Scientists discover brain's neural switch for becoming an alpha male

The Guardian, Hannah Devlin Science correspondent

@hannahdev

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Brash, brawny and keen to impose their will on anyone who enters their sphere of existence: the alpha male in action is unmistakable.

Now scientists claim to have pinpointed the biological root of domineering behaviour. New research has located a brain circuit that, when activated in mice, transformed timid individuals into bold alpha mice that almost always prevailed in aggressive social encounters.

In some cases, the social ranking of the subordinate mice soared after the scientists' intervention, hinting that it might be possible to acquire "alphaness" simply by adopting the appropriate mental attitude. Or as Donald Trump might put it: "My whole life is about winning. I almost never lose."

Prof Hailan Hu, a neuroscientist at Zhejiang University in Hangzhou, China, who led the work said: "We stimulate this brain region and we can make lower ranked mice move up the social ladder."

The brain region, called the dorsal medial prefrontal cortex (dmPFC), was already known to light up during social interactions involving decisions about whether to be assertive or submissive with others. But brain imaging alone could not determine whether the circuit was ultimately controlling how people behave.

The latest findings answer the question, showing that when the circuit was artificially switched on, low-ranking mice were immediately emboldened. "It's not aggressiveness per se," Hu said. "It increases their perseverance, motivational drive, grit."

Mice generally organise themselves in stable social hierarchies that minimise conflict between cage mates. So the scientists pitched animals of different rank against each other in a range of tests to assess dominance.

In one, pairs of mice engaged in a head-to-head contest to shove their opponent backwards out of a narrow tube. In the video, one subordinate mouse is seen putting up only light resistance, but when the "alpha" circuit is stimulated for 10 seconds it adopts a rugby-style drive, propelling its opponent along the tube. With brain stimulation, low ranking mice won 90% of the time against animals they would normally have lost to.

"When we took mice that used to lose in the tube test they could win within just several seconds of stimulation," said Hu.

Intriguingly, the experience of winning appeared to leave an imprint on the mice, making them more assertive, even when their brains' were no longer being artificially controlled. They were found to be more combative in a second scenario in which they competed to occupy the warm corner in a cage with an ice-cold floor.

"We observed that not all the mice returned to their original rank," said Hu. "Some mice [did], but some of them had this newly dominant position."

The scientists described this as the "winner effect", hinting that there may be a grain of truth in the self-help mantra "fake it 'til you make it".

The authors note that similar circuitry exists in the human brain, and although our own social hierarchies are less rigid they argue that similar mechanisms may be at play. The findings, they suggest, could have applications in understanding a variety of psychiatric conditions where people exhibit overly dominant behaviours, or lack motivation to compete socially.

Ivan de Araujo, a psychiatry researcher at the Yale University School of Medicine, agreed that the findings could be relevant in people.

"Social behaviours in rodents arguably operate under very different conditions when compared to human social behaviours," he said. "However, history of winning is one characteristic of social dominance that is relevant for almost every social species studied, from insects to primates. Because each brain region investigated has its direct primate homologue, the present study opens new opportunities for understanding the involvement of brain regions linked to planning and decision-making in establishing social hierarchies."

If the "winner effect" translates to humans, it would suggest that experience of success in one area of life could help build confidence in another. "And you can imagine for athletes before a really serious game they could maybe play a video game to have the winner experience to build up confidence," said Hu.

The study, published in the journal Science, used a technique called optogenetics, to pinpoint and ultimately take control of the neuronal circuits involved in socially dominant behaviour. The mice were genetically engineered so that the target group of neurons were light-sensitive, meaning that the scientists could switch the circuit on and off at will by shining a laser into the mouse brain.

In the past few years, optogenetics has provided a window into the brain circuitry involved in a wide range of behaviours, from romantic attachment to the killer instinct of predators.