Dusana Dorjee Ph.D.
Your Meditative Mind

What the Neuroscience of Meditation Does and Doesn't Show

The underlying paradox of neuroscience research on meditation.

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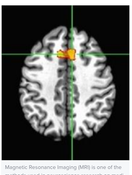
Media headlines highlighting neuroscience studies on meditation have been capturing a lot of attention. Such studies often suggest that mindfulness or compassion meditation might be changing activity in brain areas linked to improvements in meditators' attention or their ability to manage emotions. Similarly, in the last ten years, the number of books on meditation with the words "brain," "neuroscience," or "rewire" in their titles has been fast multiplying (full disclosure: that includes mine). So why does neuroscientific evidence on meditation fascinate us?

The answer to this question may lie in research evidence which shows that non-experts in neuroscience are more likely to believe explanations if they contain some neuroscience terms. In other words, referring to brain areas or neurotransmitters makes the changes resulting from meditation seem more real—more tangible and believable. Perhaps this is particularly pertinent to meditation practice, because most of the changes resulting from meditation are happening in the mind, rather than being easily outwardly observable. There are still some who think that meditation means not doing anything; but if the brain activity changes (and in ways that might improve meditators' attention or emotion regulation) the meditators are clearly not only doing something, they are likely doing something beneficial to their wellbeing.



Magnetic Resonance Imaging (MRI) is one of the methods used in neuroscience research on meditation.

Source: Dusana Dorjee

Yet there is an inherent paradox at the core of this bubbling interest in neuroscience of meditation—one that deserves some consideration. The paradox stems from the fact that neuroscience is an inherently reductionist science—it reduces the mind to the functioning of the brain. As a promotional slogan I recently saw at one university department summed it up: "Neuroscientists study how brain produces the mind." There are various versions of reductionism (and associated philosophical intricacies we don't need to get into here) but the point is that if you believe neuroscientific evidence you likely believe that by pointing to a certain part of the brain or brain network we can explain how meditation works. The problem is that this is at odds with some basic assumptions meditation is based on—assumptions about how the mind works and how it relates to the body.

Traditional Buddhist meditation systems explain the effects of meditation in terms of mental faculties, different types of consciousness and body energies. In the light of existing scientific evidence, I think most current Buddhist teachers would be happy to acknowledge that brain influences the mind, but the mind would be still considered primary. In a nutshell, the main claim of meditation traditions could be summarized as "mind over the matter," whereas neuroscience would claim "matter over the mind." So the paradox is that neuroscience studies, which assume primacy of the brain, are taken as evidence of the effects that meditation as a form of mind training can have on the brain. This dichotomy will most likely persist until we find a plausible answer to the notorious mind-body problem—how an immaterial mind could impact the material brain (and body in general)—and we are nowhere close to solving it.

The differences in assumptions between Buddhist psychology and neuroscience have practical implications for how we research effects of meditation and how we interpret them. As an example, let's take neuroscientific research into modes of existential awareness described in traditional meditation teachings. The modes of existential awareness are linked to changes in the way meditators perceive their self and the reality. For instance, one person might be experiencing a mode of existential awareness in which they are immersed in their thoughts and emotions, not realizing how these impact their well-being and often strongly reacting to them. Others may through meditation or other techniques learn to step back and notice their thoughts and emotions in a non-reactive way—they experience a mode of existential awareness which is sometimes called de-centering. And it is also possible to enter modes of existential awareness with diminished sense of ego-centered self—this is in some traditions one of the goals of meditation training. Importantly, different modes of existential awareness have therapeutic implications for well-being—for instance, de-centering has been associated with better well-being and reduced anxiety. But most modes of existential awareness have not yet been investigated neuroscientifically. What if we don't find evidence for clear brain differences among the brain activity associated with the different modes of existential awareness?

Let's imagine that a meditator's brain activity is being recorded in a neuroscience research lab. She indicates to a neuroscientist that at different points of the recording she experiences three distinct existential awareness states. In addition, 50 other meditators make very similar reports while their brain activity is being recorded. A neuroscientist analyses the data and finds no reliable brain differences between the three existential awareness states. Does this mean the meditators made the existential awareness states up? If you believe that brain produces the mind and we can't find any clear evidence of differences in brain activity, the answer would be "Yes." However, in the traditional meditation context the answer would be "No" because converging reports across meditators are sufficient evidence.

Aside from the underlying paradox of applying neuroscientific reductionism to explaining meditation, the danger here is that in our enchantment by neuroscientific evidence we might forget that the equipment, data collection methods, statistics used to derive findings and our knowledge of the brain have many limitations. It could be that the equipment is not able to pick up subtle differences between states of awareness or gives false differences in other cases. We might not be even looking at the right markers of the brain function or structure.

The presentation of neuroscientific findings on meditation in the media often leaves the impression that we have robust understanding of how meditation changes the brain—we don't. Aside from knowing virtually nothing about modes of existential awareness and how they might relate to brain activity, our understanding of gradual changes in the brain with long-term meditation practice is nearly absent. We also know very little about how different types of meditation, and there is a great variety, change the brain. Most neuroscience research has so far focused on mindfulness, and there already is some evidence suggesting that, for example, the effects of mindfulness and compassion practices on the brain can be quite different. While mindfulness in meditation beginners has been linked to increases in the anterior cingulate cortex (ACC) activation (associated with attention control) and deactivation in the amygdalae (associated with threat detection), after compassion training right amygdala activation has been found to increase coupled with decreases in depression scores.

There is much more to discover about the impact of meditation on the brain and the impact of the brain on meditation. Every rigorous scientific method has a unique contribution to make and at the same time has its underlying assumptions and limitations, and this includes the methods of neuroscience. The message here is that at this stage, we may want to be careful not to overgeneralize, overvalue, and oversimplify what we have already learned from neuroscience research on meditation or what we could learn from it.

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