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October 2009 Article of the Month

This month's article selection is by Chaplain John Ehman,
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Epel, E., Daubenmier, J., Moskowitz, J. T., Folkman, S. and Blackburn, E. "**Can meditation slow rate of cellular aging? Cognitive stress, mindfulness, and telomeres.**" *Annals of the New York Academy of Sciences* 1172 (August 2009): 34-53.

SUMMARY and COMMENT: The 2009 Nobel Prize in Medicine was awarded last week to three researchers for their investigation of how cellular aging is linked to telomeres (DNA "caps" at the end of chromosomes) and telomerase (a protein responsible for telomere length and maintenance): namely, how longer telomeres and more telomerase activity indicates greater cellular longevity, and shorter telomeres and less telomerase activity is associated with cell death. One of the Nobel laureates, Elizabeth Blackburn, is a co-author of our featured article this month, which is partly a review, partly a report of the authors' original research, and partly a theoretical speculation supporting the idea that meditative practice may slow cellular aging. Chaplains should be well-served by some familiarity with this work, both because it is presently a "hot topic" and because it holds out much to consider regarding the nature of meditation pertinent to the functioning of the body.

Telomeres have been likened by Dr. Blackburn (elsewhere -- see her essay, "Telomeres and Telomerase in Health and Disease" in Related Items of Interest, below) to the caps on the tips of shoelaces, which keep the shoelaces from becoming frayed over time. By analogy, the shorter or more "worn away" are such protective "caps" on chromosomal strands (from the cumulative effects of cell division), the greater the incidence of cell death. Previous research by the authors has drawn connections between the shortening of telomeres and *stress* reactions in the body, and so the present article takes those connections one step further to explore how certain forms of meditation may ameliorate stress reactions affecting telomere length, in turn affecting cellular longevity.

The authors focus on stress arousal in the body and on two types of *stress cognition* that influence it: *threat appraisals* (which "enhance negative emotional responses to a stressor by construing it as a threat to oneself and amplifying the significance of the stressor" [p. 34]) and *ruminations* (a repetitive thought process by which negative appraisals -- and the stress reaction resulting from them -- are prolonged, and by which a person may feel distress about the emotional response itself). To reduce these destructive responses to stress, the authors consider *mindfulness meditation*, described as a secular adaptation of traditional Buddhist meditation techniques.

The practice of mindfulness is outlined:

Instructions for the formal practice of mindfulness meditation entail purposefully directing attention to one's experience in the present moment with an attitude of open curiosity and acceptance. An upright sitting posture with minimal movement is encouraged (with eyes either

open or closed) to allow the body to relax and the mind to remain alert. Attention is directed to a pre-determined object, usually localized sensations involving respiration, such as those at the tip of the nose (external objects can also be used, such as a picture). Novice practitioners usually report that after a short period of time, they become distracted by thoughts, feelings, sounds, or physical sensations and their focus on the intended object is lost. At this point, the instruction is to notice these experiences ("distractions") fully without judgment, to "let them go," and return attention back to its intended object. Instructions for attending to "distractions" vary -- from silently applying a specific label to the object (e.g., anger, anticipation, sound) to applying the general term "thinking" to any thought, to not making any mental notation whatsoever. Labeling an experience is believed to strengthen recognition of it and this may be particularly helpful for some individuals or when experiencing intense distractions. The process of becoming distracted and returning to the attention is repeated over and over again during formal mindfulness practice. The goal is to increase awareness of present-moment experience to increasingly subtle levels and to strengthen stability of attention. The goal is not to ignore or "get rid" of thought in order to have a "blank" mind, but to notice with full attention whatever arises. In this sense, there are no distractions; whatever is noticed in the field of awareness can be observed. Interestingly, it can be painful to observe thoughts one wishes to avoid, so in this sense, the practice cultivates a willingness to experience discomfort and reduces attempts to escape it. At the other extreme, the goal is not to indulge in pleasant thought or achieve a pleasant experience (although this may occur), but to remain aware of each experience as it occurs. [p. 41]

One product of this practice is that a person may become aware of thought per se [i.e., the experience of thinking itself] rather than being simply aware of individual thoughts, and that shift in perspective on thinking may lead to a more positive and resilient response to stressors, effectively making stressors seem less of a threat and triggering a more healthy stress arousal. "Mindfulness may [also] serve to increase a sense of control, not simply by reacting more 'coolly'..., but by lessening one's perceived need to be in control, especially when situations are determined to be uncontrollable" [p. 43]. Moreover, "[i]ncreasing awareness of present-moment experience may disrupt ruminative thought processes that play a role in prolonged stress reactivity" [p. 44]. Mindfulness, as a kind of "metacognitive awareness," may "interrupt ruminative thinking, increase the ability to evaluate the accuracy of thoughts, and allow greater freedom of choice in responding to thoughts and emotions" [p. 44]. The authors point out that this "practice of changing how one *relates* to thoughts and emotions contrasts with cognitive behavioral therapies that emphasize changing the content of thoughts": "Mindfulness practice involves first allowing awareness of thought and then becoming less engaged or attached to the thoughts themselves before attempting to evaluate their accuracy" [p. 44].

In sum:

...[W]e speculate that certain types of meditation can increase awareness of present moment experience leading to positive cognitions, primarily by increasing metacognitive awareness of thought, a sense of control (and decreased need to control), and increased acceptance of emotional experience. These cognitive states and skills reduce cognitive stress and thus ability for more accurate appraisals, reducing exaggerated threat appraisals and rumination, and distress about distress. These positive states are thus stress-buffering. Increasing positive states and decreasing stress cognitions may in turn slow the rate of cellular aging. [p. 48]

The authors concentrate on the practice of mindfulness meditation and on a program of Mindfulness-Based Stress Reduction (MSBR), but they acknowledge that other types of meditation may have similar effects: mantra meditation [such as has previously been highlighted in our [November 2005 Article-of-the-Month](#)] and Tai Chi. However, the article does not address other forms of meditation that are explicitly religious, and there is no mention of "prayer." In addition, there is no assertion that adopting any form of meditation will yield quick results in terms of cellular longevity --in fact, the model here assumes that the interplay between meditation, stress, and telomere-related cellular aging is a slow process over time, and that meditative practice is effective only when it has been so deeply incorporated into one's life that it causes a fundamental shift in how one perceives the world and relates to an awareness of it. [But, see below, in Related Items of Interest, §I., the

study by Ornish, et al., which suggests that an intervention that includes a meditation component may affect telomere length in as little as three months.]

For chaplain researchers, this work holds out a number of questions and opportunities: What other forms of meditation or prayer might influence cellular aging? Would some practices produce results at the cellular level more quickly than others? Could the ability to measure telomere length help identify health-specific traits of a variety of spiritual practices by sampling religious populations with strongly identifiable "prayer lives"? Would a premeditated attempt to influence cellular aging introduce a utilitarian motive that could complicate the meditative process and make it less effective in that regard? Could mere cognizance of connections between meditation and imperceptible physiological processes enhance or diminish the meditation experience? Is there an assumption here that mindfulness meditation is a kind of superior form of practice, and how might such an assertion itself be a stressor -- with theological implications -- for people from other spiritual/religious traditions? Could mindfulness meditation be more effective for cellular longevity when it is not divorced from its (Buddhist) spiritual roots?

The article obviously delves into highly technical material, but this reader (who had no foreknowledge of the topic) found it to be quite accessible and thought-provoking. Most helpfully, the authors provide a graphic model of their theory at the outset (--see Figure 1, p. 35). Co-author Blackburn once commented in an interview in the *New York Times* about how her work was unexpectedly branching out into an exploration of meditation: "Ten years ago, if you'd told me that I would be seriously thinking about meditation, I would have said one of us is loco" [--from "A Conversation With Elizabeth H. Blackburn: Finding Clues to Aging in the Fraying Tips of Chromosomes," published [July 7, 2007](#)]. For this reader, a chaplain, I might have had a similar response if someone had said that I'd be pondering telomeres. Yet, such is now the interdisciplinary nature of the field of spirituality & health research.

Suggestions for the Use of the Article for Discussion in CPE:

CPE students might not be predisposed to tackle this article, but it should be within their grasp. The material generally confronts pastoral care providers with an important issue: What do you think about meditation being related to physiological processes at the cellular level? Does it make the process of meditation more or less rich or appealing? Is research that attempts to find such links necessarily reductionistic about spirituality itself?

In a more substantive exploration of the article, students might be challenged to think about connections between meditation (or other spiritual practices) and stress. How do meditative or spiritual exercises help people to cope with stresses? Discussion could go beyond the article to consider what spiritual practices and religious outlooks might lessen -- or heighten -- negative threat appraisals or rumination. Also, what spiritual practices and religious outlooks might enhance "psychological thriving"? [See p. 38, regarding "psychological thriving."]

Related Items of Interest:

I. For more background material on telomeres, see:

Blackburn, E. H., *Telomeres and Telomerase in Health and Disease*. Lecture, Vanderbilt University Medical Center, January 10, 2008. [Video available from Vanderbilt](#). [Note: the lecture begins at the 6-minute mark.]

Epel, E. S., Blackburn, E. H., Lin, J., Dhabhar, F. S., Adler, N. E., Morrow, J. D. and Cawthon, R. M. "Accelerated telomere shortening in response to exposure to life stress." *Proceedings of the*

National Academy Sciences 101, no. 49 (December 7, 2004): 17312–17315. [This article describes in relatively plain language the authors' original study of telomere length with a sample of 58 mothers of either healthy or chronically ill children.]

Njajou, O. T., Hsueh, W. C., Blackburn, E. H., Newman, A. B., Wu, S. H., Li, R., Simonsick, E. M., Harris, T. M., Cummings, S. R. and Cawthon, R. M. "**Association between telomere length, specific causes of death, and years of healthy life in health, aging, and body composition, a population-based cohort study.**" *Journals of Gerontology Series A-Biological Sciences and Medical Sciences* 64, no. 8 (August 2009): 860-864. [(From the abstract:) ...In a large biracial population-based cohort, we tested the hypotheses that elderly persons with shorter TL (telomere length) in peripheral white blood cells have poorer survival, shorter life span, and fewer years of healthy life (YHL). ...TL...was not associated with overall survival...or death from any specific underlying cause including infectious diseases, cancer, or cardiac and cerebrovascular diseases. TL, however, was positively associated with more YHL.... Findings suggest that TL may not be a strong biomarker of survival in older individuals, but it may be an informative biomarker of healthy aging.]

Ornish, D., Lin, J., Daubenmier, J., Weidner, G., Epel, E., Kemp, C., Magbanua, M. J., Marlin, R., Yglecias, L., Carroll, P. R. and Blackburn, E. H. "**Increased telomerase activity and comprehensive lifestyle changes: a pilot study.**" *Lancet Oncology* 9, no. 11 (November 2008): 1048-1057. [Erratum appears in vol. 9, no. 12 (December 2008): 1124.] [This study offers some indication that telomere length may be affected in the relative short term from an intervention that includes meditation. (From the abstract:) ...We aimed to assess whether 3 months of intensive lifestyle changes increased telomerase activity in peripheral blood mononuclear cells (PBMC). METHODS: 30 men with biopsy-diagnosed low-risk prostate cancer were asked to make comprehensive lifestyle changes. The primary endpoint was telomerase enzymatic activity per viable cell, measured at baseline and after 3 months. 24 patients had sufficient PBMCs needed for longitudinal analysis.... FINDINGS: PBMC telomerase activity expressed as natural logarithms increased from 2.00 (SD 0.44) to 2.22 (SD 0.49; $p=0.031$). Raw values of telomerase increased from 8.05 (SD 3.50) standard arbitrary units to 10.38 (SD 6.01) standard arbitrary units. The increases in telomerase activity were significantly associated with decreases in low-density lipoprotein (LDL) cholesterol ($r=-0.36$, $p=0.041$) and decreases in psychological distress ($r=-0.35$, $p=0.047$). INTERPRETATION: Comprehensive lifestyle changes significantly increase telomerase activity and consequently telomere maintenance capacity in human immune-system cells. Given this finding and the pilot nature of this study, we report these increases in telomerase activity as a significant association rather than inferring causation. Larger randomized controlled trials are warranted to confirm the findings of this study.]

II. This month's article refers [p. 44] to a study on mantra meditation by Jill Bormann. For more on that form of meditation and on Bormann's research, see our [November 2005 Article-of-the-Month](#).

III. This month's featured article is part of a theme issue of the *Annals of the New York Academy of Sciences* on Longevity, Regeneration, and Optimal Health Integrating Eastern and Western Perspectives. Most of the articles deal with yoga practice and Indo-Tibetan meditation and healing traditions. Among those of possible interest:

Brown, D. "**Mastery of the mind East and West: excellence in being and doing and everyday happiness.**" *Annals of the New York Academy of Sciences* 1172 (August 2009): 231-251. [(Abstract:) Western psychological research on positive psychology and Buddhism have recently converged in their emphasis on the development of positive states, like states of excellence and everyday happiness. Yet, these traditions differ in their approaches to positive states, with respect to a state-trait and doing-being distinction. Western scientific research on peak performance emphasizes discontinuous, time-limited peak performance states wherein individuals do things extraordinarily well in sports and in the arts. The Eastern spiritual traditions emphasize continuous excellence of being, in the form of traits or character strengths. In both traditions mental imagery is a key ingredient to excellence training. With respect to everyday happiness, Western psychological

research has focused on the role of meaning systems in the transformation of flow states into vital engagement in everyday life, while Buddhism stresses the role of meditation training to gain mastery over all levels of mind that leads to everyday happiness. Rorschach and tachistoscopic research on advanced meditators suggests that advanced meditators have gained unusual mastery over states of mind not yet documented in the Western psychological research on positive psychology.]

Brown, R. P. and Gerbarg, P. L. "**Yoga breathing, meditation, and longevity.**" *Annals of the New York Academy of Sciences* 1172 (August 2009): 54-62. [(From the abstract:) ...In this paper, we review data indicating how breath work can affect longevity mechanisms in some ways that overlap with meditation and in other ways that are different from, but that synergistically enhance, the effects of meditation. We also provide clinical evidence for the use of yoga breathing in the treatment of depression, anxiety, post-traumatic stress disorder, and for victims of mass disasters. By inducing stress resilience, breath work enables us to rapidly and compassionately relieve many forms of suffering.]

Bushell, W. C. "**Longevity: potential life span and health span enhancement through practice of the basic yoga meditation regimen.**" *Annals of the New York Academy of Sciences* 1172 (August 2009): 20-27. [(Abstract:) This chapter briefly reviews recent psychological, physiological, molecular biological, and anthropological research which has important implications, both direct and indirect, for the recognition and understanding of the potential life span and health span enhancing effects of the basic yoga meditational regimen. This regimen consists of meditation, yogic breath control practices, physical exercises (of both a postural- and movement-based, including aerobic nature), and dietary practices. While each of these component categories exhibit variations in different schools, lineages, traditions, and cultures, the focus of this chapter is primarily on basic forms of relaxation meditation and breath control, as well as postural and aerobic physical exercises (e.g., yogic prostration regimens), and a standard form of yogic or ascetic diet, all of which constitute a basic form of regimen found in many if not most cultures, though with variations.]

Bushell, W. C. "**New beginnings: evidence that the meditational regimen can lead to optimization of perception, attention, cognition, and other functions.**" *Annals of the New York Academy of Sciences* 1172 (August 2009): 348-361. [(Abstract:) A "framework" is presented for understanding empirically confirmed and unconfirmed phenomena in the Indo-Tibetan meditation system, from an integrative perspective, and providing evidence that certain meditative practices enable meditators to realize the innate human potential to perceive light "at the limits imposed by quantum mechanics," on the level of individual photons. This is part of a larger Buddhist agenda to meditatively develop perceptual/attentional capacities to achieve penetrating insight into the nature of phenomena. Such capacities may also allow advanced meditators to perceive changes in natural scenes that are "hidden" from persons with "normal" attentional capacities, according to research on "change blindness," and to enhance their visual system functioning akin to high-speed and time-lapse photography, in toto allowing for the perception, as well as sophisticated understanding, of the "moment to moment change or impermanence" universally characteristic of the phenomenal world but normally outside untrained attention and perception according to Buddhist doctrine.]

Loizzo, J., Charlson, M. and Peterson, J. "**A program in contemplative self-healing: stress, allostasis, and learning in the Indo-Tibetan tradition.**" *Annals of the New York Academy of Sciences* 1172 (August 2009): 123-147. [(Abstract:) This paper reviews current behavioral health interventions and introduces a self-healing program based on the Indo-Tibetan tradition. While most work on behavior change emphasizes cognition and motivation, this review highlights stress-reactivity as a rate-limiting resistance to learning. Surveying cognitive-behavioral theories, it finds these limited in modeling stress-reactivity. Reviewing current interventions that address stress by integrating relaxation, mindfulness, imagery, or movement with cognitive-behavioral education, it

attributes their limited effectiveness to the limits of their model of stress and their strategy of eclectically mixing techniques. Next, the article explores the Indic model of stress-cessation and self-healing assumed by mindfulness practice, concluding that it more fully reflects current findings on stress and learning. It reviews the theory and practice of mindfulness and of two less known contemplative "vehicles" preserved in Tibet, using more advanced techniques and insights better suited to lay lifestyles and secular cultures. It suggests that the Tibetan tradition of integrating all three vehicles of contemplative insight and skill in one self-healing practice should maximize coherence and effectiveness while minimizing confounding variables caused by eclecticism. Finally, the paper introduces an intervention that integrates mindfulness with techniques of cognitive analysis, affect modulation, motivational imagery, and reinforcing breathing, tailored over centuries into a complete, threefold path of self-healing. A pilot study of this intervention in women treated for breast and other gynecologic cancers suggests that the whole spectrum of Indo-Tibetan mind/body practices can be readily mastered and effectively used by Westerners to reduce stress and enhance learning and quality of life.]

Rapgay, L. and Bystrisky, A. "**Classical mindfulness: an introduction to its theory and practice for clinical application.**" *Annals of the New York Academy of Sciences* 1172 (August 2009): 148-162. [(Abstract:) This paper reviews current behavioral health interventions and introduces a self-healing program based on the Indo-Tibetan tradition. While most work on behavior change emphasizes cognition and motivation, this review highlights stress-reactivity as a rate-limiting resistance to learning. Surveying cognitive-behavioral theories, it finds these limited in modeling stress-reactivity. Reviewing current interventions that address stress by integrating relaxation, mindfulness, imagery, or movement with cognitive-behavioral education, it attributes their limited effectiveness to the limits of their model of stress and their strategy of eclectically mixing techniques. Next, the article explores the Indic model of stress-cessation and self-healing assumed by mindfulness practice, concluding that it more fully reflects current findings on stress and learning. It reviews the theory and practice of mindfulness and of two less known contemplative "vehicles" preserved in Tibet, using more advanced techniques and insights better suited to lay lifestyles and secular cultures. It suggests that the Tibetan tradition of integrating all three vehicles of contemplative insight and skill in one self-healing practice should maximize coherence and effectiveness while minimizing confounding variables caused by eclecticism. Finally, the paper introduces an intervention that integrates mindfulness with techniques of cognitive analysis, affect modulation, motivational imagery, and reinforcing breathing, tailored over centuries into a complete, threefold path of self-healing. A pilot study of this intervention in women treated for breast and other gynecologic cancers suggests that the whole spectrum of Indo-Tibetan mind/body practices can be readily mastered and effectively used by Westerners to reduce stress and enhance learning and quality of life.]

IV. Processes of *threat assessment* have figured into a number of our Articles-of-the-Month, but see especially the selections for [February 2008](#), regarding evolutionary theories of the structure of the brain, and [October 2006](#), which looks particularly at the role of the amygdala in processing emotions.

If you have suggestions about the form and/or content of the site, e-mail Chaplain John Ehman (Network Convener) at john.ehman@uphs.upenn.edu .

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