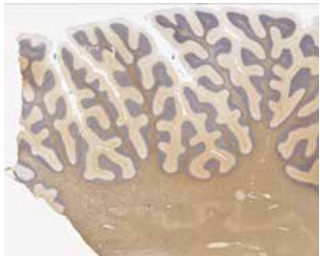


Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

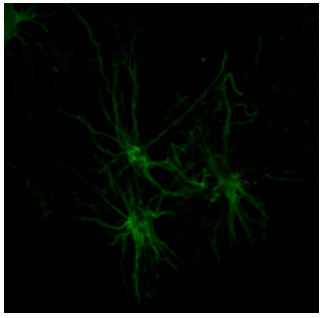
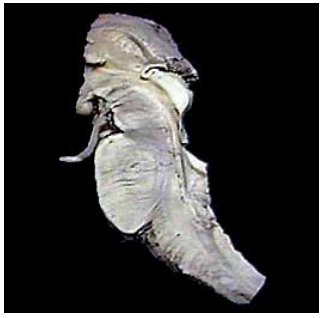


Photo 8



Answers to the neuropoetic riddles from Issue 5: Spring 2017 – Pantoum: dementia; haiku: Alzheimer's; double tetractys: cerebellum; rhyming riddle: theta oscillations; diamante: voluntary and reflexive attention; free verse: ignorance of laymen.