

GOT A PROBLEM? WE (MAY SOON) HAVE A MEDITATION for that. Mindfulness meditation is among the fastest-growing trends in health care and wellness. A quick perusal of any popular meditation app reveals the variety of conditions it can purportedly treat, including stress, anxiety, depression, pain, insomnia and loneliness.

But can any single meditation practice really serve them all?

Researchers at the UC San Diego T. Denny Sanford Institute for Empathy and Compassion are paving the way for a modern era of targeted mindfulness-based interventions. Through a series of studies, interdisciplinary teams are breaking down mindfulness into distinct components and assessing what kinds of symptoms each component is most effective at treating.

Their goal is to develop evidence-based mindfulness techniques tailored to different patient populations: A student struggling to focus in class. A lonely senior experiencing depression. A patient suffering from chronic back pain. Each would be prescribed a unique treatment plan featuring customized meditations.

“We’re getting so sophisticated about precision medicine when it comes to drugs and surgeries; it’s now time we invest the same level of precision into cognitive training,” said **Fadel Zeidan, PhD**, associate professor of anesthesiology at UC San Diego School of Medicine.

Zeidan and colleagues are using the latest tools in neuroscience and psychology to study the effects of mindfulness meditation on the brain and behavior. At its core, mindfulness is centered on the act of bringing one’s attention to the present moment, without making any judgements in the process. The technique evolved from traditional Eastern practices originating thousands of years ago, but can now be evaluated through the scientific method.

“We ultimately want to be able to prescribe personalized mindfulness programs tailored to what each person needs help with — not just based on what we think will work, but on what actually works according to the data,” Zeidan said.

PRECISION MEDITATION

BY NICOLE MLYNARYK

Backed by neuroscience and individually customized, mindfulness meditation enters an era of clinical precision.



The case for customization

ANOTHER MEMBER OF THE SANFORD TEAM is **Ariel Lang, PhD**, a licensed clinical psychologist and professor of psychiatry at UC San Diego School of Medicine and Herbert Wertheim School of Public Health and Human Longevity Science. As director of the Center of Excellence for Stress and Mental Health at the VA San Diego Healthcare System, Lang has long studied the benefits of meditation in treating military veterans with post-traumatic stress disorder (PTSD). The evidence so far suggests mindfulness does help relieve certain PTSD symptoms, but according to Lang, the effects are modest for many veterans.

“Everyone’s needs are slightly different,” Lang said. “For those particularly struggling with anxiety or irritability, mindfulness meditation can be a helpful tool to calm their nervous systems. But PTSD has many other layers to it, so we wondered if mindfulness might be more effective if we added a specific contemplation tailored to these other needs.”

Veterans with PTSD commonly struggle to relate to others after military service, particularly civilians who may not understand what deployment entails. The result-

ing social isolation can exacerbate feelings of depression and anxiety. To address this issue head on, Lang’s lab began training veterans in compassion meditation, a form of meditation specifically designed to strengthen and sustain compassion towards others.

In the 90-minute sessions, trainees were guided to tap into a sense of common humanity, contemplating the life experiences and goals we all share. The theory is that by fostering these traits of empathy and compassion, the veterans might feel a greater ease in relating to others, which might slowly restore their sense of belonging.

After 10 weeks of practice, the participants reported greater social connectedness, elevated mood and reduced symptoms of depression. Importantly, a control group that completed a general relaxation training instead of compassion meditation did not show these same improvements.

But if isolation was the problem, why not focus on providing more social resources? Lang is an advocate for social support groups, but asserts that compassion meditation remains an important addition to PTSD treatment plans.

“If you just ask people to go socialize, you’re not addressing the guilt, shame, irritability or anxiety that was holding them back in the first place,” said Lang. “Our best chance at helping folks reconnect with others is to first address the feelings and beliefs that were getting in the way.”

With compassion meditation showing promising results in veterans, Lang and her team are now testing its effectiveness in other populations experiencing social isolation, including seniors and individuals with chronic pain.

“It’s likely that different meditative practices are going to get at different aspects of psychopathology,” said Lang. Studies like this, she said, help scientists optimize the techniques and prepare them to be successfully administered in clinical settings.

“Many people already support the use of mindfulness meditation to enhance well-being. But when you talk to a therapist, they have to first suggest the most



↑ **Fadel Zeidan, PhD**



↑ **William Mobley, MD, PhD**

evidence-based approaches. So that’s what we’re doing — finally getting that evidence.”

This framework has inspired another major research effort at the institute in which Zeidan and colleagues plan to dissect the meditative technique even further.

In the new study, participants are split into different meditation groups, each focused on a particular component of meditation practice. One group is trained to non-reactively focus on their breath, while another focuses on their body using the “body scan” technique. A third group is trained to cultivate compassion towards others, while a fourth cultivates compassion toward themselves. The mindfulness groups are compared to two control groups, one of which learns a form of non-mindfulness meditation focused on deep breathing

and the other spends sessions listening to an audio book, not meditating at all.

The study is ongoing, but preliminary results suggest that after just four days of training, each group experiences distinct behavioral effects, particularly regarding anxiety and social connectedness.

“By disentangling the many dimensions of mindfulness, we’ll be able to see how each component of the meditative experience uniquely targets health,” Zeidan said. “Then we can start combining effective dimensions into customized programs depending on the individual’s needs.”

Health care workers and caregivers, for example, may show high levels of compassion for others but could benefit from developing more compassion for themselves. For individuals with neurological disorders, such as multiple sclerosis, some forms of mindfulness may be quite mentally fatiguing, “but if something less cognitively demanding like deep breathing is helpful, then that’s what we want to prescribe in that particular scenario,” Zeidan said.

"We're getting so sophisticated about precision medicine when it comes to drugs and surgeries; it's now time we invest the same level of precision into cognitive training."

FADEL ZEIDAN, PHD

“If we want to make this a real science, we have to remove our biases and expectations. If mindfulness doesn’t work, we’re not going to use mindfulness. And when it does work, we’re not suggesting it’s the end-all-be-all. Multimodal problems require multimodal solutions, and we want to know when mindfulness can be a part of that.”

Your brain on mindfulness

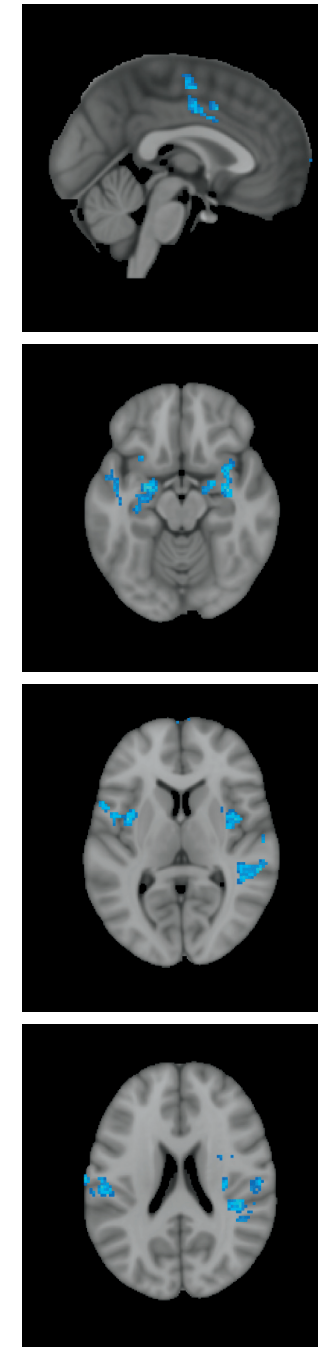
TO ZEIDAN AND OTHER RESEARCHERS AT THE Sanford Institute, mindfulness cannot be fully understood without explaining what it does to the brain.

“Neuroscientists have historically struggled to receive funding for studies examining the effects and biological substrates of empathy and compassion, but through the founding of this institute, UC San Diego is now uniquely poised to pioneer this new field,” said Zeidan.

In a growing line of research, Sanford scientists are exploring what features of the brain support mindfulness, compassion



↑ Ariel Lang, PhD, (second from right) and her lab practice mindfulness meditation at the “Stonehenge” art installation on campus.



↑ UC San Diego scientists are using neuroimaging tools to learn how meditation affects the brain. Here, the Zeidan lab showed that individuals who meditated while receiving a painful stimulus showed reduced activity (blue) in many brain areas involved in pain perception.

and empathy. The findings will help explain how these traits grow and diminish across individuals and disease states. They’ll also be a useful biomarker to evaluate the success of different mindfulness techniques, and determine effective treatment doses, such as the length and frequency of meditation sessions necessary to see a real effect.

“Many meditation programs involve a lot of discussion about empathy and compassion, but findings from our laboratory and others’ demonstrate that it really comes down to mental training,” Zeidan said. “You can’t just lecture someone into becoming more empathetic — enhancing compassion requires unique cognitive training approaches, and we can now see this process being reflected by reliable changes in the brain.”

To observe these brain changes, the Zeidan lab measures participants’ neural activity before and after mindfulness training using functional magnetic resonance imaging (fMRI). Such fMRI studies have started to explain how mindfulness works, particularly in reducing anxiety.

It’s now known that meditation can increase activity in the prefrontal cortex (PFC), a brain region associated with cognitive control and executive functioning. Anyone who’s experienced a state of high anxiety can attest that it’s not the best time to rely on one’s executive functions (such as attention, decision making and impulse control). So bringing these back online through enhanced prefrontal activity seems to have a positive effect. Furthermore, the PFC plays an important role in regulating the amygdala, a brain area involved in processing emotions and fear. Thus, by increasing PFC activity, mindfulness also reduces amygdala activity, and anxiety is quelled.

In another recent study, Zeidan’s lab looked at the effects of mindfulness meditation in treating pain. Participants completed several 20-minute training sessions during which they were instructed to notice their thoughts, sensations and emotions without judging or reacting to them. Participants’ brains were later scanned while they experienced a painful heat stimulus.

Those who were actively meditating during the stimulus reported significantly lower pain intensity and unpleasantness.

When the researchers looked at the participants’ brain activity, they found that pain relief was associated with reduced synchronization between the thalamus, a brain region that relays incoming sensory information to the rest of the brain, and parts of the default mode network that mediate self-awareness and appraisal. The more these areas were decoupled or deactivated, the more pain relief the participant reported. So while pain signals still entered the brain, they did not seem to be as closely integrated with the individuals’ sense of self.

“One of the central tenets of mindfulness is the principle that you are not your experiences, and we’re now finally seeing how this plays out in the brain during the experience of acute pain,” said Zeidan.

“Fadel’s work strengthens our ability to understand the interface between the brain and mind, and use this new knowledge to enhance both science and meditative practice,” said institute director William Mobley, MD, PhD, Distinguished Professor of Neurosciences at UC San Diego School of Medicine. “This kind of research will allow us to increasingly bridge from practice to brain function and back again, and the result will be much more rigorous and evidence-based support for mindfulness.”

This isn’t to say that anyone interested in the health-promoting benefits of meditation needs to have their brain scanned to ensure it’s working. But as with the development and testing of any new therapeutic, the more thoroughly scientists can evaluate its mechanism up front, the more successful the treatment is likely to be.

“We want mindfulness training to be as efficient and effective for our patients as possible,” said Zeidan. “But it’s clear you don’t have to be a monk to reap the benefits of mindfulness, and while we work to optimize the techniques, there’s likely no harm in practicing the ones we currently have.”

So as we wait for the future of precision mindfulness, scientists encourage us to continue embracing the present. ●