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Brain mechanism recruited to reduce noise during challenging tasks

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New research reveals a sophisticated brain mechanism that is critical for filtering out irrelevant signals during demanding cognitive tasks. The study, published by Cell Press in the February 26 issue of the journal *Neuron*, also provides some insight into how disruption of key inhibitory pathways may contribute to schizophrenia.

"The ability to keep track of information and one's actions from moment to moment is necessary to accomplish even the simple tasks of everyday life," explains senior study author, Dr. Helen Barbas from Boston University and School of Medicine. "Equally important is the ability to focus on relevant information and ignore noise."

Dr. Barbas and colleague, Dr. Maria Medalla, were interested in examining the synaptic mechanisms for selection and suppression of signals involved in working memory. They focused on the fine synaptic interactions of pathways with excitatory and inhibitory neurons in brain areas involved in attention.

"The primate dorsolateral prefrontal cortex (DLPFC) and anterior cingulated cortex (ACC) are brain regions that focus attention on relevant signals and suppress noise in cognitive tasks. However, their synaptic communication and unique roles in cognitive control are largely unknown," explains Dr. Barbas.

The researchers found that a pathway linking two related prefrontal areas within DLPFC and a pathway from the functionally distinct ACC to

DLPFC similarly innervated excitatory neurons associated with paying attention to relevant stimuli. Interestingly, large nerve fiber endings from ACC contacted selectively inhibitory neurons that help suppress "noisy" excitatory neurons nearby.

These observations suggest that ACC has a greater impact in reducing noise in dorsolateral areas during challenging cognitive tasks involving conflict, error, or reversing decisions. These mechanisms are often disrupted in schizophrenia, and previous functional imaging studies by others have shown that schizophrenia is associated with reduced activity in ACC.

The authors conclude that ACC pathways may help reduce noise by stimulating inhibitory neurons in DLPFC. "The present data provide a circuit mechanism to suggest that pathology in the output neurons of ACC in schizophrenia might reduce excitatory drive to inhibitory neurons of dorsolateral prefrontal cortices, perturbing the delicate balance of excitation and inhibition," offers Dr. Barbas.

Source: Cell Press