brainbox
initiative

23

Virtual Conference.

22nd-25th September

Welcome: Andrew Thomas, Brainbox Ltd.

Welcome to the Brainbox Initiative Conference 2020

Firstly, may I start by wishing everyone all the best in these challenging times.

This year is the fourth year of the Brainbox Initiative Conference and our tenth year as a company, and what a year it's been. Over the last seven months we have all had to make enormous adjustments to what we do and the way we do it. We have all had to think laterally about how to continue to work in challenging, socially distanced circumstances, but we have all adapted incredibly and everyone's resourcefulness has been truly amazing.

However, challenging times can provide us with new opportunities, and as result of social distancing and travel restrictions, we were forced to rethink our in-person workshops to work in the virtual world and as a result we have run an incredibly successful programme of online webinars. Since April, the Brainbox Initiative Webinar series has delivered over 40 online seminars to over 4,000 delegates. These webinars filled the hole left by the cancellation of the workshops and enabled the Brainbox Initiative to broaden the range of topics, delivered by some fantastic speakers and allowed us to reach researchers across the world.

brainbox initiative

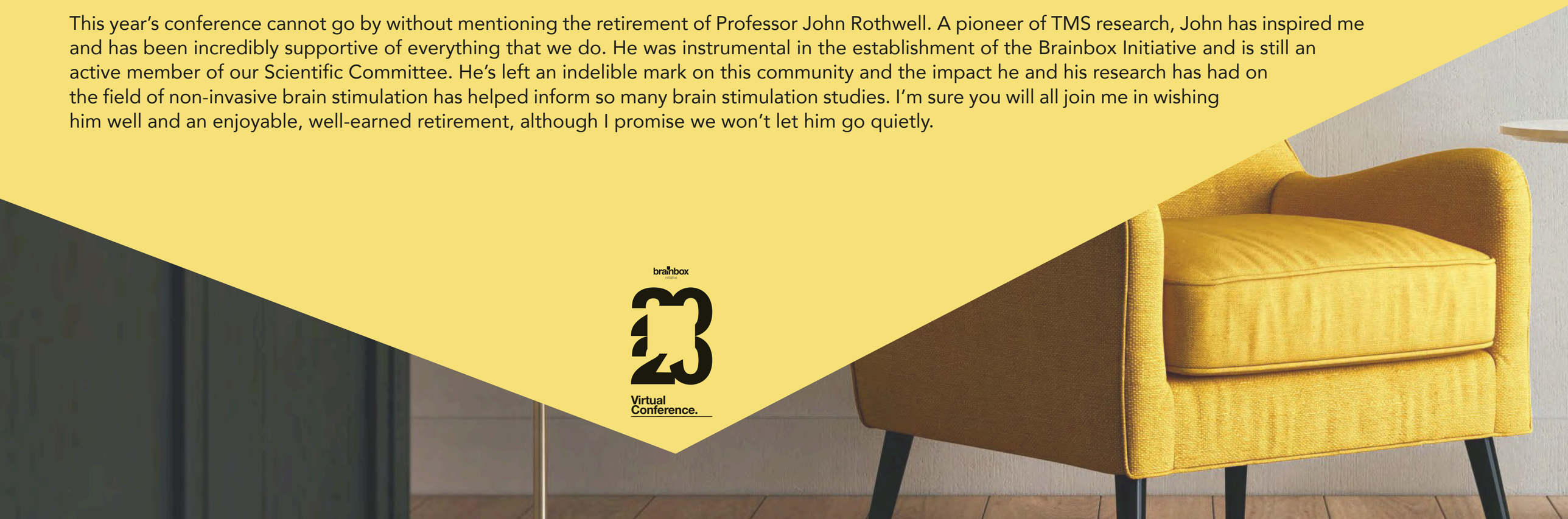
Virtual Conference.

Welcome

The last 12 months have also seen the launch of the Brainbox Initiative Forum; a discussion room for the NIBS community to engage constructively with each other and share ideas, present data, solve problems and advertise and find new positions. You will have the opportunity to experience this forum site as part of this conference as the Forum will be hosting researchers and their posters that are featured over the next four days, and I strongly recommend you go and engage with the presenters, we have tried to do our best to allow these researchers to present and talk about their research.

I'm also especially delighted to announce that this year's conference will feature a dedicated day on Focused Ultrasound Stimulation (FUS). This fascinating technique has enormous potential offering researchers an unprecedented level of spatial resolution and the ability to reach deeper brain structures.

This year's conference cannot go by without mentioning the retirement of Professor John Rothwell. A pioneer of TMS research, John has inspired me and has been incredibly supportive of everything that we do. He was instrumental in the establishment of the Brainbox Initiative and is still an active member of our Scientific Committee. He's left an indelible mark on this community and the impact he and his research has had on the field of non-invasive brain stimulation has helped inform so many brain stimulation studies. I'm sure you will all join me in wishing him well and an enjoyable, well-earned retirement, although I promise we won't let him go quietly.



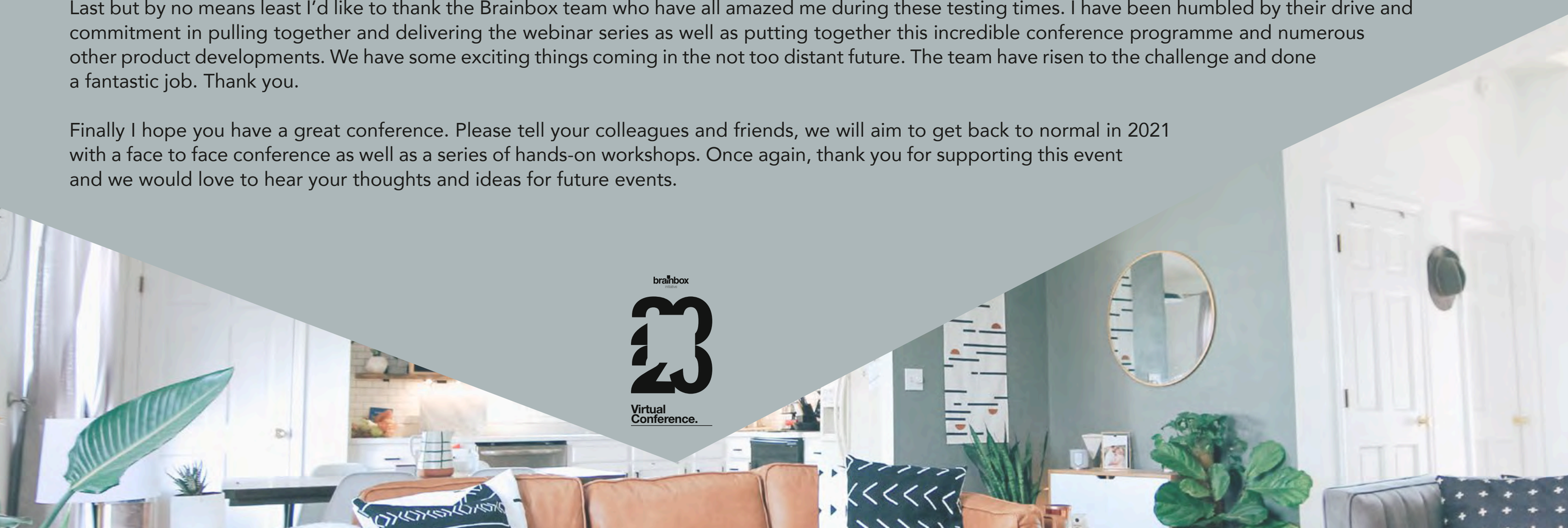
Welcome

I'm extremely excited about this year's conference. Transforming the physical event into a virtual conference presented us with the opportunity to experiment with content and format. We have been amazed with the level of engagement and I would like to take this opportunity to thank you all for your continued support of the Initiative and what it is trying to do, thank you.

I'd also like to thank the Scientific Committee, without whom we couldn't do any of this, for their valuable time and continued support and ideas. Without their involvement this conference wouldn't be the event that it is.

Last but by no means least I'd like to thank the Brainbox team who have all amazed me during these testing times. I have been humbled by their drive and commitment in pulling together and delivering the webinar series as well as putting together this incredible conference programme and numerous other product developments. We have some exciting things coming in the not too distant future. The team have risen to the challenge and done a fantastic job. Thank you.

Finally I hope you have a great conference. Please tell your colleagues and friends, we will aim to get back to normal in 2021 with a face to face conference as well as a series of hands-on workshops. Once again, thank you for supporting this event and we would love to hear your thoughts and ideas for future events.



Professor Charlotte Stagg, University of Oxford

Welcome to the Brainbox Initiative Conference 2020

Over the last few years the Brainbox Conference has been a highlight of the year for me, and to judge by the number of familiar faces each year for many others as well. I am delighted to be Chairing it this year: Brainbox is always an amazing, vibrant meeting with so many rising stars presenting novel, exciting and ground-breaking work. I am delighted to be able to do a small part to support the wonderful early career researchers who make the meeting what it is (and learn a lot along the way). This year, of course, the conference will be different in venue – we'll be spread around the world drinking our own coffee and missing the excellent lunches that were always a part of the experience. However, the conference is the same in intent: to give you a chance to interact, explore new things, and be inspired. We have taken advantage of the new opportunities virtual events allow to invite leading speakers from around the globe; and encourage you to ask questions, chat off-line and quiz the poster presenters with the same interest and enthusiasm as you would over that glass of wine in London.

Who knows what the next year will bring, but whatever happens, we hope you enjoy Brainbox 2020, and look forward to seeing you again in 2021!

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Virtual Conference.

Keynote Speaker: Professor Colleen Hanlon

Talk Title: Oops.. I did it again: Using TMS as a tool to prevent Relapse to Alcohol Drinking

Dr. Colleen A. Hanlon is a professor in the Department of Cancer Biology at Wake Forest University Health Sciences, wherein she leads a new Electromagnetic Therapeutics Research Program. The majority of her research is focused on developing evidence-based TMS protocols which may be useful therapeutic tools for patients struggling with addiction. She leads 3 NIH-suported R01 awards and is part of two NIH centers interested in translating preclinical brain stimulation knowledge into a treatment that can be delivered to patients with alcohol and substance use disorders. She was honored with the Early Career Investigator award from the National Institute of Drug Abuse. I am the senior author on the first "Consensus Paper" published by a group of over 70 scientists from over 10 countries outlining the path forward for Non-Invasive Therapeutic Development for Addiction.

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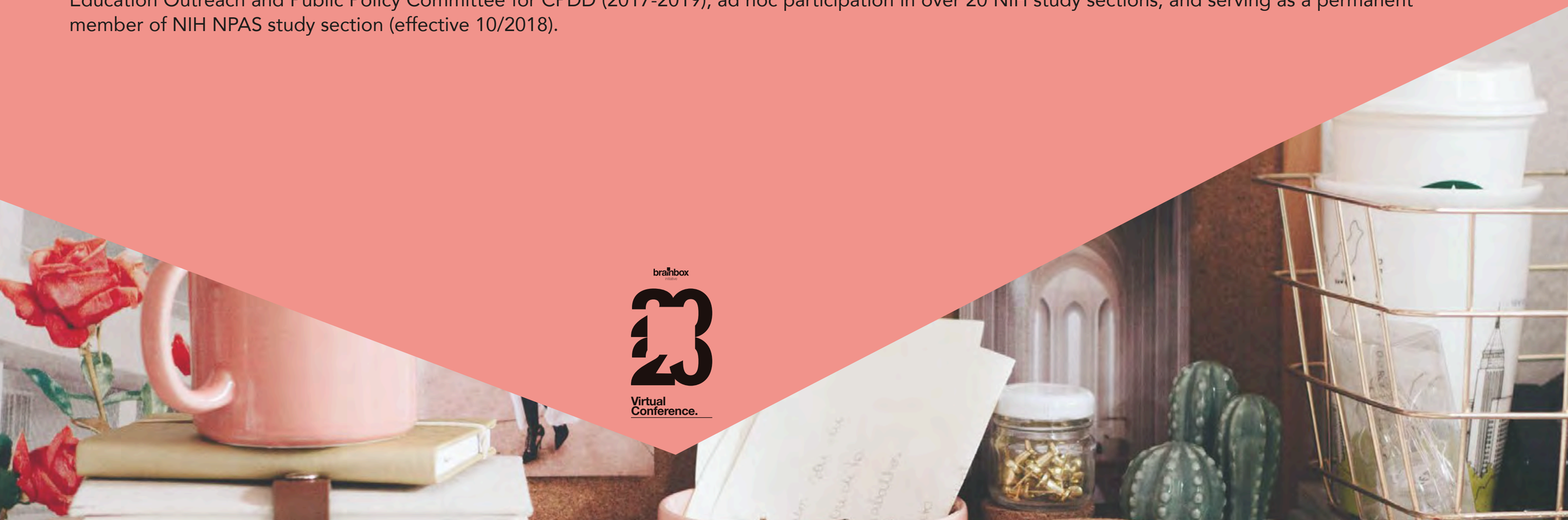
Virtual Conference.

Keynote Speaker: Professor Colleen Hanlon

She loves science and being a scientist (!!) – the process and the privilege. Perhaps more than the actual data analysis and writing however, she is finds a unique joy in mentoring and nurturing the creative ideas among her students and her colleagues. She participates in the research training and education community at both a local level (serving as a mentor to over 50 medical, graduate, post-graduate, and fellowship trainees since 2005 on a national and international scale) and national level. She has directed the Advanced TMS Training Course sponsored by the National Center for Neuromodulation for Rehabilitation, and continues to be involved in their research dissemination efforts through teaching and management of their social media presence. She has led an annual addiction outreach event at the College of Problems on Drug Dependence (CPDD) meeting (2015-2019), served on the Liaison Committee (2016-2019) and the Education and Training Committee (2019-present) for the American College of Neuropsychopharmacology, Grassroots Advocacy Team for the Society for Neuroscience (2017-2019), Chair of the Education Outreach and Public Policy Committee for CPDD (2017-2019), ad hoc participation in over 20 NIH study sections, and serving as a permanent member of NIH NPAS study section (effective 10/2018).



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Virtual Conference.

Keynote Speaker: Dr William ‘Jamie’ Tyler

William (Jamie) Tyler is an associate professor in the School of Biological and Health Systems Engineering at Arizona State University. His group's primary research and development interests focus on developing and applying noninvasive neuromodulation methods and devices intended to optimize human performance and health. In addition, Tyler is a co-founder of IST a private neurotechnology company. Over the past decade he has led the development of electrical and ultrasonic neuromodulation methods for the regulation of autonomic nervous system and brain circuit activity to regulate arousal, affect, attention, learning, sensory transduction, pain, and sleep/wake cycles.

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Virtual Conference.

Keynote Speaker: Professor Dr Agnes Flöel

Talk Title: Modulation of memory consolidation via oscillatory brain stimulation during sleep

Prof. Flöel is the Director of the Department of Neurology at the University Medicine Greifswald, and Head of the Laboratory for Cognitive Neurology at the University Medicine of Greifswald. The Department of Neurology treats around 8000 patients yearly, including 1000 patients with neurodegenerative diseases, on in- and out-patient based platforms.

Prof Flöel has conducted studies on healthy individuals and patients with neurodegenerative diseases (subjective cognitive decline, mild cognitive impairment, Alzheimer's dementia) since 1999, ranging from epidemiological and cross-sectional cohorts to proof-of-concept studies and Phase III randomized controlled clinical trials. These studies aimed at elucidating the mechanisms underlying healthy and pathological aging, employing a large range of neuroscientific tools (neuropsychology, functional and structural magnetic resonance imaging, electroencephalography; demographic data including information on nutrition, physical activity and cognitive activity). Interventions encompass pharmacological and nutritional approaches, as well as noninvasive brain stimulation (transcranial magnetic stimulation, electrical brain stimulation).

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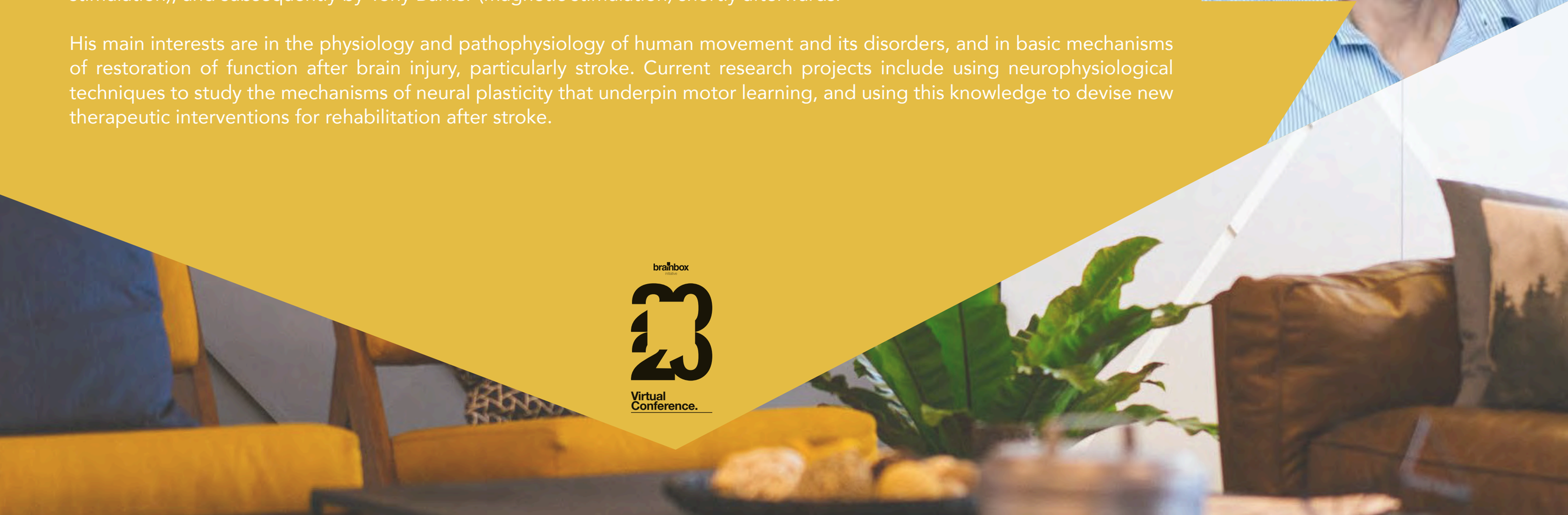
Virtual Conference.

Keynote Speaker: Professor John Rothwell

Professor John Rothwell has recently retired from his position as Professor of Human Neurophysiology at UCL Institute of Neurology.

After his initial degree in Natural Sciences (mainly neurophysiology) at Cambridge University, he studied for a PhD on (the now forgotten area of) Long Latency Stretch Reflexes in London under Professor David Marsden. Long latency reflexes were the first method of probing cortical control of movement in humans, and it was a lucky chance that he could then move seamlessly into the new area of transcranial brain stimulation that was pioneered initially by his old Cambridge tutor, Pat Merton (electric stimulation), and subsequently by Tony Barker (magnetic stimulation) shortly afterwards.

His main interests are in the physiology and pathophysiology of human movement and its disorders, and in basic mechanisms of restoration of function after brain injury, particularly stroke. Current research projects include using neurophysiological techniques to study the mechanisms of neural plasticity that underpin motor learning, and using this knowledge to devise new therapeutic interventions for rehabilitation after stroke.



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Virtual Conference.

Dr Ronan Mooney, Johns Hopkins University

Talk Title: Neurophysiological correlates of motor skill stability

Ronan received his Ph.D in Exercise Science with a specialization in Movement Neuroscience under the supervision of Prof Winston Byblow from the University of Auckland (Auckland, New Zealand) in 2019. He is currently a Postdoctoral Research Fellow under the mentorship of Dr. Pablo Celnik in the Department of Physical Medicine and Rehabilitation at Johns Hopkins University School of Medicine (Baltimore, Maryland, USA). In his research Ronan uses various non-invasive brain stimulation techniques to further understand the neurophysiological mechanisms underlying motor skill learning and motor recovery after neurological injury.

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Virtual Conference.

Dr Eleanor Cole, Stanford University

Talk Title: Optimizing TMS for Treatment-Resistant Depression

Dr Eleanor Cole is a postdoctoral scholar at Stanford University and Director of the rTMS lab at the Wu Tsai Neuroscience Institute. Dr Cole completed her PhD in Cognitive Neuroscience and Neuroimaging at The University of York in the UK where her PhD research included transcranial magnetic stimulation (TMS) projects in adults with autism spectrum disorder (ASD). Dr Cole's current research is focused on developing and optimizing novel TMS protocols to treat psychiatric conditions including depression and examine the neural basis of response. Alongside her research at Stanford, Dr Cole is an active member of the TMS in Autism Consensus Group and her next postdoctoral position involves developing TMS protocols aimed at alleviating difficulties experienced by individuals with ASD.

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Virtual Conference.

Dr Alberto Lazari, University of Oxford

Talk Title: Modulating long-range connectivity through cortico-cortical paired associative TMS

Alberto Lazari is a postdoctoral Research Associate at University of Oxford, where he completed his PhD in Neuroscience. Alberto's research focusses on the mechanisms of physiology and plasticity in myelinated long-range projections between brain areas. To study this, he uses functional and structural neuroimaging in combination with dual-site TMS to assess and modulate connectivity between areas in the motor network.

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Virtual Conference.

Dr Bettina Schwab, University Medical Center Hamburg-Eppendorf

Talk Title: Modulation of functional connectivity by dual-site tACS

Bettina Schwab is currently a postdoctoral fellow at the University Medical Center Hamburg-Eppendorf and a fellow at the Institute for Advanced Study Berlin, Germany. With a background in physics and computational neuroscience, she combines experiment and modeling, aiming at a mechanistic understanding of human neurophysiology. Specifically, her interest is brain stimulation to modulate neural activity and functional connectivity between distant brain areas. In particular, Bettina investigates how stimulation may be used to gain insights into the network pathophysiology of neurological disorders such as Parkinson's disease. She is also deeply interested in the physiology of the motor system and basal ganglia in general, including electrophysiology and neural network dynamics.

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Virtual Conference.

Dr Carys Evans, University College London

Talk Title: Modulation of functional connectivity by dual-site tACS

My main research aim is to explore interventions in pathology and healthy ageing. During my PhD and postdoctoral research, I have focused on upper limb impairments following stroke and whether motor skill learning can be enhanced with brain stimulation. Currently, I am investigating how cortical excitability changes after stroke and whether brain stimulation can reliably enhance brain plasticity when dose-controlled. My postdoctoral research has also explored how effects of brain stimulation on mood and emotion processing might differ depending on individual differences.

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Virtual Conference.

Dr Justin Riddle, University of North Carolina at Chapel Hill

Talk Title: Investigating the causal role of phase amplitude coupling in different components of hierarchical cognitive control using cross-frequency tACS

Justin Riddle is a post-doctoral fellow at the University of North Carolina at Chapel Hill and the Scientific Director of the Carolina Center for Neurostimulation. Justin is using simultaneous neuroimaging and brain stimulation to study the neural basis of cognitive control. Cognitive control is impaired in patients with psychiatric illness. A better understanding of the brain activity patterns that implement cognitive control will enable novel therapeutic interventions for psychiatry. In Flavio Frohlich's lab, Justin is using novel transcranial alternating current stimulation (tACS) techniques such as cross-frequency tACS to delineate the role of phase-amplitude coupling in dimensions of cognitive control. Justin is currently working on projects using concurrent electroencephalography (EEG) with rhythmic transcranial magnetic stimulation (TMS) to target neural oscillations during retro-cue working memory. Justin also uses electrocorticography (ECoG) and rhythmic direct cortical stimulation in collaboration with Haewon Shin at the Department of Neurology. In the long term, Justin is passionate about realizing a future for psychiatry in which non-invasive brain stimulation is integrated with present interventions of psychotherapy and pharmacology.

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Virtual Conference.

Dr Sangjin Yoo, Caltech

Talk Title: Biomolecular mechanisms of ultrasonic neuromodulation

Dr Sangjin Yoo completed his PhD in bio and brain engineering at KAIST in the South Korea, and this PhD research included development of photothermal stimulation technique for reversibly suppress the neural activity. He is currently a postdoctoral researcher under the supervision of Prof. Mikhail G. Shapiro in Division of Chemistry and Chemical engineering at Caltech. His current research is focused on investing the mechanisms of ultrasonic neuromodulation and developing sonogenetics for non-invasive and safe control of neural activity. Alongside his research at Caltech, Dr Yoo is a selected investigator in NARSAD program aimed at providing key guidelines for human applications.

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Virtual Conference.

Dr Sara Tremblay, University of Ottawa

Talk Title: Molecular brain imaging to study the neural mechanisms of theta burst stimulation

Sara Tremblay is a scientist at the Royal's Institute of Mental Health Research in Canada and an assistant professor at the Université du Québec en Outaouais. She obtained her Ph.D. in Neuropsychology in 2015 at Université de Montréal, where her research explored for biomarkers of sport concussions using neuromodulation and neuroimaging. She completed postdoctoral fellowships at University College London (UK) under the mentorship of Prof. John Rothwell and at the Center for Mental Health and Addiction (Canada), under the mentorship of Dr. Jeff Daskalakis. She is currently developing a translational neuromodulation research program that involves research development of methods and clinical applications for therapeutic interventions. Specifically, she uses multimodal measures, such as combined transcranial magnetic stimulation and electroencephalography (TMS-EEG) and positron emission tomography (PET), to further our understanding of the neural mechanisms of action of neuromodulation. She is also using these tools to optimize neuromodulation treatments for mental health disorders and develop biomarkers of response to treatment.

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Virtual Conference.

Dr Vera Mateus, Mackenzie Presbyterian University

Talk Title: Neural processing of observed and executed motor actions in 6-month-old infants: An fNIRS study

Dr Vera Mateus is a Post-Doc fellow in the Graduate Program on Developmental Disorders and the Cognitive and Social Neuroscience Lab, at the Mackenzie Presbyterian University, São Paulo, Brazil.
Dr Mateus' research interests are focused on infant and children's sociocognitive development, in typical and at-risk samples (e.g., prematurity), and the influence of parent-infant/child interactions. Currently, Dr Mateus uses functional near-infrared spectroscopy (fNIRS) to evaluate infant's neural processing of social stimuli (e.g., touch, perception of motor actions) and its contribution to socio-emotional development during the first year of life.

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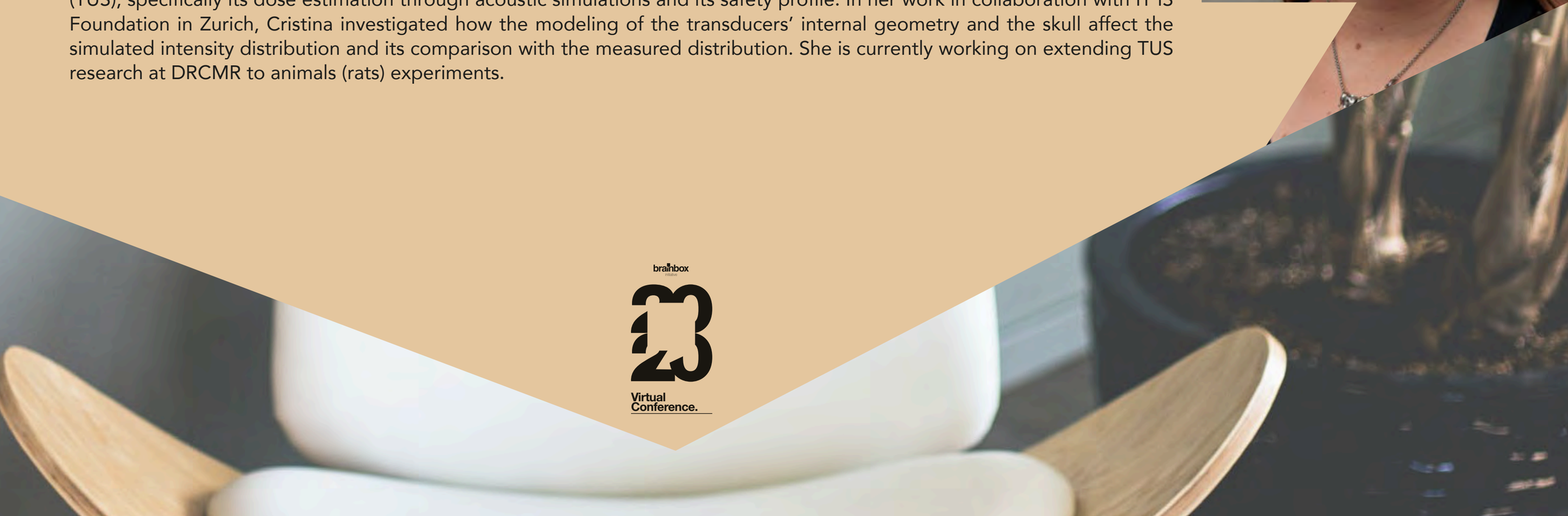
Virtual Conference.

Dr Cristina Pasquinelli, DRCMR

Talk Title: Transducer and skull modelling in acoustic simulations for transcranial ultrasound stimulation

Cristina Pasquinelli completed her PhD in the Department of Health Technology at the Technical University of Denmark (DTU) in 2019 under the supervision of Associate Professor Axel Thielscher. During her PhD she spent one year in the Brain/Bio Medical Microsystems Lab headed by Hyunjoo Jenny Lee at the Korea Advanced Institute of Science and Technology (KAIST). She was also affiliated at the Danish Research Centre for Magnetic Resonance (DRCMR), where she now works as a postdoctoral researcher in Thielscher's Neurophysics group. Her main research topic is transcranial ultrasound stimulation (TUS), specifically its dose estimation through acoustic simulations and its safety profile. In her work in collaboration with IT'IS Foundation in Zurich, Cristina investigated how the modeling of the transducers' internal geometry and the skull affect the simulated intensity distribution and its comparison with the measured distribution. She is currently working on extending TUS research at DRCMR to animals (rats) experiments.



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Virtual Conference.

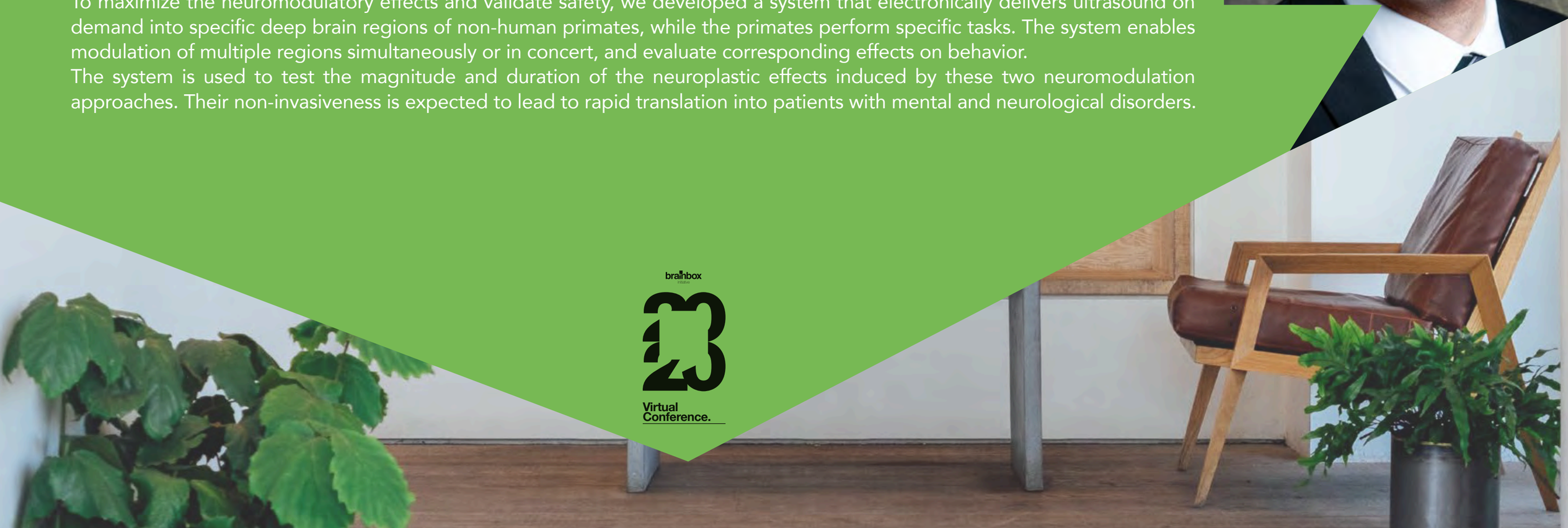
Dr Jan Kubanek, University of Utah

Talk Title: Deep brain ultrasonic modulation in behaving primates

Ultrasonic waves enable entirely noninvasive modulation of deep brain neural circuits. The interventions include direct modulation of neural activity by the mechanical aspect of ultrasound waves, and remote release of neuromodulatory drugs from nanoparticle carriers activated by ultrasound. Both approaches use ultrasound intensities below the FDA limits and are considered safe. Recent studies showed that these approaches induce lasting neuroplastic effects, specifically in the target circuits, and therefore have unique potential in treating malfunctioning deep brain circuits in mental and neurological disorders.

To maximize the neuromodulatory effects and validate safety, we developed a system that electronically delivers ultrasound on demand into specific deep brain regions of non-human primates, while the primates perform specific tasks. The system enables modulation of multiple regions simultaneously or in concert, and evaluate corresponding effects on behavior.

The system is used to test the magnitude and duration of the neuroplastic effects induced by these two neuromodulation approaches. Their non-invasiveness is expected to lead to rapid translation into patients with mental and neurological disorders.



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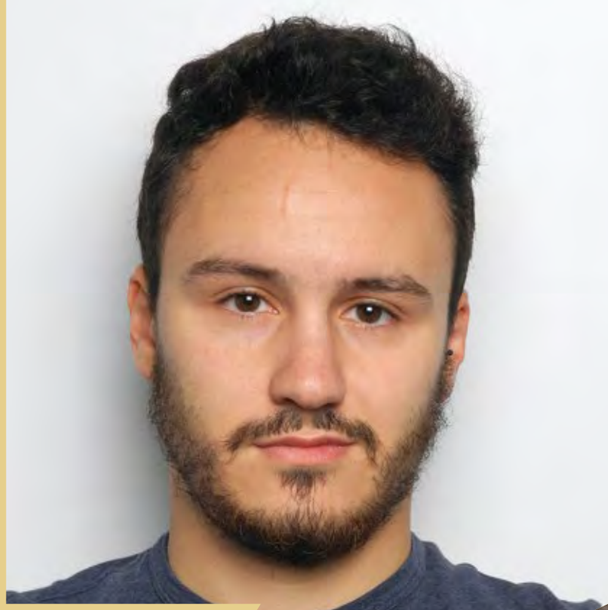
Virtual Conference.

Dr Davide Folloni, University of Oxford Young Investigator Award Winner

Dr. Davide Folloni is interested in understanding the architecture and functional dynamics of the neural circuits supporting learning and decision making. Its research uses a multi-modal approach to describe the anatomy, organization and neural activity of higher-order brain networks. Specifically, he uses transcranial focused ultrasound stimulation in combination with functional Magnetic Resonance Imaging to manipulate the activity of subcortical and cortical brain structures and causally infer their role in normal and abnormal cognitive computations underlying decision-making. His goal is to exploit the non-invasive and reversible properties of ultrasound to bridge the gap between animal and human research and help developing novel brain stimulation interventions for psychiatric and neurological diseases



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Virtual Conference.

Dr Bradley Treeby, University College London

Talk Title: Computational Methods for Dosimetry

I am a Professor of Biomedical Ultrasound in the Department of Medical Physics and Biomedical Engineering at University College London (UCL). My research sits at the interface between physical acoustics, biomedical ultrasound, numerical methods, and high-performance computing. In particular, I am interested in developing fast and accurate models of how ultrasound waves travel through the human body. This involves studying many interesting acoustic phenomena from a physical perspective, and then devising novel ways in which these can be captured by a numerical model. Much of my work has been released as an open-source acoustics toolbox for MATLAB called k-Wave.

My current EPSRC-funded research projects are related to therapeutic applications of ultrasound in the brain. The goals of this work are to: (1) develop a novel hardware platform for targeted ultrasonic neuromodulation in the deep brain, (2) to develop fast predictive models that can be used for treatment planning based on deep learning, and (3) to develop a regulatory compliant clinical user interface for the software. I work with a multidisciplinary team, and actively collaborate with researchers from a range of backgrounds, including mathematics, physics, computer science, radiology, haematology, oncology, and neurology. I teach the acoustics of ultrasound as part of the Department's undergraduate and masters courses, and I am the admissions tutor for the Department's Biomedical Engineering degrees.

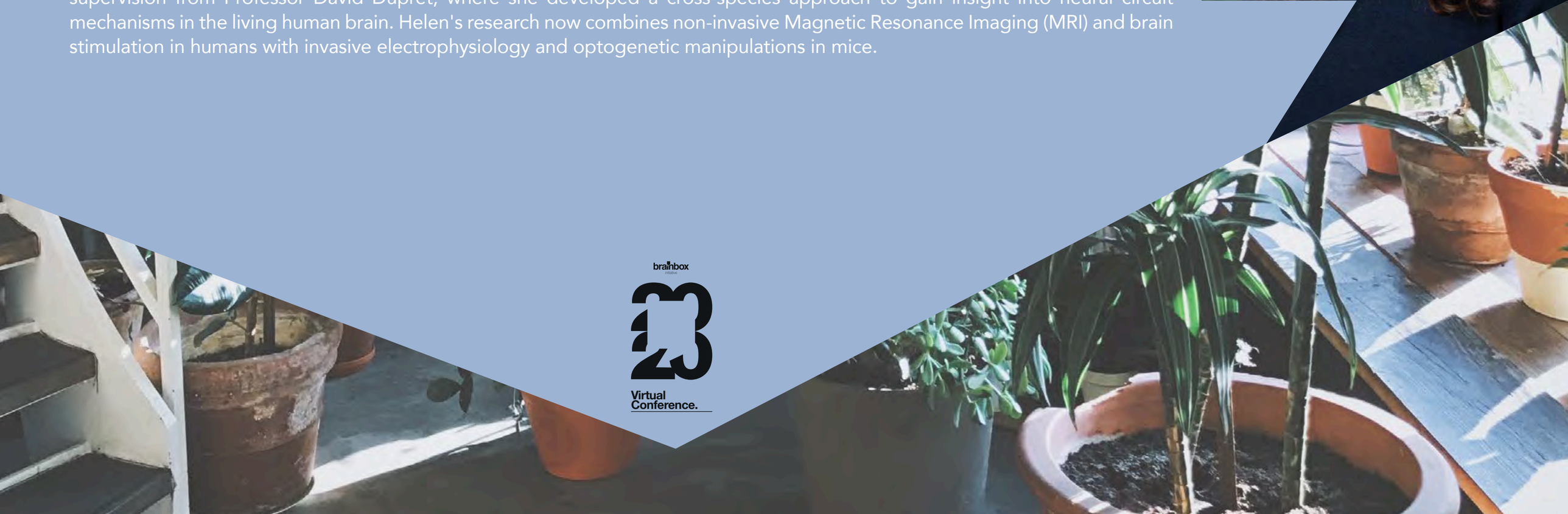
brainbox initiative

Virtual Conference.

Dr Helen Barron, University of Oxford

Talk Title: Neuronal computation underlying inferential reasoning in humans and mice

Helen Barron is a postdoctoral researcher at the MRC Brain Network Dynamics Unit, University of Oxford. Her research focuses on investigating how memories support adaptive behaviour, with particular interest in the interaction between the hippocampus and neocortex and the role of inhibition. Before moving to Oxford in 2015, Helen studied Natural Sciences (MA Cantab) at the University of Cambridge followed by a 4-Year MRC funded PhD program in Neuroscience at University College London (UCL) under supervision from Professors Tim Behrens and Ray Dolan. She then completed a Junior Research Fellowship under supervision from Professor David Dupret, where she developed a cross-species approach to gain insight into neural circuit mechanisms in the living human brain. Helen's research now combines non-invasive Magnetic Resonance Imaging (MRI) and brain stimulation in humans with invasive electrophysiology and optogenetic manipulations in mice.



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Virtual Conference.

Dr Lucia Li, Imperial College London

Talk Title: Investigating how Brain State, Polarity and White Matter Structure Shapes Brain Network Effects of tDCS

Dr Lucia Li is based at Imperial College, London. In September 2017, Dr Lucia Li submitted a poster at the BrainBox Initiative conference for which she was awarded the BrainBox Initiative poster prize.

During her medical training at Cambridge, Dr Lucia Li became very interested in the scientific and clinical aspects of traumatic brain injury. In particular, Dr Li wanted to explore ways to improve functional outcomes after this common and devastating condition. She has recently completed a body of work as part of her PhD at Imperial College London, exploring the use of transcranial direct current stimulation (tDCS) for cognitive rehabilitation after traumatic brain injury.

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Virtual Conference.

Dr Ronak Patel, Imperial College London

Talk Title: The Impact of Transcranial Direct-Current Stimulation on Surgical Performance

Ronak is a surgical registrar and a PhD candidate of Imperial College London. He received his BSc (Neuroscience) and MBChB degrees from the University of Bristol. He has recently published reviews on the impact of tDCS on motor skills and on fNIRS responses. His research is now focusing on tDCS-led effects on technical skills and the corresponding cortical activation responses in surgeons.

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Virtual Conference.

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