A microcircuit in the mouse anterior cingulate cortex that plays a role in transforming visual inputs into actions

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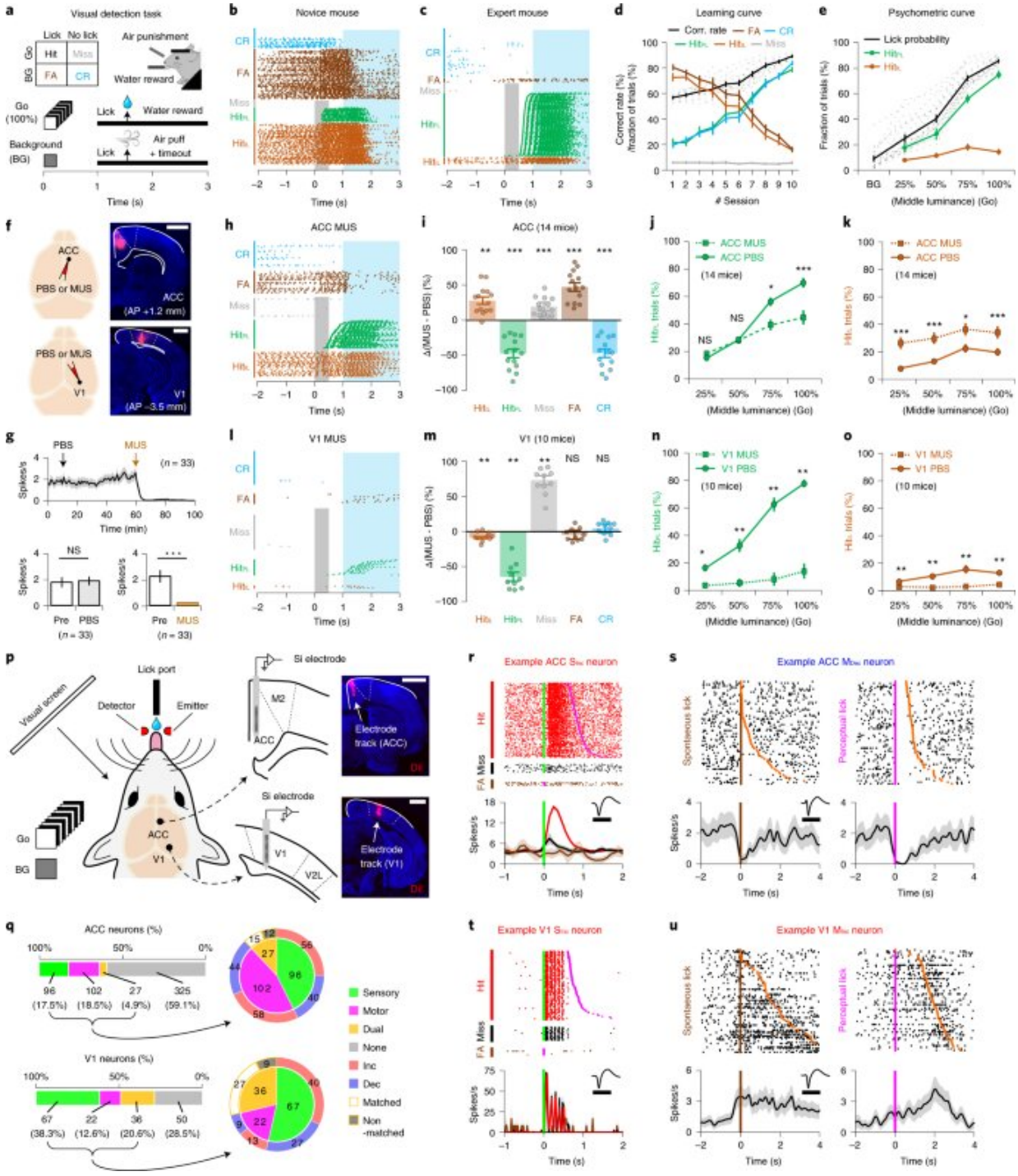

Fig. 1: Neurons in the ACC and the V1 represent sensory and motor signals in mice performing a visual GNG task. Credit: DOI: 10.1038/s41593-021-00910-9

A team of researchers at the Korea Advanced Institute of Science and Technology, has found a microcircuit in the mouse anterior cingulate cortex (ACC) that appears to play a role in transforming visual input into goal-oriented actions. In their paper published in the journal *Nature Neuroscience*, the group describes their experiments with lab mice.

As the researchers note, prior research into the neural basis of decision-making has revolved around the process by which sensory information is processed and then motor output results due to the data received. A mouse seeing a cat approach and then diving under the couch to elude capture is just one example. As they further note, most such research has taken a top-down approach in which parts of the brain involved in perceiving input are studied to see what sorts of signals arise that might lead to brain activity resulting from the information that was received. In this new effort, the researchers chose instead to study the process from the bottom-up. This meant looking first at activity in the brain related to motor activity and then finding out what set it off.

To that end, the researchers trained multiple lab mice to engage in a go/no-go task: The mice were given limited amounts of water to drink, making them thirsty, and then allowing them only to drink from a water source when exposed to a light source. In studying the brainwaves of the mice when they were allowed to drink, and by also stimulating parts of their brain while turning off other parts at different times, the researchers were able to map the action in the mouse brain. They observed how visual input data was sent from the medial secondary visual cortex to the ACC, and then how sensory neurons inhibited certain motor neurons when network activity was low. Premotor signals sent from a subset of other neurons to the dorsomedial stratum resulted in voluntary movement. The researchers conclude that visual data moving to the frontal cortex triggers gated feedback that leads to goal-directed actions.

More information: Jae-Hyun Kim et al, Gated feedforward inhibition in the frontal cortex releases goal-directed action, *Nature Neuroscience* (2021). DOI: 10.1038/s41593-021-00910-9