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An Analysis of Recent Meditation Research and Suggestions for Future Directions*

by Shauna L. Shapiro[1], Roger Walsh[2], & Willoughby B. Britton[3]

[1] Department of Counseling Psychology, Santa Clara University

[2] Department of Psychiatry and Human Behavior, University of California Irvine College of Medicine

[3] Department of Psychology, University of Arizona

Summary

Meditation offers a rich and complex field of study. Over the past 40 years, several hundred research studies have demonstrated numerous significant findings including changes in psychological, physiological, and transpersonal realms. This paper attempts to summarize these findings, and to review more recent meditation research. We then suggest directions for future research, emphasizing the necessity to continue to expand the paradigm from which meditation research is conducted, from a predominantly reductionistic, biomedical model to one which includes subjective and transpersonal domains and an integral perspective.

Introduction

Meditation has been practiced in many forms in many cultures over many centuries. Historically, it has been practiced for at least three thousand years since the dawn of Indian yoga and is a central discipline at the contemplative core of each of the world's great religions. It is most often associated with the Indian traditions of yoga and Buddhism, but has also been crucial to the Chinese Taoist and neoConfucian traditions. The great monotheisms—Judaism, Christianity and Islam—have also offered a variety of meditative techniques, although they never obtained the popularity and centrality accorded them in India.

The Perennial Philosophy

The importance accorded meditation by the perennial philosophy—the common core of wisdom and worldview that lies at the heart of each of the great religions—is based on three crucial assumptions; assumptions that speak to the most

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vital aspects of our nature and potential as human beings. Yet, with the exception of transpersonal and integral psychologies, these assumptions lie outside most mainstream Western psychology and thought.

1. Our usual, psychological state is suboptimal and immature.
   William James provided a pithy and poetic summary stating that "most people live, whether physically, intellectually or morally, in a very restricted circle of their potential being. They make use of a very small portion of their possible consciousness. We all have reservoirs of life to draw upon, of which we do not dream."
2. Higher states and stages are available as developmental potentials.
   What we call "normality" and have regarded as the ceiling of human possibilities is increasingly coming to look like a form of arbitrary, culturally determined, developmental arrest (Walsh & Vaughan, 1993; Wilber, 2000a). Mainstream developmental psychology itself is coming to a similar conclusion. Beyond Piaget's formal operational thinking lies post formal operational cognition, beyond Kohlberg's conventional morality are postconventional stages, beyond Fowler's synthetic-conventional faith lie conjunctive and universalizing faith, beyond Maslow's self-esteem needs await self-actualization and self-transcendence, and beyond Loevinger's conformist ego lie the possibilities of the autonomous and integrated ego (Fowler, 1981; Kohlberg, 1981; Loevinger, 1997; Maslow, 1971; Wilber, 1999, 2000a). In short, beyond conventional, personal stages of development await postconventional, transpersonal stages and potentials.
3. Psychological development to transpersonal states and stages can be catalyzed by a variety of psychological and spiritual practices.
   Indeed, the contemplative core of the world's religions consists of a set of practices to do just this. Comparison across traditions suggests that there are seven practices that are widely regarded as central and essential for effective transpersonal development. These seven are an ethical lifestyle, redirecting motivation, transforming emotions, training attention, refining awareness, fostering wisdom, and practicing service to others (Walsh, 1999). Contemplative traditions posit that meditation is crucial to this developmental process because it facilitates several of these processes.

Defining meditation

For all of the above reasons, meditation is of great interest to transpersonal and integral researchers. This leads to the important question, "what is meditation?" Meditation can be defined as a family of practices that train attention and awareness, usually with the aim of fostering psychological and spiritual well being and maturity. Meditation does this by training and bringing mental processes under greater voluntary control, and directing them in beneficial ways.

This control is used to cultivate specific mental qualities such as concentration and calm, and emotions such as joy, love and compassion. Through greater awareness, a clearer understanding of oneself and one's relationship to the world develops. Additionally, it is held that a deeper and more accurate knowledge of consciousness and reality manifests.

A common division is into concentration and awareness types of meditation. Concentration practices attempt to focus awareness on a single object such as the breath or a mantra (internal sound). By contrast, awareness practices allow attention to move to a variety of objects, and investigate them all.

Contemplative traditions posit that through the process of meditation, physical, psychological and spiritual health are cultivated. Contemporary research offers preliminary yet growing support to some of these claims. Below, we briefly summarize the general findings of meditation on reducing physical and psychological symptoms. We then review studies that explore the effects of meditation on psychological and transpersonal health, as well as on its physiological correlates.

Foundational Research Studies

Researchers primarily have examined meditation's effects as a self-regulation strategy for stress management and symptom reduction. Over the past three decades, there has been considerable research examining the psychological and physiological effects of meditation (for reviews see Andresen, 2000; Murphy, Donovan, & Taylor, 1997; Shapiro & Walsh, 1984; West, 1987). Meditative practices are now being utilized in a variety of health care settings. This is understandable because research suggests that meditation may be an effective intervention for: cardiovascular disease (Zamarra, Schneider, Besseghini, Robinson, & Salerno, 1996); chronic pain (Kabat-Zinn, 1982); anxiety and panic disorder (Edwards, 1991; Miller, Fletcher, & Kabat-Zinn, 1995); substance abuse (Gelderloos, Walton, Orme-Johnson, Alexander, 1991); dermatological disorders (Kabat-Zinn, Wheeler, Light, Skillings, Scharf, Cropley, Hosmer, & Bernhard, 1998); reduction of psychological distress and symptoms of distress for cancer patients (Speca, Carlson, Goodey, & Angen, 2000); and reduction of medical symptoms in both clinical and non-clinical populations (Reibel, Greeson, Brainard, & Rosenzweig, 2001; Williams, Kolar, Reger, & Pearson, 2001, Kabat-Zinn, Lipworth, Burney,& Sellers, 1985).

Few researchers have examined meditation's original purpose as a self-liberation strategy to enhance qualities such as compassion, understanding, and wisdom. However, a small number of pioneering studies provide a valuable foundation.

These studies suggest meditation can produce improvements in: self-actualization (Alexander, Rainforth, & Gelderlos, 1991); empathy (Lesh, 1970;

Shapiro, Schwartz, & Bonner, 1998); sense of coherence and stress-hardiness (Kabat-Zinn & Skillings, 1989; Tate, 1994), happiness (Smith, Compton, & West, 1995), increased autonomy and independence (Penner, Zingle, Dyck, & Truch, 1974); a positive sense of control (Astin, 1997); increased moral maturity (Nidich, Ryncarz, Abrams, Orme-Johnson, & Wallace, 1983); and spirituality (Shapiro et al., 1998). Positive behavioral effects include: heightened perception (visual sensitivity, auditory acuity); improvements in reaction time and responsive motor skill; increased field independence; increased concentration and attention (see Murphy et al., 1997). In addition, meditation appears to result in improvements in aspects of intelligence, school grades, learning ability, and short- and long-term recall (see Cranson, Orme-Johnson, Gackenbach, Dillbeck, Jones, & Alexander, 1991; Dillbeck, Assimakis, & Raimondi, 1986; Lewis, 1978), and some forms of creativity (Cowger & Torrance, 1982).

These pioneering studies are not without limitations, and several caveats should be noted. Many of these studies do not demonstrate rigorous research design (including lack of randomization, lack of follow-up, and imprecise measurement of constructs), and sometimes are based on small samples. Researchers often failed to report what type of meditation technique was taught, or the length and intensity of the practice. Also, several of the studies retrospectively compare meditators to controls, which yields useful correlational but no causal inferences. Furthermore, most meditation research is derived from relative beginners of meditation practice.

Despite these limitations, the studies provided a solid beginning upon which recent research has been building. We review a sample of recent, well-designed studies on the effects of meditation on variables important in the field of transpersonal psychology.

Analysis of recent research

Psychological Findings

Cognition and Creativity. Three recent studies by So and Orme-Johnson (2001) examined the effects of TM meditation on cognition. One hundred fifty-four Chinese high school students were randomized into a TM group or a napping group. The TM technique and napping were practiced for approximately 20 minutes twice a day. At 6-month follow-up, the TM group demonstrated significantly increased practical intelligence, field independence, creativity, and speed of information processing, as well as significantly decreased anxiety compared to the control group. The authors suggest that these findings indicate that TM's effects extend beyond those of ordinary rest.

The findings of this study were replicated in a sample of 118 junior high Chinese students who were randomly assigned to a TM group, a contemplative meditation group, or a no treatment control group. All students practiced their respective meditation techniques for 20 minutes twice a day. At 6-month follow-up the TM group showed improvement on creativity, anxiety, information processing time, and practical intelligence as compared to the contemplation group. The contemplation group improved on information processing time as compared to the control group.

These general findings were replicated in a third study examining the effects of TM compared to a no treatment control group on 99 male vocational students from Taiwan. At 12 months follow up, the TM group significantly increased practical intelligence, field independence, whole-brained creativity, and speed of information processing, and significantly decreased anxiety as compared to the control group. In summarizing the implications of these three studies, the authors suggest that the findings strongly support the hypothesis that TM improves performance on a number of cognitive and affective measures.

Attention/concentration. To examine the effects of meditation on attention, Valentine and Sweet (1999) conducted an elegant study design, which incorporated type of meditation (concentration vs. mindfulness), length of practice (long-term meditators > 25 months, short-term meditators < 24-months), and expectancy effects (expected vs. unexpected stimuli). Participants consisted of 24 controls, 5 short-term concentrative meditators, 4 short-term mindfulness meditators, 6 long-term concentrative meditators, and 4 long-term mindfulness meditators. A measure of sustained attention was employed with all participants. The meditation group was tested following their usual meditation practice. Results demonstrated that meditators' attention and accuracy was greater than the controls. Further, long-term meditators demonstrated greater attention processes than short-term meditators.

There were no differences in performance between concentrative and mindfulness meditators when the stimulus was expected. However, when the stimulus was unexpected, mindfulness meditators were superior to concentrative meditators. The authors suggest that these differences are due to the fact that, in concentration meditation, attention is focused on an expected stimulus. Therefore attention is impaired when the stimulus is unexpected. Conversely, in mindfulness meditation, attention is evenly distributed and therefore no stimulus or set of stimuli becomes more salient than others. Despite the thoughtful design of the study, limitations exist, and therefore results should be interpreted cautiously. First, there was no measurement of individual differences (e.g. education level, socioeconomic status) between groups and therefore the differential performance in attention cannot be solely attributed to meditation. Second, the meditators practiced their respective meditation before the attentional testing; therefore

the data do not represent persistent or general effects of the practice of meditation. For example, perhaps attention/concentration is increased immediately after a meditation session, but not continually throughout the day. A final limitation of this study is the small sample size.

Interpersonal functioning. Tloczynski and Tantriella (1998) examined the effects of Zen breath meditation as compared to relaxation on college adjustment. Seventy-five undergraduates, matched on initial anxiety, were randomized into meditation, relaxation and control groups. The students received only one hour of instruction in either technique and were instructed to practice it once daily for at least 20 minutes. Interestingly, after six weeks, interpersonal problem scores significantly decreased only in the meditation group. However, anxiety and depression scores significantly decreased in both meditation and relaxation groups as compared to the control group.

Prevention. In a multi-center randomized clinical trial, the effects of mindfulness-based cognitive therapy (MBCT) were evaluated for recovered recurrently depressed patients. The aim of this study was to determine if the meditation-based intervention could help prevent relapse of major depression. One hundred forty-five patients who were currently in recovery/remission for major depressive disorder were randomized to continue with treatment as usual (TAU), or in addition, to receive MBCT. The group intervention consisted of 8 weekly 2-hour sessions and 4 monthly booster sessions. Relapse/recurrence of major depression was assessed over a 60-week period. Findings indicated that for patients with recurrent major depression who had three or more episodes, MBCT approximately halved rates of relapse and recurrence during the follow-up period compared with patients who continued TAU. The absence of a comparison group limits the value of this study, since cognitive therapy by itself has been shown to reduce depression relapse rates. These findings were more recently replicated by the same group (Ma & Teasedale, 2004), but await independent replication.

Antidepressants and Meditation. Depression is a common and sometimes serious disorder, which can certainly affect meditators. Yet meditators may be resistant to using antidepressants for several reasons. These include beliefs that they should be able to heal themselves with spiritual practices alone, that drugs are "unspiritual", and that drugs may impair their meditation. Yet no data is available on drug effects in this population, despite the fact that, because of their introspective skills, meditators might make uniquely valuable informants about drug effects.

In a recent study meditators filled out survey forms on their observations of the effects of antidepressants on their daily and retreat meditation experience (Bitner, Hillman, Victor, & Walsh, 2002). As anticipated, respondents reported

reduced negative emotions and enhanced positive ones. They also reported greater energy, calm, clarity, concentration, equanimity, motivation, and self-esteem. In short, contrary to widespread fears in the meditation community, the responses were surprisingly positive. However, this conclusion must be qualified by several study limitations. Subjects were self-selected, data was subjective and retrospective, and drug type and dosage varied. Despite this, the findings are encouraging to meditators who may need antidepressant therapy.

Personality and self-esteem. In an attempt to determine whether length of meditation practice affects personality, Sridevi and Rao, (1998) used a multiple group design of TM practitioners with various durations of practice compared with non-meditative controls. In order to control for self-selection, subject motivation and expectation, experimental subjects were 120 20-28 year-old female employees from a company that requires daily supervised TM practice. Employees were divided into three groups by length of meditation practice: beginners (2-4 weeks), short-term (6-12 months), and long-term (3-8 years). Twenty non-meditating controls were selected from a separate company that manufactured the same products in the same area, but did not require meditation. The Sixteen Personality Factors Questionnaire was used to assess changes in personality characteristics.

Results revealed a significant increase in positive personality growth as a function of length of meditation practice. Specifically, meditators with more experience reported themselves to be more confident, relaxed, introverted, satisfied, conscientious and less anxious that their less experienced counterparts. These findings indicate that positive personality growth and the psychological benefits of TM practice may increase with meditative experience. This study used a rigorous design, but the extent to which the results can be generalized to other populations is unclear. Further, more comprehensive dependent measures that include non-subjective assessment (e.g. interpersonal relations and work performance) would improve the design.

Emavardhana and Tori (1997) examined the effects of participation in a 7-day Vipassana meditation retreat as compared to a matched control group. The post-retreat meditators had significant increases in overall self-esteem, feelings of worth, benevolence, and self-acceptance as compared to the matched control group. They also reported significant changes in ego-defense mechanisms (characterized by a greater maturity in coping skills). The authors suggested that a 7-day Vipassana retreat "significantly changes ways the self is perceived and defended" (p. 200). Results of this study must be interpreted cautiously as subjects were not randomly assigned to groups, but self-selected to attend the retreat. Therefore, it is unclear if individual differences between groups are the result of the meditation or if they existed prior to the retreat.

Informal practice. Assessment during daily life. Very little research has been devoted to examining the effects of practicing meditation throughout the moment-to-moment experience of daily life (informal practice). This topic of research is crucial, as the goal of meditation is not simply to alter one's state of consciousness during formal meditation practice, but to learn to bring this quality of awareness to each experience of one's life. Easterlin and Cardena (1999) evaluated effects of Vipassana meditation in the daily lives of beginning and advanced meditators. Participants consisted of 43 meditators--19 beginning and 24 advanced meditators--who responded to daily random pager signals containing questions related to awareness, acceptance, affect and cognitive style. Relative to the beginners, the advanced meditators reported greater awareness, positive mood, acceptance, lower anxiety levels, lower stress, and a healthier sense of control.

Long-term Retreats. Page et al. (1997) performed a largely exploratory qualitative analysis of the written self-perceptions of retreatants after a 6-month period of isolation and silent meditation during the third year of a 4-year Tibetan Buddhist retreat. Retreatants were 46 self-reported Tibetan Buddhists from internationally distributed locations. Three independent raters broke down the subjects' written responses into their smaller units of independently meaningful content, divided them into "internal" or "external" categories, and then grouped internal units into emergent themes.

Five themes of internal self-perception were identified: (1) Happiness/satisfaction, (2) struggle leading to insight, (3) practice/meditation, (4) sense of time and, (5) goals/expectations. Females tended to write more about satisfaction while males wrote more about struggle leading to insight. Sense of time was reported to be absent or distorted, and future goals tended to be generalized toward maintaining the conscious self-awareness acquired during isolation. These preliminary findings suggest that a long-term retreat, including 6 months of isolation, may enhance personal awareness to a level that supports increased life satisfaction. And yet these findings should be considered with caution. Only 23 of 46 original participants remained by the third year of the retreat, an attrition rate that could signify a high potential for self-selection bias in terms of motivation, happiness, and expectation. With such a unique population, more comprehensive measures, quantitative analysis and a more developed and delineated description of self-awareness would be of great benefit.

Synesthesia. Synesthesia is cross-modality perception in which stimuli in one sense modality such as sound are also experienced in other modalities, such as sight, touch or taste. It is usually considered a rare, innate, uncultivatable ability (one per several thousand people), yet surveys of meditators suggested otherwise. In a recent study by Walsh (2002), three groups of Buddhist meditators

(Tibetan Buddhist retreatants, medical students and physicians, and meditation teachers) and a comparison group of medical students were surveyed by questionnaire and two raters analyzed responses. Among retreatants, 35% of respondents described synesthesia, and they had almost twice as much meditation experience as nonsynesthetes. In the medical and teacher groups, 63% and 86% respectively met criteria for synesthesia, compared to only 9% of the nonmeditating comparison group. The presence of synesthesia correlated significantly with amount of meditation experience as measured by both years of practice and total time spent in retreat. This study is limited by small sample sizes. However, its findings, which are consistent with other perceptual studies, suggest that meditation can significantly enhance perceptual sensitivity and abilities.

Self-Concept. Using a cross-section study design, Haimerl and Valentine (2001), investigated the effect of Buddhist meditation on intrapersonal (self-directedness), interpersonal (cooperativeness), and transpersonal (self-transcendence) levels of the self-concept. Subjects included prospective meditators (n=28) with no experience, beginners (n=58) with less than 2-years of experience, and advanced meditators (n=73) with more that 2-years of experience. Advanced meditators scored significantly higher than prospective meditators on all three subscales, advanced meditators scored significantly higher than beginners on the interpersonal subscale, and beginners scored significantly higher than prospective meditators on the transpersonal subscale. Only the advanced meditators scored higher on the transpersonal than on the intrapersonal subscale. The authors concluded that scores on the intrapersonal, interpersonal, and transpersonal levels were a positive function of meditation experience, suggesting that progress in Buddhist meditation leads to significant growth in these components of personality.

This study has notable strengths. It employed a sizeable, representative sample and attempted to reduce demand characteristics by not revealing the true study question to the participants. Further, the inclusion of a "prospective meditation" group, controlled for certain personality characteristics/beliefs that would predispose one to begin a meditation practice.

Limitations of the study included (1) reliance on self-report questionnaires, which raises the possibility of false self-report due to social desirability or self-deception, (2) no comparison was made between different types of meditation practice. A final limitation, which is a major obstacle in meditation research, is the inability to control for attrition. This refers to the probability that continuing as well as quitting the practice of meditation is linked to specific personality characteristics. Therefore, it is difficult to draw strong conclusions that the meditation practice itself leads to the demonstrated intrapersonal, interpersonal and transpersonal development.

Empathy. All schools of meditation have emphasized concern for the condition of others and an intention to "promote an empathy with created things that leads toward oneness with them" (Murphy et al., 1997, p. 82).

In a randomized controlled study Shapiro, Schwartz, and Bonner (1998) examined the effects of a mindfulness meditation based program on 78 medical and premedical students. Results indicated increased levels of empathy and decreased levels of anxiety and depression in the meditation group as compared to the wait-list control group. Furthermore, these results held during the students' stressful exam period. The findings were replicated when participants in the wait-list control group received the mindfulness intervention.

Spirituality. In the study by Shapiro and colleagues (1998) noted above, the meditation group scored significantly higher on a measure of spiritual experience. These results were replicated when the control group received the same mindfulness intervention. Astin (1997) also demonstrated significant increases in spiritual experience in a randomized controlled study comparing a mindfulness meditation intervention to a control group of undergraduate students.

Physiological Correlates of Meditation

As Ryff and Singer (1998) aptly point out, " human wellness is at once about the mind and the body and their interconnections" (p. 2). Although the implications of the physiological correlates of meditation are as yet unclear, it seems likely that some of the changes represent "physiological substrates of flourishing" (Ryff & Singer, 1998).

Improvements in immune system functioning or reversal of immune suppression may be one of the most classic of such physiological substrate of health and well-beings. Davidson, Kabat-Zinn, Schumacher, Rosenkrantz, Muller, Santorelli, et al. (2003) found that immune function was found to improve following an 8 week meditation program. At the end of the course, subjects were given an injection of an influenza vaccine. Meditation subjects showed a greater increase in influenza antibodies than controls. Similarly, in cancer patients, Carlson, Speca, Patel and Goodey (2003) found that meditation had a number of effects on immune parameters that are consistent with a shift to a more normal profile.

Another widely reported physiological effect of meditation is relaxation. A state of physiological rest is indicated by changes on a wide range of parameters, including reduced respiration rate and plasma lactate levels, and increased skin resistance. Statistical meta-analysis showed that changes in these particular variables are consistent across studies (Dillbeck & Orme-Johnson, 1987) and twice as large as those associated with eyes-closed rest. Also, consistent with increased calm are declines in salivary and plasma cortisol (Carlson, Speca, Patel,

& Goodey, 2004; Marcus, Fine & Moeller, 2003) and lactates (Jevning, Wilson, & Davidson, 1978), along with more stable phasic skin resistance (Alexander et al., 1991).

Although associated with physiological rest, there are several indicators that meditation simultaneously facilitates heightened alertness (Wallace, 1986). These changes are marked by: increased cerebral blood flow; enhanced alpha and theta EEG power and coherence in the frontal and central regions of the brain; marked increased in plasma arginine vasopressin; faster H-reflex recovery; and shorter latencies of auditory evoked potential (e.g. O'Halloran, Jevning, Wilson, Skowsky, & Alexander, 1985; Orme-Johnson & Haynes, 1981; Wallace, 1986).

EEG coherence may be suggestive of enhanced functional integration of mental operations (Alexander et al., 1991). Furthermore, during meditation there appears to be a greater equalization in the workload of the two cerebral hemispheres (Banquet, 1973). It has been suggested that this may lessen the verbal, linear thinking associated with the left hemisphere (in the right-handed person) and enhance the holistic, intuitive, wordless thinking usually processed through the right hemisphere. Indeed it has been hypothesized that the therapeutic effects derived from meditation may reflect this relative shift in balance between the two hemispheres (Carrington, 1993).

More recent research has suggested that meditation may be able to shift the relative activity of two hemispheres. Davidson, Kabat-Zinn, Schumacher, Rosenkrantz, Muller, Santorelli, et al. (2003) found increases in left frontal EEG activation following an 8-week mindfulness course taught by Jon Kabat-Zinn. EEG measures were recorded before and after an 8-week mindfulness meditation course. Subjects in the meditation group showed a greater increase in left-sided resting brain activity than controls across frontal/central regions. Increases in left-sided activation are thought to be associated with a more positive and adaptive emotional styles.

A recent study by Travis (2001) compared EEG and autonomic patterns during transcending to other experiences during TM practice. The goal of the study was to correlate specific meditation experiences with physiological measures. Participants consisted of 30 undergraduate students who had been practicing the TM technique for an average of 5.4 years (SD = .67). During a meditation session, a bell rang three times, and participants categorized their experiences as either transcending or other. Transcending was defined as "taking the mind from the experience of a thought to finer states of the thought" (Maharishi, 1969, p. 470).

Transcending, in comparison to "other" experiences during TM practice, was marked by: (1) significantly lower respiratory rates; (2) higher respiratory sinus arrhythmia amplitudes; (3) higher EEG alpha amplitude; and (4) greater alpha coherence.

These findings suggest that subjectively delineated experiences of transcending and other experiences during a TM session are physiologically distinct. These findings have important implications, indicating that averaging physiological patterns over an entire meditation practice may combine significantly different physiological patterns. This study suggests that to avoid "smearing" of physiological patterns, EEG and autonomic patterns must be monitored and correlated with subjective experience throughout the meditation session. Although these findings contribute greatly to the literature, they must be replicated in larger controlled studies before strong conclusions can be drawn.

Newberg et al. (2001b) measured changes in regional cerebral blood flow (rCBF) during meditation using single photon emission computed tomography (SPECT) in order to elucidate the neurophysiological correlates of meditation. Eight Tibetan Buddhist meditators, with more than 15 years of experience, were evaluated pre and post a 1- hour meditation. Findings included significantly increased rCBF in the cingulate gyrus, inferior and orbital frontal cortex, dorsolateral prefrontal cortex (DLPFC), and thalamus. The change in rCBF in the left DLPFC correlated negatively with that in the left superior parietal lobe.

The authors suggest that the increased frontal rCBF may reflect focused concentration and that the thalamic increases reflect increased overall cortical activity during meditation. In addition, they posit that the correlation between the DLPFC and the superior parietal lobe may reflect an altered sense of space experienced during meditation. Newberg and colleagues suggest that during intense meditation, feedback to the parietal lobe is inhibited, which causes the differentiation between self and universe to disappear, and the practitioner experiences a mystical transcendent state (see Newberg, d'Aquili, & Rause 2001a). This study helps to define the underlying physiological basis of meditation in general, and transcendent states during meditation. However, further research with greater sample sizes is needed to confirm these findings.

In order to determine if self-reported transcendental consciousness during sleep had identifiable neural correlates, the overnight EEG of 11 long-term (>13 yrs) TM practitioners were compared with 11 short-term (< 1.5 yrs) TM practitioners and 13 non-meditator controls (Mason et al., 1997). All subjects were screened for potential sleep disorders and parasomnias that could produce an abnormal EEG. Results indicated that long-term meditators had more theta-alpha activity, decreased chin tone (EMG) and greater theta2 (6-8 Hz) during slow-wave sleep, and higher REM density than control groups. These results complement previous studies of waking transcendental consciousness that have showed similar increases in theta-alpha EEG.

By demonstrating a unique EEG signature not usually found in normal individuals, these findings buttress the claim that it is possible to develop an alert state of transcendental consciousness during deep sleep. These findings support the possibilities of developing not only lucid dreaming but also lucid nondream

states, possibilities which Western psychologists long dismissed as impossible. The development of lucidity during dreams may offer a valuable metaphor for the phenomenon of "enlightenment." With further replication with larger samples, these findings may be some of the most significant discoveries in the field of consciousness studies.

Dunn, Hartigan and Mikulas (1999) compared concentration meditation vs. mindfulness meditation vs. a relaxation control condition. Essentially, they were looking for different patterns of activity associated with each state using EEG. They defined concentration as the learned control of the focus of one's attention, and defined mindfulness as the maximization of the breadth and clarity of awareness. A big improvement over earlier studies of a similar nature is that they used more scalp recording sites. After collapsing both meditation groups and comparing this with the relaxed control condition, they found that the EEGs of meditators were different from the EEGs of relaxed participants. They concluded that meditation was electrophysiologically different from an eyes-closed relaxed state, and that unique frequency patterns were generated during each state. For example, at the lower frequency bands of delta and theta, relaxation produced greater mean amplitude than both meditations over large regions of the cortex, but at the higher frequency bands, the opposite pattern occurred. Differences were also found between concentration and mindfulness states.

The authors interpret their results as indicating that concentration and mindfulness meditations produce different cortical patterns relative to relaxation and, coupled with the participant's subjective reports, suggest that mindfulness and concentration may be conscious states that are uniquely different from relaxation. However, another possibility is that these could be different levels of the same conscious state. An important contribution of this study is that it pulled apart two very different types of meditation, instead of treating "meditation" as a unitary process. Study limitations include student subjects and a lack of quality control for training conditions.

Lazar et al. (2000) used functional Magnetic Resonance Imaging (fMRI) to identify brain regions that are active during Kundalini meditation and a control period. Subjects were five males with a least 4-years of meditation experience. Subjects were given an audiotape of the sounds of the scanner to practice with prior to the scan, so that they could achieve a comfortable meditative state amidst the distraction of the scanner. Primary analysis found significant increases in activation of the putamen, midbrain, pregenual anterior cingulate cortex and the hippocampal/parahippocampal formation in the meditation period compared to the control period.

A secondary analysis compared steady state meditation with meditation induction. During steady meditation there were multiple foci of activation in the prefrontal, parietal, and temporal cortices, as well as in the precentral and postcentral gyri and hippocampal/parahippocampal formation, as compared to

meditation induction. Statistical correction for multiple comparisons was made. This is an excellent first step toward the understanding of the supporting structures of meditation.

In conclusion, cerebral physiology studies constitute a valuable direction for future research. However, as yet they are limited by the resolution of current techniques and our inadequate understanding of neural pathways and brain function. Consequently, we can draw very few conclusions about the precise relationships between the subtle subjective shifts induced by meditation and their neural substrates. For critical reviews of this issue and of the new field of "neurotheology" see Groopman's (2001) "God on the brain: the curious coupling of science and religion" (2001), and Wilber (2000).

Discussion

As the above findings make clear, meditation appears to have the potential to enhance physiological, psychological and transpersonal well being on a wide variety of measures. However, for research to continue to refine and expand our knowledge of meditation and its effects, it is essential to develop broader paradigms for the field, which include specific directions for future studies. Below we discuss potential directions for the field, beginning with a theoretical orientation and concluding with specific suggestions for future study designs.

The Importance of Developing Big Maps

On the theoretical side, it seems crucial that meditation research is held within a sufficiently encompassing and comprehensive conceptual framework. Because meditation is intrinsically subjective, introspective, and induces transpersonal experiences, states and stages, much that is crucial to it lies outside current mainstream maps and models. For example, introspective approaches and transpersonal experiences and stages are currently suspect in mainstream psychology though rapidly gaining respect (Varela & Shear, 1999). Sufficiently comprehensive maps would therefore necessarily encompass these and include both ontological and developmental dimensions.

On the ontological side, such maps will necessarily include both subjective and objective domains. This seems simple and obvious enough. And yet the reigning paradigm within science is a generally unquestioned materialism, often called scientific materialism which often reduces subjective experience to mere neural fireworks. Yet materialism has gaping holes, the mind-body problem remains utterly unsolved, and some notables such as Sir. John Eccless think it may be insoluble (Griffin, 1998; Popper & Eccles, 1997). However, many scientists are somewhat philosophically naive so scientific materialism and reductionism continue on their merry way.

In some ways this is not surprising, since several additional forces favor this reductionism. The scientific enterprise, with its focus on observable, measurable data, emphasizes objective phenomena, and tends to make such things seem more real than subjective experiences. This is in spite of the fact that scientists are utterly dependent on purely subjective experiences, such as linguistic meaning and the square root of minus one.

A further factor favoring materialism and reductionism is scientism. This is the pseudo philosophy that science is the best or only means of acquiring valid information; to which the appropriate response is "please show us your scientific proof that science is the only means of acquiring valid information" (Wilber, 1999). A final factor may be the lack of actual deep meditative experience among researchers, a point we will return to later in the paper.

One nonreductionistic ontological map, which is currently exciting considerable interest is Ken Wilber's (2000b) four quadrant model. Wilber creates four quadrants by dividing reality into subjective and objective domains and these into individual and collective domains. The resulting four quadrants are individual-subjective, collective-subjective (cultural), individual-objective, (behavioral) and collective-objective (e.g. societal). A comprehensive approach to meditation research will necessarily consider all four quadrants (for one possible meditation research program using Wilber's model see Wilber & Walsh, 2000).

In the developmental domain, an adequate map will necessarily include transpersonal, postconventional stages These are "higher" stages that emerge after the conventional ones, in which the sense of identity extends beyond (trans) the individual person and personality to encompass wider aspects of humankind, life, psyche and cosmos. They include, for example, many of the classical contemplative mystical stages, as well as stages described by transpersonal theorists such as Grof, Washburn, and Wilber (Grof, 1998; Walsh & Vaughan, 1993; Wilber, 2000a). Fortunately, the inclusion of these transpersonal stages requires only a minor expansion of mainstream psychology since, as previously discussed, developmental researchers increasingly recognize three major stages: prepersonal, personal and transpersonal, or preconventional, conventional and postconventional (Wilber, 2000a).

The failure to recognize transpersonal stages results in several problems. The first is what Ken Wilber (1999) has elegantly discussed as the pre /trans fallacy. This is the confusion of prepersonal states and stages with transpersonal ones. For example, when pathological regressions such as psychosis are mistaken for spiritual openings, or on the other hand, when genuinely transpersonal experiences, such as peak experiences, are dismissed as prepersonal, borderline pathology.

The second problem which follows from this is the pathologizing of meditative experiences. Clinicians unaware of transpersonal possibilities can easily misdiagnose powerful, transpersonal meditation experiences as pathological.

Transpersonal progressions are then dismissed as prepersonal regression and the results to clients can be devastating (Grof & Grof, 1990; Walsh & Vaughan, 1993).

A further risk of not acknowledging transpersonal stages is not as clinically dangerous, but is perhaps just as theoretically and societally tragic. This is the overlooking of what are most central and crucial in meditative disciplines, namely higher states, stages and capacities. This results is a tragic constriction of our view of human nature and possibilities. As Gordon Allport (1964, 27-44) so eloquently put it, "By their own theories of human nature, psychologists have the power of elevating or degrading that same nature. Debasing assumptions debase human beings; generous assumptions exalt them." Meditation researchers have the privilege of introducing more generous assumptions into psychology and thereby exalting human beings. To do this may well require comprehensive theories that include at least the four quadrants as well as transpersonal states and stages (Wilber, 2000c; Wilber & Walsh, 2002).

Specific Suggestions for Future Research

The results of past research are qualified by their limitations in methodology. We suggest the following criteria to insure future rigorous designs:

1. Differentiation between types of meditation. There are many types of meditation. This is crucial to recognize for theoretical, practical and research reasons. Yet researchers often implicitly assume that different meditations have equivalent effects. This is an assumption to be empirically tested. Most likely, different techniques have overlapping but by no means equal effects. In general, we anticipate that there will be both general and specific effects of different types of meditation. Many meditations may foster psychological and spiritual well being and development on multiple dimensions. However, specific meditations may also produce very specific effects (e.g. Tibetan dreams yoga for developing lucid dreams, and a variety of practices that cultivate emotions of love or compassion). Therefore, it is essential that researchers clearly define the type of meditation being studied.
2. Temporal effects. Frequency and duration of meditation practice must be recorded (e.g., meditation journals) to determine if greater meditation induces greater effects and if so, is the relationship linear, curvilinear or some other more intricate pattern.
3. Follow-up assessment. Follow-up should include long-term as well as short-term assessment.
4. Inclusion of experienced meditators. Researchers should include long-term, experienced meditators as well as beginning meditators. Also, when matching control subjects to long-term meditators in retrospective studies,

in addition to age, gender, and education, it would be important to consider matching subjects on the dimension of an alternative attentional practice (e.g. playing a musical instrument).

5. Component analysis. Meditation is now recognized to be a multifaceted process with multiple potentially potent components. These range from nonspecific factors such as belief and expectancy through postural, somatic, attentional, cognitive and other factors. Research can attempt to differentiate the effects and interactions of various components. This is a kind of component analysis.
6. Examination of interaction effects. The practice of meditation may interact with a variety of relevant psychological, spiritual and clinical factors. Factors of current interest include other health and self-management strategies, and especially psychotherapy.
7. Mediating variables. Development of subjective and objective measures to determine the mediating variables that account for the most variance in predicting change.
8. Qualitative data. The subtlety and depth of meditation experiences do not easily lend themselves to quantification. Further, the interplay between subjective and objective is essential to understanding meditation. Qualitative data provides a means to access the subjective experience of the meditator.
9. Expanding the paradigm: From pathology to positivity and the transpersonal. Most meditation research has used the traditional biomedical paradigm in which the focus is on symptom reduction. Future research could expand this model by examining the effects of meditation on problem prevention and health enhancement, and on variables consistent with the classical goals of meditation, such as the development of exceptional maturity, love and compassion, and lifestyles of service and generosity.
10. The value of practice. Several lines of evidence suggest that personal practice of meditation may enhance one's understanding of meditative and transpersonal experiences, states and stages. This is a specific example of a general principle. Without direct experience, concepts (and especially transpersonal concepts) remain what Immanuel Kant calls "empty" and devoid of experiential grounding. Without this grounding we lack adequatio: the capacity to comprehend the deeper "grades of significance" of phenomena (Schumacher, 1977), which Aldous Huxley (1944) summarized in The Perennial Philosophy, as "knowledge is a function of being." As the philosopher, Philip Novak (1989, p. 67) pointed out, in meditation the "deepest insights are available to the intellect, and powerfully so, but it is only when those insights are discovered and absorbed by a psyche made especially keen and receptive by long coursing in meditative disci-

pline, that they begin to find their fullest realization and effectiveness." Good books for beginners include Bodian (1999) and Tart (2001).

Therefore, for research to progress, optimally it may be helpful for researchers themselves to have a personal meditation practice. Without direct practice and experience we may be in part blind to the deeper grades of significance of meditation experiences, and blind to our blindness.

Conclusion

During the past four decades, research in meditation has developed a strong foundation, demonstrating significant psychological, physiological and therapeutic effects. As discussed above, we suggest thirteen specific recommendations, which may help the field continue to progress. The exploration of meditation requires great sensitivity and a range of methodological glasses. Future research could benefit by looking through all of them, thereby illuminating the richness and complexity of meditation.

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Address for correspondence: Shauna L. Shapiro
Department of Counseling Psychology
Santa Clara University
Santa Clara CA
e-mail: slshapiro@scu.edu. (408) 554-4436