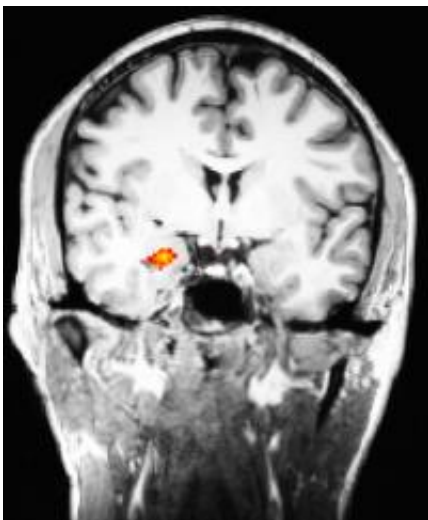


Meditation produces enduring changes in emotional processing in the brain, study shows

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Study participants who completed an eight-week meditation training course had reduced activity in the right amygdala (highlighted structure) in response to emotional images, even when not meditating. Credit: Gaëlle Desbordes, Ph.D., Martinos Center for Biomedical Imaging, Mass. General Hospital

A new study has found that participating in an 8-week meditation training program can have measurable effects on how the brain functions even when someone is not actively meditating. In their report in the November issue of *Frontiers in Human Neuroscience*, investigators at Massachusetts General Hospital (MGH), Boston University (BU), and several other research centers also found differences in those effects

based on the specific type of meditation practiced.

"The two different types of [meditation training](#) our study participants completed yielded some differences in the response of the amygdala – a part of the brain known for decades to be important for emotion – to images with emotional content," says Gaëlle Desbordes, PhD, a research fellow at the Athinoula A. Martinos Center for Biomedical Imaging at MGH and at the BU Center for Computational Neuroscience and Neural Technology, corresponding author of the report. "This is the first time that meditation training has been shown to affect emotional processing in the brain outside of a meditative state."

Several previous studies have supported the hypothesis that meditation training improves practitioners' [emotional regulation](#). While neuroimaging studies have found that meditation training appeared to decrease activation of the amygdala – a structure at the base of the brain that is known to have a role in processing memory and emotion – those changes were only observed while study participants were meditating. The current study was designed to test the hypothesis that meditation training could also produce a generalized reduction in amygdala response to [emotional stimuli](#), measurable by [functional magnetic resonance imaging](#) (fMRI).

Participants had enrolled in a larger investigation into the effects of two forms of meditation, based at Emory University in Atlanta. Healthy adults with no experience meditating participated in 8-week courses in either mindful attention meditation – the most commonly studied form that focuses on developing attention and awareness of breathing, thoughts and emotions – and compassion meditation, a less-studied form that includes methods designed to develop loving kindness and compassion for oneself and for others. A control group participated in an 8-week health education course.

Within three weeks before beginning and three weeks after completing the training, 12 participants from each group traveled to Boston for fMRI brain imaging at the Martinos Center's state-of-the-art imaging facilities. Brain scans were performed as the volunteers viewed a series of 216 different images – 108 per session – of people in situations with either positive, negative or neutral emotional content. Meditation was not mentioned in pre-imaging instructions to participants, and investigators confirmed afterwards that the volunteers had not meditated while in the scanner. Participants also completed assessments of symptoms of depression and anxiety before and after the training programs.

In the mindful attention group, the after-training brain scans showed a decrease in activation in the right amygdala in response to all images, supporting the hypothesis that meditation can improve emotional stability and response to stress. In the compassion meditation group, right amygdala activity also decreased in response to positive or neutral images. But among those who reported practicing compassion meditation most frequently outside of the training sessions, right amygdala activity tended to increase in response to negative images – all of which depicted some form of human suffering. No significant changes were seen in the control group or in the left amygdala of any [study participants](#).

"We think these two forms of meditation cultivate different aspects of mind," Desbordes explains. "Since compassion meditation is designed to enhance compassionate feelings, it makes sense that it could increase amygdala response to seeing people suffer. Increased amygdala activation was also correlated with decreased depression scores in the [compassion meditation](#) group, which suggests that having more compassion towards others may also be beneficial for oneself. Overall, these results are consistent with the overarching hypothesis that [meditation](#) may result in enduring, beneficial changes in brain function, especially in the area of emotional processing."

Eric Schwartz, PhD, of the BU Department of Electrical and Computer Engineering and Center for [Computational Neuroscience](#) and Neural Technology, is senior author of the *Frontiers in Human Neuroscience* report. Additional co-authors are Lobsang T. Negi, PhD, and Thaddeus Pace, PhD, Emory University; Alan Wallace, PhD, Santa Barbara Institute for Consciousness Studies; and Charles Raison, MD, University of Arizona College of Medicine. The study was supported by grants from the National Center for Complementary and Alternative Medicine, including an American Recovery and Reinvestment Act grant to Boston University.

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