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SPECIAL ISSUE

Mindfulness Training Has Elements Common to Other Techniques

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?1 *This article presents the argument that mindfulness-based meditation (MM) techniques are beneficial and share many of the same outcomes as similar mind-centered practices such as transcendental meditation, prayer, imagery, and visualization and body-centered practices such as progressive muscle relaxation (PMR), autogenic training (AT), and yoga. For example, many standardized mind-body techniques such as mindfulness-based stress reduction and mindfulness-based cognitive therapy (a) are associated with a reduction in symptoms of anxiety and depression, (b) can be mastered in relatively brief time frames, and (c) are relatively cost-effective. Functional magnetic resonance imaging studies suggest that MM, along with other mind-body techniques, can influence brain centers that regulate stress reactions (e.g., eliciting increased activity in cerebral areas related to attention and emotion regulation). Furthermore, MM and other mind-body techniques may provide benefit by mediating breathing processes that in turn regulate gamma amino-butyric acid, a major inhibitory neurotransmitter, which can quiet the overactivation of the sympathetic nervous system. This article compares the efficacy of mindfulness-based techniques to that of other self-regulation techniques and identifies components shared between mindfulness-based techniques and several previous self-regulation techniques, including PMR, AT, and transcendental meditation. The authors conclude that most of the commonly used self-regulation strategies have comparable efficacy and share many elements. The authors propose that additional research is needed to explore shared mechanisms among the self-regulation techniques and to identify any factors that might favor using one technique over another.*

Several large-scale meta-analyses have documented that mindfulness-based cognitive therapies used in clinical settings produce moderate to large effect sizes when used to improve symptoms of stress and strain, especially in reducing experiences of heightened anxiety or depression (Dahl & Lundgren, 2015; Demarzo et al., 2015; Khoury et al., 2013; Khoury, Sharma, Rush, & Fournier, 2015). Mindfulness-based strategies, rooted in ancient Buddhist practices, have found acceptance as one of the major, contemporary behavioral medicine techniques (Hilton et al., 2016; Khazan, 2013). Throughout this article, the term *mindfulness* will refer broadly to a mental state of paying total attention to the present moment, with a nonjudgmental awareness of the inner and/or outer experiences (Baer, Smith, & Allen, 2004; Kabat-Zinn, 1994).

In 1979, Jon Kabat-Zinn introduced a manual for a standardized mindfulness-based stress reduction (MBSR) program at the University of Massachusetts Medical Center (Kabat-Zinn, 1994, 2003). The 8-week program combines mindfulness as a form of insight meditation with specific types of yoga breathing and movement exercises designed to focus on awareness of the mind and body, as well as thoughts, feelings, and behaviors. The most recent ~~2014~~ version of the manual, which focuses on mindfulness techniques specifically, is edited by Santorelli (2014). Because the original formulation of MBSR, instructions and procedures for mindfulness-based meditation (MM) techniques have varied so extensively as to raise important questions: What do we mean by mindfulness, and how would we know that mindfulness-based techniques improve clinical outcomes? Kabat-Zinn addressed some aspects of these abstract questions in a commentary on Baer (2003) that highlighted and contextualized answers to such inquiries.

Although this brief overview of mindfulness-based approaches is a mere summary of longer documents (e.g., Kabat-Zinn, 2003), there is a substantial body of evidence showing that mindfulness-based meditation (MBCT; Teasdale, Segal, & Williams, 1995) and MBSR (Kabat-Zinn, 1994, 2003) have been effectively combined with components of cognitive therapy for ameliorating stress symp-

toms such as negative thinking, anxiety, and depression. For example, MBSR and MBCT have been confirmed to be clinically beneficial in alleviating a variety of mental and physical conditions, such as anxiety, depression, cancer, pain disorder, and high blood pressure, and enhancing immune function (Andersen et al., 2013; Carlson, Speca, Patel, & Goodey, 2003; Creswell et al., 2016; Fjorback, Arendt, Ørnbøl, Fink, & Walach, 2011; Greeson & Eisenlohr-Moul, 2014; Hoffman et al., 2012; Marchand, 2012). Currently, standardized MBSR and MBCT techniques are widely applied in schools, hospitals, companies, prisons, and other environments.

Furthermore, ongoing investigations into neural mechanisms associated with mindfulness-based techniques have provided glimpses into the workings of the brain during mindfulness practices. For instance, generally speaking, the brain research on MBSR and MBCT shows that mindfulness meditation offers both neurological and clinical benefits. For example, Chiesa and Serretti (2010) found increased alpha and theta activity on electroencephalographic (EEG) recordings during mindfulness meditation. Neuroimaging studies using functional magnetic resonance imaging have shown that long-term meditation is associated with increased activity in cerebral areas related to attention, such as the dorsomedial prefrontal cortex and the anterior cingulate cortex in both hemispheres (Hölzel et al., 2007). Pagnoni and Cekic (2007) found that Zen meditation might offer protection from cognitive decline through inhibition of the reduction in both gray-matter volume and attentional performance associated with age. Davidson and his colleagues (1995, 2003) found that mindfulness increased left prefrontal alpha activity as well as decreased anxiety and increased positive emotion and well-being (Davidson, Kabat-Zinn et al., 2003). Moreover, Lazar et al. (2000) found that specific breathing patterns during meditative MBSR and MBCT increased activation in the prefrontal, temporal, parietal, anterior cingulate cortex, and amygdala regions. Even beginners in meditation practice produced high amplitudes of alpha. On the other hand, individuals who practiced for a long time produced more theta power (Lutz, Dunne, & Davidson, 2007).

Davidson and McEwen (2012) have also explored the relationship between long-term meditation and neuroplasticity. For example, they invited the Dalai Lama and other eminent monks from Tibet to participate in their studies and found long-term Buddhist practitioners to have high-amplitude gamma range EEG activity (30–50 Hz) as well as EEG phase synchrony during meditation (Ricard, Lutz, & Davidson, 2014). Lutz et al. (2007) and Lutz, Greischar, Rawlings, Ricard, and Davidson (2003) indicated that long-term meditation increases the connectivity between the prefrontal lobes and the amygdala, changes the alpha asymmetry, and increases activity in the left hemisphere.

The Relationship Between Mindfulness and Other Self-Regulation Techniques

This section will address two questions: First, how do mindfulness-based interventions compare in efficacy to older self-regulation techniques? Second, and perhaps more basically, how new and different are mindfulness-based therapies from other self-regulation-oriented practices and therapies?

Comparing the Efficacy of MM to Other Self-Regulation Approaches

To conclude that MM techniques are more effective than other approaches, MM would need to be compared with equivalent control groups in which the participants are taught other traditional systematic approaches including progressive muscle relaxation (PMR), autogenic training (AT), transcendental meditation, or biofeedback training. Training should be conducted by practitioners who are self-practiced and have mastered these techniques and have not merely received training from a short audio or video clip, as pointed out in several meta-analyses (Cherkin et al., 2016; Khoury et al., 2015). Unsurprisingly, in one of the rare randomized and controlled comparative effectiveness studies of MBSR versus AT, no conclusions could be drawn as to which technique provided superior stress reduction in a sample of German medical students (Kuhlmann, Huss, Bürger, & Hammerle, 2016). The study by Sevinc et al. (2018), however, suggested that there may be different physiological changes depending on whether participants practiced the relaxation response or MM.

Almost all of the reported research suggests beneficial effects of mindfulness training and implies that mindfulness meditation is an excellent therapeutic technique. Unfortunately, there are few studies that compare the effectiveness of mindfulness meditation to other sitting meditation techniques such as transcendental meditation. Interestingly, Tanner et al. (2009), in a waitlist-controlled study of students in Washington, DC, area universities practicing transcendental meditation, used the concept of mindfulness, as measured by the Kentucky Inventory of Mindfulness Skills (Baer et al., 2004), as a dependent variable; this study showed that transcendental meditation practice resulted in greater degrees of mindfulness. More direct comparisons of mindfulness-based approaches with body-focused techniques, such as PMR, or AT, have not found superior

benefit. For example, Agee, Danoff-Burg, and Grant (2009) compared the stress management effects of a 5-week mindfulness meditation course to a 5-week PMR course and found no meaningful reports of superiority of one over the other program; both MM and PMR were effective in reducing symptoms of stress.

In a persuasive meta-analysis comparing MBSR with other similar stress management techniques used among military service members, Crawford et al. (2013) described various multimodal programs for addressing posttraumatic stress disorder (PTSD) and other military or combat-related stress reactions. Of note, Crawford et al. (2013) suggested that all of the multimodal approaches that include AT, PMR, yoga, tai chi, mindfulness meditation, and various types of imagery, visualization, and prayer-based contemplative practices all provide some benefit to service members experiencing PTSD.

An important observation was made by Crawford et al. (2013): When military service members had more physical symptoms of stress, the meditative techniques appeared to work best, and when the chief complaints were about cognitive ruminations, body techniques such as yoga or tai chi worked best to reduce symptoms. Such studies raise questions about mechanisms that unite and differentiate mind-body approaches used in therapeutic settings.

Is Mindfulness Training Old Wine in New Bottles?

One important question in regard to similarities and differences of mindfulness-based and other mind-body interventions concerns the critical ingredients of mind-body practices. It is well articulated using the metaphor of baking. For example, the difference between a chocolate and a vanilla cake is not ingredients such as flour, sugar, or so forth, which are common to all cakes, but rather the essential or critical ingredient of the chocolate or vanilla flavoring. So, what are the essential or critical ingredients in mind-body techniques? Extending the metaphor, Crawford et al. (2013, p. 20) observed that the critical ingredient common to the mind-body techniques they studied was that people "can change the way their body and mind react to stress by changing their thoughts, emotions, and behaviors" with techniques that, relatively speaking, "involve minimal cost and training time."

The skeptical view suggested here is that MM techniques share similar strategies with other mind-body approaches such as encouraging learners to pay attention and shift intention. In this sense, MM training repackages techniques that have been available for millennia and thus becomes old wine sold in new bottles.

One of the more intriguing theoretical perspectives about the possible mechanisms shared by a variety of mind-body techniques was proposed by Streeter, Gerbarg, Saper, Ciraulo, and Brown (2012). These authors suggested that techniques that calm the autonomic nervous system, along with symptoms such as anxiety and depression, are mediated by regulation of the major inhibitory neurotransmitter gamma aminobutyric acid (GABA), as depicted in the following figure from their article (see the Figure). Stated in a simplified way, the mind-body techniques that have beneficial effects regarding symptoms such as anxiety and depression do so because the techniques contribute to balancing the GABA pathways. For example, Streeter et al. (2012) suggested that the way that various mind-body techniques influence the GABA pathways is by teaching, guiding, and training various types of calming breathing.

Each generation of clinicians and educators rediscovers principles without always recognizing that similar principles were part of the previous generation of clinical interventions. The analogies and language have changed; however, the underlying concepts are still the same.

Some of the underlying mindfulness techniques that are shared in common with many other mind-body and self-regulation approaches are the following:

- The practitioner must be self-experienced in mindfulness practice. This means that the practitioners do not merely believe the practice is effective; they know it is effective from self-experience. Inner confidence conveyed to clients and patients enhances the healing/placebo effect. It is similar to having sympathy or empathy for clients and patients that occurs from having similar life experiences. For example, a male physician speaking to a female patient who has had a mastectomy may have sympathy; however, empathy becomes possible only when another mastectomy patient (who may also be a physician) shares how she struggled to overcome her doubts and can still be loved by her partner.
- Observing thoughts without being captured—being a witness to the thoughts, emotions, and external events results in a type of covert desensitization and skill mastery of not being captured by those thoughts and emotions.
- Ongoing daily practice, which means that the participants take an active role in their own healing process as they learn to control and focus their attention. Participants are often asked to practice up to 1 hour a day in formal practice and apply skills during the day as mini-practices or awareness cues to interrupt the dysfunctional behavior.

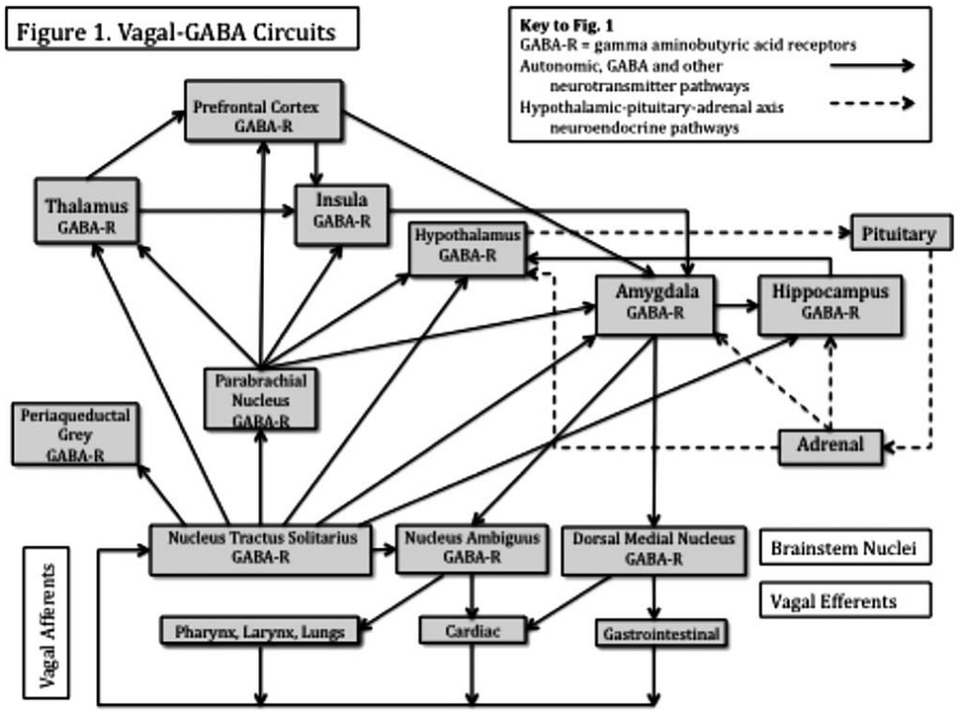

Figure. Vagal–gamma aminobutyric acid circuits (reprinted with permission from Streeter et al., 2012).

- Peer support provided by teaching mind-body practices in groups is a major factor for success as people can share their challenges and successes. Peer support tends to promote acceptance of self and others and provides role modeling of how to cope with stressors.

All mind-body approaches, including PMR, AT, yogic practices, and transcendental meditation, have been most successful when the originators, and their initial students, taught their new and evolving techniques to patients; however, they become less successful as later followers and practitioners used these approaches without learning an in-depth skill mastery. For example, PMR as taught by Edmund Jacobson focused on developing subtle awareness of different levels of muscle tension over many sessions to achieve mastery. Today, PMR is often a matter of simply listening to a 20-minute audio recording about tightening and relaxing muscles and may not be as effective (Lehrer, Woolfork, & Goldman, 1986). Similarly, AT as conducted by Johannes Schultz and Wolfgang Luthe involved learning passive attention over a 3- to 6-month period while the participant practiced multiple times daily. Stating the obvious, learning AT, mindfulness, PMR, biofeedback/neurofeedback, or any other mind-body technique demands much more than listening once to a 20-minute audio recording. Below is a review of common mind-body practices to be considered alongside mindfulness meditation.

Progressive Muscle Relaxation

In the United States during the 1920s, PMR was developed and taught by Edmund Jacobson (Jacobson, 1938). Over the 70 years in which he documented the effectiveness of PMR, Jacobson reported that it was clinically very successful for numerous conditions such as hypertension, back pain, gastrointestinal discomfort, and anxiety (Jacobson, 1977, 1978). Patients were active participants, practiced the skills at home and at work, and used them to interrupt dysfunctional behaviors during the day by becoming aware of and releasing unnecessary muscle tension (dysponetic activity). The incorporation of PMR as the homework practice was an important cofactor in the successful outcome in the treatment of muscle tension headache using electromyography (EMG) biofeedback by Budzynski, Stoyva, and Adler (1970).

Autogenic Training

In 1932, Johannes Schultz in Germany published a book about AT describing the basic training procedure (Schultz, 1932). The standard autogenic exercises were taught over 3 months or more in which the person learned to direct passive attention to the heaviness of the arms while

repeating an internal phrase (e.g., "My right arm is heavy"; Luthe, 2000). The three main principles of AT as described by Luthe (1970, 1979) are as follows: (a) mental repetition of body-oriented verbal formulae for brief periods, (b) passive concentration, and (c) reduction of exteroceptive and proprioceptive afferent stimulation. The underlying concepts of autogenic therapy, as described by Peper and Williams (1980), include the following:

- The body has an innate capacity for self-healing, and it is this capacity that is allowed to become operative in the autogenic state. Neither trainers nor trainees have the wisdom necessary to direct the course of the self-balancing process; hence, the capacity is allowed to occur and cannot be directed.
- Homeostatic self-regulation is encouraged.
- Much of the learning is done by the trainee at home; hence, the responsibility for the training lies primarily with the trainee.
- The trainer/teacher must be self-experienced in the practice.
- The attitude necessary for successful practice is one of passive attention; active striving and concern with results impedes the learning process. An attitude of acceptance is cultivated, letting whatever be comes up. This quality of attention is known as *mindfulness* in meditative traditions.

The clinical outcome for autogenic therapy was again remarkable, showing benefits across a wide variety of psychosomatic conditions such as asthma, cancer, hypertension, anxiety, pain, irritable bowel syndrome, psoriasis, and depression (Luthe & Schultz, 1970a, 1970b; Klott, 2013; Klein & Peper, 2013). Many practitioners incorporated autogenic components into biofeedback. The remarkable clinical outcomes in hand-warming biofeedback for the treatment of migraine by Elmer and Alice Green included combining AT phrases with temperature biofeedback (Green & Green, 1989). AT combined with biofeedback produced better results in clinical research with headache populations than the control group (Luthe, 1979).

Transcendental Meditation

Transcendental meditation is a practice that comes from the ancient Vedic tradition in India. Meditators use a mantra, which they mentally repeat, and when their attention wanders, they go back to saying the mantra internally. Wallace's 1970 study on transcendental meditation was the first to capture the media's attention. Wallace reported that

> during meditation, oxygen consumption and heart rate decreased, skin resistance increased, and the electroencephalogram showed specific changes in certain frequencies. These results seem to distinguish the state produced by Transcendental Meditation from commonly encountered states of consciousness and suggest that it may have practical applications. (Wallace, 1970, p. 1751)

Subsequent meta-analyses have reported that those who practiced transcendental meditation as compared with the control group experienced significant improvements of numerous disorders such as cardiovascular disease and its risk factors, anxiety, metabolic syndrome, drug abuse, and hypertension (Hawkins, 2003; Paul-Labrador et al., 2006; Rainforth et al., 2007). Herbert Benson adapted and simplified techniques from transcendental meditation training and then labeled its core element the *relaxation response* (Benson, Beary, & Carol, 1974). Instead of giving people a secret mantra as part of a spiritual tradition, he recommended using the word *one* as the mantra. Numerous studies have demonstrated that when patients practice the relaxation response, many clinical symptoms are reduced (Mandle, Jacobs, Arcari, & Domar, 1996; Peters, Benson & Porter, 1977; Stahl et al., 2015). Research found that when practiced regularly, transcendental meditation produced an increase in prefrontal low alpha and theta power in the EEG, as well as higher prefrontal alpha coherence at other locations in both hemispheres (Travis, 2001; Travis & Wallace, 1999). Moreover, some individuals also showed lower sympathetic activation and higher parasympathetic activation, increased respiratory sinus arrhythmia, increased frontal blood flow, and a decreased breathing rate (Travis, 2001, 2014). Although transcendental meditation and Benson's relaxation response continue to be practiced, mindfulness training and mindfulness meditation have largely taken their place.

Biofeedback/Neurofeedback Training

Starting in the late 1960s, biofeedback procedures were developed as a successful treatment approach for numerous illnesses, ranging from headaches to hypertension to ADHD. In most cases, instructions very similar to those provided for mindfulness meditation were part of the biofeedback and neurofeedback instructions. The participants were instructed to learn control over some physiological parameter and then to practice the skill in daily life. This meant that during the learning process, the person learned passive attention while not being captured by difficult thoughts and feelings and developed awareness of the dysfunctional pattern and began to substitute more functional behavior.

Conclusion

MBSR and MBCT may be considered old wine in new bottles, where the metaphor refers to millennia-old meditation techniques as old wine and MBSR or MBCT as new bottles. There are remarkable outcome data for studies that use MBSR or MBCT training with clients and patients; however, it is not clear that mindfulness training is better than PMR, AT, transcendental meditation, or other well-taught strategies. The reported significant benefits may be the result of demonstrating changes with technologies and biological assays that were not available when most of the research in PMR or AT was done. One has to assume that the clinical improvements reported from practicing AT and PMR suggest that they affected brain function and the immune system because numerous disorders improved (Luthe & Schultz, 1970a, 1970b).

As with many other new therapeutic approaches, we suggest using them now before they become stale and lose part of their placebo power. As long as the application of the new technique is taught with the intensity and dedication of the innovators of the approach, and as long as the participants are required to practice while receiving support, the outcomes will likely be continue being beneficial and most likely similar in effect to other mind-body approaches.

The challenge facing mindfulness practices, similarly to the challenges faced by AT, PMR, and transcendental meditation, is that familiarity breeds contempt and that clients and therapists are continuously looking for a new technique that promises a better outcome. As mindfulness training is taught to more people in less time (e.g., fewer minutes and/or fewer sessions), and with less well-trained instructors, who may offer less support and supervision for people experiencing possible negative effects, the overall benefits are likely to decrease. Thus, mindfulness practice, AT, PMR, transcendental meditation, movement practices, as well as the many spiritual practices, all appear to share a common fate of fading over time. Although the core principles of mind-body techniques are ageless, the execution is not always ensured.

References

Agee, J. D., Danoff-Burg, S., & Grant, C. A. (2009). Comparing brief stress management courses in a community sample: Mindfulness skills and progressive muscle relaxation. *Explore: The Journal of Science and Healing*, *5*, 104–109.

Andersen, S. R., Würtzen, H., Steding-Jessen, M., Christensen, J., Andersen, K. K., Flyger, H., . . . Dalton, S. O. (2013). Effect of mindfulness-based stress reduction on sleep quality: Results of a randomized trial among Danish breast cancer patients. *Acta Oncologica*, *52*, 336–344.

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice*, *10*, 125–143.

Baer, R. A. (2015). *Mindfulness-based treatment approaches: Clinician's guide to evidence base and applications*. New York: Elsevier.

Baer, R., Smith, G., & Allen, K. (2004). Assessment of mindfulness by self-report: The Kentucky Inventory of Mindfulness Skills. *Assessment*, *11*, 191–206.

Benson, H., Beary, J. F., & Carol, M. P. (1974). The relaxation response. *Psychiatry*, *37*, 37–46.

Budzynski, T., Stoyva, J., & Adler, C. (1970). Feedback-induced muscle relaxation: Application to tension headache. *Journal of Behavior Therapy and Experimental Psychiatry*, *1*, 205–211.

Carlson, L. E., Speca, M., Patel, K. D., & Goodey, E. (2003). Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer outpatients. *Psychosomatic Medicine*, *65*, 571–581.

Cherkin, D. C., Sherman, K. J., Balderson, B. H., Cook, A. J., Anderson, M. L., Hawkes, R. J., . . . Turner, J. A. (2016). Effect of mindfulness-based stress reduction vs cognitive behavioral therapy or usual care on back pain and functional limitations in adults with chronic low back pain: A randomized clinical trial. *Journal of the American Medical Association*, *315*, 1240–1249.

Chiesa, A., & Serretti, A. (2010). A systematic review of neurobiological and clinical features of mindfulness meditations. *Psychological Medicine*, *40*, 1239–1252.

Crawford, C., Wallerstedt, D. B., Khorsan, R., Clausen, S. S., Jonas, W. B., & Walter, J. A. (2013). A systematic review of biopsychosocial training programs for the self-management of emotional stress: Potential applications for the military. *Evidence-Based Complementary and Alternative Medicine*, *747694*, 1–23.

Creswell, J. D, Taren, A. A., Lindsay, E. K., Greco, C. M., Gianaros, P. J., Fairgrieve, A., . . . Ferris, J. L. (2016). Alterations in resting-state functional connectivity link mindfulness meditation with reduced interleukin-6: A randomized controlled trial. *Biological Psychiatry*, *80*, 53–61.

Dahl, J., & Lundgren, T. (2015). Mindfulness-based stress reduction for chronic pain. In R. H. Baer (Ed.), *Mindfulness-based treatment approaches: Clinician's guide to evidence base and applications* (pp. 269–292). New York: Academic Press.

Davidson, R. J (1995). Cerebral asymmetry, emotions, and affective style. In R. J. Davidson & K. Hugdahl (Eds.), *Brain asymmetry* (pp. 361–387). Cambridge: Massachusetts Institute of Technology.

Davidson, R. J. (2003). Affective neuroscience and psychophysiology: Toward a synthesis. *Psychophysiology*, *40*, 655–665.

Davidson, R. J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S. F., . . . Sheridan, J. F. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine*, *65*, 564–570.

Davidson, R. J., & McEwen, B. S. (2012). Social influences on neuroplasticity: Stress and interventions to promote well-being. *Nature Neuroscience*, *15*, 689–695.

Demarzo, M. M., Montero-Marin, J., Cuijpers, P., Zabaleta-del-Olmo, E., Mahtani, K. R., Vellinga, A., . . . García-Campayo, J. (2015). The efficacy of mindfulness-based interventions in primary care: A meta-analytic review. *Annals of Family Medicine*, *13*, 573–582.

Fjorback, L. O., Arendt, M., ~~Ornbl,~~ E., Fink, O., & Walach, H. (2011). Mindfulness-based stress reduction and mindfulness-based cognitive therapy: A systematic review of randomized controlled trials. *Acta Psychiatrica Scandinavica*, *124*, 102–119.

Green, E., & Green, A. (1989). *Beyond biofeedback*. New York: Knoll.

Greeson, J., & Eisenlohr-Moul, T. (2014). Mindfulness-based stress reduction for chronic pain. In R. A. Baer (Ed.), *Mindfulness-based treatment approaches: Clinical guide to evidenced-based applications* (2nd ed., pp. 269–292). New York: Elsevier.

Hawkins, M. A. (2003). Effectiveness of the transcendental meditation program in criminal rehabilitation and substance abuse recovery, *Journal of Offender Rehabilitation*, *36*(1–4), 47–65.

Hilton, L., Hempel, S., Ewing, B. A., Apaydin, E., Xenakis, L., Newberry, S., . . . Maglione, M. A. (2016). Mindfulness meditation for chronic pain: Systematic review and meta-analysis. *Annals of Behavioral Medicine*, *51*, 199–213.

Hoffman, C. J., Ersser, S. J., Hopkinson, J. B., Nicholls, P. G., Harrington, J. E., & Thomas, P. W. (2012). Effectiveness of mindfulness-based stress reduction in mood, breast-and endocrine-related quality of life, and well-being in stage 0 to III breast cancer: A randomized, controlled trial. *Journal of Clinical Oncology*, *30*, 1335–1342.

Hölzel, B. K., Ott, U., Hempel, H., Hackl, A., Wolf, K., Stark, R., & Vaitl, D. (2007). Differential engagement of anterior cingulate and adjacent medial frontal cortex in adept meditators and non-meditators. *Neuroscience Letters*, *421*, 16–21.

Jacobson, E. (1938). *Progressive relaxation*. Chicago: University of Chicago Press.

Jacobson, E. (1977). The origins and development of progressive relaxation. *Journal of Behavior Therapy and Experimental Psychiatry*, *8*, 119–123.

Jacobson, E. (1978). *You must relax* (4th ed.). New York: McGraw-Hill.

Kabat-Zinn, J. (1994). *Wherever you go, there you are: Mindfulness meditation in everyday life*. New York: Hyperion.

Kabat-Zinn, J. (2003). Mindfulness-based stress reduction (MBSR). *Constructivism in the Human Sciences*, *8*, 73–107.

Khazan, I. Z. (2013). *The clinical handbook of biofeedback: A step-by-step guide for training and practice with mindfulness*. Oxford, UK: John Wiley & Sons.

Klein, A., & Peper, E. (2013). There is hope: Autogenic biofeedback training for the treatment of psoriasis. *Biofeedback*, *41*, 194–201.

Khoury, B., Lecomte, T., Fortin, G., Masse, M., Therien, P., Bouchard, V., . . . Hofmann, S. G. (2013). Mindfulness-based therapy: A comprehensive meta-analysis. *Clinical Psychology Review*, *33*, 763–771.

Khoury, B., Sharma, M., Rush, S. E., & Fournier, C. (2015). Mindfulness-based stress reduction for healthy individuals: A meta-analysis. *Journal of Psychosomatic Research*, *78*, 519–528.

Klott, O. (2013). Autogenic training: A self-help technique for children with emotional and behavioural problems. *Therapeutic Communities: The International Journal of Therapeutic Communities*, *34*, 152–158.

Kuhlmann, S. M., Huss, M., Bürger, A., & Hammerle, F. (2016). Coping with stress in medical students: results of a randomized controlled trial using a mindfulness-based stress prevention training (MediMind) in Germany. *BMC Medical Education*, *16*, 316.

Lazar, S. W., Bush, G., Gollub, R. L., Fricchione, G. L., Khalsa, G., & Benson, H. (2000). Functional brain mapping of the relaxation response and meditation. *NeuroReport*, *11*, 1581–1585.

Lehrer, P. M., Woolfolk, R. L., & Goldman, N. (1986). Progressive relaxation then and now: Does change mean progress? In R. J. Davidson, G. E. Schwartz, & E. Shapiro (Eds.), *Consciousness and self-regulation* (Vol. 4, pp. 183–216). New York: Plenum.

Luthe, W. (1970). *Autogenic therapy: Research and theory*. New York: Grune and Stratton.

Luthe, W. (1979). About the methods of autogenic therapy. In E. Peper, S. Ancoli, & M. Quinn (Eds.), *Mind body integration* (pp. 167–186). New York: Plenum.

Luthe, W., & Schultz, J. H. (1970a). *Autogenic therapy: Applications in psychotherapy*. New York: Grune and Stratton.

Luthe, W., & Schultz, J. H. (1970b). *Autogenic therapy: Medical applications*. New York: Grune and Stratton.

Lutz, A., Dunne, J. D., & Davidson, R. J. (2007). Meditation and the neuroscience of consciousness. In P. D. Zelazo, M. Moscovich, & E. Thompson (Eds), *Cambridge handbook of consciousness* (pp. 499–555). New York: Cambridge University Press.

Lutz, A., Greischar, L. L., Rawlings, N. B., Ricard, M., & Davidson, R. J. (2004). Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. *Proceedings of the National Academy of Sciences of the United States of America*, *101*, 16369–16373.

Mandle, C. L., Jacobs, S. C., Arcari, P. M., & Domar, A. D. (1996). The efficacy of relaxation response interventions with adult patients; A review of the literature. *Journal of Cardiovascular Nursing*, *10*, 4–26.

Marchand, W. R. (2012). Mindfulness-based stress reduction, mindfulness-based cognitive therapy, and Zen meditation for depression, anxiety, pain, and psychological distress. *Journal of Psychiatric Practice*, *18*, 233–252.

Pagnoni, G., & Cekic, M. (2007). Age effects on gray matter volume and attentional performance in Zen meditation. *Neurobiology of Aging*, *28*, 1623–1627.

Paul-Labrador, M., Polk, D., Dwyer, J. H., Velasquez, I., Nidich, S., Rainforth, M., . . . Merz, C. N. (2006). Effects of a randomized controlled trial of transcendental meditation on components of the metabolic syndrome in subjects with

coronary heart disease. *Archives of Internal Medicine*, *166*, 1218–1224.

Peper, E., & Williams, E. A. (1980). Autogenic therapy. In A. C. Hastings, J. Fadiman, & J. S. Gordon (Eds.), *Health for the whole person* (pp. 137–141). Boulder, CO: Westview Press.

Peters, R. K., Benson, H., & Porter, D. (1977). Daily relaxation response breaks in a working population, *American Journal of Public Health*, *67*, 946–953. doi:10.2105/AJPH.67.10.946

Rainforth, M. V., Schneider, R. H., Nidich, S. I., Gaylord-King, C., Salerno, J. W., & Anderson, J. W. (2007). Stress reduction programs in patients with elevated blood pressure: A systematic review and meta-analysis. *Current Hypertension Reports*, *9*, 520–528.

Ricard, M., Lutz, A., & Davidson, R. J. (2014). Mind of the meditator. *Scientific American*, *311*, 38–45.

Santorelli, S. (2014). *Mindfulness-based stress reduction (MBSR): Standards of practice*. Worcester: Center for Mindfulness in Medicine, Health Care & Society, University of Massachusetts Medical School. Retrieved July 3, 2019, from https://146.189.217.91/contentassets/24cd221488584125835e2eddce7dbb89/mbsr_standards_of_practice_2014.pdf

Schultz, J. H. (1932). *Das Autogene Training-Konzentrative Selbstentspannung* [Autogenic training: Concentrative self-relaxation]. Leipzig, Germany: Thieme.

Sevinc, G., Hölzel, B. K., Hashmi, J., Greenberg, J., McCallister, A., Treadway, M., . . . Lazar, S.W. (2018). Common and dissociable neural activity after mindfulness-based stress reduction and relaxation response programs. *Psychosomatic Medicine*, *80*, 439–451.

Stahl, J. E., Dossett, M. L., LaJoie, A. S., Denninger, J. W., Mehta, D. H., Goldman, R., . . . Benson, H. (2015). Relaxation response and resiliency training and its effect on healthcare resource utilization. *PLoS One*, *10*, e0140212.

Streeter, C. C., Gerbarg, P. L., Saper, R. B., Ciraulo, D. A., & Brown, R. P. (2012). Effects of yoga on the autonomic nervous system, gamma-aminobutyric-acid, and allostasis in epilepsy, depression, and post-traumatic stress disorder. *Medical Hypotheses*, *78*, 571–579.

Tanner, M. A., Travis, F., Gaylord-King, C., Haaga, D. A. F., Grosswald, S., & Schneider, R. H. (2009). The effects of the transcendental meditation program on mindfulness. *Journal of Clinical Psychology*, *65*, 574–589.

Teasdale, J. D., Segal, Z., & Williams, J. M. (1995). How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help? *Behaviour Research and Therapy*, *33*, 25–39.

Travis, F. (2001). Autonomic and EEG patterns distinguish transcending from other experiences during transcendental meditation practice. *International Journal of Psychophysiology*, 42, 1–9.

Travis, F. (2014). Transcendental experiences during meditation practice. *Annals of the New York Academy of Sciences*, *1307*, 1–8. doi:10.1111/nyas.12316

Travis, F., & Wallace, K. (1999). Autonomic and EEG patterns during eyes-closed rest and transcendental meditation (TM) practice: The basis for a neural model of TM practice. *Consciousness and Cognition*, *8*, 302–318.

Wallace, K. W. (1970). Physiological effects of transcendental meditation. *Science*, *167*, 1751–1754.

Queries for biof-47-03-02

1. **Author: This article has been lightly edited for grammar, style, and usage. Please compare against your original document and make changes on these pages. Please limit your corrections to substantive changes that affect meaning. If no change is required in response to a question, please write "OK as set" in the margin. Copy editor**
2. **Author: Please provide a reference for Luthe (2000), cited in the "Autogenic Training" section. Copy editor**
3. **Author: Please provide an in-text citation for Baer (2015) or remove from the reference list. Copy editor**

Editor's questions:

e1. Should this be something like "cancer-related pain and anxiety"? -- it's not claiming that tumors actually shrink and disappear?

e2. Should this be "feelings of well-being"?

e3. Should this be "who had practiced for a long time" (years) instead of "who practiced for a long time" (e.g., practiced for 3 hours today)?