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# Mindfulness Research Update: 2008

Jeffrey M. Greeson, PhD, MS

*Objective:* To briefly review the effects of mindfulness on the mind, the brain, the body, and behavior. *Methods:* Selective review of MEDLINE, PsycINFO, and Google Scholar databases (2003–2008) using the terms “mindfulness,” “meditation,” “mental health,” “physical health,” “quality of life,” and “stress reduction.” A total of 52 exemplars of empirical and theoretical work were selected for review. *Results:* Both basic and clinical research indicate that cultivating a more mindful way of being is associated with less emotional distress, more positive states of mind, and better quality of life. In addition, mindfulness practice can influence the brain, the autonomic nervous system, stress hormones, the immune system, and health behaviors, including eating, sleeping, and substance use, in salutary ways. *Conclusion:* The application of cutting-edge technology toward understanding mindfulness—an “inner technology”—is elucidating new ways in which attention, awareness, acceptance, and compassion may promote optimal health—in mind, body, relationships, and spirit.

**Keywords:** *mindfulness; meditation; mental health; physical health; quality of life; stress reduction*

## INTRODUCTION

There is rapidly accumulating evidence in the field of complementary health practices that greater mindfulness can not only reduce stress and stress-related medical symptoms but can also enhance positive emotions and quality of life. Moreover, studies are beginning to show a relationship between (a) how much people practice meditation, (b) how much more mindful they become, and (c) the positive effects they experience in terms of mental and physical health. This brief, selective review presents some of the most recent scientific findings that demonstrate how practicing mindfulness meditation can affect the mind, the brain, the body, and behavior in ways that may promote whole-person health.

## METHOD

Articles were retrieved by searching MEDLINE, PsycINFO, and Google Scholar databases between the years 2003–2008 using the terms “mindfulness,” “meditation,”

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“mental health,” “physical health,” “quality of life,” and “stress reduction.” A total of 52 exemplars of empirical and theoretical work were selected by the author for review. Articles were selected to represent a cross-section of research that spanned four domains: The Mind, The Brain, The Body, and Behavior. Priority was given to studies that were not included in previous quantitative or qualitative reviews of the scientific literature.

## RESULTS

### Mindfulness Meditation and the Mind

Research on mindfulness supports the idea that cultivating greater attention, awareness, and acceptance through meditation practice is associated with lower levels of psychological distress, including less anxiety, depression, anger, and worry (cf. Baer, 2003; Brown, Ryan, & Creswell, 2007; Greeson & Brantley, 2008; Grossman, Niemann, Schmidt, & Walach, 2004). Furthermore, studies have begun to elucidate *how* mindfulness training can reduce distress. One observational study found that more time spent on formal meditation practices (body scan, yoga, sitting meditation) at home during an 8-week intervention led to increased mindfulness, which, in turn, explained decreased psychological distress and increased psychological well-being (Carmody & Baer, 2008). A recent randomized controlled trial (RCT) in students showed that 4 weeks of mindfulness meditation training, relative to somatic relaxation training or a nonintervention control group, reduced distress by decreasing rumination, a cognitive process associated with depression and other mood disorders (Jain et al., 2007). Another clinical study found that 8 weeks of mindfulness meditation training significantly reduced ruminative thinking in persons with a history of depression (Ramel, Goldin, Carmona, & McQuaid, 2004). Together, these studies indicate that one salutary mechanism of mindfulness appears to involve reshaping ways of thinking that engender improved emotional well-being.

Mindfulness scale development research has found that people with higher natural levels of mindfulness—irrespective of formal meditation training—report feeling less stressed, anxious, and depressed, and more joyful, inspired, grateful, hopeful, content, vital, and satisfied with life (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Brown & Ryan, 2003; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007; Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006). In addition to the mental health benefits of meditation practice and cultivating mindful awareness in daily life, simply being in a mindful state momentarily is associated with a greater sense of well-being (Lau et al., 2006).

Research further suggests that people with higher levels of mindfulness are better able to regulate their sense of well-being by virtue of greater emotional awareness, understanding, acceptance, and the ability to correct or repair unpleasant mood states (Baer et al., 2008; cf. Brown et al., 2007; Feldman et al., 2007). The ability to skillfully regulate one's internal emotional experience in the present moment may translate into good mental health long-term.

Finally, a number of different mindfulness-based training programs—including Mindfulness-Based Stress Reduction (MBSR), Mindfulness-Based Cognitive Therapy (MBCT), Acceptance and Commitment Therapy (ACT), Dialectical Behavior Therapy

(DBT), and Mindfulness-Based Eating Awareness Training (MB-EAT)—can effectively treat more serious mental health conditions, including anxiety disorders (MBSR; ACT), recurrent major depression (MBCT), chronic pain (MBSR; ACT), borderline personality disorder (DBT), and binge eating disorder (MB-EAT; Baer, 2006). Although additional well-designed studies using active control groups are needed to replicate and verify the mental health benefits of mindfulness meditation training (Toneatto & Nguyen, 2007), the body of evidence to date supports a relationship between cultivating a more mindful way of being on one hand, and a tendency to experience less emotional distress, more positive states of mind, and better overall quality of life on the other hand.

## **Mindfulness Meditation and the Brain**

A number of studies have demonstrated that systematic mindfulness training as well as brief meditation practices in novices can influence areas of the brain involved in regulating attention, awareness, and emotion (cf. Cahn & Polich, 2006; Lutz, Slagter, Dunne, & Davidson, 2008b). One key element of mindfulness is the ability to pay attention to the present moment, on purpose (Kabat-Zinn, 2003). A recent clinical study found that 8 weeks of mindfulness meditation training (MBSR) led to an increased ability to orient one's attention to the present moment, as measured by a laboratory attention test (Jha, Krompinger, & Baime, 2007). Another experimental study found that compared with a relaxation training control group, 5 days of integrative meditation training—including mindfulness—significantly improved the efficiency of executive attention during a computerized attention test (Tang et al., 2007).

A second key element of mindfulness is the ability to recognize and accurately label emotions (Analayo, 2003). Brain imaging research has found that more mindful people appear to have a greater ability to control emotional reactions in the middle part of the brain (the amygdala and the dorsal anterior cingulate cortex [ACC]) by engaging the front part of the brain (the prefrontal cortex [PFC]), which is associated with attention, concentration, and emotion regulation (Creswell, Eisenberger, & Lieberman, 2008; Creswell, May, Eisenberger, & Lieberman, 2007). Another study found that employees in a corporate setting showed changes in front brain electrical activity (EEG) following 8 weeks of MBSR that were consistent with the experience of positive emotions like joy and content (Davidson et al., 2003).

A third key element of mindfulness is more refined self-awareness (Kabat-Zinn, 2003). One recent functional magnetic resonance imaging (MRI) study on this topic found that 8 weeks of MBSR was associated with greater neural activity in two brain regions believed to partially subserve self-awareness—the dorsolateral PFC and the medial PFC—during experiential and narrative self-focus tasks, respectively (Farb et al., 2007). A structural MRI study reported that experienced mindfulness meditators, relative to demographically matched controls, had increased grey matter in brain regions that are typically activated during meditation, such as the right anterior insula, which subserves interoceptive awareness (Hölzel et al., 2007a).

Researchers are also exploring the effect of specific meditation practices on the brain. For example, in adept meditators versus nonmeditators, mindful breathing practice

(contrasted to mental arithmetic) was associated with increased rostral ACC and dorsomedial PFC activation, which may reflect stronger processing of distracting events and emotions, respectively (Hölzel et al., 2007b). Another functional brain imaging study found that practicing a brief loving kindness meditation activated regions of the brain associated with positive feelings toward others (Hutcherson, Seppala, & Gross, 2008). Loving kindness meditation—traditionally included as part of mindfulness training—is a contemplative practice designed to foster acceptance and compassion for oneself and others (Kabat-Zinn, 1990; The Dalai Lama, 2001). Finally, some studies suggest that greater meditation expertise is related to an increased ability to experience shifts in brain activity associated with positive emotions like compassion (Lutz, Brefczynski, Johnstone, & Davidson, 2008a).

Overall, it appears that focused, concentrative meditation practices can increase one's ability to maintain steady attention on a chosen object, like the breath or another person, whereas open awareness meditation practices can increase one's ability to flexibly monitor and redirect attention when it becomes distracted (Lutz et al., 2008b). Based on these findings, not only is it possible to train the mind to change the brain, but, in fact, one's ability to do so may get stronger as one gains meditation experience.

## Mindfulness Meditation and the Body

There is increasing scientific evidence to support the therapeutic effect of mindfulness meditation training on stress-related medical conditions, including psoriasis (Kabat-Zinn et al., 1998), Type 2 diabetes (Rosenzweig et al., 2007), fibromyalgia (Grossman, Tiefenthaler-Gilmer, Raysz, & Kesper, 2007), rheumatoid arthritis (Pradhan et al., 2007; Zautra et al., 2008), chronic low back pain (Morone, Greco, & Weiner, 2008), and attention-deficit hyperactivity disorder (Zylowska et al., 2008). In addition, research has consistently shown that mindfulness training reduces symptoms of stress and negative mood states and increases emotional well-being and quality of life among persons with chronic illness (cf. Brown et al., 2007; Grossman et al., 2004; Ludwig & Kabat-Zinn, 2008; Shigaki, Glass, & Schopp, 2006). The use of mindfulness training in treating specific pain conditions, hypertension, myocardial ischemia, weight control, irritable bowel syndrome, insomnia, human immunodeficiency virus (HIV), and substance abuse is presently under investigation in research supported by the National Institutes of Health (Ludwig & Kabat-Zinn, 2008).

The beneficial physical effects of mindfulness training may occur, in part, by learning how to better cope with the inevitable stresses of daily life and to remember that there is usually more right with the body than wrong. Theoretical models of mindfulness have endeavored to explain empirical observations of salutary effects by articulating the role of improved meta-cognitive skills, such as decentering (Teasdale et al., 2002) or re-perceiving (Shapiro, Carlson, Astin, & Freedman, 2006), and adaptive coping processes, such as positive reappraisal (Garland, Gaylord, & Park, **IN PRESS**). It has specifically been postulated that mindfulness may preempt stress-related illness through a number of psychological, biological, and behavioral pathways, including (a) clarifying primary appraisal of stressors, (b) facilitating accurate secondary appraisal of stressor demands and

coping resources, (c) mitigating dysfunctional coping styles, such as catastrophizing and ruminating, (d) enhancing adaptive coping processes, such as positive reappraisal, and (e) reducing distress and psychophysiological activation (Garland, 2007).

Cutting-edge laboratory research is beginning to reveal some of the biological pathways through which mindfulness training may positively affect physical health and healing processes. For example, the 8-week MBSR study by Davidson and colleagues (2003) showed that individuals who had the largest shifts in frontal brain activity also had the strongest antibody responses to a flu vaccine. That study was the first to show that mindfulness training can change the brain and the immune system in a way that might bolster resistance to disease. More recent MBSR studies in people with serious medical conditions, including breast cancer, prostate cancer, and other types of cancer, have documented lower levels of cortisol—a primary stress hormone—and normalized immune function, measured by natural killer cell activity and pro-inflammatory cytokine levels (Carlson, Speca, Faris, & Patel, 2007; Witek-Janusek et al., 2008). Research on patients with HIV infection further indicates that MBSR may produce beneficial effects on the immune system, including increased natural killer cell activity—an important first line of defense against viral infection—as well as increased production of  $\beta$ -chemokines, molecules that block HIV from infecting healthy immune cells (Robinson, Mathews, & Witek-Janusek, 2003). A different study on adults with HIV infection suggested that MBSR may protect against the loss of “helper” T cells over time—a primary measure of HIV disease progression (Creswell, Myers, Cole, & Irwin, **IN PRESS**).

Initial laboratory studies suggest that mindfulness meditation practices can alter autonomic and neuroendocrine system functioning, both at rest and when stressed. For example, one RCT found that a mindful body scan meditation produced greater increases in parasympathetic nervous system activity, indexed by cardiac respiratory sinus arrhythmia (RSA), than progressive muscle relaxation—a standard relaxation training technique (Ditto, Eclache, & Goldman, 2006). Another RCT showed that 5 days of meditation training, including mindfulness, significantly reduced the cortisol response to acute mental stress relative to a relaxation training control group that did not receive mindfulness or meditation instruction (Tang et al., 2007). Finally, a third RCT found that adults who reported home practice times above the median during a 6-week compassion meditation training program exhibited significantly lower stress-induced levels of negative emotion and inflammation (interleukin-6) postintervention compared with individuals below the home practice median, who did not differ from controls (Pace et al., **IN PRESS**). Taken together, these experimental studies indicate that mindfulness practices may promote health, in part, by attenuating stress reactivity and stimulating parasympathetic tone, perhaps more strongly than relaxation techniques.

## **Mindfulness Meditation and Behavior**

Another key element of mindfulness is the cultivation of equanimity or nonreactivity. Specifically, mindfulness meditation teaches one to pay attention to and acknowledge both one’s inner experience and the outer world, without necessarily reacting. The ability to simply observe and accurately sense thoughts, emotions, and physical sensations—

without having to change them, or act on them—can be instrumental in breaking habitual behavior patterns that can harm one’s health, such as smoking a cigarette when feeling stressed, eating comfort food when feeling sad or “empty,” or turning to alcohol or other substances to “numb out” when feeling overwhelmed. Promising findings from behavioral research suggest that mindfulness training may help people experience stress and negative emotions without acting impulsively and self-destructively in their attempt to self-soothe (cf. Brown et al., 2007). For example, some of the studies to date have found that people trained in mindfulness show a better ability to quit smoking (Davis, Fleming, Bonus, & Baker, 2007), decrease binge eating (Kristeller, Baer, & Quillian-Wolever, 2006), and reduce alcohol and illicit substance use (Bowen et al., 2006). At least one study has shown that reduced substance use following mindfulness training was partially explained by acceptance, rather than avoidance, of unwanted thoughts (Bowen, Witkiewitz, Dillworth, & Marlatt, 2007). Mindfulness may also promote better health, in part, by improving sleep quality, which can be disrupted by stress, anxiety, and difficulty turning off the mind (Winbush, Gross, & Kreitzer, 2007).

## CONCLUSION

The latest scientific research on mindfulness has demonstrated beneficial effects on several aspects of whole-person health, including the mind, the brain, the body, and behavior. Clinical trials and laboratory studies alike suggest that the mechanisms of mindfulness involve not only relaxation, but important shifts in cognition, emotion, biology, and behavior that may work synergistically to improve health. There is also emerging evidence that mindfulness training is associated with greater meaning and peace in one’s life (spirituality) as well as enhanced relationships with others (Carmody, Reed, Kristeller, & Merriam, 2008; Carson, Carson, Gil, & Baucom, 2004). A number of cutting-edge technologies, including brain imaging, are being used to examine the potential health benefits of mindfulness, an “inner technology” we all possess. Finally, research is beginning to prove what mindfulness practitioners have known for centuries—that greater attention, awareness, acceptance, and compassion can facilitate more flexible, adaptive responses to stress, which, in turn, can help free us from suffering and realize greater health and well-being.

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