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Translated from Malay

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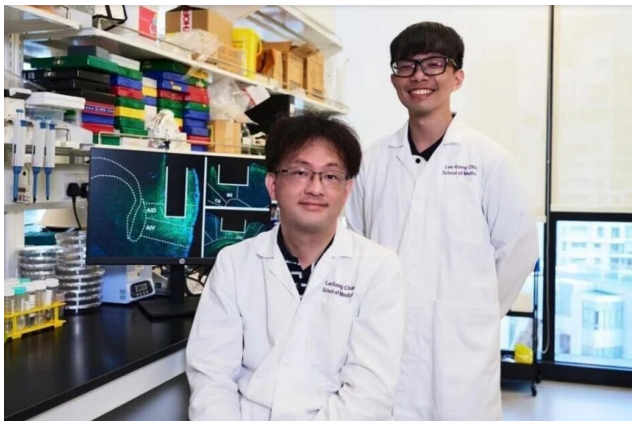

A study in Singapore has uncovered the mystery of how parts of our brain work together to control ourselves.

It is like an orchestra that coordinates actions to restrain impulses and ensure we act at the right moment.

The findings not only deepen understanding of problems such as Attention Deficit Hyperactivity Disorder (ADHD) and addiction, but also pave the way for more effective management methods, said researchers from the Lee Kong Chian School of Medicine (LKCMedicine) at Nanyang Technological University (NTU).

The focus of their study was on three key regions of the brain involved in complex thought and cognitive function: the anterior insular cortex, the posterior parietal cortex, and the dorsomedial frontal cortex.

These three areas are believed to be important in controlling impulses.

Professor Tsukasa Kamigaki, assistant professor of systems neuroscience at LKCMedicine, who is also one of the authors of the study, explained that each of these areas has a unique role.

The dorsomedial frontal cortex acts like a 'brake pedal', stopping reckless actions and fostering patience. Meanwhile, the anterior insular cortex functions like a 'gas pedal', encouraging the emergence of impulsive behavior.

The posterior parietal cortex, Professor Kamigaki explained, functions like an internal clock, controlling how the brain tracks the passage of time.

The study tested self-control in rats with researchers designing a task in which rats were trained to wait before being allowed to lick a water funnel.

A rat that rushes will not get a reward.

The test used optogenetics, a technique that uses light to control cell activity, to block the function of specific brain areas in the mice.

The researchers found that the animals waited shorter before licking the water funnel when the dorsomedial frontal cortex was blocked, but could wait longer when the anterior insular cortex was inactive.

When the posterior parietal cortex was blocked, the mice showed erratic waiting behaviour, suggesting that this brain region aids in self-control by ensuring a stable measurement of time.

By measuring neuronal activity in these areas, the researchers found that some neurons in the posterior parietal cortex fired sequentially, like the ticking of a clock. This helped the mice track how much time had passed during the waiting period.

The findings were published in the journal *Science Advances* in October 2025.

Although the functions of various brain regions have been mapped, these findings suggest that self-control is not a unified process.

Instead, it involves “coordinated computation across at least three different brain circuit systems,” says Professor Kamigaki.

"This means that by targeting each different brain area precisely, in essence, we can change the level of impulsive behaviour in a controlled way," he said.

“This has profound implications for how we view people who struggle with self-control.”

Without ruling out the influence of factors such as genetics or environment, Professor Kamigaki said the study provided a "clear map" of which parts of the brain to target when treating conditions such as addiction or ADHD.

Although ethical and practical issues with the use of optogenetics in humans still exist, the discovery has the potential to aid in the development of therapies for such conditions in the future, he explained.

Associate Professor Jimmy Lee, a psychiatrist at the Institute of Mental Health (IMH), who was not involved in the study, said:

“By identifying the specific role of each brain region in controlling impulsive behavior, we are getting closer to understanding conditions like ADHD more deeply, and this could ultimately lead to more targeted treatments.”

"More importantly, this study demonstrates that impulse control problems have a clear biological basis in the brain, confirming that this is a real medical condition and not just a personal weakness."

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