

The Science of Mindfulness

by Dan Siegel MD

DANIEL J. SIEGEL, M.D. looks for the “active ingredient” that makes mindfulness so beneficial to our health, psyche, and overall quality of life.

The practice of intentional, nonjudgmental awareness of moment-to-moment experience has been practiced since ancient times in both East and West. Wisdom traditions have for thousands of years recommended mindful practice in a variety of forms to cultivate well-being in an individual’s life. Now science is confirming these benefits. Here, we’ll explore the common elements of these practices and review the research findings which affirm that daily mindfulness practice is good for your health. We’ll then explore a new field called interpersonal neurobiology that integrates a wide range of sciences and other ways of knowing about reality into a common language that illuminates the subjective world of the human mind.

Mindful awareness practices include yoga, tai chi, qigong, centering prayer, chanting, and mindfulness meditation derived from Buddhist tradition. The science of mindfulness could have delved into any of the practices of intentionally focusing on the present moment without judgment, but through the impact of the Buddhist-inspired program of Mindfulness-Based Stress Reduction, much of our in-depth research on the impact of mindful awareness on brain and immune function, as well as psychological and interpersonal changes, has emerged from the study of mindfulness meditation.

Jon Kabat-Zinn, a microbiology Ph.D. then teaching at the University of Massachusetts Medical Center, was inspired in the late 1970s to apply the basic principles of mindfulness meditation to patients in a medical setting. His work developing the MBSR program proved effective in helping alleviate the suffering of chronic and previously debilitating medical conditions such as chronic pain. It also served as fertile ground for a systematic set of research investigations in collaboration with one of the founders of the field of affective neuroscience, Richard Davidson of the University of Wisconsin at Madison.

Kabat-Zinn repeatedly clarifies in his writings and teachings that MBSR, despite its Buddhist roots, is a secular application of mindfulness, which is a practice of carefully focusing attention, not a form of religion. Indeed, each of the mindfulness practices mentioned above share common, secular elements: cultivating an awareness of awareness and paying attention to intention.

Studies show that the ways we intentionally shape our internal focus of attention in mindfulness practice induces a state of brain activation during the practice. With repetition, an intentionally created state can become an enduring trait of the individual as reflected in long-term changes in brain function and structure. This is a fundamental property of neuroplasticity—how the brain changes in response to experience. Here, the experience is the focus of attention in a particular manner.

A question that is raised regarding the specific features of MBSR is what is the “active ingredient” in its powerful effects. Naturally, the experience of joining with others to reflect on life’s stresses, listen to poetry, and do yoga may each contribute to the program’s scientifically proven effectiveness. But what specific role does meditation itself play in the positive outcomes of the MBSR program? One clue is that those practicing mindfulness meditation during light-treatment for psoriasis revealed four times the speed of healing for the chronic skin condition. And in other studies, long-term improvements were seen and maintained in proportion to the formal reflective meditation time carried out at home in their daily practice.

Further research will be needed to verify the repeated studies affirming that long-term improvements are correlated with the mindfulness practice, and are not just the effect of gathering in a reflective way as a group. Sara Lazar and her colleagues at Massachusetts General Hospital have found that people who have been mindfulness meditators for several decades have structural features in their brains that are proportional

to their number of hours of practice.

But this finding, too, along with studies of “adepts” — those who have spent often tens of thousands of hours meditating — need to be interpreted with caution as to cause and effect. Are those with differing brain activity and structure simply those who’ve chosen to meditate, or has the meditation actually changed their brains? These questions remain open and in need of further studies.

MBSR has proven an excellent source of insight into these questions because it enables novices to engage in new practices which can then be identified as the variables that induce the positive changes that follow. What are these changes, whatever their specific causes? Studies of MBSR have consistently found several key developments that demonstrate its effectiveness as a health-promoting activity. These may be key to the “science of mindfulness.”

First, a “left-shift” has been noted in which the left frontal activity of the brain is enhanced following MBSR training. This electrical change in brain function is thought to reflect the cultivation of an “approach state,” in which we move toward, rather than away from, a challenging external situation or internal mental function such as a thought, feeling, or memory. Naturally, such an approach state can be seen as the neural basis for resilience.

Second, the degree of this left-shift is proportional to the improvement seen in immune function. Our mind not only finds resilience, but our body’s ability to fight infection is improved. At the University of California, Los Angeles, David Cresswell and his colleagues have found that MBSR improves immune function even in those with HIV. Improved immune system function may help explain the increase in healing found in the psoriasis treatment studies with mindful reflection during treatment.

Third, MBSR studies reveal that patients feel an internal sense of stability and clarity. Using a modified version of a general MBSR approach in our own pilot study at the UCLA Mindful Awareness Research Center, we’ve found that adults and adolescents with attentional problems achieved more executive function improvements (sustaining attention, diminishing distractibility) than are accomplished with medications for this condition. Other researchers (Alan Wallace, Richie Davidson, Amiji Jha) have also found significant improvements in attentional regulation in those who have had mindfulness meditation training, such as enhanced focus as revealed in the reduction of the “attentional blink,” or times when new information is not seen because of prolonged attention on the prior stimulus. Some of these studies have been done during three-month retreats with the primary focus on isolated meditative practice rather than group discussions.

Fourth, researchers in a wide array of mental health situations have found that adding mindfulness as a fundamental part of their treatment strategies has proven to be essential in treating conditions such as obsessive compulsive disorder, borderline personality disorder, and drug addiction, and is also helpful in the prevention of chronically relapsing depression.

Some insight into the possible core mechanisms that enable application to the treatment of a wide range of mental disorders was offered in a recent study by Norman Farb and colleagues in Toronto. After just the eight-week MBSR program, subjects were able to alter their brain function in a way that confirmed they could distinguish the “narrative chatter” of their baseline states from the ongoing sensory flow of here-and-now experience. This ability to develop discernment — to differentiate our unique streams of awareness — may be a crucial step for disentangling our minds from ruminative thoughts, repetitive destructive emotions, and impulsive and addictive behaviors.

Finally, studies of mindfulness based programs have revealed that medical students experienced improved empathy and physicians had decreased burnout and enhanced attitudes to their patients.

The Learnable Skill of Mindsight

How do we make sense of this science of mindfulness? Here is a brief foray into the emergence of an independent way of knowing called interpersonal neurobiology.

At the same time as Jon Kabat-Zinn was creating the MBSR program some thirty years ago, I was starting medical school just a few miles east in Boston. Discouraged by the lack of empathy in my professors and the way patients—and students—were treated as physical objects seemingly devoid of an internal world, I stopped school to wrestle with this widespread blindness to the inner reality of the mind.

When I ultimately returned to finish my degree, what became clear to me was that there were two fundamental ways people could see reality. One was through a lens of the physical, the other through a lens of the mind. Many of my teachers in medicine had honed the physical lens—seeing the subtle signs and symptoms of physiological disease. This was an important, but incomplete, aspect of being a healer. I came to realize that these professors lacked the development of the lens that enabled them to see the mind's feelings or thoughts, its hopes, dreams, and attitudes. Theirs was a world of the physical, and the subjective, internal life of the patient was painfully missing from their worldview.

This realization set me on a decades-long journey to explore what the mind was, and how seeing the mind could help alleviate psychological distress and perhaps even enhance physiological well-being. First in pediatrics and then in clinical and research psychiatry, I dove deeply into the science of psychiatric suffering.

I found that patients seemed to come for help with situations of rigidity, chaos, or both. They were stuck in repeating unhelpful patterns of thinking or behaving, or flooded by intrusive and unpredictable feelings or thoughts. Accompanying their disabling states was an inability to see the mind clearly or deeply. If I could teach them ways to see their mind—the world inside—they could become open to shaping that world toward a more adaptive and flexible way of being. I came to call this ability to monitor and modify the internal world in oneself or others “mindsight.”

I became a researcher in the field of parent–child relationships, and studied how attuned communication from a caregiver to an infant cultivated a child's healthy and resilient development. The 1990s were the Decade of the Brain and I was immersed in working with scientists from a wide range of disciplines, including anthropology and neurobiology. We could now peer into the function and structure of the healthy, active brain, and then work to combine those findings with an exploration of the mind itself.

Ultimately, this journey led to the creation of an interdisciplinary field called interpersonal neurobiology (IPNB). It offered a working definition of the mind that researchers from more than a dozen disciplines of science could agree upon: A core aspect of the mind is an embodied and relational process that regulates the flow of energy and information. This definition enabled me to refine the concept of mindsight as the way we can sense and shape energy and information flow as it is shared in relationships, moves through the neural mechanism of the brain (seen here as the extended nervous system throughout the body), and is regulated by the mind. Relationships, brain, and mind formed a triangle of human experience that was the focus of our interdisciplinary investigations.

After I wrote a professional text on this subject, and then a parenting book that translated IPNB for practical use and suggested that “being mindful” was a basic principle of parenting, people in my workshops asked when they'd be taught to meditate. Not being trained in meditation, I was at a loss at first, but then I became exposed to the whole ancient world of mindfulness and its recent scientific discoveries. A chance meeting with Jon Kabat-Zinn at a conference led to a new world for me when he encouraged me to gain direct experience in mindfulness. I soon participated in the first weeklong silent retreat for scientists offered by the Insight Meditation Society and the Mind and Life Institute, and then a week of MBSR training. This journey is described in my book, *The Mindful Brain*. Its basic concept is that mindfulness, instead of being seen primarily as attention or emotion regulation, might be considered an “internal form” of attunement—one in which the observing self is open and accepting, tuned-in, and curious about the experiencing self.

In my own exploration, I experienced mindfulness as a “wheel of awareness,” in which the central hub was the metaphor for awareness, the rim anything that I could be aware of, and the spokes the intentional focus of attention. A key to mindfulness, in my experience, was the capacity to separate hub from rim, to not become swept up by anything within awareness as the totality of one’s experience. This differentiation of rim from hub, and the reflection on awareness itself to enable a deeper sense of the present, the past, and the anticipated future, fit well with the IPNB theme of “integration.”

Integration is defined as the linkage of differentiated parts of a system. With integration we can achieve a flexible flow of energy and information—an adaptive and coherent state that has the subjective feeling of harmony and vitality. When we are not integrated, we are in chaos, rigidity, or both. That IPNB view enabled me to finally have an explanation for why my patients came for help with one of these states, now seen as impairments to integration. From the IPNB perspective, integration is health. The way we move toward integration is to use mindsight to promote the necessary differentiation and then linkage of elements in the system—our brain, our relationships with other people, the larger planet of interconnected life.

Mindful awareness from this IPNB perspective can be seen as a powerful way to integrate consciousness. With kindness and compassion, we differentiate awareness from that which we are aware of. Attuning to the self is like attuning in a loving way to a friend or an infant: we are fully present and accepting with care and concern.

Mindfulness also enables us to differentiate distinct streams of awareness that can include sensations, observations, constructed concepts, and even nonconceptual knowing. Once we strengthen mindsight’s lens with training exercises that promote openness, objectivity, and observation, we are then given the opportunity to cultivate integration in our individual and collective lives. The unfolding of well-being, compassion, and resilience from such practices is a wonder to watch.

Reflection, relationships, and resilience can become the new “R’s” of basic education. Reflective practices that help integrate the brain, mind, and our relationships can offer new hope for how youth can grow toward health and more compassionate ways of being. In many ways, such reflective practices combine the ancient wisdom of mindfulness and the contemporary discoveries of interdisciplinary science. With reflection, we come to see clearly that the mind is real and our interconnections with one another the vital pulse of life. Our brains can become integrated, our relationships empathic, and our minds honored as they are cultivated to develop resilience in our lives.

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