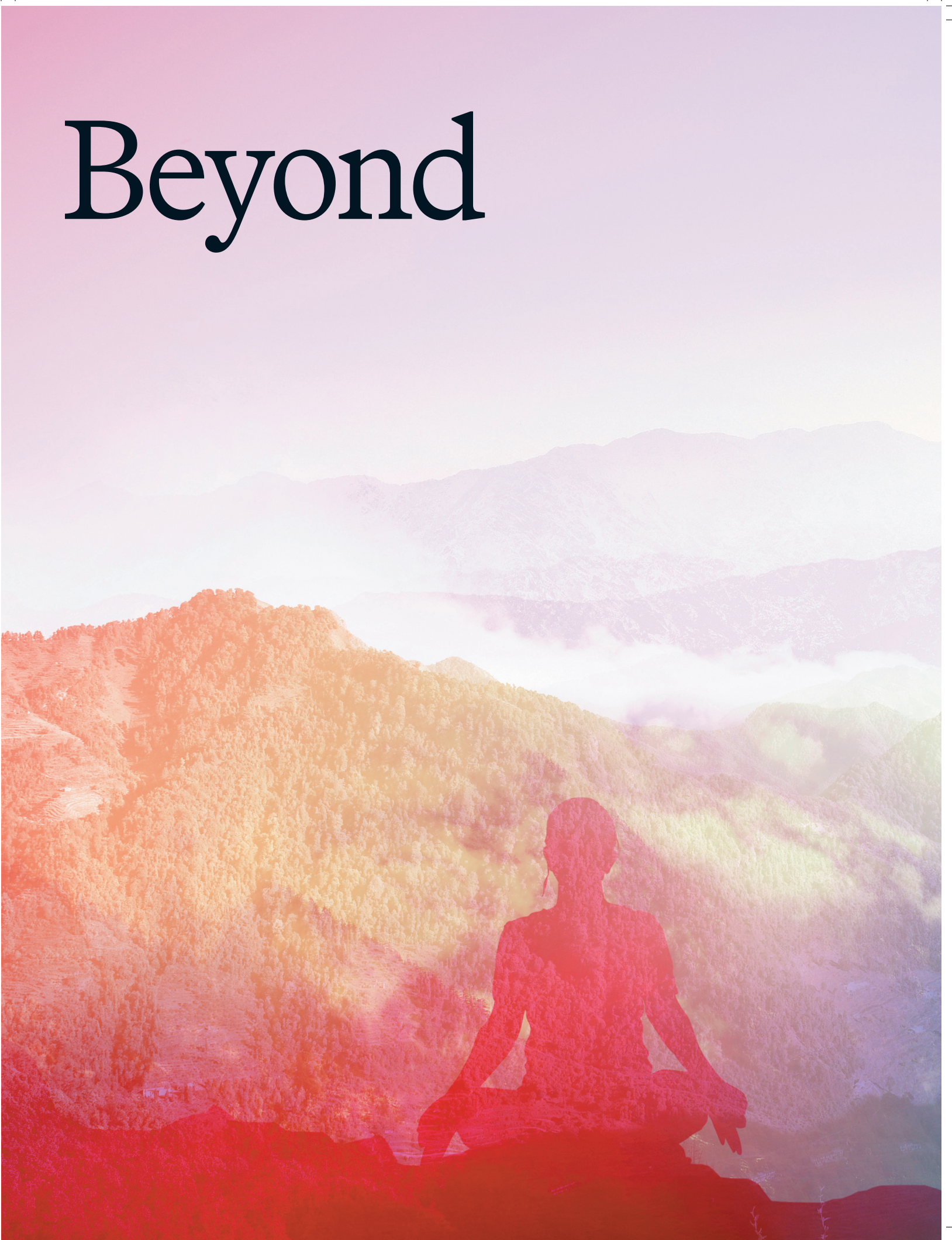


# Beyond





# Mindfulness

PSYCHOLOGY

**An emerging science of advanced meditation could transform  
mental health and our understanding of consciousness**

**BY MATTHEW D. SACCHET AND JUDSON A. BREWER**

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**ILLIONS WORLDWIDE** practice mindfulness meditation, not just for their mental health but as a means to enhance their general well-being, reduce stress and be more productive at work. The past decade has seen an extraordinary broadening of our understanding of the neuroscience underlying medi-

tation; hundreds of clinical studies have highlighted its health benefits. Mindfulness is no longer a fringe activity but a mainstream health practice: the U.K.'s National Health Service has endorsed mindfulness-based therapy for depression. Mobile apps have brought meditation techniques to smartphones, enabling a new era in meditative practice.

The approach to research on meditation has been evolving in equal measure. Looking back, we can identify distinct “waves.” The first wave, from approximately the mid-1990s into the early 2000s, assessed meditation’s clinical and therapeutic potential for treating a broad set of psychological and physical health concerns. The second wave, starting in the early 2000s, focused on mechanisms of mindfulness’s effectiveness, revealing why it yields benefits for mental health that are at times comparable to those achieved with pharmaceuticals. Meditation science is now entering a third wave, exploring what we call advanced meditation—deeper and more intense states and stages of practice that often require extended training and can be experienced through increasing mastery. University research programs are being established to study these altered mental states, similar to new academic endeavors to investigate the merits of psychedelic drugs for personal well-being and a variety of medical conditions.

In the media and in academia, meditation is often

seen as a tool primarily for managing the stresses of modern life and work. But our research suggests it can be used for much more. Although meditation can help people improve their psychological well-being, it also can be a gateway to experiences that lead to deep psychological transformation.

People often come to meditation because of some kind of suffering. Others are drawn to it because they perceive a lack of meaning in the materialism of the modern world. Still others may feel a pull toward “something greater” when they realize that a self-absorbed pursuit of “happiness” has its limitations.

Meditation’s potential has been demonstrated by numerous contemplative, philosophical, religious and spiritual traditions that teach it as a core element that leads to enlightenment or salvation. Buddhism, Vedic and Hindu practices, Jewish kabbalism, Islamic Sufism and shamanism, among others, have all explored meditation in their traditions. Some of them have multimillennia-long histories and encompass experiences that include states of ecstasy,

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insights into the nature of the self and the world around us, the cultivation of empathy, and the pursuit of altruistic goals. Such experiences have also been reported to sometimes lead to a sense of transcendence.

The experiences and personal transformations that practitioners describe are thought to undergird entirely new psychological perspectives and ways of existing in the world. Advanced meditation may help inspire people and provide deep insight and clarity about how to achieve meaning in life. It is not uncommon, in fact, for individuals to reassess their careers or life goals after a meditation retreat and go on to pursue a path that is more fulfilling and that is more aligned with their deeper values and perspectives.

The term “advanced meditation” might evoke images of monks in robes, but these experiences are not limited to ascetics isolated from the rest of the world. Laypeople who lead secular lives can become practitioners of advanced meditation and achieve a sense of profound well-being. In the new and emerging science of this third wave, advanced meditation includes deeper states and stages of meditation that a person may progress through with increasing mastery over time.

The study of advanced meditation examines meditative development—the unfolding of advanced meditative states and stages of practice. Then there is research on meditative endpoints, which represent the outcomes of advanced meditation. In Buddhist traditions, one outcome may be called enlightenment or awakening.

We believe that advanced meditation has potentially broad implications for people’s understanding of what it means to be human and for interventions for mental health and well-being, and it therefore deserves the attention of the scientific community. One of us (Sacchet) leads an effort at Massachusetts General Hospital and Harvard Medical School named the Meditation Research Program, established to develop a comprehensive multidisciplinary understanding of advanced meditation states and stages of practice related to well-being and clinical outcomes (meditative endpoints). We use a rich array of state-of-the-art scientific approaches. Our intention is to expand the program into a much larger research and educational effort and establish the first

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center dedicated to the study and training of advanced meditation.

Another research endeavor on advanced meditation has been taking place at Brown University’s Mindfulness Center (led by Brewer). Scientists there have discovered signatures of brain activity during several forms of meditation used in Tibetan Buddhism that are able to produce feelings of timelessness and states of heightened awareness. Research on advanced meditation is also taking place elsewhere and is expected to grow rapidly in the coming years.

All of these investigations promise to help us find new ways to train people in advanced meditation. We envision developing specific programs that leverage insights from the science of advanced meditation to directly train people with certain clinical diagnoses. These programs could offer new therapeutic avenues for treating persistent cycles of negative thoughts in patients with major depression or the chronic worrying that characterizes generalized anxiety disorder. The idea is not just to manage symptoms but to foster a sense of deep and pervasive well-being that affects all aspects of a practitioner’s life.

Our findings are starting to inform models of how advanced meditation affects and changes the brain, paving the way for a more comprehensive grasp of these practices. In time, our research may lead to a new generation of mental health interventions that could be as simple as a set of verbal instructions or as technologically sophisticated as neurofeedback or brain stimulation.

ADVANCED MEDITATION lends itself to modern, empirical scientific study for several reasons, one of which is the robust research foundation provided by decades of studies from the prior waves. This research included initial attempts to characterize the brain activity of experienced meditators. Notable examples can be seen in the seminal work of teams led by Richard Davidson of the University of Wisconsin–

Madison and Sara Lazar of Massachusetts General and Harvard Medical School. Their work with long-term meditators included electroencephalography (EEG) and the first magnetic resonance imaging study of brain activity in such practitioners. A major limitation of this early research, however, was that it did not explore the rich firsthand descriptions of what people experience during advanced meditation, encompassing states of mind in which consciousness itself may vanish.

The latest wave of research coincides with a broader surge of interest in altered states of consciousness, including those studied in psychedelic research. From a technical perspective, the study of advanced meditation has been facilitated by the recognition that certain altered states can be induced at will by adept practitioners. Advanced meditation, once considered on the scientific fringe, has now made it possible to scientifically understand practices previously limited to monks and mystics.

Our team at Massachusetts General and Harvard’s Meditation Research Program has begun to integrate advanced meditation into rigorous experimental paradigms using cutting-edge methods such as neuroimaging. Studying the neural activity of practitioners in deep meditative states is important because it provides evidence for the biological existence of these states—a first step toward understanding and gaining widespread access to advanced meditation and its benefits.

To cite one example, our group at Harvard recently conducted a study on the experiences and neuroscientific underpinnings of what we have classified as advanced concentrative absorption meditation (ACAM), one form of which is *jhana* from Theravada Buddhism. Practitioners of *jhana* report unfettered calmness, clarity of mind and self-transcendence (going beyond the concept of the self and perceiving diminishing boundaries between oneself and others). They also usher in open consciousness, a state of mind that is receptive, adaptable and accepting of perspectives

beyond the existing narrative that shapes how someone sees the world.

To investigate these states, we used a powerful, seven-tesla MRI machine at Massachusetts General—a first in meditation research. Seven-tesla MRI lets us map the entire brain at high resolution. Its deep-brain imaging extends to the brain stem and cerebellum, areas crucial for healthy mental and physiological functioning that are difficult to study with conventional MRI at lower magnetic field strengths. Brain stem activity, which controls breathing and heart rate, is a prerequisite for consciousness and alertness, so it was a primary target for our work.

Our aim was to create a detailed map of the brain's activity during ACAM and link it to the meditator's reported experiences. We conducted an intensive case study of ACAM spanning 27 MRI data-collection periods that were completed over the course of five days. The case study was of a meditator who had more than 25 years of experience with ACAM and had completed more than 20,000 hours of meditation. We identified distinctive patterns of brain activity in the cortex, subcortex, brain stem and cerebellum regions that were active during ACAM.

Furthermore, we observed correlations between brain activity and certain qualities of ACAM related to attention, joy, mental ease, equanimity, narrative processing (the organization of information into a structured story), and formlessness (in which the sensation of inhabiting the body completely falls away). We also highlighted the distinct nature of brain activity during ACAM compared with that in several non-meditative states. We found that patterns of local activity across brain regions were unique during advanced concentrative absorption meditation and that they were different from those we observed during ordinary states of consciousness.

**I**N ANOTHER STUDY, conducted at the University of Massachusetts's Center for Meditation, researchers employed EEG to investigate 30 advanced meditators using practices from the Tibetan Buddhist tradition. Four advanced meditation states were characterized by self-transcendence, emptiness (a state of awareness beyond the mind's constant word patter) and compassion. This study, on which Brewer was the senior researcher, is important in part because these characteristics are associ-



An array of electrodes can be used for electroencephalography (EEG) to study electrical activity in the brains of advanced meditators.

ated with psychological well-being and are disrupted in people with certain mental illnesses. The results indicated that the density of EEG currents was lower during advanced meditation. This effect was strongest in brain regions involved in self-referential processing (self-related mental activities) and executive-control regions. There is some evidence that advanced meditation practices may dampen self-referential processes and reduce the mind's focus on the self.

We found from this research that a

deeper meditation state was associated with increases in high-frequency brain activity in the anterior cingulate cortex, precuneus and superior parietal lobule and with elevation of the beta-band brain wave in the insula. Together, these results provide initial evidence for specific electrophysiological markers relevant to advanced practices. These brain-activity signatures have particular relevance to non-self-referential states advanced meditators can attain, known as nondual states. This study is also notable because

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it is an example of research on advanced meditation informed by Tibetan Buddhism. It will be a crucial development for the field to compare advanced meditative states among diverse contemplative traditions that historically have been separated geographically, culturally and philosophically.

In a third study, our Harvard/Massachusetts General team investigated, for the first time, what are called cessation events. We used EEG combined with a novel investigative approach that involves the meditators' description of their own experiences, with the goal of finding a neural signature of these advanced meditation experiences. Cessations are radically altered states characterized by a full loss of consciousness. They are thought to result from deep mastery of a mindfulness-based meditation that is part of the *vipassana* tradition in Theravada Buddhism.

When we discuss the loss of consciousness during advanced meditation cessation events, it is crucial to differentiate it from unconsciousness that is caused by anesthesia, coma (including medically induced coma), physical trauma such as head injuries, and naturally occurring events such as sleep. Unlike these states, cessation events in advanced meditation represent a peak meditative experience in which ordinary self-awareness and sensory processing are temporarily suspended.

After a cessation event, the practitioner undergoes a profound shift in mental perspective and well-being, including deep mental clarity and a sense of renewal. In Theravada Buddhism, these events are known as *nirodha* and represent an important meditative endpoint.

For our study, we examined cessations experienced by a single advanced meditator with more than 23,000 hours of meditation training. We analyzed EEG data for 37 cessation events recorded during numerous sessions. Immediately after each EEG run, the participant graded different qualities of any cessations that had occurred. We used a unique approach in which we tied the practitioner's first-person descriptions of the meditation experience to our objective neuroimaging data. We found that specific EEG signatures—notably, one called alpha spectral power and another called alpha functional connectivity—started to decrease approximately 40 seconds before a cessation and returned to normal about 40 seconds after it ended.

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The lowest levels of alpha power and connectivity occurred immediately before and after cessation. The results of this study are consistent with the suggestion that this type of meditation diminishes hierarchical predictive processing—that is, the mind's tendency to predict and rank self-related narratives and beliefs. The cessation process can ultimately result in the absence of consciousness and the emergence of a deeply present form of awareness and thought that accepts whatever arises, whether positive or negative. Our findings provide preliminary insight into the mechanisms underlying the highly unusual capacity to induce a momentary lapse of consciousness during cessations, suggesting it involves measurable changes in brain activity.

MUCH LIKE PSYCHEDELICS, advanced meditation is sometimes linked to challenging psychological disturbances, so it needs to be practiced along with the guidance of properly skilled practitioners. Initial forays into the science of advanced meditation we've described here lay the groundwork for further investigation. One of our objectives is to achieve a scientific understanding that facilitates broader accessibility to these practices. Like simpler forms of mindfulness meditation, advanced meditation can be practiced in diverse settings, when seated on the floor or a chair, with eyes open or closed.

Advanced meditation holds remarkable promise for supporting well-being in both clinical and nonmedical settings. This domain of meditation has the potential to massively reduce or otherwise alter narrative and self-referential thinking, improve attention, and foster feelings of self-generated joy and contentment far beyond what is currently understood in the domain of "mindfulness" research and practice—qualities that are often difficult for people with mental health conditions to attain. Mindfulness meditation has indeed helped millions of people, but ad-

vanced meditation research could revamp the field of mental health, offering entirely new avenues for the treatment of psychiatric disorders and, more generally, fostering a sense of well-being.

Evidence is growing for the efficacy of psychedelics as treatments for some psychiatric conditions, especially depression and post-traumatic stress disorder. We think that people can make similar progress through meditation. Future research may benefit from examining how ACAM and other forms of advanced meditative states relate to psychedelic experiences and how they may similarly help to alleviate symptoms of psychopathology.

Advanced meditation interventions could be integrated with established mindfulness-based techniques, novel meditation-based therapies, and innovative technologies designed to modulate specific neural networks through neurofeedback and brain stimulation. These methods may make it possible for people to have the experience of an advanced meditative state without undergoing extensive training.

Advanced meditation therefore holds significant and untapped opportunities to diminish suffering and help people flourish. It may even provide a gateway to entirely new ways of understanding our basic humanity.

As interest in meditation continues to grow, so does the potential to explore its full spectrum of possibilities for bettering the mental and physical health of individuals and society. Our work in the new wave of advanced meditation research is not just about coping with the stress of modern living. It could improve our understanding of and approach to the mind, mental health and well-being, allowing each of us to lead a more fulfilled, compassionate and "enlightened" life. ●

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### FROM OUR ARCHIVES

**Mind of the Meditator.** Matthieu Ricard, Antoine Lutz and Richard J. Davidson; November 2014. [ScientificAmerican.com/archive](https://www.scientificamerican.com/archive)