玉川大学脳科学研究所講演会（社会神経科学研究拠点主催）

社会神経科学研究拠点の講演会として2023年11月までに5件の講演会を開催した。本年はHuman Brain Science Hallにて対面での開催とし、加えてオンライン配信も行った。オンラインの場合、遠方の参加者でも気軽に参加できるというオンラインの強みを活かし、多くの方に参加いただいた。講演を通じて最先端の知見を得て、研究内容に関する議論も行うことができた。

（玉川大学脳科学研究所　高岸治人）

日時：2023年2月21日（火）15：00–16：30
場所：玉川大学HBSH棟1Fレクチャールーム（ハイブリッド開催）
講演者：鈴木真介先生（一橋大学　ソーシャル・データサイエンス教育研究推進センター・教授）
講演タイトル：Reinforcement learning in obsessive-compulsive and gambling disorders
講演内容：In this talk, I will present my recent work that elucidates neurocomputational mechanisms of reinforcement learning in patients with obsessive-compulsive and gambling disorders (OCD and GD, respectively). Compared with healthy controls, patients with OCD learned less from worse-than-expected outcomes, with attenuated representations of the negative reward prediction error in the dmPFC and dorsal striatum. Furthermore, patients with GD exhibited excessive/deficient learning from better/worse-than-expected outcomes, respectively, reflecting the enhanced representation of positive reward prediction error in the insula. These findings provide a potential account of abnormal compulsive behaviors in those mental disorders.

日時：2023年3月31日（金）15：00–16：30
場所：玉川大学HBSH棟1Fレクチャールーム（ハイブリッド開催）
講演者：Uri Maoz, Ph.D.（Assistant Professor, Chapman University Visiting Assistant Professor, UCLA Visiting Associate, Caltech）
講演タイトル：Emerging from Libet's shadow–new developments in the neuroscience of volition: the readiness potential, timing the onset of the conscious intentions to move, and arbitrary and deliberate decisions
講演内容：Exactly 40 years ago, Libet and colleagues demonstrated that the onset of brain activity that has been commonly associated with voluntary, spontaneous action (the readiness potential, RP) precedes the reported onset of the conscious decision to move (W time). Many took this result as evidence that consciousness plays no causal role in decision making and action formation. This, if true, has serious repercussions for social pillars like free will and moral responsibility. However, the seminal Libet results have come under severe methodological and conceptual criticism. Still, they left the neuroscience of volition with three key debates. The first relates to the nature of the RP. Does it reflect preparation to move, or is it a byproduct of an autocorrelated accumulation-to-bound process, backward averaged from movement onset (recent reinterpretation)? The second debate focuses on the best way to measure W time, if it is at all possible. The third relates to the generalizability of the Libet results from arbitrary decisions, which were the historical focus of the neuroscience of volition, to deliberate ones, which are at the heart of discussions

related to free will and moral responsibility. Below we discuss some of our recent results, which bear upon all three debates.

日時：2023 年 4 月 19 日（水）15：00–17：00
場所：玉川大学 HBSH 棟 1F レクチャールーム（ハイブリッド開催）
講演者：Alain Dagher, MD（モントリオールマギル大学（Professor））
講演タイトル：Obesity and Brain–Bidirectional Influences
講演内容：The regulation of body weight relies on homeostatic mechanisms to initiate and terminate food intake. However, there is growing evidence that higher-level cognitive function may also influence energy balance. For instance, research has shown that BMI is consistently linked to neuroanatomical, cognitive and personality measures implicating executive systems.
I will suggest that prefrontal systems involved in executive and inhibitory control act to limit food overconsumption when food is scarce or expensive, but promote over-eating when food is abundant, an optimum strategy from an economic standpoint. I will also present contradictory evidence showing that neurocognitive correlates in obesity may be a consequence not a cause.
Finally I will review evidence that chronic adiposity leads to cerebrovascular dysfunction, cortical atrophy, and cognitive impairment. I will conclude by reviewing evidence that treatment of obesity in adults may reverse these effects and prevent later development of dementia and cerebrovascular disease.

日時：2023 年 7 月 27 日（木）16：00–17：30
場所：玉川大学 HBSH 棟 1F レクチャールーム（ハイブリッド開催）
講演者：Jerome N. Sanes 先生（Department of Neuroscience, Robert J. & Nancy D. Carney Institute for Brain Science, Brown University）
講演タイトル：Light intensity coding in the human prefrontal cortex
講演内容：Light intensity affects mood and cognition in humans and experimental animals, and a distinctive component of retinal output encodes absolute light intensity in the visual environment. This pathway derives largely from melanopsin-expressing intrinsically photosensitive retinal ganglion cells (ipRGCs). These cells innervate multiple subcortical targets and drive diverse physiological effects of light including circadian entrainment, pupillary reflexes, neuroendocrine and sleep modulation, along with retinal and visual brain development. A relatively direct pathway to the medial frontal cortex in mice appears to mediate depression-like symptoms. Using functional magnetic resonance imaging, we have now determined that regions in the human prefrontal cortex code light intensity, and that these regions appear to operate independently of occipital regions that also have light intensity sensitivity. Furthermore, the response properties of the prefrontal regions have similarity to physiological responses of ipRGCs, suggesting that the photic information to the prefrontal cortex that codes mood has independence from the retinal-geniculate-striatal pathway. Since some of the prefrontal regions having light intensity sensitivity overlap with regions implicated in depression, we also examined whether seasonal-affective disorder and major depressive disorder modified prefrontal responses to different illumination levels. While people with depression exhibited light intensity coding in the prefrontal cortex, we did find a region in the inferior frontal cortex with differential light intensity coding between healthy controls and depressed patients. From these experiments, we have provided evidence that supports the use of light therapy for depression disorders.

日時：2023 年 8 月 7 日（月）15：00–16：30
場所：玉川大学 HBSH 棟 1F レクチャールーム（ハイブリッド開催）
講演者：Barbara Feulner 先生（Aignostics GmbH, Berlin）
講演タイトル：Sensory feedback can drive adaptation in motor cortex and facilitate generalization
講演内容：Experimental and computational studies

suggest that motor cortex acts as a feedback controller, allowing for 'on-the-fly' movement corrections in response to afferent sensory feedback. However, it remains unclear whether feedback control relates to longer-term learning, and how this would be implemented in neural circuitry. Here, we tackled these questions by testing how a recurrent neural network (RNN) can use feedback to control its own output, and whether this process can enable learning. We built an RNN that received feedback signaling the error between its intended and observed output. An initial training phase that required producing a broad range of outputs (i.e., 'movements') enabled the model to learn to use this feedback to correct its output on-the-fly. After constructing this RNN, we tested directly whether the feedback signal used for online output correction could enable learning by guiding synaptic plasticity in the recurrent connections within the network. We devised a biologically plausible plasticity rule where the recurrent weight changes were proportional to the error feedback signals received by the postsynaptic neurons. This simple rule allowed the network to adapt to persistent perturbations (e.g., a 'visuomotor rotation') by changing its initial output pattern, a process that was mediated through recurrent connectivity changes. Remarkably, the model learned in a way that was similar to adaptation studies in humans [1,2]: i) learning generalized to non-learned but similar movements [1] and ii) followed multiple learning timescales [2]. When we examined the network activity before and after adaptation, we found a signature of our learning rule that was also present in neural population recordings from monkey motor cortex (data from [3]). In short, this work links computational models of motor control and learning to a biologically plausible implementation in neural circuitry, thus offering the potential to guide future experimental studies on the neural basis of motor learning.

References: [1] Krakauer et al., 2000, J Neurosci, [2] Smith et al., 2006, PLOS Biol., [3] Perich et al., 2018, Neuron