A study finds neuropeptide somatostatin enhances visual processing

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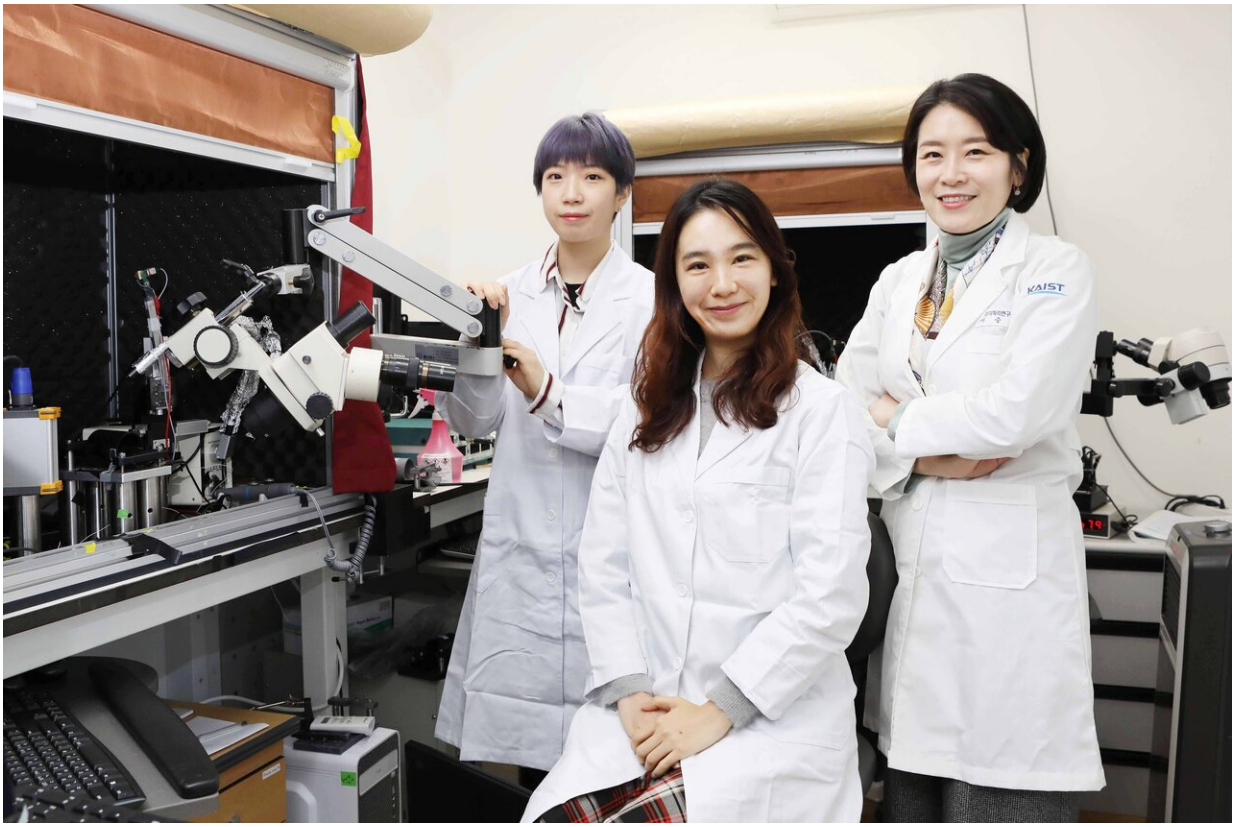

Researcher Yang-Sun Hwang (left), Researcher You-Hyang Song (center), and Professor Seung-Hee Lee (right). Credit: The Korea Advanced Institute of Science and Technology (KAIST)

Researchers have confirmed that neuropeptide somatostatin can improve

cognitive function in the brain. A research group of Professor Seung-Hee Lee from the Department of Biological Sciences at KAIST found that the application of neuropeptide somatostatin improves visual processing and cognitive behaviors by reducing excitatory inputs to parvalbumin-positive interneurons in the cortex.

This study, reported at *Science Advances* on April 22nd, sheds a new light on the therapeutics of neurodegenerative diseases. According to a recent study in Korea, one in ten seniors over 65 is experiencing dementia-related symptoms in their daily lives such as memory loss, cognitive decline, and motion function disorders. Professor Lee believes that somatostatin treatment can be directly applied to the recovery of cognitive functions in Alzheimer's disease patients.

Professor Lee started this study noting the fact that the level of somatostatin expression was dramatically decreased in the cerebral cortex and cerebrospinal fluid of Alzheimer's disease patients.

Somatostatin-expressing neurons in the cortex are known to exert the dendritic inhibition of pyramidal neurons via GABAergic transmission. Previous studies focused on their inhibitory effects on cortical circuits, but somatostatin-expressing neurons can co-release somatostatin upon activation. Despite the abundant expression of somatostatin and its receptors in the cerebral cortex, it was not known if somatostatin could modulate cognitive processing in the cortex.

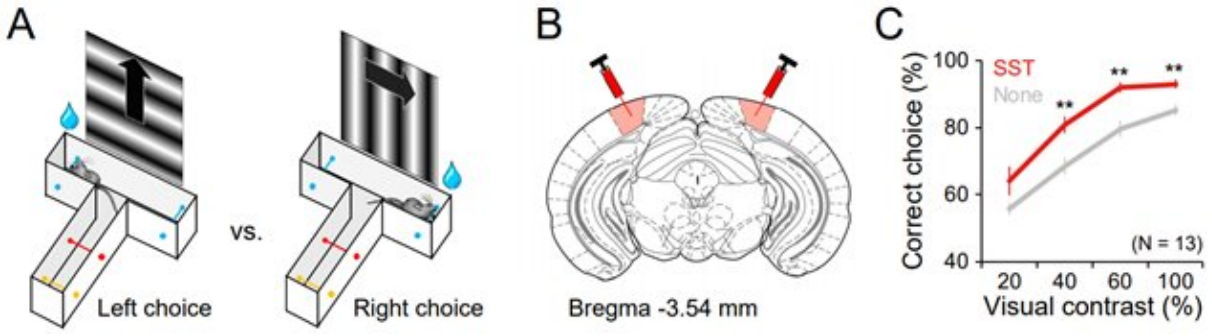

Figure 1. Effects of SST and cyclo-SST injections on the visual discrimination performance of mice. Credit: The Korea Advanced Institute of Science and Technology (KAIST)

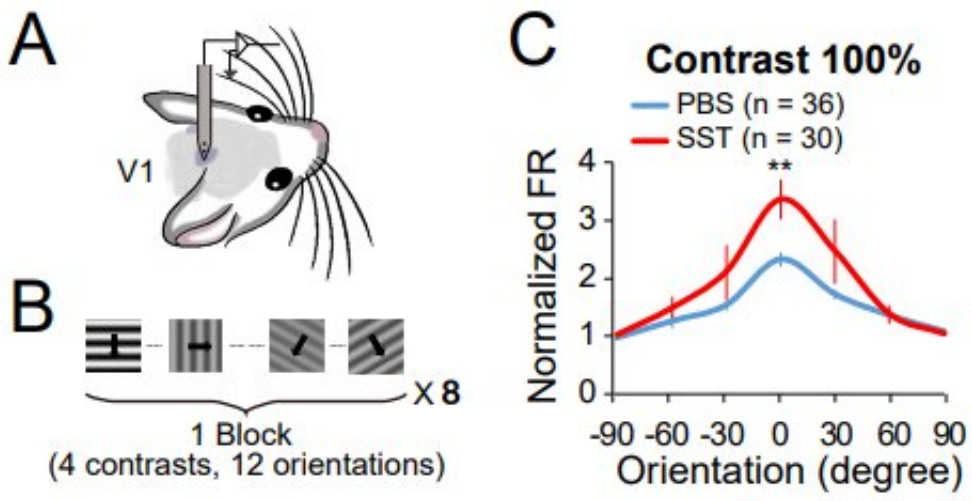

Figure. 2 SST increases the orientation selectivity and visual-evoked activity in the V1 of anesthetized mice. Credit: The Korea Advanced Institute of Science and Technology (KAIST)

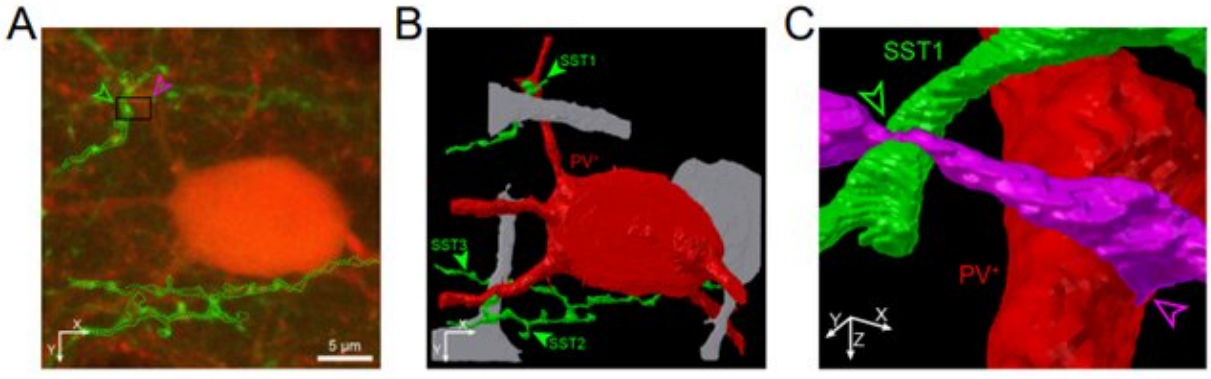

Figure 3. PV+ neurons receive perisomatic excitatory synaptic inputs that are innervated by axons of SST neurons. Credit: The Korea Advanced Institute of Science and Technology (KAIST)

The research team demonstrated that the somatostatin treatment into the cerebral cortex could enhance visual processing and cognitive behaviors in mice. The research team combined behaviors, in vivo and in vitro electrophysiology, and electron microscopy techniques to reveal how the activation of somatostatin receptors in vivo enhanced the ability of visual recognition in animals. Interestingly, somatostatin release can reduce excitatory synaptic transmission to another subtype of GABAergic interneurons, parvalbumin (PV)-expressing neurons.

As somatostatin is a stable and safe neuropeptide expressed naturally in the mammalian brain, it was safe to be injected into the cortex and cerebrospinal fluid, showing a potential application to drug development for curing cognitive disorders in humans.

Professor Lee said, "Our research confirmed the key role of the neuropeptide SST in modulating cortical function and enhancing cognitive ability in the mammalian brain. I hope new drugs can be developed based on the function of somatostatin to treat cognitive disabilities in many patients suffering from neurological disorders."

More information: You-Hyang Song et al. Somatostatin enhances visual processing and perception by suppressing excitatory inputs to parvalbumin-positive interneurons in V1, *Science Advances* (2020). DOI: 10.1126/sciadv.aaz0517