Can a mouse meditate? Why these researchers want to find out

February 21 2017, by Deborah Netburn, Los Angeles Times

Credit: martha sexton/public domain

Can a mouse meditate? A new study suggests the answer is ... kind of.

Researchers from the University of Oregon in Eugene have replicated some of the same brain patterns exhibited by human meditators in the brains of mice - no tiny meditation cushions or squeaky "oms" required.

Still, experiments show that the "meditating mice" were more relaxed and less stressed than those with no rodent meditation training.

The authors say the work, published Monday in *PNAS*, provides a proof of concept that will allow them to learn more about how meditation affects the brain.

Previous research has shown that just one month of mindful meditation can have a significant impact on humans both physically and psychologically.

It reduces self-reported anxiety and decrease the amount of the stress hormone cortisol in the blood.

Imaging studies of meditators' brains also have detected increased activity in the anterior cingulate cortex, or ACC. This area of the brain is involved in a wide variety of functions, including emotional regulation and cognitive control.

Scientists also have seen an increase in white matter around the ACC of meditators. That's important because white matter serves as a kind of insulator, enabling electrical impulses to move more easily between neurons.

Although scientists have observed these positive physical effects of meditation on the human brain, they still don't know what causes them.

"We think of meditation as a human thing, a high-level thing, but we want to examine the low level biology of it," said Cris Niell, a neuroscientist at the University of Oregon who co-led the study.

The team's first step in this quest was to create a mouse model that could replicate a human meditator's brain.

They called it, jokingly, the mouse meditation project.

Training mice to focus on the breath, or spend 20 minutes on a body scan was obviously not an option, but the scientists had another plan up their sleeves.

Michael Posner, a psychologist at the University of Oregon, had shown in earlier work that another effect of meditation in humans was a change in the rhythms of the brain. Specifically, he found that particular oscillations near the ACC became "louder" after a meditation session.

"Everyone has these oscillations in their ACC, but they are stronger and more powerful in people after they do meditation," said Aldis Weible, a researcher at the University of Oregon's Institute of Neuroscience and the first author on the study.

The authors knew they couldn't get mice to meditate in a traditional way, but they wondered if they could make the mouse's ACC oscillate in the same rhythm as human meditators.

To do this, they genetically engineered mice that have a special protein in their brains that causes neurons to fire when they are exposed to light. The researchers were able to put the genetic code for these proteins exclusively in the neurons of the ACC.

Next they connected a light source to the mice's brains so they could expose these proteins to different patterns of light. By flashing the light, they were able to make the ACC neurons fire at the same pace that they saw in human meditators.

"We are not necessarily making the mice meditate, but we are changing the pattern of activity in the brain region," Niell said.

Tests revealed that mice that were exposed to the same patterns exhibited by human meditators were more relaxed than those that did not get the "meditation" treatment.

When placed in a box that had a dark side and a light side, the meditating mice were more likely to explore the light side, and to rear up on their little hind legs and look around than other mice.

Both these behaviors indicate a de-stressed mouse and suggest that the behavioral effects of meditation in humans can be recreated in mice.

The authors also experimented with getting the ACC to oscillate at different frequencies, but they saw the most calming effects when the mouse brain was set to oscillate at the same pace as a human meditator's brain - about eight times per second.

Niell said the work is significant because it gives researchers a scientific tool to study how meditation works in the brain, and it suggests that periodic stimulation could be used to affect change in the brains of people who don't want to meditate.

The researchers wonder if one day a similar protocol could be used to help people recover from stroke or post-traumatic stress disorder more rapidly.

"This first publication is a proof of principle," he said. "But hopefully in six months or a year, I'll be talking to you about what it is that actually changes in the brain as a result of meditation."

More information: "Rhythmic brain stimulation reduces anxiety-related behavior in a mouse model based on meditation training," by Aldis Weible et al. *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1700756114