IN BRIEF

NEURAL CIRCUITS

Flowing with the visual stream

The pulvinar is a higher-order thalamic nucleus in the human visual system whose role is poorly understood. Anatomical circuit mapping and high-density electrophysiology of the mouse homologue of this region (lateral posterior thalamic nucleus (LP)) revealed three functionally distinct subregions. Silencing LP inputs from the superior colliculus (SC) or primary visual cortex (V1) revealed that V1 input drives visual responses in anterior LP, whereas SC input drives visual responses to object motion in posterior LP, with motion-related information primarily routed to visual areas in the ventral stream, rather than those in the dorsal stream (as in primates).

ORIGINAL ARTICLE Bennett, C. et al. Higher-order thalamic circuits channel parallel streams of visual information in mice. *Neuron* https://doi.org/10.1016/j.neuron.2019.02.010 (2019)

NEURAL CIRCUITS

Double satiety

A satiety circuit involving agouti-related peptide (AGRP)-expressing neurons in the arcuate nucleus (ARC) and neurons in the paraventricular nucleus of the hypothalamus (PVH) expressing the melanocortin 4 receptor (MC4R) and single minded 1 (SIM1) helps to control food intake in response to caloric deficiency. Using genetically enabled circuit mapping and real-time chemogenetic techniques, the authors found a class of anatomically and functionally distinct SIM1$^+$ PVH neurons that express dynorphin and regulate satiety in an additive manner with MC4R$^+$ PVH neurons.

ORIGINAL ARTICLE Li, M. M. et al. The paraventricular hypothalamus regulates satiety and prevents obesity via two genetically distinct circuits. *Neuron* https://doi.org/10.1016/j.neuron.2019.02.028 (2019)

SENSORY NEUROSCIENCE

Listening to vibrations

In mammals, physical vibrations in the environment are sensed by Pacinian corpuscles, which in mice forelimbs are located in deep tissue next to bones. Activation of these receptors triggers responses in the primary somatosensory cortex (S1). Two-photon imaging of the responses of layer 2/3 neurons in the contralateral forelimb S1 to a high-frequency vibrational stimulus showed that S1 spike rates were selectively tuned to stimulus features and specific combinations of frequency and amplitude of vibration. S1 encoding of high-frequency vibration frequency is similar to sound pitch representation in auditory cortex.

ORIGINAL ARTICLE Prsa, M. et al. Feature-selective encoding of substrate vibrations in the forelimb somatosensory cortex. *Nature* **567**, 384–388 (2019)

NEURODEGENERATIVE DISORDERS

Traumatized brains

Chronic traumatic encephalopathy (CTE) is a neurodegenerative tauopathy that occurs following repetitive traumatic head injury. Electron microscopy revealed the structure of tau filaments sampled from the brains of three sportspeople with CTE to be the same across these individuals but different from tau structures in other tauopathies such as Alzheimer disease. Unlike in other tauopathies, CTE tau filaments formed hydrophobic cavities containing non-proteinaceous molecules, indicating that distinct conformers of assembled tau underlie different neurodegenerative diseases.

ORIGINAL ARTICLE Falcon, B. et al. Novel tau filament fold in chronic traumatic encephalopathy encloses hydrophobic molecules. *Nature* https://doi.org/10.1038/s41586-019-1026-5 (2019)

CEREBRAL CORTEX

Conversational control in singing mice

Turn-taking and the rapid adaptation of an individual's actions to respond appropriately to those of their social partner are key components of many social interactions, including human conversation. Okobi, Banerjee et al. now demonstrate the role of the motor cortex in the precise timing of complex acoustic exchanges in 'singing' mice.

Our understanding of the neural basis of human social exchange has been limited, in part, by the scarcity of animal models that can mimic the features and complexities of human conversation. The authors here propose a new rodent model of vocal communication: Alston's singing mouse is a native of Central American cloud forests that communicates with its social partners through a rapid exchange of 'songs', the timing of which resembles human conversation.

The authors found that the acoustic characteristics of the songs produced by an individual mouse were highly stereotyped when recorded in isolation. However, when the same mouse (the 'recruit') was transferred into a room in which they could hear, but not see, a 'resident' mouse, it sang more often and its songs were more variable. Moreover, in order to engage in coordinated turn-taking, the recruit mice were able to precisely start and stop their songs to avoid overlap with the resident's songs.

The authors next sought to identify the neural mechanisms responsible for such 'countersinging' and found that intracortical microstimulation of the orofacial motor cortex (OMC) activated the jaw muscles involved in song production. Thermoelectric cooling of the OMC slowed cortical dynamics and led to prolonged songs without dilating individual notes. Furthermore, electrical stimulation of this region briefly 'paused' spontaneous singing, with mice picking up at the point in the song sequence at which they had stopped when the stimulation was removed.

These findings indicated that the OMC controls the timing of singing rather than the song structure, which may be generated by subcortical circuits. This suggests that the OMC might contribute to the effects of social interaction on song timing. Indeed, the authors found that muscimol-induced inhibition of the OMC reduced responses to playback of a conspecific mouse's song.

This study provides evidence for an executive role of the motor cortex in the rapid and precise control of vocal responses, enabling social exchange. Comparative studies are required to determine whether similar control mechanisms operate in humans; however, the authors speculate that the singing mouse model might provide information relevant to the study of disorders in which communication is affected, such as autism or stroke.

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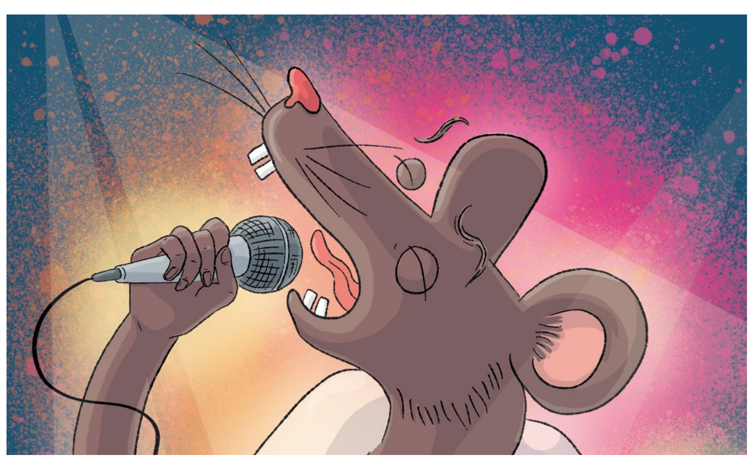
ORIGINAL ARTICLE Okobi, D. E. Jr. et al. Motor cortical control of vocal interaction in neotropical singing mice. *Science* **363**, 983–988 (2019)



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