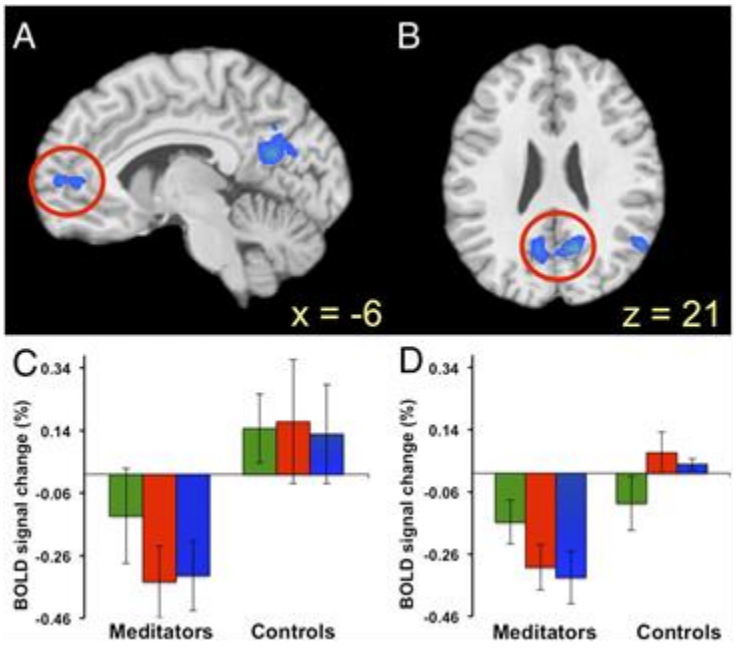
The Healing Art of Meditation

By **Kaitlin McLean** May 10, 2012 17:25

For thousands of years, Buddhist monks have used meditation to obtain a transcendental experience on the path to enlightenment. More recently, physicians have clinically employed meditation to successfully help treat disorders like depression, anxiety, addictions, and chronic pain. However, until recently, the effects of meditation on the brain were largely unknown. Dr. Judson Brewer of the Yale School of Medicine has identified functional changes in the brains of experienced meditators in an exciting new fMRI brain imaging study, one of the first to show the impact of meditation on brain function and connectivity.

Brewer started meditating during medical school to help cope with stress. He found it very helpful, and about 10 years later, began studying it clinically using functional magnetic resonance imaging (fMRI). fMRI is a safe, non-invasive technique that measures oxygen levels in the brain, correlating oxygen concentration to brain activity; more active regions require more oxygen. In his study, Brewer performed fMRI brain scans on experienced meditators and controls (inexperienced meditators) both at rest and while using mindfulness meditation, a meditation that encourages acute awareness of physical or spiritual realities. The subjects in the study used three types of mindfulness meditation techniques: concentration, in which the subject focuses on breathing; loving-kindness, where the subject focuses on a feeling of good will toward oneself and others that is supported by silently repeating phrases such as “may X be happy”; and choiceless awareness, where the subject can focus on whatever object comes to them.

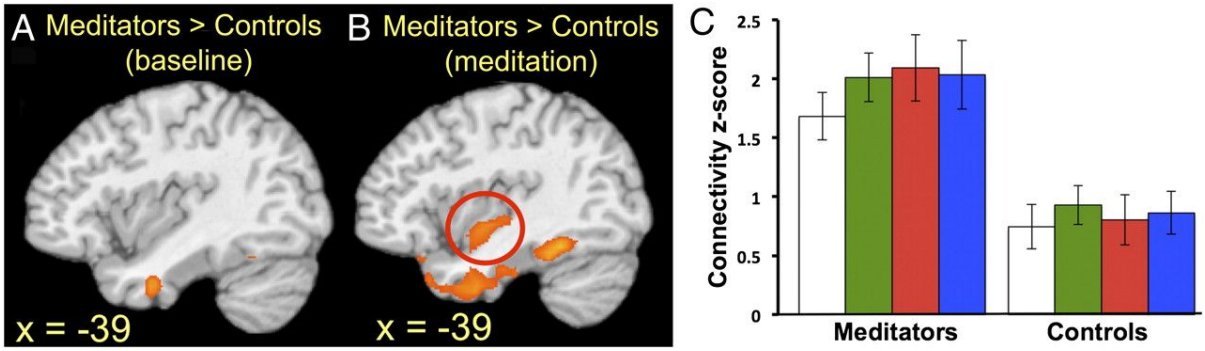
Brewer and his team found two notable trends in the results of the study. First, experienced meditators showed deactivation of the part of the brain known as the default mode network (DMN), a region involved in self-referential processing, including daydreaming. All three forms of meditation showed similar results. This discovery is interesting because one of the goals of meditation is to remain focused, and deactivation of the DMN seems to show that meditation is functionally doing just that in the brain. As meditators self-reported significantly less mind-wandering, these results support the hypothesis that deactivation of the DMN is related to a reduction in mind-wandering.



The study shows that experienced meditators demonstrate decreased DMN activation during meditation. C and D show relative activity between experienced meditators and controls in the posterior cingulate cortex (PCC) and medial prefrontal cortex (mPFC) , which are both important regions of the default mode network. Deactivation of these regions is seen in the brains of experienced meditators. Choiceless Awareness is represented by the green bars, Loving-Kindness is represented by the red bars, and Concentration meditation is shown by the blue bars. Note that decreased activation in PCC in meditators is common across different meditation types. Courtesy of Dr. Brewer.

Second, the brains of experienced meditators showed different connectivity patterns, i.e. different networks of the brains talking to each other, which

had not been seen before in this context. They found that experienced meditators showed co-activation of the posterior cingulate cortex (PCC), dorsal anterior cingulate cortex (dACC), and dorsolateral prefrontal cortex (dlPFC) at baseline and during meditation. These altered connectivity patterns were consistent both during rest and during meditation. The PCC is an important part of the default mode network, and the dACC and dlPFC are both crucial regions for cognitive control. Exactly how these connectivity changes translate into functional changes is currently unclear, but the fact that the changes were seen during both meditation and resting periods suggests that with practice, meditation may transform the normal, resting functioning of the brain into one that more closely resembles a meditative state. In other words, the default state could shift from that of mind-wandering to one of being centered in the present.



The study shows that experienced meditators demonstrate coactivation of the medial prefrontal cortex (mPFC), insula, and temporal lobes during meditation. This figure shows the differential functional connectivity with the mPFC region and left posterior insula is shown in meditators vs controls: (A) at baseline and (B) during meditation. Courtesy of Dr. Brewer.

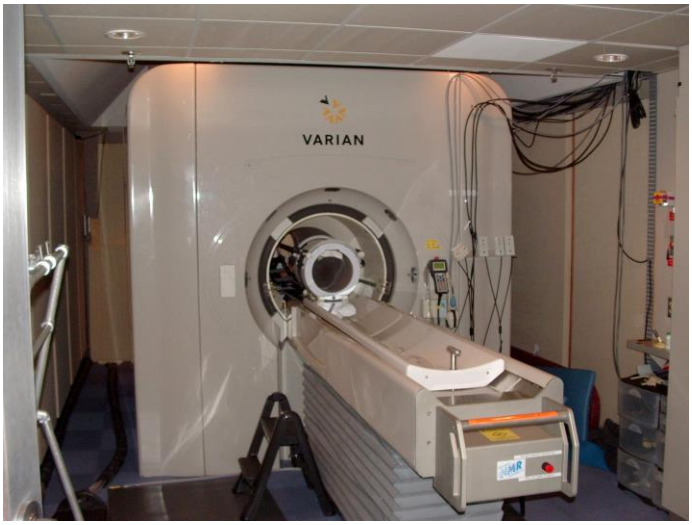
Why a decrease in activity in the part of the brain involved in self-referential processing and daydreaming is beneficial may not be immediately intuitive. Most people spend a great deal of time allowing their minds to wander since it usually seems more enjoyable than writing papers, crunching numbers, or listening during class. However, a 2010 study conducted by researchers from Harvard published in Science, entitled "A Wandering Mind is an Unhappy Mind," found that subjects daydreamed during nearly 50 percent of their waking hours, and that overall, doing so made them unhappy. Not surprisingly, when their minds wandered toward negative things, they were less happy, but when daydreaming about positive things, they were actually no happier than when thinking about their current task. Given that on average, "a wandering mind is an unhappy mind," it is easy to understand the overall benefits of reducing daydreaming on emotional health.

Meditation, however, does not only have emotional benefits. A growing body of evidence suggests that mindfulness training can help anxiety, chronic pain, addictions, and other disorders, but exactly how meditation affects these conditions is still unknown. As Brewer asserts, what is exciting about his research is that it "might bring in some of the neurobiological evidence as to what's actually happening, and how the brain might be changing with practice." He also points out that his study is a preliminary cross-sectional study that only examines one time point, but the evidence is quite persuasive.

This research supports the role that meditation can play in the clinic. According to Brewer, "It [meditation] could certainly be used to help people work through frustration and anxiety so that they don't move into a clinical depression or clinical anxiety disorder, or start using drugs. But at the same time, it can be used when people already have these disorders." In a previous study, Brewer taught mindfulness training to people who wanted to quit smoking who had tried unsuccessfully an average of five to six times before. Meditation was able to help these individuals quit smoking when all other methods failed.

His recent discovery of functional changes in the brains of experienced meditators is a starting point down a longer road of determining the biological changes associated with meditation; Brewer says:

“My hope is that we can start to marry some of these ancient techniques that have been around for 2,500 years with some of the modern technology that might help actually synergize with these such that we actually help people. We’re excited that this could lead to some clinical benefit tangibly down the road, and not just in reaffirming what’s going on in the brain, but bringing what we learn from these neurobiological studies to actually augment the clinical practice.”



The fMRI machine uses magnetic resonance to determine the amount of oxygen usage in the brain. Higher oxygen levels correlate to higher activity of that area of the brain. Courtesy of Wikipedia.

The future for clinical meditation seems bright. Indeed, it is remarkable to observe that cutting-edge techniques are confirming what certain cultures have practiced for thousands of years.

If you are interested in getting involved with meditation, there are many easy ways to get started. Mindfulness in Plain English is a book on mindfulness training that can be downloaded for free online, and a free app called “Get Some Headspace” gives ten days of free guided meditations. Joining a local meditation group is also a common way to begin. Brewer leads a drop-in meditation group at Yale’s Dwight Hall Chapel on Mondays and Thursdays at 8:00 that is open to all who are interested. Beginners are given instruction and guided meditation, and the session ends with a discussion about meditative practices. Brewer urges, “Don’t get discouraged if at first seeing how much your mind wanders when trying to meditate is distressing. Stick with it. Find a good group and a good teacher.” Research shows that, with practice, meditation can be helpful in reaching a happier, healthier state of mind.

The art of meditation has been practiced for thousands of years. Buddhist monks in particular have long used this technique to obtain a transcendental experience on the path to achieving enlightenment. Courtesy of Fotopedia.

About the Author

Kaitlin McLean is a junior in Jonathan Edwards College majoring in Molecular, Cellular and Developmental Biology with a concentration in Neurobiology. She works in Professor Crews’ lab studying the molecular mechanisms of limb regeneration in axolotls.

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Further Reading

Brewer, JA, Worhunsky, PD et al. “Meditation Experience is Associated with Differences in Default Mode Network Activity and Connectivity.” *Proc. Natl. Acad. Sci.* 108 (2011) 20254-9.

http://www.yalescientific.org/2012/05/the-healing-art-of-meditation/