associated with synaptic functions and movement disorders. Results gained from scTRAP-seq and subsequent validations identified novel cell types in corticostriatal circuits involved in motor learning, and provided mechanistic insights into pre- and postsynaptic genes that regulate synaptic plasticity induced by motor learning.

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P1455 / #4293

Topic: AS09 Motor and Sensory Systems

CORTEX-WIDE MECHANISM OF REINFORCEMENT SIGNALING VIA A CHOLINERGIC PATHWAY

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Reward and punishment powerfully inform ongoing behaviors and drive learning throughout the brain, including the neocortex. Yet it remains elusive how these global signals reach the cortex, how they are represented there and how they impact local cortical computations. To address these questions, we used 3D random-access two-photon microscopy to monitor neural activity in dozens of cortical areas while mice performed simple auditory decision tasks. We found that VIP and SOM interneurons were recruited differently by reinforcers during the initial learning procedure. The amplitude of the reward response and the responses to predictive cues were modulated by reward expectation. The rapid, cortex-wide activation of most VIP interneurons upon reinforcement decreased when mice learned the task. This change was mirrored in the acetylcholine release recorded at the vicinity of the VIP cells, implying that this neuromodulator may be responsible for the transmission of reinforcement signals. We suggest that this acetylcholine-dependent global response mode of VIP cortical inhibitory neurons provides a cell-type-specific circuit mechanism by which organism-level information about reinforcers regulates local circuit processing and plasticity.

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P1456 / #755

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A NEURAL CIRCUIT FOR DESCENDING PAIN MODULATION

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Trigeminal neuropathic pain is a debilitating condition, and its treatment is not satisfactory. Despite advances in the neurobiological basis of such pain, the underlying brain neural circuit mechanisms remain poorly understood. In the present study, we employed a cutting-edge approach called “Targeted Recombination in Active Populations (TRAP)” to identify brain neurons specifically activated by peripheral trigeminal nerve injury, and we observed that the neurons in the parasubthalamic nucleus (PSTN) are activated by chronic constriction injury of the infraorbital nerve (CCI-ION). Using anterograde and retrograde viral tracing, we revealed that PSTN neurons project to dorsal raphe nucleus (DRN). Optogenetic activation of the PSTN-DRN pathway inhibits CCI-ION-induced trigeminal neuropathic pain. Moreover, intra-DRN injection of MK-801 diminishes the modulatory effect of PSTN-DRN pathway activation on the trigeminal neuropathic pain. Thus, our results suggest that the neural circuit from PSTN to DRN is critical for descending pain inhibition, which could be targeted to develop an effective neuromodulation therapy for such pain.

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Topic: AS09 Motor and Sensory Systems

MODULATORY EFFECTS OF ANODAL TRANSCRANIAL DIRECT CURRENT STIMULATION (TDCS) ON SOMATOSENSORY GATING IN PATIENTS WITH FIBROMYALGIA SYNDROME

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Several studies have demonstrated a reduced habituation to redundant somatosensory stimuli (i.e., an impaired sensory gating) in Fibromyalgia Syndrome (FMS). In this sense, anodal transcranial direct current stimulation (tDCS) has been shown to modulate the early and late stages of somatosensory processing, generating functional and structural changes. The aim of the present study was to examine the modulatory effects of anodal tDCS applied over the left primary somatosensory cortex on sensory gating in FMS patients. Thirty-nine female right-handed FMS patients aged between 43 and 71 years (mean 55.56 ± 7.85) participated in the study. Participants were randomly assigned to the active anodal tDCS (n = 17) or non-electrical stimulation (SHAM; n = 22) conditions. Before and after tDCS stimulation, somatosensory evoked potentials (SEPs) were

recorded during a paired-pulse paradigm, which consisted in two identical somatosensory stimuli (S1 and S2) applied in the right forefinger in rapid succession duration; 100ms; inter-stimulus interval: 550 ± 50ms). P50, N100 and the Late Positive Complex (LPC) components of the SEPs were analyzed. Whereas P50 and N100 were unaltered after stimulation, a significant modulatory effect of anodal tDCS on sensory gating (S1 – S2) in the LPC component was found. This effect resulted in a widespread enhanced sensory gating in the right hemisphere (contralateral to the stimulation), as well as a surprisingly worsened gating in the left hemisphere (ipsilateral to the stimulation). Although the above reported lateralizing pattern remains to be clarified, present results suggest brain excitability and somatosensory processing may be modulated by using anodal tDCS in FMS patients.

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P1458 / #1964

Topic: AS09 Motor and Sensory Systems

DYNAMICS OF VISUAL REPRESENTATIONS IN PRIMARY VISUAL CORTEX OF MICE DURING RIVALROUS STIMULUS PRESENTATION

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Binocular rivalry occurs in human and non-human primates when the two eyes are presented with conflicting images in the binocular visual field. Instead of generating a subjective experience of a merged image, the perceived image alternates coherently between the stimulus presented to one eye or the other. Electrophysiological and imaging studies have provided evidence that the image which is dominant during binocular rivalry is determined by both bottom-up and top-down factors. Here we study binocular rivalry as a paradigm to investigate top-down regulation of visual representations in the sensory cortex. Until now, binocular rivalry has not been comprehensively described in rodents which, if they exhibited rivalry, would allow a more in-depth understanding of the circuit mechanisms of this phenomenon. In this study, we develop an experimental approach to assess binocular rivalry in mice while functionally imaging and decoding the activity of the sensory cortex. A mirror system was used to present binocularly matched or mismatched drifting gratings, natural images or natural movies to awake head fixed mice, while neural activity was monitored in the primary visual cortex using 2-photon calcium imaging. Visual cortex representations were decoded using support vector machine. Consistent with previous reports we found that most binocular neurons responded preferentially to binocularly matched grating stimuli. We also observed that in general the input driven by the contralateral eye dominated the visual cortex representation unless stimulus contrast was controlled to counteract this. Consistent with a rivalry-like process, we observed that during presentation of conflicting stimuli, visual cortex representations are less predictable than during presentation of binocularly matched stimuli. During mismatched presentations, representations were also often highly similar to those elicited by monocular presentation of one of the two rivalrous stimuli. These results are consistent with a rivalry-like process occuring at the level of primary visual cortex in mice.

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P1459 / #1461

Topic: AS09 Motor and Sensory Systems

ELECTROENCEPHALOGRAM ANALYSIS OF FINGER PROPRIOCEPTION IN HEALTHY SUBJECTS

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Proprioception enables us to perceive the position and movement of our body parts, which is essential for motor control and performance. In this study, we investigated the neural processing underlying proprioception using electroencephalogram (EEG) signals during Crisscross, a robotic proprioception task. Nine healthy adults (aged 22-34) performed the task with their right-hand during EEG acquisition. In the Crisscross task, a robot crossed the index and middle fingers in an alternating flexion/extension pattern with vision of the hand occluded. Participants performed Crisscross in two modes; the Non-Button Pressing mode, (CC-NBP), where participants simply relaxed the fingers as the robot moved them, and the Button Pressing mode (CC-BP), where participants additionally pressed a button when they perceived their fingers were overlapped. We analysed the Event-Related Potential (ERP) of EEG data at the instance of movement onset and of button pressing, and compared responses when participants were actively engaged in making decisions based on proprioception (CC-BP) to when they were not (CC-NBP). In both conditions, we observed a positive ERP in the P3 channel that was significantly larger in the CC-PB condition (MWU, $p < 0.001$), indicating this response is modulated by participants attending to proprioceptive information. In the CC-BP condition observed a Contingent Negative Variation (CNV) in the Cz channel that was time-locked to movement onset and peaked in magnitude at button-press, suggesting that it is associated with the proprioceptively-driven decision of when to press the button. Finally, both responses were larger when the robot moved the fingers at high speed (36 deg/s) compared to slow speeds (16 deg/s, $p = 0.03$). These EEG features provide insight into proprioceptive processing in healthy individuals, and allow us to assess sensorimotor function at the neural level. Future work will study these responses in post-stroke individuals to better understand sensorimotor deficits.

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