How the immune system can alter our behavior

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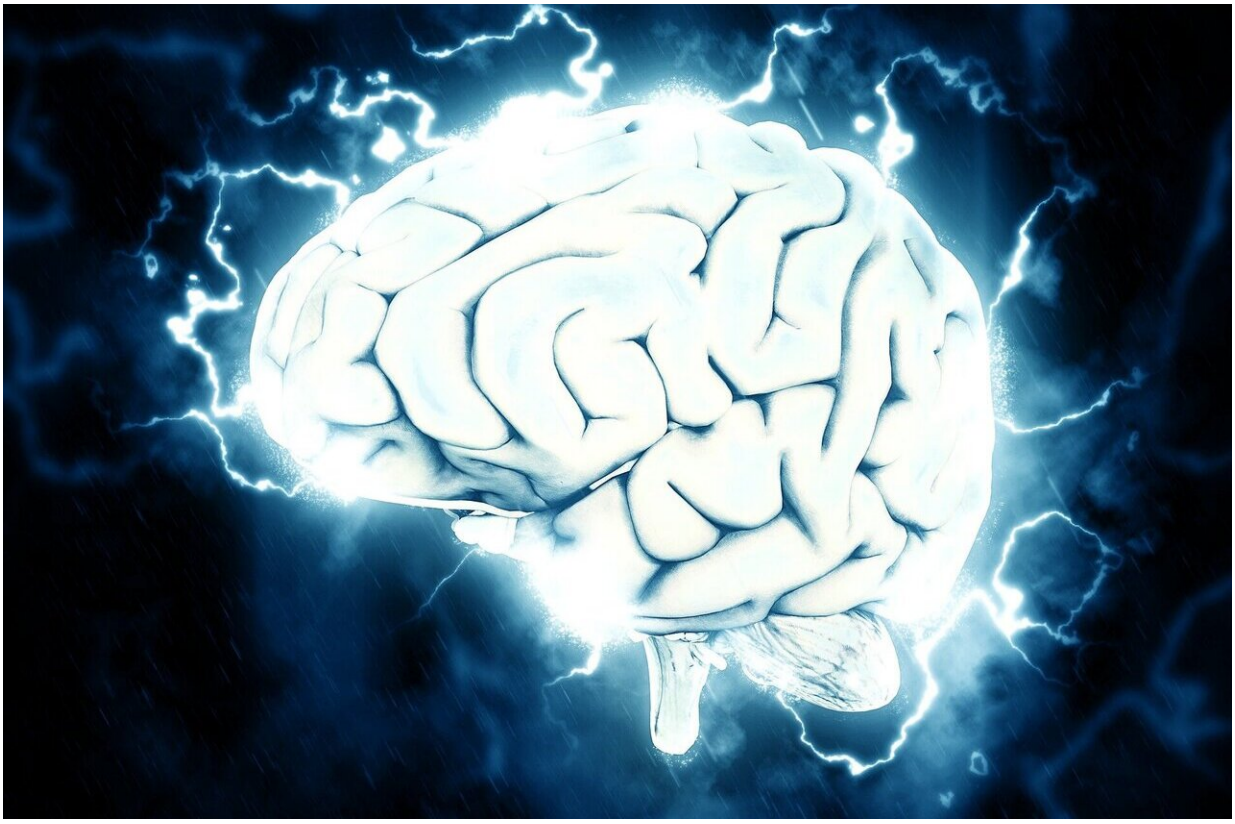

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Simply the smell of seafood can make those with an allergy to it violently ill—and therefore more likely to avoid it. The same avoidance behavior is exhibited by people who develop food poisoning after eating

a certain meal.

Scientists have long known that the immune system played a key role in our reactions to allergens and pathogens in the environment, but it was unclear whether it played any role in prompting these types of behaviors towards allergic triggers.

According to Yale-led research published July 12 in the journal *Nature*, it turns out that the immune system plays a crucial role in changing our behaviors.

"We find immune recognition controls behavior, specifically defensive behaviors against toxins that are communicated first through antibodies and then to our brains," said Ruslan Medzhitov, Sterling Professor of Immunobiology at Yale School of Medicine, investigator for the Howard Hughes Medical Institute, and senior author of the study.

Without immune system communication, the brain does not warn the body about potential dangers in the environment and does not try to avoid those threats, the study shows.

A team in the Medzhitov lab, led by Esther Florsheim, at the time a postdoctoral researcher at Yale and now an assistant professor at Arizona State University, and Nathaniel Bachtel, a graduate student at the School of Medicine, studied mice that had been sensitized to have allergic reactions to ova, a protein found in chicken eggs. As expected, these mice tended to avoid water laced with ova, while control mice tended to prefer ova-laced water sources. The aversion to ova-laced water sources in sensitized mice lasted for months, they found.

The team then examined whether they could alter the behavior of sensitized mice by manipulating immune system variables. They found, for instance, that mice allergic to ova lost their aversion to the protein in

their water if Immunoglobulin E (IgE) antibodies, produced by the immune system, were blocked.

IgE antibodies trigger the release of mast cells, a type of white blood cell that, along with other immune system proteins, plays a crucial role in communicating to areas of the brain that control aversion behavior. Without IgE as an initiator, the transmission of information was interrupted, so that mice no longer avoided the allergen.

Medzhitov said that the findings illustrate how the immune system evolved to help animals avoid dangerous ecological niches. Understanding how the immune system memorizes potential dangers, he added, could one day help suppress excessive reactions to many allergens and other pathogens.

More information: Esther B. Florsheim et al, Immune sensing of food allergens promotes avoidance behaviour, *Nature* (2023). DOI: 10.1038/s41586-023-06362-4

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