

TEACHING NEUROSCIENCE TO PSYCHIATRISTS

Professor Wendy Burn CBE

Contents

- Importance of integrating neuroscience into clinical practice
- Royal College of Psychiatrists (RCPsych) Gatsby/Wellcome Neuroscience Project
- Some examples of recent advances in neuroscience

Importance of neuroscience

- Neuroscience is advancing fast and will change the treatments we offer to patients
- Future workforce needs to understand basic neuroscience so that they can understand the advances as they come
- It's interesting – attracts people to work in mental health and enjoyed by those already here



RCPsych Gatsby/Wellcome Neuroscience Project

- Launched in 2016 as a 2-year initiative led by the RCPsych to introduce a modern neuroscience perspective into psychiatrists' clinical work
- Generously supported by The Gatsby Foundation and The Wellcome Trust
- I Co-Chair the Project Board
- Based on a USA experience



National Neuroscience Curriculum Initiative (USA)

- Making Neuroscience accessible and relevant
- Online, open-access (NIH-funded) learning resource
- www.nncionline.org
- Innovative teaching methods

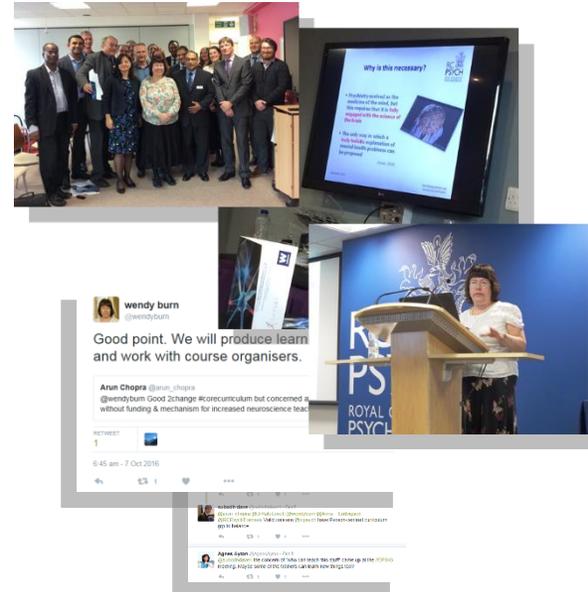
NNCI  NATIONAL
NEUROSCIENCE
CURRICULUM INITIATIVE

HOME · LEARNING MODULES · OUTSIDE RESOURCES · ABOUT · GET INVOLVED 



Initial phase of project: Stakeholder consultation

- Spoke at conferences and meetings, ran workshops
- Trainers
- Trainees ('residents')
- Patients
- Medical students



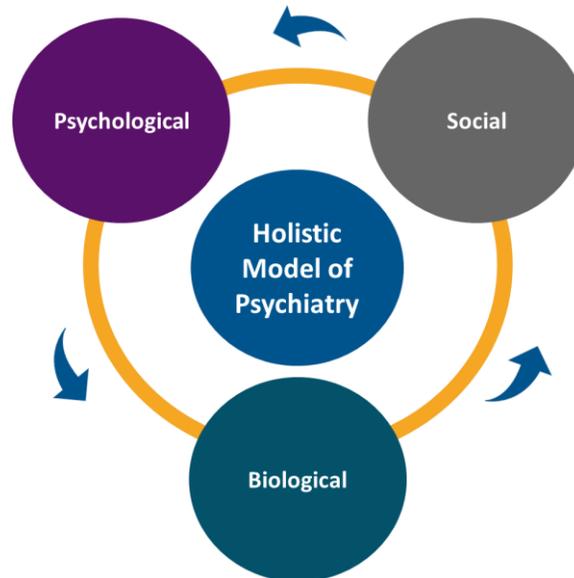
Results of consultation

- Huge interest and support
- Requests for education, trainers keen not to be left behind
- Was agreed that the exam syllabus on neuroscience would be updated
- Commitment made that Psychiatry depends on the integration of the physical, psychological and social



New curriculum for core training: August 2022

- Reiterates that the biological, psychological and social aspects of a patient's care are all of equal importance when practicing psychiatry



MRCPPsych examination

- All UK trainees need to pass membership examination of RCPsych to progress in training
- Paper A – Basic sciences, including neuroscience
- Paper B – Clinical topics and Critical Appraisal
- Clinical (practical) exam



MRCPPsych Paper A Syllabus: Updated July 2018

3. Neuroscience

The trainee shall demonstrate knowledge of the neuroscience that underpins the practice of clinical psychiatry. This will include: (1) elementary knowledge of the normal structure and functioning of the nervous system as it relates to psychiatry, i.e., the generation of normal mental states and behaviours, and of the dysfunction that leads to mental disorder; (2) ability to relate the symptoms and signs of mental disorder, and the examination of the nervous system, to underlying neural structures and their activity.

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- 3.1.4 Comp

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3.5 Neural circuits

3.7 Genetics

3.8.6. Effects of injury at different ages on the brain and mental function (including traumatic brain injury, inflammatory lesions e.g. multiple sclerosis)

Appendix 1

Syllabic curriculum content:

Summary of Areas of Core Medical Knowledge Underpinning Specialist Training in Psychiatry

Last updated July 2018

3. Neuroscience

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RCPsych Gatsby/Wellcome Neuroscience Project

- Extended for 3 more years (2018–21)
- Focus on adoption and embedding of neuroscience in psychiatry
- Understanding what changes this will bring to clinical practice



Neuroscience Project

- Conferences
- Talks and training events
- Brain Camps: workshops to showcase cutting-edge neuroscience research and educational techniques



Brain Camps

- Hundreds of psychiatric educators have taken part to date
- Each event heavily oversubscribed
- Participants from Tewkesbury to Toronto, Hull to Hong Kong



Brain Camp format

- One-day interactive event
- Refresher on selected cutting-edge, clinically-relevant brain research topics
- Workshops on teaching strategies
- Run by researchers & educationalists
- All welcome



Programme

09:30-10:00	Registration and refreshments
10:00-10:15	Welcome and Introduction with Dr Kate Lovett, Dean, RCPsych
	Advances in brain research
10:15-10:50	<i>Investigating neuropsychological mechanisms in depression using novel rodent models</i> Professor Emma Robinson (Bristol)
10:50-11:25	<i>Epigenetics and the challenge of chronic pain</i> Dr Sandrine <u>Géranton</u> (UCL)
11:25-12:00	<i>Experimental models of cortical rhythms: translational biomarkers for drug development for the treatment of schizophrenia</i> Professor Mark Cunningham (Newcastle)
12:00-12:45	Lunch and networking
	Teaching workshops
12:45-13:35	<i>Storytelling: the role of narrative in neuroscience</i> Dr Derek Tracy (IPPN, KCL)
13:35-14:25	<i>How to build a brain</i> Dr Gareth Cuttle (RCPsych)
14:25-14:55	Tea
14:55-15:45	<i>Mental maps and bicycle riding: the neurobiology of learning and memory</i> Dr Elisa Galliano (KCL)
15:45-16:00	Plenary
16:00	Close

Example exercise: Building Play-Doh brains

- First watch a video (speeded up here)



Insert video here: Slide 16
Making PlayDoh brain

NNCI

National Neuroscience
Curriculum Initiative

Neuroanatomy: A modern approach

- Active learning
- Team work
- Fun!



JUNE 2021



17

Neuroanatomy: A modern approach

- Active learning
- Team work
- Fun!



Insert video here: Slide 18
Men discussing model brain



Building Play-Doh brains

- Scientifically proven to educate...

Adv Physiol Educ 35: 241–243, 2011;
doi:10.1152/advan.00087.2010.

Illuminations

Active learning by play dough modeling in the medical profession

Anita Herur,¹ Sanjeev Kolagi,² Surekharani Chinagudi,¹ Manjula R.,³ and Shailaja Patil⁴

Departments of ¹Physiology, ²Anatomy, and ³Community Medicine, S. Nijalingappa Medical College, Bagalkot, Karnataka, India

Submitted 27 July 2010; accepted in final form 15 February 2011

Learning the nervous system has always been a difficult task for undergraduate students. In particular, the complexity of the system and the condensed time available present a difficult challenge. Regardless of audiovisual aids (blackboard, PowerPoint presentations, ready-made models, or CD-ROMs), deep learning is difficult to achieve. Therefore, we developed an active learning component to teach about the nervous system based on the Chinese proverb "When I hear, I forget; when I see, I remember; and when I do, I understand."

consent was obtained. Approval was obtained from the Ethical Committee of the institution.

All 100 students were first taught about the different sensory and motor tracts using the blackboard, ready-made models, PowerPoint presentations, and CD-ROMs (passive learning) during a 75-min lecture. Immediately after the lecture, the 50 students in the control group were assessed with a questionnaire of 15 questions, each scoring a maximum of 4 points, making the total maximum score achievable 60 points (Table 1). The answer to each question was

Regional networks: 'NeuroNets'

- Regional **excellence** in neuroscience and teaching
- Brain researcher—psychiatrist **collaboration**
- **Support** for trainers

In place:

- Scotland
- SW England
- Pan-Midlands
- Yorks & Humber

Coming this year:

- SE England
- Eastern England
- NW England + N. Ireland
- Wales



Local programmes by Neuro Nets

The Neuroscience in Psychiatry Course 2019 



Redwood Education Centre

To all Medical Colleagues:
We would like to invite you to NIP, a new and exciting course that has been designed to inspire collaborative learning of neuroscience concepts and shape our understanding of mental illness.

Explore The Role Of Neuroscience In Psychiatry
The course is inspired by the RCPsych Neuroscience Project, which aims to focus psychiatry training on "advances in basic and clinical neuroscience" so that psychiatrists "are better equipped to provide care in the future".

An Interactive And Innovative Teaching Programme
This is a peer-led course packed with clinically relevant teaching resources, interactive learning upon expertise from leading figures in the field. The programme includes material from the high level Neuroscience Curriculum Initiative but is highly tailored to 2gether doctors.

Not Just "Biological Psychiatry"
We'll be thinking about how neuroscience can complement our thinking about all aspects of psychiatry and clinically focussed, with skills to take to the clinic.

Three-week course by SWNeuroNet

<p>Monday 4th March, 2-5pm</p> <p>Neuroscience Refresher</p> <p>Exploring the Role of Neuroscience in Psychiatry</p> <p>Neuroanatomy Refresher</p>  <p>A Quick Guide To Research Techniques In Neuroscience</p>	<p>Monday 11th March, 2-5pm</p> <p>Applications in Clinical Psychiatry</p> <p>New Insights Into Schizophrenia And Depression</p> <p>Integrating Neuroscience Into Conversations With Patients</p> <p>Developing New Treatments</p> 	<p>Monday 18th March, 2-5pm</p> <p>The Bio-Psychosocial Interface</p> <p>Visualising Psychotherapy Through Neuroimaging</p>  <p>Epigenetics: Trauma and the Brain</p> <p>A Neuroscience Model Of Personality Disorder</p>
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Course Facilitators:

Dr George Morris, Dr Lindsey Sinclair, Dr Nik Bhandari,
Dr Emma Phillips, Dr Kim Humby, Dr Clara Martinez, Dr Adrian Yan

Recent Conference in Wales

- Free to attend

RCPsych in Wales



First Neuroscience for Wales Virtual Conference

8 June 2021

- Showcasing world-class neuroscience research in Wales
- Highlighting opportunities and sharing ideas to integrate neuroscience, psychiatry and mental health

Spring Conference 2017 – 2021

- Numbers have grown each year
- Virtual format allowed us to invite speakers from around the world



100% subsidy from Gatsby/Wellcome 50% subsidy Self-financing

Participants



Neuroscience Champions: Our ambassadors

- Scheme launched March 2019
- 28 trainees from across the UK



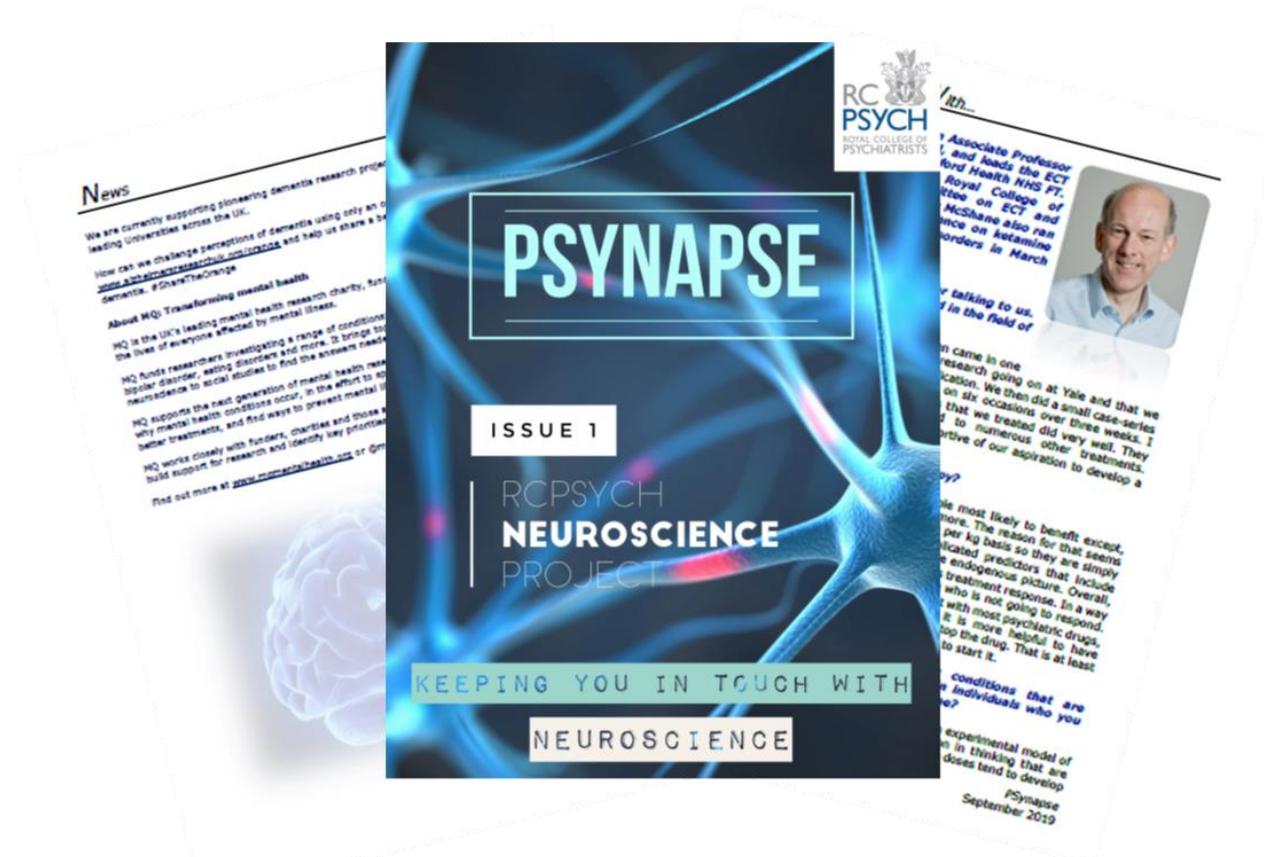
Neuroscience Champions: Activities

- **Communications:**
Newsletter co-production; cascade of inspiration, information and opportunities
- **Events development:**
Local training (Brain Camps, Neuroscience Days, short courses) with NeuroNets



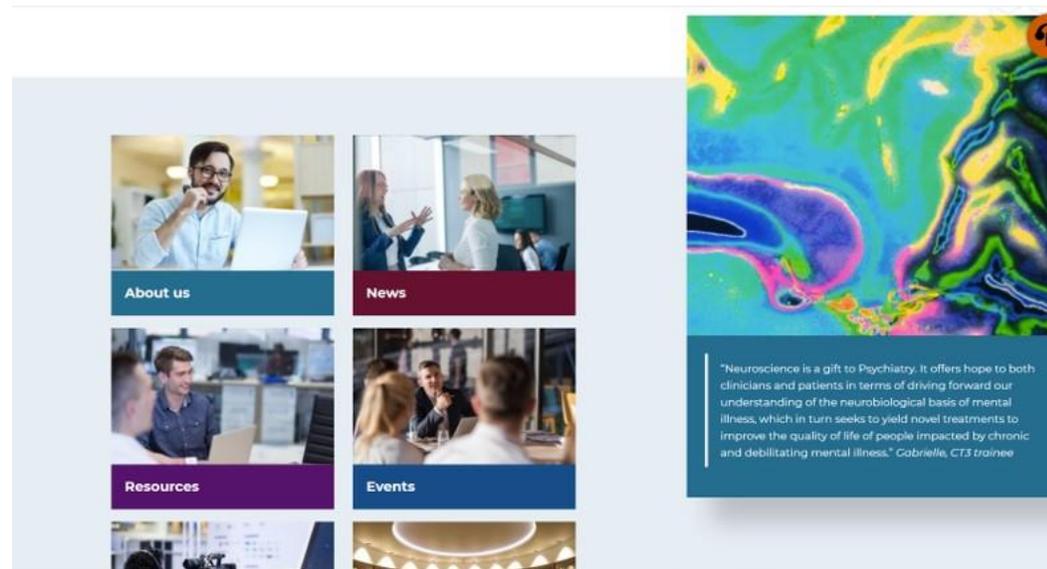
'PSynapse': Our neuroscience newsletter

- Quarterly
- Informing and keeping up-to-date



Resources on RCPsych website

- Information and education
- <https://www.rcpsych.ac.uk/training/neuroscience-in-training-project>



TrOn (Trainees Online) Updated

- RCPsych online learning resource
- Produced by higher specialist trainees and junior consultants who have recent knowledge of the examinations themselves



TrOn

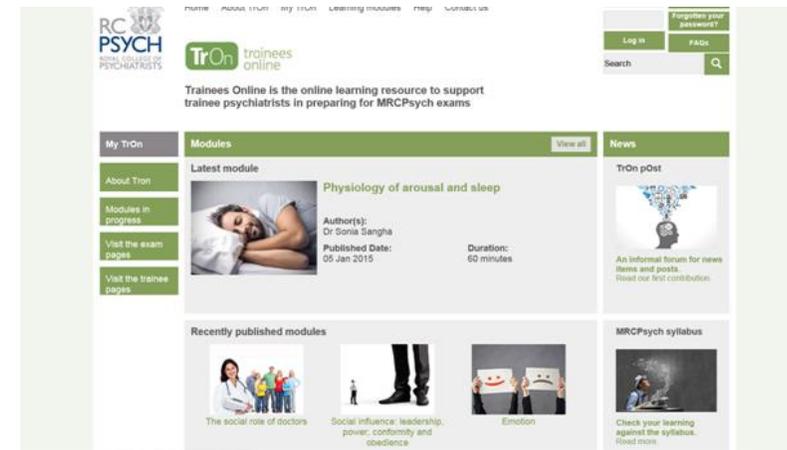
- Modules checked by an expert in the topic
- Also checked by a member of the exams committee
- Acts as an expanded syllabus for Paper A, covers the basic sciences to the standard required



The screenshot displays the TrOn (Trainees Online) website interface. At the top, there is a navigation bar with links for 'About TrOn', 'My TrOn', 'Learning modules', 'Contribute', 'Help', and 'Contact us'. The main content area features the RCPSYCH logo and the TrOn 'trainees online' branding. A 'Modules List' sidebar on the left highlights the current module, 'The development of cerebral functions'. The main content area includes the module title, author information (Dr. Deeba Parry-Gueta and Dr. Joshita Mukherjee, reviewed by Dr. Darren Carr), and a list of learning objectives. A central image shows a brain with colored regions. To the right, there are links to related articles and a 'Printable version' button. The bottom of the page shows the BJPsych logo and 'Advances' branding.

TrOn updates

- Existing modules revised, new modules commissioned
- 3 Trainee psychiatrists appointed TrOn Neuroscience Editors
- Supported by Neuroscience Project Manager



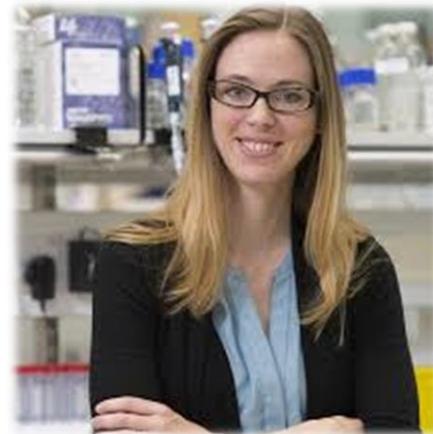
TrOn

- Free for Pre-Membership Psychiatric Trainees registered with RCPsych
- All UK trainees have to register, those from overseas can choose to register, fee depends on country of origin
- TrOn available to purchase for £50 for 12 months



- The project has used examples of recent progress in neuroscience to stimulate interest

- Dr Madeline Lancaster, University of Cambridge
- Modelling human brain development and connectivity in “mini brain” organoids’



Brain organoids

- Brain organoids are lab-grown groups of cells that self-organise to a pea-size object that resembles an organ
- She made this video about her work...





**Insert video here: Slide 35
Madeline Lancaster**



Schizophrenia and brain development

- Group from Stanford used organoids to investigate origins of schizophrenia
- <https://www.nature.com/articles/s41591-020-1043-9>

The screenshot shows the top portion of a research article page on the Nature Medicine website. At the top, there are navigation links: 'Explore Content', 'Journal Information', 'Publish With Us', and 'Subscribe'. On the right side, there are links for 'Sign Up For Alerts' and 'RSS Feed'. Below the navigation, a breadcrumb trail reads 'nature > nature medicine > articles > article'. The article title is 'Neuronal defects in a human cellular model of 22q11.2 deletion syndrome', published on 28 September 2020. The authors listed are Thomasap A. Khan, Omer Revah, and Sergiu P. Paşa. The journal information is 'Nature Medicine 26, 1888–1898(2020)'. Metrics show 7600 accesses, 4 citations, and 195 altmetric scores. The abstract section is visible, starting with '22q11.2 deletion syndrome (22q11DS) is a highly penetrant and common genetic cause of neuropsychiatric disease. Here we generated induced pluripotent stem cells from 15 individuals with 22q11DS and 15 control individuals and differentiated them into three-dimensional (3D) cerebral cortical organoids. Transcriptional profiling across 100 days showed high reliability of differentiation and revealed changes in neuronal excitability-related genes. Using electrophysiology and live imaging, we identified defects in spontaneous neuronal activity and calcium signaling in both organoid- and 2D-derived cortical neurons. The calcium deficit was related to resting membrane potential changes that led to abnormal inactivation of voltage-gated calcium channels. Heterozygous loss of'. On the right side of the article, there is a box for 'Access this article via Royal College of Psychiatrists' with a button for 'Access through your institution' and a 'Change institution' field. Below this, there are tabs for 'Sections', 'Figures', and 'References'. The 'Sections' tab is active, showing a list of links: Abstract, Data availability, References, Acknowledgements, Author information, Ethics declarations, Additional information, Extended data, Supplementary information, and Rights and permissions.

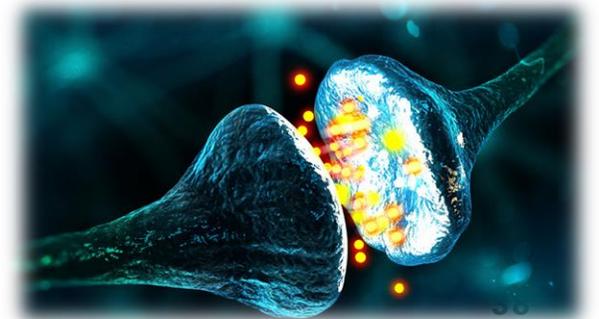
Schizophrenia and brain development

- One in every 3,000 people carries the genetic defect called 22q11.2 deletion syndrome, or 22q11DS
- People carrying 22q11DS are at a 30-fold risk for schizophrenia compared with the general population
- 30%—40% of individuals with this deletion receive a diagnosis of autism spectrum disorder early in their lives



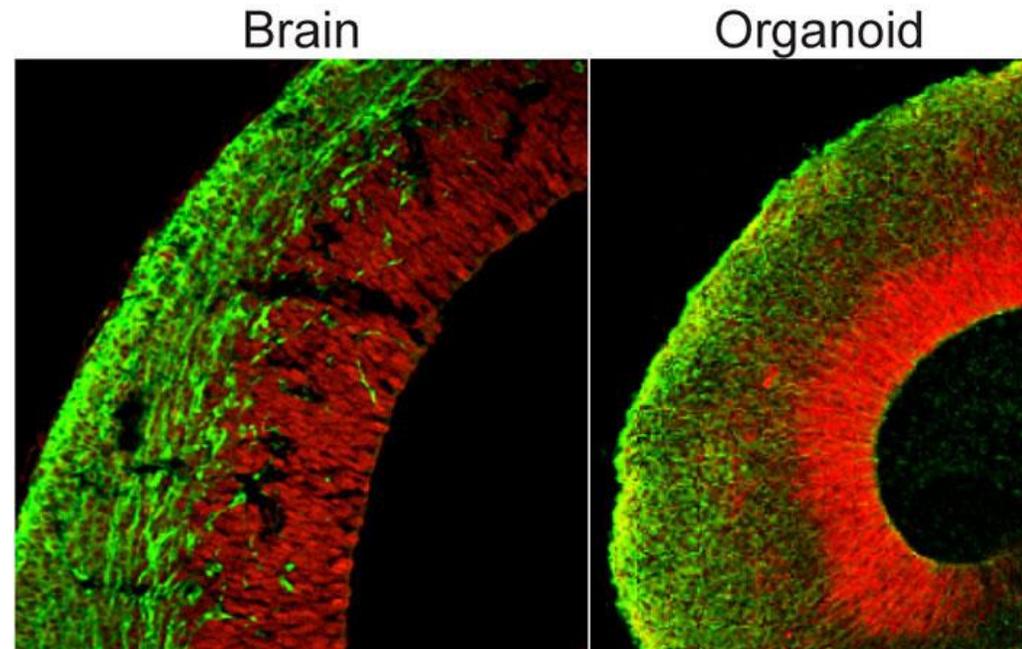
Schizophrenia and brain development

- Brain organoids generated from skin cells taken from 15 different 22q11DS carriers and 15 healthy control subjects
- Cortical neurons derived from 22q11DS carriers were more excitable, spontaneously fired 4 times as frequently as controls
- Treating these neurons with antipsychotic drugs reversed the defects in resting membrane potential and calcium signalling, and prevented these neurons from being so excitable



Brain organoids

- Work on these will enable better understanding of mental illnesses and then will lead to better treatments



- Professor Karl Deisseroth
- Talk at Neuroscience Spring Conference 2021: Inner workings of channelrhodopsins and brains: a new way of looking at the mind in action
- What happens in the brain during dissociation?



Dissociation

- Strange, common and important experience
- Feeling of disconnection from thoughts, feelings, memories, and surroundings
- Causes include PTSD, drugs, trauma, epilepsy
- “If my mind is a car, I’m in the passenger seat watching myself driving”



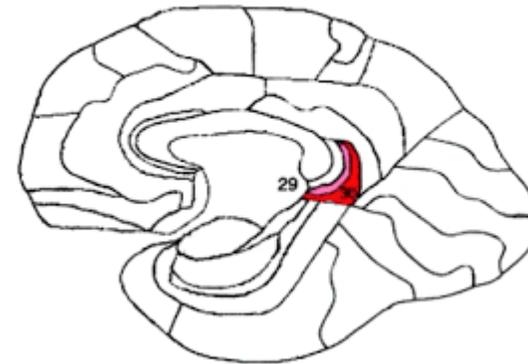
Dissociative state explored in mice

- Used ketamine or phencyclidine
- Imaging of neural activity showed these dissociative agents elicited a 1–3-Hz rhythm in layer 5 neurons of the retrosplenial cortex



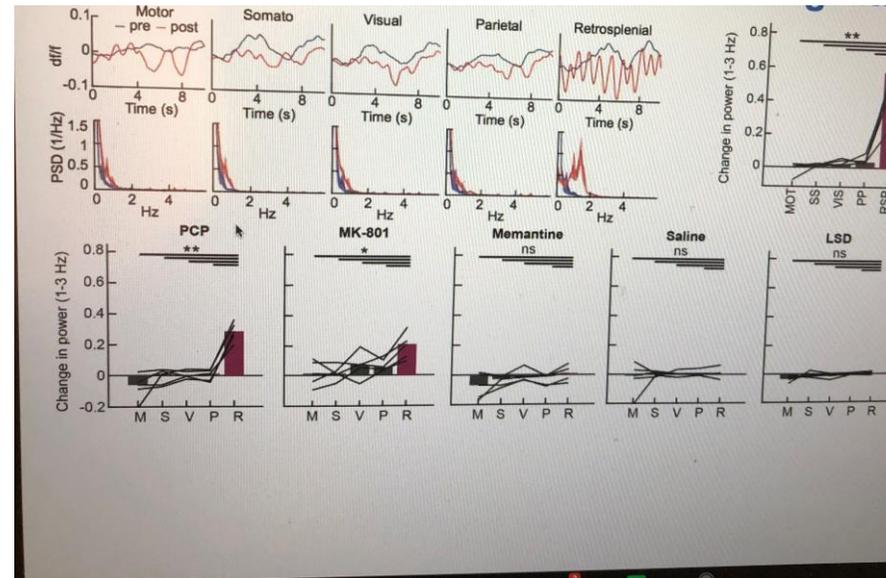
The Retrosplenial Cortex (RSC)

- RSC is a cortical area in the brain comprising Brodmann areas 29 and 30
- It is secondary association cortex, making connections with numerous other brain regions



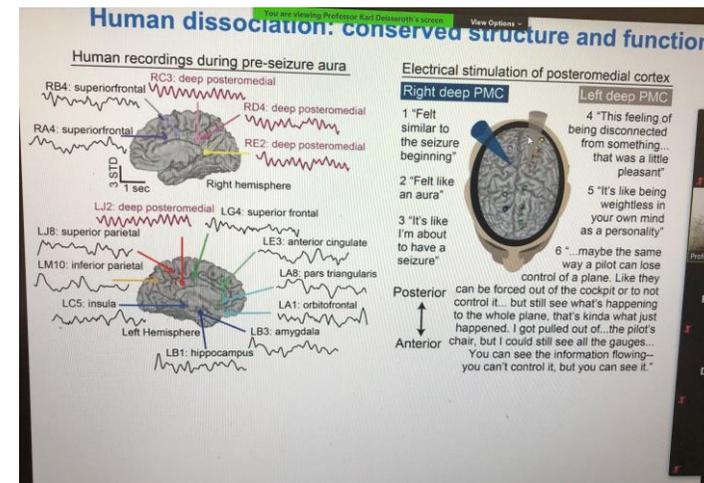
Dissociative states in mice

- Electrophysiological recording showed rhythmic coupling of the retrosplenial cortex with thalamus circuitry, but uncoupling from most other brain regions was observed



Patient with focal epilepsy

- Simultaneous intracranial stereoencephalography recordings from across the brain found a similarly localised rhythm in the homologous deep posteromedial cortex
- Correlated with pre-seizure self-reported dissociation
- Local, brief electrical stimulation of this region elicited dissociative experience



- <https://web.stanford.edu/group/dlab/media/papers/vesunaNature2020.pdf>
- Understanding the physical processes that underly dissociation will help us to find new treatments

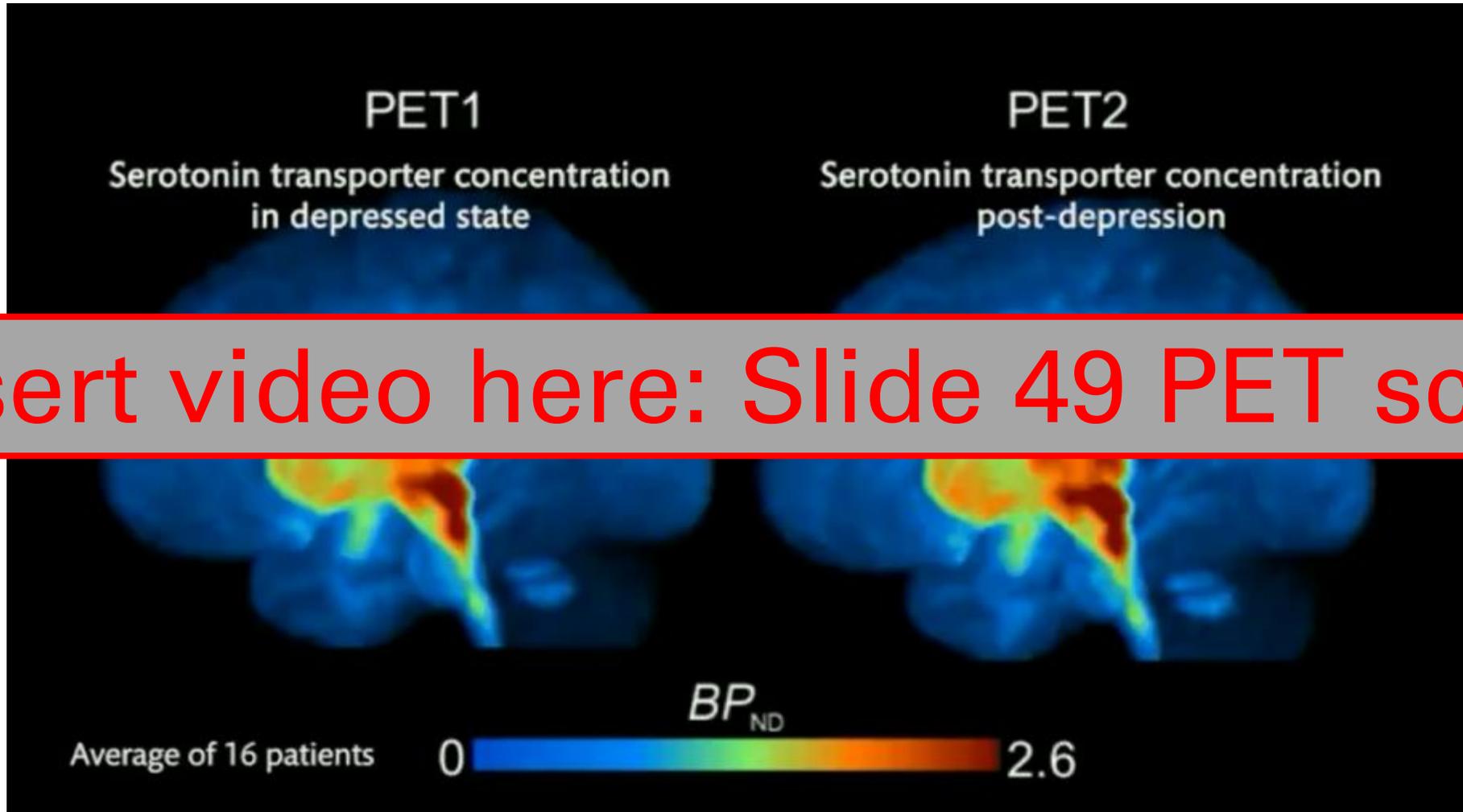
Serotonin transporter availability increases in patients recovering from a depressive episode

- Jonas E. Svensson, Cecilia Svanborg, Pontus Plavén-Sigray, Viktor Kaldo, Christer Halldin, Martin Schain & Johan Lundberg
- *Translational Psychiatry*
<https://www.nature.com/articles/s41398-021-01376-w>



Used positron emission tomography (PET) scanning

- Looked at levels of 5-HTT, the serotonin transporter
- 5-HTT is the target of many antidepressant medications of the SSRI and tricyclic antidepressant classes
- Measured in depressed, medication-free patients before and after CBT
- Prior to treatment, the individuals with depression had roughly the same average level of 5-HTT as a control group of 17 healthy individuals
- Levels of 5-HTT in those with depression were on average 10% higher after three months' treatment



Insert video here: Slide 49 PET scan

Conclusions

- Neuroscience is advancing rapidly
- We will see major advances in the coming years
- Psychiatrists need to have an understanding of the basics so that they can integrate neuroscience into their clinical practice as these advances are made



- Thanks to Dr Gareth Cuttle, Project Manager



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- Twitter @wendyburn

