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Envisioning a Future Contemplative Science of Mindfulness: Fruitful Methods and New Content for the Next Wave of Research

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Abstract

Mindfulness is an ancient spiritual practice as well as a unique behavioral technique involving the cultivation of non-judgmental, non-reactive, metacognitive awareness of present-moment experience. Given the growing interest in mindfulness across numerous academic and clinical disciplines, an agenda is needed to guide the next wave of research. Here, we suggest four areas that, in our view, are important for a future contemplative science of mindfulness: performance-based measures of mindfulness, scientific evaluation of Buddhist claims, neurophenomenology of mindfulness, and measuring changes in mindfulness-induced gene expression. By exploring these domains, the wisdom of the meditative traditions may be complemented by leading-edge empirical research methodologies.

Keywords

mindfulness; methods; neurophenomenology; psychosocial genomics; qualitative

Mindfulness is an ancient spiritual practice as well as a unique behavioral technique that is now being studied for its health benefits. Mindfulness involves the effort to attend, nonjudgmentally, to present-moment experience, and to sustain this attention over time, with the aim of cultivating stable, nonreactive, metacognitive awareness. Introduced over 2,500 years ago by Shakyamuni Buddha, mindfulness has been recommended as a technique for calming the mind and generating insight and compassion, all important for improving the human condition. As interest in research on mindfulness is building in fields as disparate as medicine, psychology, social work, and neuroscience, it is timely that we examine the methods and content of exploration, to ensure that the process and product of our research is optimally fruitful. Here, we suggest 4 areas that, in our view, are important for a future contemplative science of mindfulness (Wallace, 2006), an investigative approach that couples the wisdom of the meditative traditions with complementary, leading-edge empirical research methodologies.

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Performance-Based Measures of Mindfulness

Increasingly, there is a need to further specify and operationalize the measurement of mindfulness for use in both clinical and basic science research programs. A number of questionnaires are currently used to quantify both state and trait mindfulness in studies, such as the Five Facet Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), the Toronto Mindfulness Scale (Lau et al., 2006), and the Mindful Attention and Awareness Scale (Brown & Ryan, 2003). However, self-report scales are notoriously subject to threats to validity, such as inadequate explication of constructs, reactivity to being in an experimental or treatment condition, experimenter expectancies, social desirability biases, and misinterpretation of question items (Shadish, Cook, & Campbell, 2002). Indeed, it should be recognized that questionnaire items serve as proxies for latent variables of interest (DeVellis, 2003). Oftentimes, multiple operationalizations of a given construct are possible, and allow for triangulation, thereby reducing monooperation bias, that is, the tendency for any one operationalization to inadequately represent the construct of interest (Shadish et al., 2002).

Given these concerns, we predict the growing need for performance-based, cognitive-behavioral measures of mindfulness. Methodologies from both cognitive and experimental psychology can serve as exemplars of this type of measurement. Although recent investigations have used cognitive measures such as the Attention Network Test to index mindfulness training-induced cognitive changes (Chambers, Lo, & Allen, 2007; Jha, Krompinger, & Baime, 2007; Tang et al., 2007), to our knowledge, no ecologically valid performance-based measure has been pioneered. As an example of research that might lead to the development of such a measure, Khalsa et al. (2008) recently investigated the ability of experienced meditators (Tibetan Buddhist and Kundalini yoga adepts) to detect their own heartbeats, a capability purported to be enhanced by meditative practice. Although the authors could not confirm their hypothesis that experienced meditators would exhibit heightened interoceptive awareness of the heart, the detection of other physiological or cognitive processes might serve as valid measures of mindfulness. Such a measure might be directly associated with mindfulness practices, such as the ability to focus on the breath as an anchor for one's awareness or the ability to know when one's mind has wandered (i.e., a sustained attention to response task, cf. Smallwood, McSpadden, & Schooler, 2007).

Similarly, behavioral measures of equanimity in response to laboratory stressors could be used as a somewhat more indirect proxy. Reports of mental events (thoughts, memories, imagery, emotional states) prompted by ecological momentary assessment during mindful breathing practice could be used to assess the quality and depth of state levels of mindfulness. Use of such measures would complement self-report scales, and if incorporated along with psychophysiological, biomarker, and brain imaging methodologies, could allow for a rich quantification of mindfulness.

Scientific Evaluation of Buddhist Claims

Across many Buddhist traditions, the intent of mindfulness training was to dispel ignorance (*avidya*) resulting in attachment and suffering and to realize the impermanence of the self. By cultivating nondiscursive awareness, one may gain insight (*vipassana*) into one's own essential nature, ultimately coming to the realization that there is no permanent self (*anatman*), that all objects are ultimately devoid of an independent identity (*sunyata*) and that all phenomena arise from an interdependent, cooriginating field (*pratityasamutpada*). These realizations are thought to result in the cessation of personal suffering and the genesis of compassion.

Qualitative interviews could tap the development of these ontological realizations in mindfulness practitioners, while self-report instruments and psychophysiological indices of stress and negative affect could assess their purported effect. Cognitive tasks could be used to objectively assess mindfulness-induced changes related to self-identification; for example, using a dichotic listening task, autobiographically relevant distractor stimuli such as the listener's name could be played in one's ear while he or she attempts to attend to and repeat a narrative played in the other ear. Growth curve analysis could be used to model how the inception of these realizations predicts variation in health trajectories over time.

Qualitative methodology could also be used to further explore changes in spiritually related constructs such as compassion, selflessness, and devotion with increased mindfulness and present-moment awareness. Traditional claims made about mindfulness may be supported by such research; however, it is also possible that training in mindfulness may have other effects among modern Westerners whose culture differs so greatly from the ancient Indo-Sino-Tibetan cultural roots of Buddhism. Such effects might include the facilitation of meaning-making processes like positive reappraisal (Garland, Gaylord, & Park, 2009), an emotion focused coping strategy used to find benefit in adversity for the purpose of healthy adaptation.

Neurophenomenology of Mindfulness

In line with neurophenomenology (Rudrauf, Lutz, Cosmelli, Lachaux, & Le Van Quyen, 2003; Varela, 1996), experimenters could combine first-person self-report data with neuroimaging technologies such as functional magnetic resonance imaging (fMRI) and electroencephalogram (EEG) to study the dynamic psychobiological effects of mindfulness practice on consciousness. With this methodology, one could reveal the structural features (Rudrauf et al., 2003) of the states of consciousness induced by mindfulness training. Such a mixed methods approach would capture the interpenetrating qualitative and quantitative aspects of the phenomena in question.

The neurophenomenological approach involves the active generation of experiential or phenomenological descriptive categories by a participant who is well trained in articulating fine-grained distinctions of mental experience. Long-term adepts of meditation are purportedly able to consistently invoke stable psychological states and describe them in greater and more accurate detail. By modeling associations between these precise phenomenological descriptions and changes in neural activity over time, mindfulness researchers may discover the biobehavioral correlates of specific mental processes relevant to both the experience of meditation and its clinical application.

Measuring Changes in Mindfulness-Induced Gene Expression

Recent evidence that mindfulness training increases antibody titers (Davidson et al., 2003) leads to recovery of natural-killer cell activity after cancer-related reductions (Witek-Janusek et al., 2008) and decreases cytokine production (Carlson, Speca, Faris, & Patel, 2007). These cellular changes may be mediated by experience-dependent gene expression, the process whereby social-environmental signals turn genes “on” and “off,” modulating gene translation and leading to alterations in protein synthesis (Pinaud, 2004). This hypothesis is supported by suggestive evidence that years of meditation experience correlates with increased cortical thickness in the right anterior insula and left superior temporal gyrus, brain areas associated with visceral attention, and self-awareness (Holzel et al., 2007; Lazar et al., 2005). Such mindfulness-induced neuroplasticity is likely mediated by changes in gene expression, the mechanism by which neurons secrete growth factors that activate gene translation in cell nuclei, resulting in the remodeling of synaptic connections (Mundkur, 2005).

Because stress affects neurogenesis through alterations in gene expression and translation (Glaser et al., 1990; Warner-Schmidt & Duman, 2006), ultimately leading to dysregulation of affect (Post, 1992), psychosocial interventions designed to reduce distress and improve mood may affect physiology through this pathway. Maximillian Muenke (2008), Chief of the Medical Genetics Branch at the National Institutes of Health, recently suggested that the therapeutic effects of stress reduction interventions such as clinical hypnosis may be mediated by changes in gene expression. Indeed, many mind–body interventions, including mindfulness, may affect the body through experience-dependent gene expression (Rossi, 2004). In line with this hypothesis, a recent study of Sudarshan Kriya, a meditative breathing practice, found increases in cellular markers of gene expression in practitioners relative to controls (Sharmaa et al., 2008). Although this research supports the experience-dependent gene expression hypothesis of mind–body medicine, its cross-sectional design does not allow for causal inference. However, in light of this potential shortcoming, another study identified alterations in the expression of 1,561 genes involved in the stress response before and after exposure to 8 weeks of meditation training (Dusek et al., 2008). As DNA microarray technology becomes more available, it may be possible to correlate the genomic effects of mindfulness with treatment outcomes in the not-too-distant future (Rossi, 2005).

Conclusion

The four domains of research direction outlined above are but a few of the many potential areas for future research. The positive findings so far on the health benefits of mindfulness (Greeson, 2009, in this issue) justify using the best tools of science to increase the evidence base for this increasingly popular complementary therapy while seeking to elucidate claims proffered by the classical canons of the meditative traditions.

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Susan A. Gaylord, Ph.D. is Director of the Program on Integrative Medicine and Assistant Professor in the Department of Physical Medicine and Rehabilitation, University of North Carolina School of Medicine, where, since 1998, she has led the development of research, education, and clinical initiatives in complementary, alternative, and integrative medicine. In 1995, she founded the multidisciplinary course “Principles and Practices of Complementary and Alternative Medicine (CAM),” attended in the past twelve years by over 700 health professions students and faculty. She is also course director for two other UNC CAM medical school electives: “Fieldwork in Complementary and Alternative Medicine” and “Introduction to Integrative Medicine.” She was principal investigator on a five-year NIH grant to develop and evaluate innovative CAM educational methodologies for health professionals, and is currently principal investigator on an NIH grant to study Mindfulness for IBS, as well as co-PI (with Doug Mann, PI) on a grant to study Craniosacral Therapies for Migraine. She is also the PI on a Blue-Cross Blue-Shield funded project to develop a pilot integrative diabetes management program in a rural underserved population in NC. She is the founder and director of the UNC Mindfulness-based Stress and Pain Management program (with Douglas Mann, MD as co-director) and led the development of the interdisciplinary Integrative Medicine Consult Service in the Department of Physical Medicine and Rehabilitation. She has played a leadership role in implementing the Planetree program (holistic, patient-centered care) at UNC Health Care, with its pilot program in the Rehabilitation Inpatient Unit, and is the chair of the Planetree Taskforce on CAM. Research interests include studies of outcomes and mechanisms of action of specific complementary therapies - including homeopathy, mindfulness, craniosacral therapy and acupuncture; the role of health beliefs in determining care pathways; cancer therapeutics; geriatrics; and women's health issues.