

Our heart is restless: meditation and the origin of our species

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Whatever religion is, there sure is a lot of it. Historians theorize that religion, broadly defined, has been part of the human experience for at least 40,000 years, engaging a range of practices from proto-religious concepts, burial rites, and cave drawings, to complex rituals, ontologies, and Mozart. A certain kind of study of religion is a certain kind of study of human history, and perhaps human nature.

Universality is not a virtue in itself, of course, and the jury is still out on whether religion's universality has been, much less remains, a boon or a hindrance for human flourishing. In this paper, I will limit my investigation to one small, discrete area of the debate, asking the following questions: 1) does religion make people healthier? 2) If so, how? 3) What does that say about whether we are a religious species, *homo religiosus*?

My starting point is the medical research area of psychoneuroimmunology, the study of how emotional states affect health. From research in peer-reviewed medical journals, I find that certain religious practices, specifically forms of meditation, seem to positively affect health, perhaps by reducing stress. I will review the physiological mechanisms by which the body responds to stressors, as well as the body's theorized relaxation response that has such beneficial effects.

Finally, I will situate my findings within the conversation regarding the evolutionary standing of religion. My claims will be modest: I posit only that one type of religious practice – meditation – could have one potentially adaptive function, the reduction of plasma cortisol. I will use the example of increased reproductive success as a benefit of meditation that would seem to bear particularly strongly on evolutionary questions. Collectively, these studies provide justification for seeing this religious practice as an evolutionary adaptation that was naturally selected and, therefore, one potential answer to the perennial question of what it means to be a human being.

STRESS

I begin with a fact of life that is most likely all too familiar for attendees at a symposium for graduate students: that is, stress. Stress causes disease – this much we know – but how does stress “get inside the body,” as one researcher put it (Segerstrom and Miller 2004)? The mechanisms by which the body responds to stress are fairly well-known, and operate along two systems: the nervous system and the endocrine system. What follows is a brief review of the body's physiological response to stress, and a description of a potential “relaxation response” that may mitigate the stress response.

In 1914, a researcher named Walter Cannon first discovered that both physical states and emotional states can affect the body's healthy equilibrium (1914:356-372). The process begins with the individual becoming aware of a stimulus, and that awareness being processed in the limbic system of the brain. The amygdala receives the sensory input, then references the input with the hippocampus, which is involved in processing emotions and memory. If the stimulus, or something like it, has been a cause of danger before, the hippocampus will communicate that to the amygdala, which will initiate the next step of the stress response by

passing that on to the hypothalamus, which stimulates both the endocrine and nervous systems.

The end products of the endocrine response include the glucocorticoid cortisol and the inducement of the “fight or flight” response: fat and protein are converted into energy; the immune system is suppressed; and sexuality, growth, and appetite are inhibited. The end products of the nervous system’s response include epinephrine (also called adrenaline), and norepinephrine. Epinephrine stimulates the classic sympathetic responses: heart rate is increased; the amount of available sugars and fatty acids is increased; and there is an increase in alertness. Norepinephrine affects brain regions associated with emotions, also increasing alertness, as well as evoking anxiety and fear. Ideally, this stress response is temporary. As the classic example goes, the hunter sees the lion, processes the memory that lions are dangerous; the “fight or flight” response is evoked; energy is released; a sprint is made across the savanna, bringing the individual to safety. Once safe, the chemical and electrical responses shut off, and the body returns to a peaceful homeostasis.

Each of these temporary disruptions – the increase in cortisol, increase in heart rate and blood pressure, suppression of the immune system – is useful for managing a temporary stressor, such as a nearby lion. If chronic, however, thus continually evoked, each effect is detrimental to both mental health and physical health, as injurious in the long run as it is helpful in the short run: the depression of the immune system frees up energy at first, but leaves the body vulnerable to sickness; the norepinephrine that so focuses the mind when confronted with a serious risk is emotionally debilitating if continually present.

The relaxation response and meditation

Because this stress response is so potentially toxic, some researchers have posited that the body has developed a relaxation system as well: Herbert Benson titled it “the relaxation response” in his book of the same name in 1975 (Benson 1975); Leonard Wisneski calls it the “theta healing system,” on the theory that the response correlates with the brain’s movement into theta waves (2009:131), which instigates the release of melatonin, part of a response that begins a “hormonal cascade” from the pineal gland that eventually restores homeostasis. The pineal gland in the brain is able to integrate the nervous and endocrine systems, transforming neural input into endocrine output. This integration would explain how positive psychological factors, as neural processes, could then have beneficial chemical effects by being “translated” into hormones. In other words, the electrical activity of the brain indirectly stimulates chemical activity.

There are any number of methods by which individuals can lower cortisol and norepinephrine levels, both pharmacological and behavioral. This essay will concentrate on the practice of meditation specifically, for two reasons. First, research indicates that meditation can invoke the dissociative states that increase theta wave activity in frontal regions of the brain (Baijal and Srinivasan 2010; Lagopoulos et al. 2009), and that this theta wave activity may be what induces the relaxation response, with its consequent health benefits (Wisneski 2009).

The second reason for focusing on meditation is that its dissociative states have been traditionally associated with religious practices or rituals. Forms of shamanistic ritual were most likely the first practices that we would refer to as “religious,” and the trance-like states of those rituals bear a family resemblance to meditation by whatever name. Studying meditation, therefore, is studying one aspect of religion that may be applicable across religious traditions.

To be sure, meditative activity is only one aspect of highly complex and particular traditions. Nonetheless, they are one aspect that, studied in isolation, may have universal applicability.

How might meditation work to benefit health? One relatively good marker of health is the level of plasma cortisol in a person's blood; higher cortisol usually correlates with lower health; researchers often use cortisol levels as a short-hand for whether a particular behavior or treatment is effective or harmful. Research has revealed a positive correlation between cortisol levels and many diseases, or complications with a disease, including adrenal disease (Michalakis and Ilias 2009), obesity (Bose, Oliván, and Laferrère 2009), diabetes (Chiodini et al. 2007), and AIDS (Leserman et al. 2002). Injections of cortisol into experimental subjects have resulted in an increase in beta brain waves, along with increased anxiety (van Peer, Roelofs, and Spinhoven 2008). On the other hand, the practice of meditation has been linked with a reduction in cortisol levels across many studies (Sudsuang, Chentanez, and Veluvan 1991; Robert-McComb et al. 2004; Walton et al. 2004; Pawlow and Jones 2005; Phillips et al. 2008; Klatt, Buckworth, and Malarkey 2009; Xiong and Doraiswamy 2009; Kiecolt-Glaser et al. 2010).

Reproductive Success

As a result, the ritual inducement of a meditative state, through its effect on the regulation of cortisol, could be a potential boon to an evolving human species. The dissociative states it invokes modulate the potential damage done by the stress response (McClenon 2006). I believe that there is a very specific instance of human behavior that would lead to those therapeutic results being especially evolutionarily advantageous. While escape from predators is obviously important, there is another behavior that is required for passing on genes of any kind: reproductive success.

If the hypothesis that meditative religious practice positively affects health is correct, one of the ways that would seem most immediately relevant, in evolutionary terms, would be in its affect on reproduction. If we could identify behavior that could affect physiology in such a way that reproductive success was improved, surely we would have a good case to make that that behavior was the product of evolutionary adaptation. Indeed, James McClenon identifies the relationship of ritual and fertility (a positive correlation) as one of the primary pieces of evidence for his ritual healing theory (2002:46-57). There are any number of potential dangers for which humans have evolved adaptations, he reasons, but human reproduction is one that is universal and predictable, as applicable on the savanna as in the rain forest; in nomadic groups, early hunter-gatherer communities, and urban areas. If a behavior could improve fitness for reproduction specifically, the affected individual would obviously be particularly competitive. If this theory is correct, it shows a direct selection of genes as a result of the meditative experience.

Recent research has shown that the effects of stress on reproduction precede the time of birth. Natal cortisol is regulated by the maternal neural and endocrinal systems; from the maternal woman's hypothalamic-pituitary-adrenal (HPA) axis, the cortisol produced crosses the placenta and is absorbed by the fetus. Reducing maternal cortisol therefore directly decreases fetal cortisol (Field et al. 2009).

An increase in maternal cortisol has been shown to have detrimental effects, sometimes severe, on fetal health and newborn health. Pregnancies of women with higher cortisol levels were nearly three times more likely to be unsuccessful than those of women with cortisol levels in the normal range (Nepomnaschy et al. 2007). In a 2008 review, titled "Cortisol: the culprit

prenatal stress variable,” the authors linked increased maternal cortisol to health risks from pregnancy through infancy, childhood, and even adulthood (Field and Diego 2008). If these researchers are correct, any activity that consistently lowered cortisol levels of pregnant women without other negative side effects would increase evolutionary fitness.

Efforts to invoke the relaxation response have showed increases in reproductive health directly. Yoga practice during pregnancy was shown to correlate with increased birth weight and lower complications (Narendran et al. 2005). The neurobehavior of fetuses of pregnant women who engaged in guided relaxation exercises improved significantly in terms of decreased heart rate, increased variability of heart rate, decrease in motor activity, and increased correlation between heart rate and motor activity (DiPietro et al. 2008). It would seem, therefore, that reproductive success could be increased through meditative activities.

Meditation & Evolution

Hopefully at this point I have established the following facts: that meditation is a proto-religious behavior; that meditative activities have been shown to reduce cortisol; and that reduced cortisol increases reproductive success. If this set of facts is true, it bears directly on the evolutionary study of religion, and the religious study of human nature. Specifically, it provides one piece of evidence for seeing a particular religious practice as an evolutionary adaptation that was naturally selected to increase the species’ fitness.

It is a modest case. First, this hypothesis makes no ontotheological claims, about either the existence or the involvement of a god or of gods. It doesn’t preclude divine intervention, but it doesn’t require such intervention to be effective. Second, it doesn’t make an exclusive claim to being the only explanation for the evolution of religion; there could be a variety of advantages of religion that cumulatively proved adaptive, of which health benefits were one, perhaps sociality another (Bulbulia 2006), or shared loyalty another (Sosis 2000). Third, the mechanism by which the relaxation response occurs is still unclear, certainly far less clear than the stress response. There is a growing mountain of correlative evidence, but the particular mechanisms are still under investigation.

Nonetheless, being able to trace the physiological effects that begin with brain waves moving from the beta to the theta state, and end with healthier, more reproductively successful individuals, is a fascinating glimpse at the complex interactions between body and culture, including religion. It appears that this primitive religious practice has long had beneficial consequences for human flourishing, and that being religious, in this one sense, is biologically intrinsic, a propensity reflected in our physiology. That is to say, our nature engenders religious worship. It is part of what it means to be a human being.

If this is, in fact, the case, we can’t say we didn’t receive fair warning: St. Augustine said as much in his description of the human self as “doxological” (Hanby 2003:90). It could be that there is something unexpectedly literal about his prayer in the opening lines of the *Confessions*: “Our heart is restless until it rests in you” (Augustine 1998:3). Our heart is restless: religious practices aren’t only “spiritual,” they are bodily, and human bodies have evolved in such a way that there is not only a natural proclivity, but a natural benefit, to engaging in them.

References

- Augustine. 1998. *Confessions*. Trans. Henry Chadwick. Oxford; New York: Oxford University Press.
- Baijal, Shruti, and Srinivasan. 2010. "Theta activity and meditative states: spectral changes during concentrative meditation." *Cognitive Processing* 11:31-38.
- Benson, Herbert. 1975. *The Relaxation Response*. New York: Morrow.
- Bose, Mousumi, Blanca Oliván, and Blandine Laferrère. 2009. "Stress and obesity: the role of the hypothalamic-pituitary-adrenal axis in metabolic disease." *Current Opinion in Endocrinology, Diabetes, and Obesity* 16:340-346.
- Bulbulia, Joseph. 2006. "Nature's medicine: religiosity as an adaptation for health and cooperation." In *Where God and science meet: how brain and evolutionary studies alter our understanding of religion*, vol. 1, ed. Patrick McNamara, 87-122. Westport, CT: Praeger.
- Cannon, W. B. 1914. "The emergency function of the adrenal medulla in pain and the major emotions." *American Journal of Physiology* 33:356-372.
- Chiodini, Iacopo et al. 2007. "Cortisol secretion in patients with type 2 diabetes: relationship with chronic complications." *Diabetes Care* 30:83-88.
- DiPietro, Janet A., Kathleen A. Costigan, Priscilla Nelson, Edith D. Gurewitsch, and Mark L. Laudenslager. 2008. "Fetal responses to induced maternal relaxation during pregnancy." *Biological Psychology* 77:11-19.
- Field, Tiffany, and Miguel Diego. 2008. "Cortisol: the culprit prenatal stress variable." *The International Journal of Neuroscience* 118:1181-1205.
- Field, Tiffany, Miguel Diego, Maria Hernandez-Reif, Osvelia Deeds, and Barbara Figueiredo. 2009. "Pregnancy massage reduces prematurity, low birthweight and postpartum depression." *Infant Behavior & Development* 32:454-460.
- Hanby, Michael. 2003. *Augustine and Modernity*. New York: Routledge.
- Kiecolt-Glaser, Janice K et al. 2010. "Stress, inflammation, and yoga practice." *Psychosomatic Medicine* 72:113-121.
- Klatt, Maryanna D, Janet Buckworth, and William B Malarkey. 2009. "Effects of low-dose mindfulness-based stress reduction (MBSR-ld) on working adults." *Health Education & Behavior* 36:601-614.

- Lagopoulos, Jim et al. 2009. "Increased Theta and Alpha EEG Activity During Nondirective Meditation." *Journal of Alternative and Complementary Medicine* 15:1187-1192.
- Leserman, J. et al. 2002. "Progression to AIDS, a clinical AIDS condition and mortality: psychosocial and physiological predictors." *Psychological Medicine* 32:1059-1073.
- McClenon, James. 2006. "The Ritual Healing Theory: Therapeutic Suggestion and the Origin of Religion." In *Where God and Science Meet*, vol. 1, ed. Patrick McNamara, 135-158. Westport, Conn.: Praeger.
- McClenon, James. 2002. *Wondrous Healing: Shamanism, Human Evolution, and the Origin of Religion*. DeKalb, IL: Northern Illinois University Press.
- Michalakis, K., and I. Ilias. 2009. "Medical management of adrenal disease: a narrative review." *Endocrine Regulations* 43:127-135.
- Narendran, Shamanthakamani, Raghuram Nagarathna, Vivek Narendran, Sulochana Gunasheela, and Hongasandra Rama Rao Nagendra. 2005. "Efficacy of yoga on pregnancy outcome." *Journal of Alternative and Complementary Medicine* 11:237-244.
- Nepomnaschy, Pablo A., Eyal Sheiner, George Mastorakos, and Petra C. Arck. 2007. "Stress, Immune Function, and Women's Reproduction." *Annals of the New York Academy of Sciences* 1113:350-364.
- Pawlow, Laura A, and Gary E Jones. 2005. "The impact of abbreviated progressive muscle relaxation on salivary cortisol and salivary immunoglobulin A (sIgA)." *Applied Psychophysiology and Biofeedback* 30:375-387.
- van Peer, Jacobien M., Karin Roelofs, and Philip Spinhoven. 2008. "Cortisol administration enhances the coupling of midfrontal delta and beta oscillations." *International Journal of Psychophysiology* 67:144-150.
- Phillips, Kristin M. et al. 2008. "Stress management intervention reduces serum cortisol and increases relaxation during treatment for nonmetastatic breast cancer." *Psychosomatic Medicine* 70:1044-1049.
- Robert-McComb, Jacalyn J., Anna Tacon, Patrick Randolph, and Yvonne Caldera. 2004. "A pilot study to examine the effects of a mindfulness-based stress-reduction and relaxation program on levels of stress hormones, physical functioning, and submaximal exercise responses." *Journal of Alternative and Complementary Medicine* 10:819-827.
- Segerstrom, Suzanne C., and Gregory E. Miller. 2004. "Psychological Stress and the Human Immune System: A Meta-Analytic Study of 30 Years of Inquiry." *Psychological Bulletin*

130:601-630.

Selye, Hans. 1949. "Effect of ACTH and cortisone upon an anaphylactoid reaction." *Canadian Medical Association Journal* 61:553-556.

Sosis, Richard. 2000. "Religion and Intragroup Cooperation: Preliminary Results of a Comparative Analysis of Utopian Communities." *Cross-Cultural Research* 34:70-87.

Sudsuang, R., V. Chentanez, and K. Veluvan. 1991. "Effect of Buddhist meditation on serum cortisol and total protein levels, blood pressure, pulse rate, lung volume and reaction time." *Physiology & Behavior* 50:543-548.

Walton, Kenneth G. et al. 2004. "Lowering cortisol and CVD risk in postmenopausal women: a pilot study using the Transcendental Meditation program." *Annals of the New York Academy of Sciences* 1032:211-215.

Wisneski, Leonard A. 2009. *The Scientific Basis of Integrative Medicine*. 2nd ed. Boca Raton: CRC Press.

Xiong, Glen L., and P. Murali Doraiswamy. 2009. "Does meditation enhance cognition and brain plasticity?" *Annals of the New York Academy of Sciences* 1172:63-69.