Duke Institute for Brain Sciences

2018 Germinator Award Recipients: Investigators & Project Synopses

Investigators	*Project Synopsis*
Christina Bejjani and **Tobias Egner**, Psychology & Neuroscience (P&N), Center for Cognitive Neuroscience (CCN); **John Pearson**, Biostatistics & Bioinformatics and CCN; **Terrie E. Moffitt**, P&N, Psychiatry & Behavioral Sciences, Center for Genomic & Computational Biology (CGCB); Social Behaviour & Development, King's College, London; **Avshalom Caspi**, P&N, Psychiatry & Behavioral Sciences, CGCB; Social Behaviour & Development, King's College, London; and **R. Alison Adcock**, P&N, CCN, Psychiatry & Behavioral Sciences	***Toward a Computational Psychiatry of Transdiagnostic Deficits in Cognitive Control*** This research project brings together the fields of psychiatry, developmental psychology, machine learning, biostatistics, cognitive psychology, and neuroscience with a goal of improving diagnosis and treatment of psychiatric disorders. The team will use computational psychiatry, a relatively new field described by the National Institute of Mental Health as, "analytical approaches for the prediction of risk and treatment response and the understanding of the pathophysiology underlying mental disorders." This could provide alternative methods of diagnosis, currently based primarily on external observed behaviors and self-reporting.
Lysianne Beynel, **Nathan Kimbrel**, **Greg Appelbaum**, Psychiatry & Behavioral Sciences; **Simon Davis**, Neurology	***Effect of Connectivity-based rTMS and State-Dependency on Amygdala Activation*** Post-traumatic stress disorder (PTSD) is can be highly debilitating, with low response rates to pharmacological treatment. Repetitive transcranial magnetic stimulation (rTMS), which uses magnetic fields to affect the brain, has demonstrated only modest efficacy. The shallow penetration of rTMS is insufficient to directly affect deep brain structures such as the amygdala, the brain area affected in PTSD. This team seeks to improve the therapeutic efficacy of rTMS for PTSD by reaching the amygdala indirectly, through its connections to other brain regions. Successful completion of this project could lead to significant long-term contributions to both clinical applications and mechanistic understanding of brain/behavior relationships. The project will involve Duke School of Medicine and the Durham VA Health Care System.
Nicholas Grebe and **Christine Drea**, Evolutionary Anthropology	***Eulemur as a Primate Model for Oxytocin System Evolution and Function*** Among closely related group-living primates of the genus *Eulemur* (lemurs, native to Madagascar), some male and female lemurs form monogamous pair bonds; others mate with multiple partners. This unique behavior may be related to the mammalian neuropeptide oxytocin, which facilitates formation and maintenance of social bonding. Being able to assess the comparative neuroendocrinology of pair-bonding in *Eulemur* will offer significant insights on how this neuropeptide works. This non-invasive research is a collaboration involving Evolutionary Anthropology and Biology and the Research Division of the Duke Lemur Center. It represents a new program of lemur brain science with potential implications for human behavior.
Kevin LaBar, P&N, CCN; **Simon Davis**, Neurology; **Andrada Neacsiu**, Psychiatry & Behavioral Sciences; **John Powers**, P&N	***Testing a Neurocognitive Model of Emotional Distancing Using Transcranial Magnetic Stimulation*** Emotion regulation is a core component of therapeutic approaches to alleviate distress associated with psychiatric disorders. Distancing is an

	emotion regulation strategy that relies on self-projection, or the ability to shift perspective from the here and now to a simulated time, place, or person. The team has developed a new model of the neurocognitive processes that contribute to distancing as a successful emotion regulation strategy. We aim to test this model using transcranial magnetic stimulation (TMS) in healthy adults.
Rosa Li, Duke Center for Interdisciplinary Decision Science, DIBS	***A Flexible Neural Framework for Decision-Making Across Human Development: Testing the Influence of Information and Arousal*** Prevailing neural models of decision-making across human development propose that risk-taking peaks in adolescence due to a unique adolescent imbalance between cognitive control via the prefrontal cortex and reward-processing via limbic regions. Though such dual-systems models seem to fit neural data, they have not generated behavioral predictions borne out in the laboratory. One theory is that they fail to account for differences between laboratory and daily decisions related to relative levels of information available and arousal, or attentiveness. Dr. Li, a postdoctoral fellow, hypothesizes a more flexible neural model would yield better information to help understand adolescent neural circuitry and decision-making.
Marc A. Sommer and **Martin O. Bohlen**, Biomedical Engineering	***Virally Mediated Transduction of Light-Sensitive Ion Channels in Brainstem Motoneurons of Macaques*** This project will apply optogenetics, a biological technique to control neurons by using light, to non-human primates, with a goal of understanding more completely how nerve cells drive muscle activity. That could lead scientists to the ability to manipulate neuromuscular circuitry in non-human primates, an outcome that holds potential benefit to humans with neuromuscular diseases such as multiple sclerosis. The project also has a substantial education component for graduate students and medical students studying “Brain and Behavior” at Duke.
Amol Yadav, postdoctoral associate, **Muhammad Abd-El-Barr**, and **Nandan Lad**, Neurosurgery; **Tim Sell**, Orthopedic Surgery; **Paul Howell**, Durham VA Health Care System, Physical Medicine and Rehabilitation Services	***Restore Tactile Sensation and Proprioception in Lower Limb Amputees Using Epidural Spinal Cord Stimulation*** Amputation of a lower limb hinders movement significantly. Modern prosthetic leg technology helps, but cannot duplicate the ability of the human leg to relay vital sensory information to the brain about the body’s surroundings, nor can it address the often-intense “phantom pain,” which is pain felt in missing limbs, likely generated by the brain and spinal cord. A team of neurosurgeons, physical therapists, and rehabilitation medicine experts will work with amputees using spinal-cord stimulation to generate missing sensory information. The goals are to improve rehabilitation and control phantom pain. The project will involve the Duke School of Medicine and the Durham VA Health Care System.