Researchers uncover 'predictive neuron orchestra' behind looking and reaching movements

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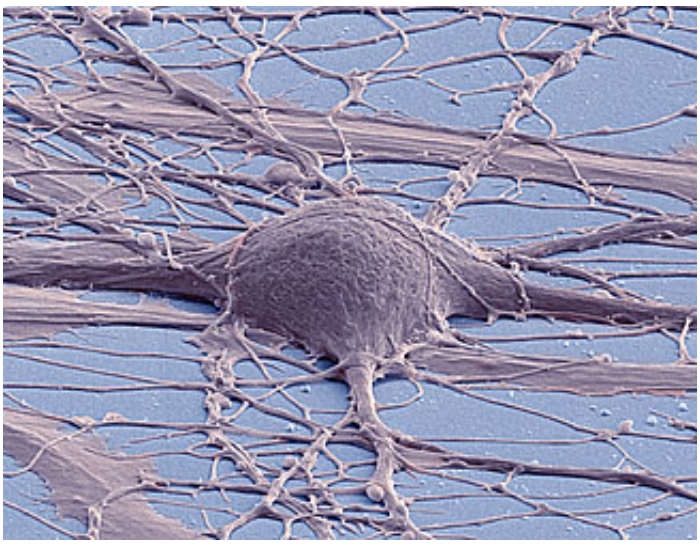

This is a scanning electron micrograph (false color) of a human induced pluripotent stem cell-derived neuron. Credit: Thomas Deerinck, UC San Diego

Different groups of neurons "predict" the body's subsequent looking and reaching movements, suggesting an orchestration among distinct parts of the brain, a team of neuroscientists has found. The study enhances our understanding of the decision-making process, potentially offering insights into different forms of mental illness—afflictions in which this dynamic is typically impaired.

"Identifying which neurons are involved in looking and reaching actions means we can actually see them firing before these decisions are made, offering a crystal ball of sorts into subsequent movements," said Bijan Pesaran, an associate professor at NYU's Center for Neural Science, member of NYU's Institute for the Interdisciplinary Study of Decision Making, and the study's senior author.

It's long been known that selecting and planning actions involve recruiting neurons across many areas of the brain. Specifically, it had been previously established that neurons in the lateral, or side, portion of the brain's intraparietal sulcus (IPS) were active prior to eye movements while neurons on its medial bank fired before arm movements.

Less clear, however, is how ensembles of neurons work together to make decisions—such as eyeing a target, then reaching for it.

To address this question in their study, which appears in the journal *Nature Neuroscience*, the researchers examined different groups of neurons that were active ahead of a decision that involved discrete actions: eye movement and arm movement, or reach. This allowed the scientists to map an array of neuronal activity during two simultaneous actions.

In the study, primates engaged in a series of activities that involved both looking and reaching for different colored targets on a computer screen. During these tasks, the scientists recorded neurological activity in the IPS.

Here, they found "coherent" patterns of spike in activity among groups of neurons in both the lateral and medial regions of the IPS that predicted both eye and reaching movements. Other groups of neurons fired spikes without coherent patterns, and they did not predict the movements. The results, then, offered both a prediction of subsequent

actions—based on preceding neuronal activity—and indicated an orchestration between these distinct sets of neurons.

"The timing of the spiking of these populations of neurons indicates they are working together ahead of a decision being made—apparently 'sharing' information before any overt action is taken," observes Pesaran.

More information: Yan T Wong et al. Coherent neuronal ensembles are rapidly recruited when making a look-reach decision, *Nature Neuroscience* (2016). DOI: 10.1038/nn.4210

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