The Human Dimensions of Resilience:

A Theory of Contemplative Practices and Resilience

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Abstract

Why do some people crumble under adversity while others bounce back stronger than ever? Challenging situations—from small disappointments to terrible traumas—are a part of daily life, and disruptions such as extreme weather events, conflict and economic dislocation are increasing in frequency. Humans are capable of adapting to a wide variety of difficult physical and psychological circumstances, although in any particular situation, those with resilience will have a greater ability than others to recover and even flourish.

In this paper we define the concept of resilience and build a rationale for how contemplative practices (such as meditation and yoga) represent an effective means of developing qualities that contribute to resilience. We argue that contemplative practices promote resilience via positive impacts on specific psychobehavioral domains, brain activity, stress response, gene regulation and post-traumatic growth, and we review the evidence supporting these mechanisms. We conclude by exploring how improved individual resilience can strengthen the resilience of larger social networks, and we outline key considerations for future research studying the impact of contemplative practices on resilience.

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Introduction

Both risk and the perception of risk have increased over the past 50 years along with the complexity of society. Disruptions such as extreme weather events and economic dislocation are increasing in frequency, creating a need for responsive interventions.[1] In many different contexts—such as poverty, war, abuse and trauma—we can observe that some people collapse and fail while others manage to succeed and thrive. Humans are capable of responding to a wide variety of physical and psychological threats, but individuals considered to possess resilience have a greater capacity to endure and even thrive in response to challenging circumstances.

Acute and chronic stress can cause significant psychological and physiological damage, but resilience skills can serve to buffer individuals and communities from the many negative effects of stress. Resilience is a construct that encompasses psychological and physiological processes. Resilient individuals are not just "lucky accidents." Those who possess resilience share certain qualities that can be identified and learned, among them, confidence, emotional regulation and mental flexibility.[2] To the extent that resilience can be taught or transmitted within a system, the aggregated body of research collected over the last two decades strongly suggests that contemplative practices are effective—even preferential—methods to train and develop the skills that contribute to resilience.

Certain contemplative practices produce deep concentration and equanimity, establishing a base of calm from which to explore meaning, purpose and values. These practices, which are found in all major faith traditions, include rituals, movement, meditation, prayer, sacred music, and creative and relational practices.[3] Over the past two decades, scientific research into contemplative practices has focused on specific meditation techniques (e.g., concentration, mindfulness, loving-kindness, compassion) and yoga. A substantive body of work demonstrates that meditation can increase attention and emotional regulation; enhance neural plasticity; modulate brain activity; optimize immune and inflammatory systems; improve psychosocial functioning; and positively modify gene expression. In this paper, we review the relevant evidence to demonstrate that the areas in which contemplative practices exert their influence—including biobehavioral domains, brain activity, stress response, gene expression and post-traumatic growth—contribute to building and sustaining resilience.

Conversations about resilience are common in the context of environmental studies, as scientists seek to understand how certain ecosystems are able to withstand destructive impacts without degradation, while some experience destructive impacts but appear to restore themselves, and others sustain a level of degradation that is seemingly beyond repair. While we focus herein on factors contributing to human resilience, our perspective has been deeply informed by the efforts to apply systems thinking to understand changes taking place from the smallest ecosystems to the planet as a whole. Applying resilience thinking to humans requires consideration of the social systems in which they are embedded.

The purpose of this paper is to present the interconnected layers of emotional and physiological functioning that contribute to resilience and to review the evidence for how contemplative practices promote resilience. The paper argues for and is guided by the following hypotheses:

- That resilience is a cluster of positive behaviors and habits of mind that can be cultivated and reinforced through contemplative interventions;
- That the skills and attitudes of resilience can be transmitted from one person to another through social networks, and that these skills will themselves strengthen social bonds and therefore communities; and
- That strengthening the resilience of an individual will have a positive impact on the resilience of the larger communities in which that individual is embedded.

The investigation of contemplative practices and resilience is in its infancy and little work has been done at the group and community levels. We construct a case for the role of contemplative practices in promoting resilience by aggregating the evidence established by researchers in a broad variety of fields. Our work has been informed by the extensive literature review compiled by Martin-Breen and Anderies for the Rockefeller Foundation in 2011[4]; by Walker and Salt's work in 2006[5]; by Andrew Zolli's thinking on resilience, including his 2012 book by that name[6]; and by the considerable work of the Garrison Institute in applying contemplative methods in professional development programs that address trauma experienced by front-line workers in highly stressful occupations.[7]

We begin our discussion by describing resilience and contemplative practices, followed by a review of the rationale and evidence for how contemplative practices contribute to improved resilience. We conclude by discussing how improved individual resilience can strengthen the resilience of larger social networks, and we outline key considerations for future research examining the impact of contemplative practices on resilience.

I. Characterizing Resilience

At the simplest level, resilience implies the ability to bounce back after stress, and to remain minimally disturbed by a given amount of stress.[4] *Psychological resilience* is defined by flexibility in response to changing situational demands, and the ability to bounce back from negative emotional experiences.[8–10] Although the word resilience is in danger of losing its meaning through overuse,[11] the term is a useful referent for a constellation of qualities demonstrated as crucial for individual health and wellbeing; qualities that also create and sustain vibrant, thriving communities (**Figure 1**).[12–14] Resilience is not an all-or-nothing quality; because it comprises a spectrum of merits that can be possessed to varying degrees, resilience can be built and enhanced by developing and training its component traits.

Figure 1. Resilience Traits[12–14]

*Includes cognitive reappraisal (recognition of one's negative response to a situation and reinterpretation of the situation in a more positive light) and metacognitive awareness (awareness of one's own thinking process).

People often view themselves as static entities, when in fact they are dynamic systems who are constantly in flux. As such, individuals have the capacity to sustain themselves through disruption and the capacity for reorganization and self-repair when they have been physically or emotionally harmed—that is, they have the capacity for resilience. In the psychological and educational fields, resilience is understood as being both intrapersonal (how a person relates to their own thoughts and feelings) and interpersonal (how a person relates to others). In this sense, each person could be considered a small ecosystem that is also embedded within other ecosystems. More importantly, to continue our ecological metaphor, recent studies in interpersonal psychology are demonstrating that the very interrelatedness of self and other is key to the formation of a resilient identity. An ecosystem constantly recalibrates and will attempt to maintain equilibrium. However, just as pollution can overwhelm a natural ecosystem to the point that it loses its ability to bounce back, so too can an individual be overwhelmed by acute or chronic stress, rendering them vulnerable to mental and physical dysfunction.

The definition of resilience set forth so far is straightforward and consistent with current common usage. However, another less frequently invoked aspect of resilience is the possibility

of not only surviving a challenge and returning to a given baseline state, but actually thriving in the face of adversity—the notion that difficult experiences are opportunities for growth and thus can be beneficial. This concept is called post-traumatic growth.[6,15] If adversity does not push us beyond our limits, it can strengthen us by helping us to learn new ways of coping and compelling us to broaden our capacities, giving life further depth and meaning. Like the currently popular term "grit," at the core of resilience is a certain spirit that enables a person to keep going in the face of adversity. Conventionally, we think of resilience as *bouncing back*; however, it is preferable to think of resilience as *adapting* to change. Simply returning to a baseline state may not be desirable if that represents a state that predisposed the individual to react adversely to a challenging experience in the first place. Developing adaptive, flexible coping skills in response to a challenging experience can position a person so that the next challenge is less difficult.

Resilience and Stress

One key aspect of resilience is the ability to cope with stress effectively and in a healthy manner. Stress can be physically and psychologically damaging, but resilience can help to prevent and protect from the negative effects of stress.[16–18]

Walter Cannon is credited with naming the "fight or flight response"[19] and Hans Selye furthered the work, noting that "stress is not necessarily undesirable...The stress of failure, humiliation, or infection is detrimental; but that of exhilarating, creative, successful work is beneficial. The stress reaction, like energy consumption, may have good or bad effects."[20] Short stressors can be energizing and optimizing, inspiring the psychological foundations of outstanding physical or musical performance, challenging creativity, or enabling a heroic act. Single instances of extreme or acute stress can be incidental or traumatizing.

Biological mediators of the stress response, including stress hormones (e.g., cortisol, adrenaline) and inflammation, can themselves be damaging to long-term physical and mental health.[21,22] Indeed, chronic stress can adversely affect cognitive function and contribute to the development of a number of chronic conditions, including cardiovascular disease, type 2 diabetes, and psychiatric disorders such as major depression.[23–30] Chronic stress has also recently been shown to harm the structure of DNA; for example, long-term stress wears down the telomeres that protect the ends of chromosomes from damage.[31]

The actions of stress hormones are beneficial in the short-term, but can create damage if the stress response is not shut off when it is no longer needed.[32] To maintain the body and mind in a state of healthy equilibrium requires appropriate on-off switching of the mediators of the stress response in order to avoid excessive exposure to those mediators.[33] One aspect of building resilience is the ability to modulate the stress response so that it is not inappropriately activated in the absence of an actual stressor. In this context, to be resilient is to respond to stress appropriately and to bounce back quickly.[4] See **Appendix Section A** for a more detailed discussion on the stress response and its relationship with resilience.

Psychological and physiological reactivity often vary together. People who are psychologically reactive tend to have more reactive physiological responses, whereas those who are more psychologically "steady" also have more stability and less reactivity in their physiological responses to stress.[34] For example, individuals who suffer from anxiety, depression, loneliness or low self-esteem are inclined to perceive circumstances as threatening far more frequently than is warranted.[35]

Stress results from an interaction between a person and a situation; whether stress ensues in any given context depends fully on how one evaluates the situation based on how much it *means* to them in terms of their values, goals and physical or psychological safety. This evaluation, called appraisal, drives the consequences of the person's interaction with the stressor. Thus, stress and trauma result not only from an individual's external environment and experiences but also, and more importantly, from *what and how a person thinks about them.* The process of appraisal reveals the possibility of change: if you change your appraisal of an event, you can change the outcome.[36] The most powerful stressors for humans are almost exclusively psychological and experiential.[34] The consequences of a stressor are in large part determined by the context, including how the situation is perceived and interpreted, the individual's psychological state at the time of the stressor, and their reaction.[34] Agency—whether the individual feels empowered and in control, or helpless and threatened—will contribute significantly to the psychological consequences of a stressful event.[37] Both acute and chronic stressors are part of daily life; many stressors are neither predictable nor controllable, and some are so large in scope—such as a nuclear bomb or chronic, grinding poverty—that it is impossible for anyone to remain unaffected. Nevertheless, it is possible for an individual to govern their reaction to a stressor.[38]

The negative effects of stress point to a need for interventions that positively impact the regulation of the stress response. Moreover, the psychological nature of the stress response provides a basis for cognitive and psychobehavioral interventions. "Inoculating" against stress by building resilience skills would be protective against damage from chronic stress, particularly if those interventions regulate mediators of the stress response and have positive effects on brain function.

II. Introducing Contemplative Practices

Contemplative practices, including various forms of meditation and yoga, denote a collection of methods intended to systematically train the mind and body.[3] The objectives of each of the many forms of contemplative practices vary, as each was developed and put into practice within a specific cultural context that framed its purpose in particular ways.

Meditation

There are several varieties of meditation practices, including mindfulness, concentration, loving-kindness and compassion meditation drawn from the Buddhist tradition; mantra repetition, found in the Hindu and Buddhist traditions; Sufi ritual prayer; Christian centering prayer; and the contemplative prayers and meditations of Judaism. But meditation is not necessarily a religious practice.[39] At the heart of any form of meditation lies attention: how to pay attention and how to choose what we pay attention to. Meditation practices can help us to develop focus and concentration or develop a particular attitude or emotion through reasoned analysis.[40] The practice of meditation is a practice of reinforcement: of choosing the object of our attention, placing our attention on that object, and returning to it over and over again. In this way we can develop skills such as concentration, mindfulness and compassion.[41] In contrast, it is also perfectly possible to meditate on anger: to reflect on a conflict with another person, to generate a feeling of anger, and to return our attention to that anger, again and again. Thus, we will reinforce the neural and emotional networks that support anger. This is where metacognitive ("thinking about thinking") skills are crucial to enable us to watch the workings of our own minds, and to change course when necessary.[42] By choosing where to place the focus of our attention, and choosing our reactions to the circumstances of our lives, we gain great freedom.[43] These choices are the heart of resilience.

Mindfulness: We differentiate between concentration and mindfulness using the definition established by Jon Kabat-Zinn, who developed mindfulness-based stress reduction (MBSR): mindfulness involves paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally.[44,45] Current research on the use of contemplative practices has largely been framed through the lens of stress reduction. Participation in MBSR courses—the most well-known of the meditation-based psychosocial interventions—has been shown not only to improve symptoms of stress and anxiety, but also to improve emotional wellbeing, and lessen depression symptoms, anger, and anger-related rumination (focusing on bad feelings and experiences from the past). Accordingly, MBSR has been increasingly incorporated into psychotherapeutic settings.[46–50] Mindfulness-based interventions have been used to treat substance abuse, eating disorders, psoriasis, fibromyalgia, rheumatoid arthritis, ADHD, heart disease, and as an adjunct treatment for individuals with HIV.[51,52] Mindful individuals perceive stress differently and use more approach-oriented coping mechanisms (e.g., problem-solving mechanisms, rather than avoidant mechanisms) which contribute directly to resilience.[49,53–55]

Mindfulness practices have been incorporated into treatments for depression that are becoming more widely used; for example, mindfulness-based cognitive therapy (MBCT) enables people to become more aware of the bodily sensations, thoughts and feelings that signal depressive relapse and to relate differently to these occurences.[56] Participants' experiences with MBCT indicate that it is transformative, particularly because the mindfulness component introduces attitudes of acceptance and "living in the moment" rather than ruminating over the past or worrying about the future.[57,58] MBCT has been shown to be as effective as antidepressant

treatment to prevent relapse of depression.[59,60] Other key outcomes of mindfulness-based interventions relating to resilience are the sense of agency and empowerment that participants experience, as well as the ability to consciously and constructively refocus attention.[56] Most recently, the concept of equanimity has been proposed as an appropriate measure of mindfulness, as it encompasses an even-minded mental state towards experiences and objects.[61]

Loving-kindness and Compassion: Research on loving-kindness and on compassion meditation practices started later than the work on mindfulness, but the pace of inquiry has accelerated in recent years, driven by excitement about the effects of these practices, as well as media attention around the individual and societal benefits of compassion (and the detriments of a lack of compassion). The benefits of compassion have been extolled by many of the most respected secular and religious leaders, including His Holiness the XIV Dalai Lama, Bishop Desmond Tutu, and the late Nelson Mandela, Thomas Merton and Ghandi, among many others. Efforts to create a secular ethical framework—which might provide guidance in ethical behavior apart from formal religious affiliations—often center on the concept of compassion. In the Buddhist context, love is the wish for others to be happy, and compassion is the wish for them to be freed from suffering; the two concepts are seen as two sides of the same coin. Practices can be simple or complex; all share the goal of transforming the practitioner's relationships with self and other.

Compassion has uniquely mammalian neural origins, and the effectiveness of meditation practices in this domain stems from recruiting these neural circuits, which are incompatible with judgmental, evaluative, defensive behaviors.[62,63] (We distinguish empathy as the ability to experience what another is feeling and compassion as the wish to free others from their suffering.) Compassion and loving-kindness meditation enhance our ability to generate positive emotions, even in response to distressing situations.[64,65] Positive emotions broaden awareness, allowing us to see more possibilities in a given situation and to make more connections to others. Experiencing positive emotions initiates a cascade of biological reactions within the body and prompts changes in behavior that resonate with others, influencing their behavior in turn.[35,66,67]

Training in compassion and loving-kindness meditation has been shown to alter the activation of brain circuits linked to empathy.[68] Loving-kindness meditation also enhances vagal tone (indicating an internal state of rest and repair), suggesting that increased feelings and expressions of love actually enhance health.[69] Further, increased vagal tone enables individuals to take advantage of opportunities for social and emotional interaction. Thus, enhanced vagal tone and positive emotions create an "upward spiral" of increasing psychological and physical health.[70]

Yoga

Hatha Yoga is an example of a contemplative practice that engages both the body and the mind. Hatha Yoga is branch of the ancient system of Raja Yoga that combines breathing,

meditation and physical postures (called "asanas").[71] Originating in India, Hatha Yoga and the associated system of traditional medicine known as Ayurveda provided a complete method of attaining and maintaining physical and mental health.[72] The practice of yoga was originally developed as a spiritual practice with its own teleological goal of achieving nirvana, a state of union with God; the physical postures were practiced to prepare the mind for meditation.[71] Yoga, particularly the physical asanas, is increasingly practiced for its therapeutic benefits, including physical relaxation, enhanced activity of the parasympathetic nervous system (known as the "rest and digest" system), modulation of the sympathetic nervous system (responsible for the fight or flight response), and positive effects on the limbic system (a series of brain structures involved in emotion and motivation).[73–75] For example, yoga has demonstrated beneficial effects on vagal tone—that is, stimulation of the vagus nerve, a key component of the parasympathetic nervous system whose activation is associated with calmness, rest and bodily repair.[76–78] For these reasons, yoga practices are progressively employed as complementary therapy for a variety of physical conditions and disorders; for example, yoga has been shown to be as effective as antidepressant treatment in the prevention of depressive relapse.[79,80] The capacity of yoga to optimize wellbeing in the absence of disease is also being explored.[81–83] The theoretical underpinnings of yoga suggest that consistent practice will help the practitioner achieve increasingly healthier physical, emotional and spiritual states.[73,81,84]

Connecting Contemplative Practices to Resilience

It is perhaps not surprising that practices engaging mental processes would have a corresponding impact on those very mental processes. What is notable, however, is that working with the mind can have a corresponding impact on the body as well. The field of contemplative science is now looking not only to understand the effects of specific practices as therapies, but also to explore the underlying physiological and psychological mechanisms of their efficacy. Within this context, it is worth noting that contemplative practices such as meditation and yoga were not originally designed as interventions for specific problems (e.g., yoga for cancer; meditation for stress) but rather as holistic programs that addressed the larger human questions of how to live well and face death with ease.[85] At the heart of resilience is the question of how to approach life meaningfully and effectively, and so it is a reasonable progression to link these practices with the development of resilience.

Within the Buddhist tradition, from which most meditation interventions are drawn, we find practices designed to cultivate positive states of mind, reduce the incidence of negative emotions, stabilize attention, and focus conscious awareness. In their religious context, the practices were intended to lead to a state of enlightenment. These traditions define a way of being in the world characterized by awareness of the impermanence of self and other; understanding the interdependence of all living things; non-harm toward self and other; the detriments of an exclusive focus on one's own needs; an emphasis on empathic and compassionate behavior that sustains community; and the need for continuous practice and attention to this way of being.[86,87]

In other words, contemplative practices prescribe what we now know to constitute the components of a physically and mentally healthy person embedded within a flourishing community. In a certain way, contemplative practices represent an important behavioral adaptation of the individual and the community to move toward resilience. Multiple interacting factors contribute to resilience at all levels.[20]

III. Examining the Relationship Between Contemplative Practices and Resilience

Resilient qualities contribute to the ability to be proactive when confronted with challenging or unexpected events. Resilience implies positive psychosocial behaviors, including: optimism; confidence; ego resilience and control; cognitive reappraisal; emotional regulation; the ability to learn; a lack of denial; positive coping strategies; a sense of purpose and ability to find meaning; metacognitive awareness; flexibility of thinking; openness to social support; and the capacity to reorganize in response to changing external circumstances.[88–91] Beyond the individual health benefits associated with these positive emotional behaviors, they appear to affect our cognitive processing in ways that enable us to be more flexible, open and creative, as opposed to narrowing in on negative thoughts that lock us into a particular course of action.[92]

Resilience is normative, arising from the operation of basic human adaptation systems. We have evolved to function competently in diverse contexts; even situations that might be considered adverse (such as insufficient maternal care) can bring with them compensatory adaptations.[93] So there is no one set point of optimal functioning, but rather an optimal way of *relating* to one's environment. It is in this sense that contemplative practices are uniquely suited to develop resilience: to empower individuals to become aware of their own thinking and reactions in face of the inevitable stresses of life, and to make choices that will optimize their way of relating to their experiences. While we often cannot change or avoid the difficulties we face in life, it *is* possible to change the way that we prepare for and react to these difficulties. The way that we think about an experience shapes that experience.[82] Here, we discuss how contemplative practices enhance qualities of resilience to overcome susceptibilities to stress and trauma.

The mechanism through which contemplative practices promote resilience is through mental training: repetitive reinforcement of positive habits of mind, inducing favorable changes in brain activities and physiological processes in ways that positively impact psychological function and behavioral outcomes.[68,95,96] In every moment, we are taking information in from our environment, which is carried along the electrical/chemical pathways of the brain and nervous system. By means of neurotransmitters that are released in the brain, some types of information and experiences can change the brain structures themselves, and also cause a temporary change in functioning throughout the body. Over time, some of these patterns of response in the brain and body become "hard wired" and create changes in emotional behavior and physical health.

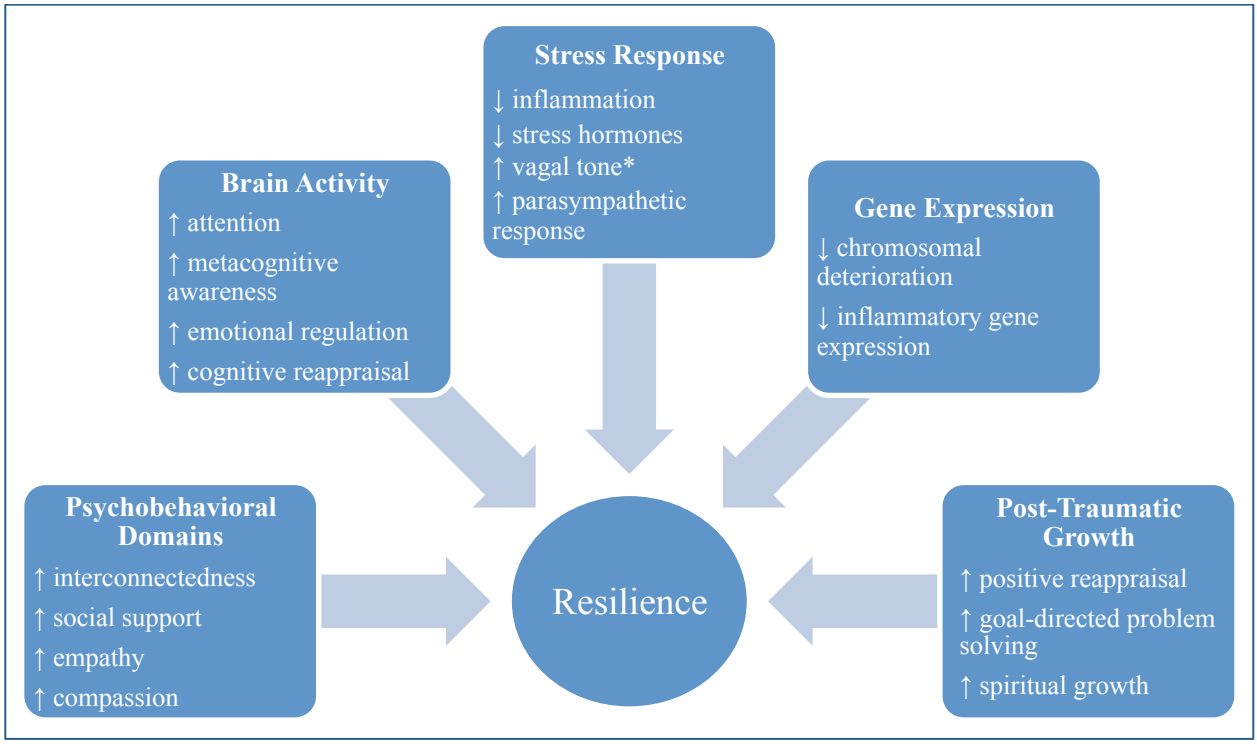
This is what is meant when the brain is described as "plastic": that it can be changed by experience.[97] These experiences can be things that originate outside of our selves: a lecture on algebra, learning to play the violin, a rape, an attack during war. These experiences can also originate inside our selves, as feelings and thoughts. That an immaterial thought can influence both the functioning and the structure of the brain and body is perhaps the most fundamental and ground-breaking understanding to emerge from the field of contemplative science.

It is from this understanding that we propose five domains in which contemplative-based interventions can be targeted to promote resilience:

- **Psychobehavioral domains.** Contemplative practices can promote resilience by fostering appropriate personal and interpersonal behaviors via techniques that enhance optimism, increase pro-social behaviors (e.g., empathy, kindness, compassion) and regulate and stabilize mood.
- **Brain activity.** Contemplative-based interventions can promote resilience by reinforcing beneficial neural processes related to attention, cognitive reappraisal, metacognitive awareness, accurate appraisal of threats and emotional regulation.
- **Stress physiology.** Contemplative practices can enhance resilience by optimizing the stress response, via regulation of stress hormones, decreasing inflammatory response, moderating the sympathetic nervous system's (fight or flight) response, and enhancing the parasympathetic nervous system's (rest and digest) response.
- **Healthy gene expression.** Contemplative-based interventions can promote resilience by supporting healthy gene expression, via epigenetic effects that preserve the structural integrity of DNA.
- **Post-traumatic growth.** Contemplative practices can contribute to resilience by promoting growth following difficulty, and by providing the tools needed for positive reappraisal, goal-directed problem solving and spiritual growth.

Figure 2 presents a visual framework for how contemplative practices increase key components of resilience within these five domains. Below we review the evidence demonstrating how contemplative practices positively impact these areas and contribute to resilience.

Figure 2. Components of Resilience Promoted by Contemplative Practices Within Five Domains



*Vagal tone refers to the activity of the vagus nerve, originating in the brainstem and extending into the viscera, a key component of the parasympathetic branch of the autonomic nervous system, which controls bodily functions beneath conscious control (e.g., heart rate, digestion). In healthy people, a higher level of vagal tone is desirable, as this indicates a state of calmness, rest or relaxation, which is a sign that the body is repairing itself.

IV. Reviewing the Evidence: How Contemplative Practices Promote Resilience

Traditions of contemplative practice have existed for thousands of years; however, the specific mechanisms by which these practices impact physiological and psychological functioning are only now being explored scientifically. The pathways can be traced from brain to body—and from body to brain—optimizing the stress, immune and inflammatory systems that determine successful interaction with our environment.

Research on contemplative practices is derived from three broad categories of inquiry: first, exploration of techniques that are drawn directly from their source traditions, practiced generally as they would be in their original cultural context (e.g., loving-kindness meditation, insight meditation); second, explorations of constructed interventions, based on techniques from one or more traditions and created specifically as clinical or research interventions (e.g., MBSR, Mindfulness-Based Cognitive Therapy [MBCT], Cognitively-Based Compassion Training [CBCT]), and third, exploration of professional training programs rooted in contemplative practices (e.g., Cultivating Awareness and Resilience in Education [CARE] and Contemplative-Based Resilience Training [CBRT]).[98–101] (CARE and CBRT were developed at the Garrison Institute. Data on the efficacy of the CARE program will be published in 2015. Components of

the CBRT program have been demonstrated to be effective [lovingkindness and compassion meditation; yoga asanas] but the integrated program has not yet been evaluated.) This variety makes it challenging to aggregate the research, as the techniques and quality of the contemplative practices differ across studies, as does the quality of the research itself.[102] Nevertheless, a broad review of the literature reveals a body of work of appropriately rigorous methodology, using replicable techniques that have measurable impacts on physiological and psychological states.

Table 1 compares the various contemplative practices discussed in this paper, including key outcomes reported in the literature. The studies that we cite herein examining the efficacy of these programs are limited to reports from peer-reviewed scientific journals; many of the studies were randomized, controlled trials. These programs are specifically secular, as the practices have been adapted from their sources to make them accessible to Western participants that may not share the practices' original philosophical, cultural, or ontological views.[103]

Here we explore the evidence that contemplative practices promote resilience by (1) developing appropriate intrapersonal and interpersonal behaviors; (2) fostering beneficial brain activity related to attention, emotional regulation and metacognition; (3) optimizing stress response; (4) supporting healthy gene expression; and (5) promoting post-traumatic growth.

Table 1. Summary of Contemplative Practices Used in Research Programs

Practices Drawn from Source Traditions			
Name	**Sources**	**Used by**	**Outcomes & Skills Trained**
Loving-kindness (also known as: metta; compassion)	Buddhist Theravada tradition	University of Wisconsin – Madison; University of North Carolina – Chapel Hill; others	Enhances pro-social behavior and works against negative affect processes[104,105]; enhances vagal tone
Shamatha (also known as: attention training; concentration meditation)	Buddhist Theravada and Mahayana traditions	University of California – Davis; Emory University	Improves ability to choose and focus on object of concentration[106]; mechanism of action may be via regulation of stress hormones[107]
Yoga asana practice	Ancient Indian tradition	Numerous academic research programs	Enhances physical and emotional balance and flexibility
Constructed Interventions			
Name	**Sources**	**Founded at**	**Outcomes & Skills Trained**
Mindfulness-Based Stress Reduction (MBSR)	Theravada Buddhism; Zen Buddhism; yoga	University of Massachusetts Medical Center	Increases emotional and physical wellbeing[108]; the first "manualized" contemplative program; usually the foundation for "mindfulness" efforts that are often discussed in the media
Mindfulness-Based Cognitive Therapy (MBCT)	MBSR combined with Cognitive Behavioral Therapy (CBT)	University of Toronto; University of Cambridge; University of Massachusetts Medical Center	Proven as effective as medication for prevention of relapse of depression (perhaps most so in individuals with history of early life trauma)[109,110]
Cognitively-Based Compassion Training (CBCT)	Secularized version of Tibetan Buddhist (Mahayana) mind-training teachings, plus concepts from CBT	Emory University	Modulates inflammatory and immune-system activity[111]; supports pro-social behaviors and positive psychology in foster care children[112]; modulates limbic brain activation[113]
Compassion Cultivation Training (CCT)	Secularized version of Tibetan Buddhist (Mahayana) mind-training teachings, plus concepts from CBT	Stanford University	Enhances emotional regulation and psychological flexibility[114]
Cultivating Awareness and Resilience in Education (CARE)	Secularized versions of various wisdom traditions	The Garrison Institute	Promotes teachers social and emotional competencies, improves teaching skills and student academic performance
Contemplative-Based Resilience Training (CBRT)	Loving-kindness and compassion meditation; yoga; psychosocial education	The Garrison Institute	Research underway
Dialectical Behavioral Therapy (DBT)	Incorporates CBT and mindfulness practices	University of Washington	First therapy demonstrated to be effective for the treatment of borderline personality disorder[115,116]

Psychobehavioral Domains of Resilience: The Impact of Contemplative Practices

Contemplative practices develop key psychobehavioral components of resilience: interconnectedness, social support, empathy, altruism, compassion, and helping others.[117–119] Social integration and support protect humans from the negative effects of allostatic load—that is, the "wear and tear" on the body that builds over time from chronic stress[37,105,120,121]

Brain Activity: The Impact of Contemplative Practices

Contemplative practices have been demonstrated to positively impact several cognitive processes linked to resilience, including attention, metacognitive awareness, emotional regulation and cognitive reappraisal. Experienced meditators also exhibit changes in brain structure related to these cognitive processes.[122,123]

Attention is crucial to the construct of resilience. The ability to focus attention, rather than operating in a "mind wandering" mode, is associated with improved emotional wellbeing and reduced negative emotions.[124] In this sequential relationship, self-regulation of attention is a necessary precursor of emotional wellbeing.[125–129] The development of cortical networks involving attention helps to regulate emotions and enhances cognitive flexibility in interacting with our environment.[130–132] Meditation practices excel at training attention, an outcome of both long-term and short-term meditation experience.[133] Meditation practices designed to enhance concentration and train attention have been demonstrated to have precisely that impact.[134–141] These effects are explicit in advanced meditators, but can be trained in as little as six weeks of practice.[142–145] Both mindfulness training and concentration training also reduce rumination,[146] which differs from mind-wandering in that it denotes a hyper-focus on negative thoughts and distress, and is linked to anger, aggression and depression.[147]

The capacity to learn is directly related to the ability to pay attention and to possess sufficient concentration to absorb new concepts and to synthesize new and extant information. Contemplative practices excel in building brain plasticity—that is, forming new connections between areas of the brain.[148–155] The capacity to reorganize resources incorporates the ability of perspective-taking, a skill that is overtly taught in compassion practices.[156,157] There must also be a sense of the self as being capable and adequate, which is trained through the contemplative practice of self-compassion.[158,159]

Metacognitive awareness—awareness of one's own thinking— is a skill that is logically integral to resilience. This skill allows a person to observe thoughts and feelings as passing mental events, rather than identifying with them. Metacognitive awareness allows us to recognize that the mind is wandering, and to correct it.[160] Metacognitive awareness contributes to learning and problem solving, and it is one of the skills most reliably trained by meditation practices.[161–163] The skill of observing thoughts and sensations without being caught up in them translates into the ability to take a meta-perspective on experiences and situations, and to

intentionally choose a response. This creates the space between action and reaction to respond creatively and with consideration of the consequences.

Another key component of resilience strengthened by contemplative training is emotional regulation—the ability to be aware of and modify emotional reactions. These modifications can be adaptive or maladaptive. Ideally, a person is able to use a combination of metacognitive awareness and compassion to regulate their emotions so that they are appropriate to the given situation. The functioning of key brain networks associated with regulating emotions and controlling attention naturally decreases with age, but mindfulness has a positive effect on this functioning.[164,165] The amygdala contributes significantly to emotional processing and is prone to over-reactivity in individuals who have been exposed to significant stressors. Brain imaging studies have demonstrated that various meditation practices decrease amygdala activity and that these effects appear to persist even when the individual is not meditating.[166,167] Individuals who participated in a four-week yoga teacher training program also demonstrated improvements in emotional regulation, including enhanced non-reactivity, observation and awareness, as well as a shift to a more internal locus of control, which is a key component of resilience and denotes the belief that there is something one can do to manage one's feelings and cope.[81]

In the short term, mindfulness practices appear to contribute to emotional regulation through cognitive reappraisal—recognition of one's negative response to a situation and reinterpretation of the situation in a more positive light. This is a top-down strategy that interrupts negative emotions,[168,169] which is very different from trying to *control* emotions. Over the longer term, mindfulness practices may contribute to emotional regulation by building one's capacity to observe the occurrence of emotions with a non-judgmental stance, without active reappraisal efforts.[170] Experiences are not inhibited; that is, a mindfulness practitioner will still feel pain to the same degree as a non-practitioner, but they will evaluate experiences differently and can be less bothered by them.[171,172]

The emotional regulation effects of contemplative practices are also relevant for treating clinical populations.[173,174] Mindfulness is associated with significant improvements in spirituality and positive health measures, as well as decreases in depressive relapse/recurrence and psychological distress.[175–177] The effects appear to occur through structural changes in both white and grey matter in the brain.[178] A meta-analysis of mindfulness-based interventions for depression found them to be effective for adults with mental disorders, possibly through the mechanisms of reducing fear of negative emotions, greater self-awareness, reducing autonomic arousal, inducing relaxation, and increasing coping skills.[179] MBCT has been used successfully with people who have a variety of diagnoses and life challenges.[180,181] In bipolar patients, MBCT not only significantly improved mindfulness, anxiety, emotional regulation, working memory, spatial memory and verbal fluency, but also increased activity in an area of the brain associated with cognitive flexibility.[182] Other positive effects of MBCT include reduced emotional reactivity to stress and improved metacognitive awareness.[183–186] The amount of time required to observe positive benefits has been established at approximately 20 minutes per day for three to

four days per week, although positive effects have been observed following periods of meditation lasting less than 10 minutes.[187–190] A direct dose-response relationship between practice and benefits has been established by several studies.[191]

Stress Response: The Impact of Contemplative Practices

There is evidence that contemplative practices improve one's ability to cope with stress effectively and in a healthy manner—a key component of resilience.[192] Stressful experiences can lead to beneficial adaptation or to negative consequences, depending on how the experience is interpreted and the individual's coping resources.[193,194] Mindful individuals perceive stress differently and use more approach-oriented coping techniques, contributing directly to resilience.[49,53,54] Resilience requires that we minimize chronic stress and maximize the time we spend in a low-stress state; it also requires the ability to mount an effective, robust response to stressors. Meditation, yoga and compassion training promote this flexibility and equilibrium.[21,84,195,196]

Physiological stress systems are regulated by compassion and mindfulness practices, which reduce resting levels of inflammatory and stress hormone activity in the body, and enhance recovery from stressors.[112,197,198] Loss of a positive attitude during acute stress is associated with increased inflammatory markers in the body, which are in turn associated with future depressive episodes.[199] CBCT has been shown to decrease the inflammatory immune response to psychological stress in healthy people. The same program has been found to decrease the activity of the inflammatory immune system among adolescents in foster care.[111,112,200,201] MBSR has been shown to modulate inflammation in response to stress and both MBSR and compassion meditation regulate cortisol profiles.[202–208] The psychological wellbeing that accompanies MBSR training has been linked to increased natural killer cell activity (a component of healthy immune activity) and decreased levels of C-reactive protein, a biomarker for inflammation in the body.[209] There is weaker evidence to suggest that short-term mindfulness training can be protective for individuals who are preparing to face extreme stressors, such as deployment to a war zone.[137]

Yoga practice, which can include movement linked with breathing or yogic breathing on its own, has profound effects on the sympathetic and parasympathetic nervous systems, quieting physical arousal.[210,77] Yoga training has been demonstrated to increase optimism in healthy participants,[81,211] improve memory, reduce anxiety, and improve attention in depressed patients.[76,212,213] Hatha yoga has also demonstrated beneficial effects on emotional self-regulation—an effect that appears to stem from balancing the activity of the sympathetic and parasympathetic stress responses.[77,214–217]Although "the body keeps the score" of extremely stressful and traumatic events, yoga practice has been shown to act positively on all of the brain and body systems that are compromised by those events, acting through the vagal system.[78,218–220] As is the case for meditation practices, there is a dose-response effect for yoga practice, and time spent practicing yoga is a predictor of subjective wellbeing.[221]

Meditation practices also enhance vagal tone, which is adaptive for recovery from physiological and psychological stress.[222–224] Vagal tone is an indicator of parasympathetic nervous system activity and autonomic flexibility, and compassion meditation is also supportive of physiological and psychological health by enhancing these pathways.[225] The effect of meditation practices on the parasympathetic system is noteworthy because this activity counterbalances sympathetic activity and also decreases inflammation.[37,226]

Inasmuch as the biological aspects of the stress response contribute in a fundamental way to the development of trauma-related illness, findings from intervention studies indicate that physiological systems, at least, can be modified. The extent to which these physiological improvements translate to psychological gains has not been sufficiently explored, but we hypothesize that improvements to physical systems open the door to psychological recovery.

Gene Expression: The Impact of Contemplative Practices

Psychological stress has been found to have a direct and deleterious effect on telomeres, the "end caps" on chromosomes. Telomeres—caps made of DNA on the ends of human chromosomes—shorten naturally in the process of cell division and are thus an indicator of aging; however, the enzyme telomerase can restore telomere length to some degree. Shortened telomere length is associated with a number of conditions such as cardiovascular disease, diabetes and some cancers, and also with chronic psychological stress, depression and post-traumatic stress disorder.[227,228] In one study, women who were experienced practitioners of loving-kindness meditation were found to have longer relative telomere length than non-practitioners.[229] Other research has found that intensive meditation practice increases levels of telomerase, and also reduces levels of pro-inflammatory gene expression.[230,231] This line of inquiry is relatively new, but thus far the evidence is pointing towards a link between positive psychological change as a result of meditation practice and immune cell longevity.

Recent work has also demonstrated that our perception of ourselves within our social setting affects the way that our genes express themselves, with concomitant effects on our bodies and our health. For example, in people who perceive themselves as being lonely, some beneficial gene expression is impaired and inflammatory gene expression is enhanced, to the detriment of long-term health.[232] These epigenetic effects are modifiable through contemplative training. For example, MBSR has been shown to reduce pro-inflammatory gene expression in older adults.[233] Compassion training may exert its effects on inflammatory systems by helping individuals to redefine and perhaps reimagine their social environment in a more positive way, by training them to understand and appreciate their connections to others. It is important to note that it is our perception of our social situation that is relevant here. It matters little whether a person has one friend or 10—the *perception* of loneliness will initiate pro-inflammatory gene expression and impairment of beneficial gene expression. Recent work with experienced practitioners has indicated that changes in genetic expression as a result of practice can be observed in as little as one day.[234]

V. Community Resilience: Moving from "Me" to "We"

Our theoretical foundation for the translation of contemplative practices from individual to community interventions lies on two pillars: (1) the potential for pro-social behaviors to spread through social networks, and (2) the potential for post-traumatic growth.

Before the 21st century, humans sought to control their environment and those who could amass the most physical capital were the most materially successful. But no individual or group can fully insulate themselves from disruptions such as extreme weather and climate change. The economic disruptions of the past five years have turned dominant notions of security on their heads. It has been argued that community bonds and obligations are not as central to US society as they were 50 or more years ago, but this does not mean that they are any less important.[235] A key determinant of the success of communities in the future will be the ability to collectively build resilience in the face of constant and unpredictable change. One of our main hypotheses is that social networks that are the most inclusive—those with the most connections between individuals, whose members are bound by strong, duplicative ties, with the fewest marginalized members—will be the most adaptive and thus the least vulnerable to disintegration in times of crisis.

We cited social support as a key component of resilience and we believe this is the crucial point of connection between individual and community resilience. Contemplative practices excel in their ability to enhance relationships between people and to build social capital.[236–242] Contemplative practices support the creation of inclusive groups by increasing social support and reducing bias towards stigmatized others. For example, compassion meditation strengthens socially inclusive neural circuits (those that are incompatible with judgmental, evaluative, defensive behaviors).[62,63] Loving-kindness meditation strengthens community bonds and fosters the creation of inclusive groups by softening in-group/out-group distinctions.[243] The positive emotions generated from contemplative practices enable us to connect with others, to form bonds, and to live immersed in communities whose members sustain each other.[35,244] Moreover, the physiological benefits of contemplative practices described above (e.g., reduced inflammation and stress hormone levels, improved vagal tone and parasympathetic stress response, decreased chromosomal deterioration) result in healthier individuals with less chronic disease who are therefore more capable of actively participating in their communities.

Further, we propose that using contemplative practices to support the resilience of key individuals can have a cascading impact on the resilience of the community as a whole because resilient behaviors may spread through social networks in the same way that positive and negative emotions do.[245] As humans, we copy others around us and, in turn, influence others. In addition, when key community leaders learn to think and act as models of resilience, resilient behaviors will be adopted by others and may become normalized within the group. This can be seen in contemplative interventions in K-12 classrooms: work with individual teachers or

students has resulted in measurable positive effects on the classroom environment as a whole.[96,98,246,247]

To create resilient communities, we can potentially use contemplative practices to initiate changes in individuals' behaviors, which might then be adopted by others, ultimately shifting the culture of the community.[94] This concept was explored in the work of the Garrison Institute's Wellness Project, a five-year program (2004-2009) of trainings for staff at domestic violence shelters where workers face an increased risk of developing symptoms of secondary and vicarious trauma due to their empathic connections with the populations they serve. This program trained supervisory and front-line staff, who in turn incorporated the skills into their daily routines and modeled resilient behaviors to their coworkers.[248,249] The Wellness Project provided the groundwork and model for the Institute's current CBRT work.

Post-Traumatic Growth: The Impact of Contemplative Practices

Within our discussion of resilience, we included the possibility that an individual can undergo significant disruption and come through better than before, having developed significant new coping abilities and stronger social ties as a result of the experience—an effect known as post-traumatic growth. Instances of post-traumatic growth demonstrate how traumatic experiences can lead to beneficial changes in perception of self, in relationships with others, and in life philosophy.[250] This can incorporate the feeling of having transcended a difficulty and can connect a person to a greater sense of meaning and purpose.[251,252]

The traits that comprise resilience enhance the capacity for post-traumatic growth, as do contemplative interventions.[253] Researchers have noted that some of the most significant growth occurs in the context of social relationships. Thus, improvements in perceived interconnectedness and social support may be a mechanism by which contemplative interventions foster post-traumatic growth. While various experiences can serve as vehicles for post-traumatic growth, it is the internal appraisal of an experience—rather than any particular experience per se—that provides the context for growth.[250] Finding meaning in difficulty or tragedy can occur via psychosocial processes that are supported by contemplative practices, including positive reappraisal, goal-directed problem solving, and spiritual experiences.[254,255] Building connections to meaning and spirituality, whether grounded within a religious tradition or not, contributes substantively to post-traumatic growth.[253,256] (We use the term spirituality to denote a search for the sacred—something set apart from the ordinary—outside of the context of religion.[257]) Thus contemplative practices have a role to play in healing and an even more pervasive, day-to-day role in supporting healthy individuals who wish to flourish in their lives.[258]

One of our key hypotheses is that post-traumatic growth can be fostered at the community level. Resilience training has the potential to enhance the ability of the individual to withstand and recover from stress and to build perceived and actual social ties, thus enhancing resilience on an adaptive systems level. By inoculating more and more members of the community with

resilience tools and developing more positive emotions and pro-social behaviors, this training has the potential to transform individuals and the communities in which they are embedded. We know that contemplative practices, such as mindfulness, will spread in small, well-connected groups, such as in the workplace. Mindful leaders in the workplace have a positive effect on employees; conversely, negative emotions also spread from one employee to the next, and even on to that person's family. For more information on theories of community resilience, please see **Appendix section B**.

VI. Research Agenda

Contemplative practices and interventions continue to gain credibility as evidence demonstrates their effectiveness in treating disordered health and bolstering pro-resilience traits among healthy individuals. We propose that the next level of research should focus on extending this work to understand the causal connections between resilience at the individual level and resilience at the community and systems levels. Carefully designed, well controlled interventional studies and randomized clinical trials will be crucial for ensuring that contemplative practices can be used in large-scale, cost-effective interventions that achieve the desired results while being acceptable to participants.[259, 260]

To further this research agenda, we propose the following next steps, which are explored in greater detail below:

- To further develop a theoretical model for human resilience;
- To establish appropriate methods to measure human resilience;
- To translate new discoveries about contemplative science into practical programs to effect social change and to assess the impact of these programs; and
- To explore further research opportunities at the interface of contemplation and community resilience

Research Hypotheses, Interventions, Settings, and Outcomes

Establishing appropriate methods to measure human resilience: Ann Masten has identified the need to determine measures of resilience that can be validated across cultural contexts in order to proceed with global research on resilience.[261] A dynamic research model will encompass neurobiology, behavior, and environmental conditions.[262] Some relevant work has been done to evaluate resilience factors and to test interventions in children in the aftermath of war and natural disasters. An "ecological" model of youth resilience is emerging that focuses not solely on the individual, but on the cultural context in which that individual is embedded.[14,261]

Translating new discoveries about contemplative science into practical programs to effect social change, and assessing the impact of these programs: Longitudinal studies of contemplative interventions can measure changes in individuals and communities over time. At the individual level, physiological and psychological functions that are impacted by contemplative practices have measurable correlates. For example, changes in attention and the ability to focus and concentrate on a chosen object can be evaluated through computer-based tests. Vagal tone, improved by meditation and yoga, can be measured by changes in heart rate variability. As stress and immune systems adjust and become optimized by contemplative practices (e.g., softening of in-group/out-group distinctions), these changes can also be measured through simple blood and saliva tests. Two very significant biomarkers can be collected and assessed through salivary cortisol, and the links between these markers and other inflammatory and immune system markers is becoming increasingly known.[263] Telomere length is a measure of aging and a biomarker for the impact of chronic stress.[21] Interleukin-6 and tumor necrosis factor-α, both inflammatory markers linked to damaging levels of inflammation and cardiovascular disease, have been correlated to shortened telomeres.[264] The complex response of the body's hypothalamic-pituitary-adrenal axis and autonomic nervous system, which can be protective in their response to stress but can also contribute to pathophysiology in chronic, unchecked stress, can be assessed by measuring levels of cortisol and alpha-amylase in saliva.[21] Advances in laboratory techniques have made physiological measurement both easier and more cost-effective than it was even a few years ago. Correlation studies have demonstrated that some markers that were previously only collectible through invasive and complex blood collection procedures can now be obtained through much more forgiving salivary cortisol samples.

Exploring further research opportunities at the interface of contemplation and community resilience: On a collective level, social network mapping can be used to determine individuals to target for contemplative interventions and to measure changes in connectivity and resilience among participants of an intervention.

VII. Conclusions

In this paper, we have presented evidence that resilience is a cluster of positive behaviors and habits of mind that can be cultivated and reinforced through contemplative practices, and that strengthening the resilience of individuals will have a positive impact on the resilience of communities. Resilience encompasses physiological and psychological processes, including adapting to change, emotional regulation, mental flexibility, and appropriate stress response. We have outlined how these resilience skills can serve to buffer individuals and communities from the negative effects of stress, and to endure and even thrive in challenging circumstances.

There is no fixed way to react optimally to any given situation, but rather an optimal way of *relating* to one's circumstances. It is in this sense that contemplative practices are uniquely suited to develop resilience: to empower individuals to become aware of their own thinking and

reactions to the inevitable stresses of life and to make choices that will optimize their way of relating to their experiences. While we often cannot change or avoid the difficulties we face in life, we can change the way that we prepare for and react to these difficulties.

Research conducted over the last two decades supports the notion that contemplative practices are effective methods of training and developing the skills that contribute to resilience, having demonstrated that various meditation and yoga practices can increase attention and emotional regulation, develop neural plasticity, optimize stress response, and improve psychosocial functioning. People engaged in contemplative practices perceive stressors as less threatening and use more effective coping and problem-solving strategies. Other key outcomes of contemplative practices relating to resilience are a sense of empowerment and control over one's circumstances, and the ability to reinterpret challenging situations in a more positive light.

Learning to work with our mind so that we have some awareness and control over our thinking is crucial to both our own happiness and to the wellbeing of those around us. At the heart of contemplative practice lies the development of positive habits of mind: of awareness of our own thoughts and the inner workings of our own minds, of choosing what we pay attention to, of regulating our emotions, and of recognizing our interconnectedness with others. Returning to this awareness over and over again reinforces certain neural and emotional networks, and thus contemplative practices employ consciousness to optimize physiological functioning (e.g., stress response) and behavioral outcomes (e.g., positive coping).

Resilience can spread within communities, both informally (e.g., through normalization of resilient traits) and formally (e.g., through interventions that teach resilience skills). Contemplative practices strengthen resilience within communities by emphasizing empathy and compassion, the impermanence of self and other, and the interdependence of all living things. Contemplative practices broaden our definitions of "friend" and "family" to encompass everyone in our communities, and enhance our perceived and actual social support. These transformations are measurable through our changing biology: increased vagal tone and flexibility in our frontal lobes, and increased connections within the areas of the brain that are responsible for interconnectedness, caring, and social engagement. Connections associated with fear and vigilance are decreased so that we no longer misjudge social situations as being more threatening than they are. Our social interactions become warmer, creating a positive feed-forward loop. Our behaviors ripple out to others; enmeshed in a reciprocal, supportive community, the day-to-day hassles of life become a little easier to take and disruptions become survivable instead of overwhelming. We make the transition from "me" to "we" and in doing so we learn that not only our happiness but also our very survival resides in our ability to focus less on ourselves and more on others.

Contemplative practices are a preferential means of developing resilience because they are portable, accessible, and economical. They do not require a religious affiliation or adherence to a particular belief system and can be taught to groups or individuals. Most importantly, people

enjoy these practices and appreciate the effects that can begin to accrue with even a short amount of practice.

Daily life presents humans with an inexhaustible supply of irritating, stressful and difficult situations. The way that we react to these situations in large part determines their effect on us and this is largely a matter of personal awareness and choice. Contemplative training can help us to make adaptive, positive choices more consistently, resulting in individuals and communities that can endure amidst acute and chronic challenges. Despite personal history, despite the patterns established by previous experiences, in each moment, each person has the opportunity to make a choice about how they will perceive and respond to their circumstances. This hinges on resilience skills that can be developed by contemplative practices: awareness and control over emotional reactions, social interconnectedness, adaptive problem-solving and help-seeking skills, belief in one's own capacity to cope and, ultimately, the ability to cope with stress in a healthy manner.

References

1. Rockefeller Foundation. *Rebound : Building a More Resilient World*.; 2014. Available at: http://100resilientcities.rockefellerfoundation.org/blog/entry/rebound-building-a-more-resilient-world. Accessed 30 January 2014.

2. Coutou D. How resilience works. *Harv Bus Rev*. 2002;HBR At Lar(May):46–55.

3. Center for Contemplative Mind in Society. Available at: http://www.contemplativemind.org/. Accessed October 18, 2013.

4. Martin-Breen P, Anderies JM. Resilience: A Literature Review. 2011.

5. Walker B, Salt D. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*. Kindle. Island Press; 2006:192.

6. Zolli A, Healy AM. Resilience: Why things bounce back. In: New York: Free Press; 2012:172–186.

7. The Garrison Institute. Contemplative-Based Resilience Training. Available at: http://www.garrisoninstitute.org/transforming-trauma/contemplative-based-resilience-training. Accessed February 17, 2014.

8. Block JH, Block J. The role of ego-control and ego-resiliency in the organization of behavior. In: Collins WA, ed. *Development of cognition, affect, and social relations: Minnesota Symposia on Child Psychology*. Volume 13. Hillsdale, NJ: Erlbaum; 1980:43.

9. Block J, Kremen AM. IQ and ego-resiliency: Conceptual and empirical connections and separateness. *J Pers Soc Psychol*. 1996;70:349–361.

10. Lazarus RS. From Psychological Stress to the Emotions: A History of Changing Outlooks. *Annu Rev Psychol*. 1993;44:1–21.

11. Ager A. Annual Research Review: Resilience and child well-being--public policy implications. *J Child Psychol Psychiatry*. 2013;54(4):488–500. doi:10.1111/jcpp.12030.

12. Masten AS. Ordinary Magic: Lessons from Research on Resilience. *Educ Canada*. 2010;49(3). Available at: www.cea-ace.ca.

13. This Emotional Life. *Resilience*. Available at: http://www.pbs.org/thisemotionallife/topic/resilience/what-resilience.

14. Masten AS, Narayan AJ. Child development in the context of disaster, war, and terrorism: pathways of risk and resilience. *Annu Rev Psychol*. 2012;63:227–57. doi:10.1146/annurev-psych-120710-100356.

15. Almedom AM. Resilience, Hardiness, Sense of Coherence, and Posttraumatic Growth: All Paths Leading To “Light At the End of the Tunnel”? *J Loss Trauma*. 2005;10(3):253–265. doi:10.1080/15325020590928216.

16. McEwen BS, Seeman T. Protective and damaging effects of mediators of stress. Elaborating and testing the concepts of allostasis and allostatic load. *Ann N Y Acad Sci*. 1999;896:30–47.

17. McEwen BS. Protective and damaging effects of stress mediators. *N Engl J Med*. 1998;338(3):171–179.

18. McEwen BS. Protective and damaging effects of stress mediators: central role of the brain. *Dialogues Clin Neurosci*. 2006;8(4):367–381.

19. Cannon WB. *Bodily changes in pain, hunger, fear, and rage*. New York: Appleton-Century-Crofts; 1929.

20. Selye H. The Nature of Stress. *Basal Facts*. 1985;7(1):3–11.

21. Peters A, McEwen BS. Introduction for the allostatic load special issue. *Physiol Behav*. 2012;106(1):1–4.

22. Viswanathan K, Daugherty C, Dhabhar FS. Stress as an endogenous adjuvant: augmentation of the immunization phase of cell-mediated immunity. *Int Immunol*. 2005;17(8):1059–69. doi:10.1093/intimm/dxh286.

23. Rasmusson AM, Schnurr PP, Zukowska Z, Scioli E, Forman DE. Adaptation to extreme stress: post-traumatic stress disorder, neuropeptide Y and metabolic syndrome. *Exp Biol Med (Maywood)*. 2010;235(10):1150–62. doi:10.1258/ebm.2010.009334.

24. Lupien SJ, Fiocco A, Wan N, et al. Stress hormones and human memory function across the lifespan. *Psychoneuroendocrinology*. 2005;30(3):225–42. doi:10.1016/j.psyneuen.2004.08.003.

25. Howren MB, Lamkin DM, Suls J. Associations of depression with C-reactive protein, IL-1, and IL-6: a meta-analysis. *Psychosom Med*. 2009;71(2):171–86. doi:10.1097/PSY.0b013e3181907c1b.

26. Sprague AH, Khalil R a. Inflammatory cytokines in vascular dysfunction and vascular disease. *Biochem Pharmacol*. 2009;78(6):539–52. doi:10.1016/j.bcp.2009.04.029.

27. Olefsky JM, Glass CK. *Macrophages, inflammation, and insulin resistance.*; 2010:219–46. doi:10.1146/annurev-physiol-021909-135846.

28. Danese A, McEwen BS. Adverse childhood experiences, allostasis, allostatic load, and age-related disease. *Physiol Behav*. 2012;106(1):29–39.

29. Straub RH. Concepts of evolutionary medicine and energy regulation contribute to the etiology of systemic chronic inflammatory diseases. *Brain Behav Immun*. 2011;25(1):1–5. doi:10.1016/j.bbi.2010.08.002.

30. Blume J, Douglas SD, Evans DL. Immune Suppression and Immune Activation in Depression. 2011;25(2):221–229. doi:10.1016/j.bbi.2010.10.008.Immune.

31. Gouin J, Hantsoo L, Kiecolt-Glaser J. Immune Dysregulation and Chronic Stress Among Older Adults: A Review. *Neuroimmunomodulation*. 2008;15(4-6):251–259. doi:10.1159/000156468.Immune.

32. McEwen BS. The neurobiology of stress: from serendipity to clinical relevance. *Brain Res*. 2000;886(1-2):172–189.

33. Folkman S, Lazarus RS, Gruen RJ, DeLongis a. Appraisal, coping, health status, and psychological symptoms. *J Pers Soc Psychol*. 1986;50(3):571–9. Available at: http://www.ncbi.nlm.nih.gov/pubmed/3701593.

34. McEwen BS. Stress, adaptation, and disease. Allostasis and allostatic load. *Ann N Y Acad Sci*. 1998;840:33–44.

35. Fredrickson BL. Love 2.0: How our supreme emotion affects everything we feel, think, do, and become. 2013.

36. Lazarus RS. Progress on a cognitive-motivational-relational theory of emotion. *Am Psycholgist*. 1991;46(8):819–834.

37. McEwen BS. Brain on stress: How the social environment gets under the skin. *Proc Natl Acad Sci U S A*. 2012;109(suppl. 2):17180–17185. doi:doi/10.1073/pnas.1121254109.

38. Karatsoreos IN, McEwen BS. Psychobiological allostasis: resistance, resilience and vulnerability. *Trends Cogn Sci*. 2011;15(12):576–584. doi:10.1016/j.tics.2011.10.005.

39. Andresen J. Meditation Meets Behavioural Medicine. *J Conscious Stud*. 2000;7(11-12):17–73.

40. B. Alan Wallace. The Buddhist Tradition of Samatha: Methods for Refining and Examining Consciousness. *J Conscious Stud*. 1999;6(2-3):175–187.

41. Wallace BA. *The Attention Revolution: Unlocking the Power of the Focused Mind*. 1st Wisdom. Wisdom Publications; 2006:224.

42. Grabovac AD, Lau M a., Willett BR. Mechanisms of Mindfulness: A Buddhist Psychological Model. *Mindfulness (N Y)*. 2011;2(3):154–166. doi:10.1007/s12671-011-0054-5.

43. Rosenberg EL. Meditation and Emotion. In: *The Healing Power of Meditation*. Boston and London: Shambhala; 2013.

44. Kabat-zinn J. Mindfulness-Based Interventions in Context : Past, Present, and Future. *Clin Psychol Sci Pract*. 2003;10(2):144–156. doi:10.1093/clipsy/bpg016.

45. Baer RA. Mindfulness Training as a Clinical Intervention : A Conceptual and Empirical Review. *Clin Psychol Sci Pract*. 2003;10(2):125–143. doi:10.1093/clipsy/bpg015.

46. Anderson N, Lau MA. Mindfulness-based stress reduction and attentional control. *Clin Psychol Psychother*. 2007;14:449–463. doi:10.1002/cpp.

47. Schroevers MJ, Brandsma R. Is learning mindfulness associated with improved affect after mindfulness-based cognitive therapy? *Br J Psychol*. 2010;101(Pt 1):95–107. doi:10.1348/000712609X424195.

48. Jain S, Shapiro SL, Swanick S, et al. A randomized controlled trial of mindfulness meditation versus relaxation training: effects on distress, positive states of mind, rumination, and distraction. *Ann Behav Med*. 2007;33(1):11–21.

49. Tacón AM, McComb J, Caldera Y, Randolph P. Mindfulness meditation, anxiety reduction, and heart disease: a pilot study. *Fam Community Health*. 2003;26(1):25–33. Available at: http://www.ncbi.nlm.nih.gov/pubmed/12802125.

50. Hölzel BK, Carmody J, Vangel M, et al. Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Res*. 2011;191(1):36–43.

51. Cullen M. Mindfulness-Based Interventions: An Emerging Phenomenon. *Mindfulness (N Y)*. 2011;2(3):186–193. doi:10.1007/s12671-011-0058-1.

52. Reibel DK, Greeson JM, Brainard GC, Rosenzweig S. Mindfulness-based stress reduction and health-related quality of life in a heterogeneous patient population. *Gen Hosp Psychiatry*. 2001;23(4):183–92. Available at: http://www.ncbi.nlm.nih.gov/pubmed/11543844.

53. Weinstein N, Brown KW, Ryan RM. A multi-method examination of the effects of mindfulness on stress attribution, coping, and emotional well-being. *J Res Pers*. 2009;43(3):374–385. doi:10.1016/j.jrp.2008.12.008.

54. Witek-Janusek L, Albuquerque K, Chroniak KR, Chroniak C, Durazo-Arvizu R, Mathews HL. Effect of mindfulness based stress reduction on immune function, quality of life and coping in women newly diagnosed with early stage breast cancer. *Brain Behav Immun*. 2008;22(6):969–981. doi:10.1016/j.bbi.2008.01.012.

55. Hayes AM, Feldman G. Clarifying the Construct of Mindfulness in the Context of Emotion Regulation and the Process of Change in Therapy. *Clin Psychol Sci Pract*. 2004;11(3):255–262. doi:10.1093/clipsy/bph080.

56. Allen M, Bromley A, Sonnenberg SJ, Kuyken W. Participants' Experiences of Mindfulness-Based Cognitive Therapy. *Behav Cogn Psychother*. 2009.

57. Mason O, Hargreaves I. A qualitative study of mindfulness-based cognitive therapy for depression. *Br J Med Psychol*. 2001;74:197–212. Available at: http://onlinelibrary.wiley.com/doi/10.1348/000711201160911/abstract. Accessed February 24, 2012.

58. Finucane A, Mercer SW. An exploratory mixed methods study of the acceptability and effectiveness of Mindfulness-Based Cognitive Therapy for patients with active depression and anxiety in primary care. *BMC Psychiatry*. 2006;6:14. doi:10.1186/1471-244X-6-14.

59. Teasdale JD, Moore RG, Hayhurst H, Pope M, Williams S, Segal Z V. Metacognitive awareness and prevention of relapse in depression: Empirical evidence. *J Consult Clin Psychol*. 2002;70(2):275–287. doi:10.1037//0022-006X.70.2.275.

60. Piet J, Hougaard E. The effect of mindfulness-based cognitive therapy for prevention of relapse in recurrent major depressive disorder: a systematic review and meta-analysis. *Clin Psychol Rev*. 2011;31(6):1032–40. doi:10.1016/j.cpr.2011.05.002.

61. Desbordes G, Gard T, Hoge EA, et al. Moving Beyond Mindfulness: Defining Equanimity as an Outcome Measure in Meditation and Contemplative Research. *Mindfulness (N Y)*. 2014;(January).

62. Porges SW. Regulation of the stress response: Stress and parasympathetic control. Squire LR, ed. *Encycl Neurosci*. 2008.

63. Grippo AJ, Lamb DG, Carter CS, Porges SW. Social isolation disrupts autonomic regulation of the heart and influences negative affective behaviors. . *Biol Psychiatry*. 2007;62:1162–1170.

64. Klimecki OM, Leiberg S, Lamm C, Singer T. Functional Neural Plasticity and Associated Changes in Positive Affect After Compassion Training. *Cereb Cortex*. 2012. doi:10.1093/cercor/bhs142.

65. Jazaieri H, Jinpa GT, McGonigal K, et al. Enhancing compassion: A randomized controlled trial of a compassion cultivation training program. *J Happiness Stud*. 2012. doi:10.1007/s10902-012-9373-z.

66. Fredrickson BL, Cohn MA, Coffey KA, Pek J, Finkel S. Open Hearts Build Lives: Positive Emotions, Induced Through Loving-Kindness Meditation, Build Consequential Personal Resources. *J Pers Soc Psychol*. 2008;95(5):1045–1062. doi:10.1037/a0013262.Open.

67. Kok BE, Coffey KA, Cohn MA, et al. How positive emotions build physical health: Perceived positive social connections account for the upward spiral between positive emotions and vagal tone. *Psychol Sci*.

68. Lutz A, Brefczynski-Lewis J, Johnstone T, Davidson RJ. Regulation of the neural circuitry of emotion by compassion meditation: Effects of meditative expertise. *PLoS One*. 2008;3(3):e1897. doi:10.1371/journal.pone.0001897.

69. Cohn MA, Fredrickson BL. In search of durable positive psychology interventions: Predictors and consequences of long-term positive behavior change. *J Posit Psychol*. 2010;5(5):355–366.

70. Kok BE, Fredrickson BL. Upward spirals of the heart: Autonomic flexibility, as indexed by vagal tone, reciprocally and prospectively predicts positive emotions and social connectedness. *Biol Psychol*. 2010;85(3):432–436. doi:10.1016/j.biopsycho.2010.09.005.

71. K. Narayanasvami Aiyar T. Yogatattva-Upanishad of Krshna-Yajurveda. In: ; 1914. Available at: http://www.sacred-texts.com/hin/tmu/tmu25.htm.

72. National Center for Complementary and Alternative Medicine NI of H. Ayurvedic Medicine : An Introduction. 2013. Available at: http://nccam.nih.gov/health/ayurveda/introduction.htm. Accessed February 17, 2014.

73. Riley D. Hatha Yoga and the Treatment of Illness. *Altern Ther Health Med*. 2004;10(2):20–21. Available at: https://login.proxy.library.emory.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=awh&AN=12662593&site=ehost-live.

74. Collins C. Yoga: intuition, preventive medicine, and treatment. *J Obstet Gynecol Neonatal Nurs*. 1998;27(5):563–8. Available at: http://www.ncbi.nlm.nih.gov/pubmed/9773368.

75. Raub JA. Psychophysiologic Effects of Hatha Yoga on Musculoskeletal and Cardiopulmonary. *J Altern Complement Med*. 2002;8(6):797–812.

76. Shapiro D, Cook I a, Davydov DM, Ottaviani C, Leuchter AF, Abrams M. Yoga as a complementary treatment of depression: effects of traits and moods on treatment outcome. *Evid Based Complement Alternat Med*. 2007;4(4):493–502. doi:10.1093/ecam/nel114.

77. Yoga and Post Traumatic Stress Disorder, an interview with Bessel Van Der Kolk. *Integr Yoga Mag*. 2009:12–13.

78. Kolk BA Van Der. THE BODY KEEPS THE SCORE : Memory and the evolving psychobiology of post traumatic stress. 1994:1–21.

79. Sharma VK, Das S, Mondal S, Goswampi U, Gandhi a. Effect of Sahaj Yoga on depressive disorders. *Indian J Physiol Pharmacol*. 2005;49(4):462–8. Available at: http://www.ncbi.nlm.nih.gov/pubmed/16579401.

80. Uebelacker L a, Tremont G, Epstein-Lubow G, et al. Open trial of Vinyasa yoga for persistently depressed individuals: evidence of feasibility and acceptability. *Behav Modif*. 2010;34(3):247–64. doi:10.1177/0145445510368845.

81. Conboy LA, Wilson A, Braun T. Moving beyond health to flourishing: the effects of yoga teacher training. *ScientificWorldJournal*. 2010;10:788–795. doi:10.1100/tsw.2010.87.

82. Streeter CC, Jensen JE, Perlmutter RM, et al. Yoga Asana sessions increase brain GABA levels: a pilot study. *J Altern Complement Med*. 2007;13(4):419–26. doi:10.1089/acm.2007.6338.

83. Oken BS, Zajdel D, Kishiyama S, et al. Randomized, controlled, six-month trial of yoga in healthy seniors: effects on cognition and quality of life. *Altern Ther Health Med*. 2006;12(1):40–47.

84. Parshad O. Role of yoga in stress management. *West Indian Med J*. 2004;53(3):191–194.

85. B. Alan Wallace. *Contemplative Science: Where Buddhism and Neuroscience Converge*. New York: Columbia University Press; 2007.

86. Grossman P. On measuring mindfulness in psychosomatic and psychological research. *J Psychosom Res*. 2008;64(4):405–408. doi:10.1016/j.jpsychores.2008.02.001.

87. Grossman P, Van Dam NT. Mindfulness, by any other name…: trials and tribulations of sati in western psychology and science. *Contemp Buddhism*. 2011;12(1):219–239. doi:10.1080/14639947.2011.564841.

88. ISET, ed. *Asian Cities Climate Change Resilience Network (ACCCRN): Responding to the Urban Climate Challenge*. Boulder, CO

89. Feder A, Nestler EJ, Charney DS. Psychobiology and molecular genetics of resilience. *Nat Rev Neurosci*. 2009;10(6):446–57. doi:10.1038/nrn2649.

90. Bonanno G a, Ho SMY, Chan JCK, et al. Psychological resilience and dysfunction among hospitalized survivors of the SARS epidemic in Hong Kong: a latent class approach. *Health Psychol*. 2008;27(5):659–67. doi:10.1037/0278-6133.27.5.659.

91. Bonanno G a, Galea S, Bucciarelli A, Vlahov D. What predicts psychological resilience after disaster? The role of demographics, resources, and life stress. *J Consult Clin Psychol*. 2007;75(5):671–82. doi:10.1037/0022-006X.75.5.671.

92. Tugade MM, Fredrickson BL, Barrett LF. Psychological Resilience and Positive Emotional Granularity: Examining the Benefits of Positive Emotions on Coping and Health. *J Pers*. 2004;72(6):1161–1190.

93. Del Giudice M, Ellis BJ, Shirtcliff E a. The Adaptive Calibration Model of stress responsivity. *Neurosci Biobehav Rev*. 2011;35(7):1562–92. doi:10.1016/j.neubiorev.2010.11.007.

94. Konner M. *The Tangled Wing: Biological Constraints on the Human Spirit*. Revised an. Holt Paperbacks; 2003:560.

95. Education L, Richard M, Dunne J, et al. Contemplative Practices and Mental Training: Prospects for American Education. *Child Dev Perspect*. 2012;6(2):146–153. doi:10.1111/j.1750-8606.2012.00240.x.

96. Mind and Life Education Research Network (MLERN): Richard J. Davidson Jacquelynne S. Eccles, Adam Engle, Mark Greenberg, Patricia Jennings, Amishi Jha, Thupten Jinpa, Linda Lantieri, David Meyer, Robert W. Roeser, and David Vago JD. *Contemplative Practices and Mental Training: Prospects for American Education*. The Society for Research in Child Development; 2012. doi:10.1111/j.1750-8606.2012.00240.x.

97. Paulson S, Davidson R, Jha A, Kabat-Zinn J. Becoming conscious: the science of mindfulness. *Ann N Y Acad Sci*. 2013;1303:87–104. doi:10.1111/nyas.12203.

98. Greenberg MT, Harris AR. Nurturing Mindfulness in Children and Youth: Current State of Research. *Child Dev Perspect*. 2012;6(2):161–166. doi:10.1111/j.1750-8606.2011.00215.x.

99. Jennings P a., Greenberg MT. The Prosocial Classroom: Teacher Social and Emotional Competence in Relation to Student and Classroom Outcomes. *Rev Educ Res*. 2009;79(1):491–525. doi:10.3102/0034654308325693.

100. Jennings PA, Snowberg KE, Coccia MA, Greenberg MT. Improving Classroom Learning Environments by Cultivating Awareness and Resilience in Education (CARE): Results of Two Pilot Studies. *J Classr Interact*. 2011;46(1):37–48.

101. Jennings P. Promoting Teachers' Social and Emotional Competencies to Support Performance and Reduce Burnout. In: Cohan A, Honigsfeld A, eds. *Breaking the Mold of Preservice and Inservice Teacher Education: Innovative and Successful Practices for the Twenty-first Century*. Rowman & Littlefield Education; 2011.

102. Awasthi B. Issues and perspectives in meditation research: in search for a definition. *Front Psychol*. 2012;3(January):613. doi:10.3389/fpsyg.2012.00613.

103. Baer RA. Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clin Psychol Sci Pract*. 2003;10(2):125–143. doi:10.1093/clipsy.bpg015.

104. Garland E, Fredrickson B, Kring A, Johnson D, Meyer P, Penn D. Upward spirals of positive emotions counter downward spirals of negativity: insights from the broaden-and-build theory and affective neuroscience on the treatment of emotion dysfunctions and deficits in psychopathology. *Clin Psychol Rev*. 2010;30(7):849. doi:doi:10.1016/j.cpr.2010.03.002.

105. Weng HY, Fox AS, Shackman AJ, et al. Compassion training alters altruism and neural responses to suffering. *Psychol Sci*. 2013;24(7):1171–80. doi:10.1177/0956797612469537.

106. MacLean KA, Ferrer E, Aichele SR, et al. Intensive meditation training improves perceptual discrimination and sustained attention. *Psychol Sci*. 2010;21(6):829–839.

107. Jacobs T, Shaver P, Epel E, et al. Self-reported mindfulness and cortisol during a Shamatha meditation retreat. *Health Psychol*. 2013;32(10):1104–9. doi:doi: 10.1037/a0031362.

108. Anderson ND, Lau M a., Segal Z V., Bishop SR. Mindfulness-based stress reduction and attentional control. *Clin Psychol Psychother*. 2007;14(6):449–463. doi:10.1002/cpp.544.

109. Munshi K, Eisendrath S, Delucchi K. Preliminary long-term follow-up of Mindfulness-based cognitive therapy-induced remission of depression. *Mindfulness (N Y)*. 2013;4(4):354–361.

110. Williams J, Crane C, Barnhofer T, et al. Mindfulness-Based Cognitive Therapy for Preventing Relapse in Recurrent Depression: A Randomized Dismantling Trial. *J Consult Clin Psychol*. 2013;(Dec 2):[Epub ahead of print].

111. Pace TW, Negi LT, Sivilli TI, et al. Innate immune, neuroendocrine and behavioral responses to psychosocial stress do not predict subsequent compassion meditation practice time. *Psychoneuroendocrinology*. 2010;35(2):310–315.

112. Pace TWW, Negi LT, Dodson-Lavelle B, et al. Engagement with Cognitively-Based Compassion Training is associated with reduced salivary C-reactive protein from before to after training in foster care program adolescents. *Psychoneuroendocrinology*. 2012.

113. Desbordes G, Negi LT, Pace TW, Wallace BA, Raison CL, Schwartz EL. Effects of mindful-attention and compassion meditation training on amygdala response to emotional stimuli in an ordinary, non-meditative state. *Front Hum Neurosci*. 2012;6(292):1.

114. Jazaieri H, McGonigal K, Jinpa T, Doty JR, Gross JJ, Goldin PR. A randomized controlled trial of compassion cultivation training: Effects on mindfulness, affect, and emotion regulation. *Motiv Emot*. 2013. doi:10.1007/s11031-013-9368-z.

115. Bloom JM, Woodward EN, Susmaras T, Pantalone DW. Use of dialectical behavior therapy in inpatient treatment of borderline personality disorder: a systematic review. *Psychiatr Serv*. 2012;63(9):881–8. doi:10.1176/appi.ps.201100311.

116. Rizvi SL, Linehan MM. Dialectical behavior therapy for personality disorders. *Curr Psychiatry Rep*. 2001;3(1):64–9. Available at: http://www.ncbi.nlm.nih.gov/pubmed/11177762.

117. Hofmann SG, Grossman P, Hinton DE. Loving-kindness and compassion meditation: potential for psychological interventions. *Clin Psychol Rev*. 2011;31(7):1126–32. doi:10.1016/j.cpr.2011.07.003.

118. Ozawa-de Silva BR, Dodson-Lavelle B. An Education of Heart and Mind: Practical and Theoretical Issues in Teaching Cognitive-Based Compassion Training to Children. *Pract Matters*. 2011;(4):1–28.

119. Wallmark E, Safarzadeh K, Daukantaitė D, Maddux RE. Promoting Altruism Through Meditation: An 8-Week Randomized Controlled Pilot Study. *Mindfulness (N Y)*. 2012;4(3):223–234. doi:10.1007/s12671-012-0115-4.

120. Seeman T, Singer B, Ryff C, Love G, Levy-Storms L. Social relationships, gender, and allostatic load across two age cohorts. *Psychosom …*. 2002;406:395–406. Available at: http://www.psychosomaticmedicine.org/content/64/3/395.short. Accessed May 24, 2013.

121. Condon P, Desbordes G, Miller WB, DeSteno D. Meditation increases compassionate responses to suffering. *Psychol Sci*. 2013;24(10):2125–7. doi:10.1177/0956797613485603.

122. Lazar SW, Kerr CE, Wasserman RH, et al. Meditation experience is associated with increased cortical thickness. *Neuroreport*. 2005;16(17):1893–1897.

123. Luders E, Clark K, Narr KL, Toga AW. Enhanced brain connectivity in long-term meditation practitioners. *Neuroimage*. 2011;57(4):1308–16. doi:10.1016/j.neuroimage.2011.05.075.

124. Brewer J a, Worhunsky PD, Gray JR, Tang Y-Y, Weber J, Kober H. Meditation experience is associated with differences in default mode network activity and connectivity. *Proc Natl Acad Sci U S A*. 2011;108(50):20254–9. doi:10.1073/pnas.1112029108.

125. Goldin P, Ziv M, Jazaieri H, Hahn K, Gross JJ. MBSR vs aerobic exercise in social anxiety: fMRI of emotion regulation of negative self-beliefs. *Soc Cogn Affect Neurosci*. 2012;27:27.

126. Mrazek MD, Franklin MS, Phillips DT, Baird B, Schooler JW. Mindfulness Training Improves Working Memory Capacity and GRE Performance While Reducing Mind Wandering. *Psychol Sci*. 2013. doi:10.1177/0956797612459659.

127. Paul N, Stanton S, Greeson JM, Smoski M, Wang L. Psychological and Neural Mechanisms of Trait Mindfulness in Reducing Depression Vulnerability. *Soc Cogn Affect Neurosci*. 2012;in press. Available at: http://scan.oxfordjournals.org/content/early/2012/06/19/scan.nss070.short. Accessed August 20, 2012.

128. Sahdra BK, MacLean KA, Ferrer E, et al. Enhanced response inhibition during intensive meditation training predicts improvements in self-reported adaptive socioemotional functioning. *Emotion*. 2011;11(2):299–312.

129. Farb NA, Anderson AK, Segal Z V. The mindful brain and emotion regulation in mood disorders. *Can J Psychiatry*. 2012;57(2):70–77.

130. Anicha CL, Ode S, Moeller SK, Robinson MD. Toward A Cognitive View of Trait Mindfulness: Distinct Cognitive Skills Predict Its Observing and Non-Reactivity Facets. *J Pers*. 2011:1–42. doi:10.1111/j.1467-6494.2011.00722.x.

131. Rubia K. The neurobiology of Meditation and its clinical effectiveness in psychiatric disorders. *Biol Psychol*. 2009;82(1):1–11.

132. Malinowski P. Neural mechanisms of attentional control in mindfulness meditation. *Front Neurosci*. 2013;7(February):8. doi:10.3389/fnins.2013.00008.

133. Zeidan F, Johnson SK, Diamond BJ, David Z, Goolkasian P. Mindfulness meditation improves cognition: evidence of brief mental training. *Conscious Cogn*. 2010;19(2):597–605. doi:10.1016/j.concog.2010.03.014.

134. Bishop SR, Lau MA, Shapiro SL, et al. Mindfulness: A Proposed Operational Definition. *Clin Psychol Sci Pract*. 2004;11(3):230–241. doi:10.1093/clipsy/bph077.

135. Brown KW, Ryan RM, Creswell JD. Mindfulness: Theoretical Foundations and Evidence for its Salutary Effects. *Psychol Inq*. 2007;18(4):211–237. doi:10.1080/10478400701598298.

136. Tang Y-Y, Ma Y, Wang J, et al. Short-term meditation training improves attention and self-regulation. *Proc Natl Acad Sci U S A*. 2007;104(43):17152–17156. doi:10.1073/pnas.0707678104.

137. Jha AP, Stanley E a, Kiyonaga A, Wong L, Gelfand L. Examining the protective effects of mindfulness training on working memory capacity and affective experience. *Emotion*. 2010;10(1):54–64. doi:10.1037/a0018438.

138. MacLean KA, Ferrer E, Aichele SR, et al. Intensive meditation training improves perceptual discrimination and sustained attention. *Psychol Sci*. 2010;21(6):829–839. doi:10.1177/0956797610371339.

139. Ortner CN, Kilner SJ, Zelazo PD. Mindfulness meditation and reduced emotional interference on a cognitive task. *Motiv Emot*. 2007;31(4):271–283. doi:10.1007/s11031-007-9076-7.

140. Lutz A, Slagter HA, Dunne JD, Davidson RJ. Attention regulation and monitoring in meditation. *Trends Cogn Sci*. 2008;12(4):163–169. doi:10.1016/j.tics.2008.01.005.

141. MacLean KA, Ferrer E, Aichele SR, et al. Intensive meditation training improves perceptual discrimination and sustained attention. *Psychol Sci*. 2010;21(6):829–839.

142. Lutz A, Slagter HA, Rawlings NB, Francis AD, Greischar LL, Davidson RJ. Mental training enhances attentional stability: Neural and behavioral evidence. *J Neurosci*. 2009;29(42):13418–13427. doi:10.1523/JNEUROSCI.1614-09.2009.

143. Allen M, Dietz M, Blair KS, et al. Cognitive-Affective Neural Plasticity following Active-Controlled Mindfulness Intervention. *J Neurosci*. 2012;32(44):15601–15610. doi:10.1523/JNEUROSCI.2957-12.2012.

144. Hasenkamp W, Barsalou LW. Effects of meditation experience on functional connectivity of distributed brain networks. *Front Hum Neurosci*. 2012;6:38. doi:10.3389/fnhum.2012.00038.

145. Manna A, Raffone A, Perrucci MG, et al. Neural correlates of focused attention and cognitive monitoring in meditation. *Brain Res Bull*. 2010;82(1-2):46–56. doi:10.1016/j.brainresbull.2010.03.001.

146. Borders A, Earleywine M, Jajodia A. Could mindfulness decrease anger, hostility, and aggression by decreasing rumination? *Aggress Behav*. 2009;36(1):28–44. doi:10.1002/ab.20327.

147. Nolen-Hoeksema S. The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *J Abnorm Psychol*. 2000;109(3):504–11. Available at: http://www.ncbi.nlm.nih.gov/pubmed/11016119.

148. Pagnoni G. Dynamical properties of BOLD activity from the ventral posteromedial cortex associated with meditation and attentional skills. *J Neurosci*. 2012;32(15):5242–5249.

149. Hasenkamp W, Barsalou LW. Effects of meditation experience on functional connectivity of distributed brain networks. *Front Hum Neurosci*. 2012;6(38).

150. MacLean KA, Ferrer E, Aichele SR, et al. Intensive meditation training improves perceptual discrimination and sustained attention. *Psychol Sci*. 2010;21(6):829–839.

151. Davidson RJ, McEwen BS. Social influences on neuroplasticity: stress and interventions to promote well-being. *Nat Neurosci*. 2012;15(5):689–695. doi:10.1038/nn.3093.

152. Slagter HA, Davidson RJ, Lutz A. Mental training as a tool in the neuroscientific study of brain and cognitive plasticity. *Front Hum Neurosci*. 2011;5(17).

153. Baron Short E, Kose S, Mu Q, et al. Regional brain activation during meditation shows time and practice effects: an exploratory FMRI study. *Evid Based Complement Alternat Med*. 2010;7(1):121–7. doi:10.1093/ecam/nem163.

154. Luders E, Kurth F, Mayer E a, Toga AW, Narr KL, Gaser C. The unique brain anatomy of meditation practitioners: alterations in cortical gyrification. *Front Hum Neurosci*. 2012;6(February):34. doi:10.3389/fnhum.2012.00034.

155. Slagter HA, Davidson RJ, Lutz A. Mental training as a tool in the neuroscientific study of brain and cognitive plasticity. *Front Hum Neurosci*. 2011;5(17).

156. Hölzel BK, Carmody J, Vangel M, et al. Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Res*. 2011;191(1):36–43.

157. Farb NA, Segal Z V, Anderson AK. Mindfulness meditation training alters cortical representations of interoceptive attention. *Soc Cogn Affect Neurosci*. 2012.

158. Neff KD. The Role of Self-Compassion in Development: A Healthier Way to Relate to Oneself. *Hum Dev*. 2009;52(4):211–214.

159. Neff KD, Vonk R. Self-compassion versus global self-esteem: two different ways of relating to oneself. *J Pers*. 2009;77(1):23–50.

160. Smallwood J, Fishman DJ, Schooler JW. Counting the cost of an absent mind: mind wandering as an underrecognized influence on educational performance. *Psychon Bull Rev*. 2007;14(2):230–236. Available at: http://www.ncbi.nlm.nih.gov/pubmed/17694906. Accessed January 26, 2012.

161. Teasdale JD. Metacognition, mindfulness and the modification of mood disorders. *Clin Psychol Psychother*. 1999;6(2):146–155. doi:10.1002/(SICI)1099-0879(199905)6:2<146::AID-CPP195>3.0.CO;2-E.

162. Teasdale JD, Moore RG, Hayhurst H, Pope M, Williams S, Segal Z V. Metacognitive awareness and prevention of relapse in depression: Empirical evidence. *J Consult Clin Psychol*. 2002;70(2):275–287. doi:10.1037//0022-006X.70.2.275.

163. Bieling PJ, Hawley LL, Bloch RT, et al. Treatment-specific changes in decentering following mindfulness-based cognitive therapy versus antidepressant medication or placebo for prevention of depressive relapse. *J Consult Clin Psychol*. 2012;80(3):365–72. doi:10.1037/a0027483.

164. Shaurya Prakash R, De Leon AA, Klatt M, Malarkey W, Patterson B. Mindfulness disposition and default-mode network connectivity in older adults. *Soc Cogn Affect Neurosci*. 2013;8(1):112–7. doi:10.1093/scan/nss115.

165. Pagnoni G. Dynamical properties of BOLD activity from the ventral posteromedial cortex associated with meditation and attentional skills. *J Neurosci*. 2012;32(15):5242–5249.

166. Desbordes G, Negi LT, Pace TWW, Wallace BA, Raison CL, Schwartz EL. Effects of mindful-attention and compassion meditation training on amygdala response to emotional stimuli in an ordinary, non-meditative state. *Front Hum Neurosci*. 2012;6:292. doi:10.3389/fnhum.2012.00292.

167. Froeliger BE, Garland EL, Modlin LA, McClernon FJ. Neurocognitive correlates of the effects of yoga meditation practice on emotion and cognition: a pilot study. *Front Integr Neurosci*. 2012;6:48. doi:10.3389/fnint.2012.00048.

168. Brown KW, Goodman R. Dispositional mindfulness and the attenuation of neural responses to emotional stimuli. *Soc Cogn Affect Neurosci*. 2012;in press. doi:10.1093/scan/nss004.

169. Taylor VA, Grant JA, Daneault V, et al. Impact of mindfulness on the neural responses to emotional pictures in experienced and beginner meditators. *Neuroimage*. 2011;57(4):1524–1533. doi:10.1016/j.neuroimage.2011.06.001.

170. Chiesa A, Mandelli L, Serretti A. Mindfulness-based cognitive therapy versus psycho-education for patients with major depression who did not achieve remission following antidepressant treatment: a preliminary analysis. *J Altern Complement Med*. 2012;18(8):756–760.

171. Lutz A, McFarlin DR, Perlman DM, Salomons T V, Davidson RJ. Altered anterior insula activation during anticipation and experience of painful stimuli in expert meditators. *Neuroimage*. 2013;64:538–46. doi:10.1016/j.neuroimage.2012.09.030.

172. Perlman DM, Salomons T V, Davidson RJ, Lutz A. Differential effects on pain intensity and unpleasantness of two meditation practices. *Emotion*. 2010;10(1):65–71. doi:10.1037/a0018440.

173. Geschwind N, Peeters F, Huibers M, van Os J, Wichers M. Efficacy of mindfulness-based cognitive therapy in relation to prior history of depression: randomised controlled trial. *Br J Psychiatry*. 2012;201(4):320–5. doi:10.1192/bjp.bp.111.104851.

174. Robins CJ, Keng S-L, Ekblad AG, Brantley JG. Effects of mindfulness-based stress reduction on emotional experience and expression: A randomized controlled trial. *J Clin Psychol*. 2012;68(1):117–131. doi:10.1002/jclp.20857.

175. Mars TS, Abbey H. Mindfulness meditation practise as a healthcare intervention: A systematic review. *Int J Osteopath Med*. 2010;13(2):56–66. doi:10.1016/j.ijosm.2009.07.005.

176. Kenny M a, Williams JMG. Treatment-resistant depressed patients show a good response to Mindfulness-based Cognitive Therapy. *Behav Res Ther*. 2007;45(3):617–25. doi:10.1016/j.brat.2006.04.008.

177. Kaviani H, Hatami N, Javaheri F. The impact of Mindfulness-based Cognitive Therapy (MBCT) on mental health and quality of life in a sub-clinically depressed population. *Arch Psychiatry Psychother*. 2012;1:21–28.

178. Kang DH, Jo HJ, Jung WH, et al. The effect of meditation on brain structure: cortical thickness mapping and diffusion tensor imaging. *Soc Cogn Affect Neurosci*. 2012;8:8.

179. Klainin-Yobas P, Cho MAA, Creedy D. Efficacy of mindfulness-based interventions on depressive symptoms among people with mental disorders: a meta-analysis. *Int J Nurs Stud*. 2012;49(1):109–21. doi:10.1016/j.ijnurstu.2011.08.014.

180. Green SM, Bieling PJ. Expanding the Scope of Mindfulness-Based Cognitive Therapy: Evidence for Effectiveness in a Heterogeneous Psychiatric Sample. *Cogn Behav Pract*. 2012;19(1):174–180. doi:10.1016/j.cbpra.2011.02.006.

181. Eisendrath SJ, Delucchi K, Bitner R, Fenimore P, Smit M, McLane M. Mindfulness-based cognitive therapy for treatment-resistant depression: a pilot study. *Psychother Psychosom*. 2008;77(5):319–320. doi:10.1159/000142525.

182. Ives-Deliperi VL, Howells F, Stein DJ, Meintjes EM, Horn N. The effects of mindfulness-based cognitive therapy in patients with bipolar disorder: a controlled functional MRI investigation. *J Affect Disord*. 2013;150(3):1152–7. doi:10.1016/j.jad.2013.05.074.

183. Britton WB, Shahar B, Szepsenwol O, Jacobs WJ. Mindfulness-based cognitive therapy improves emotional reactivity to social stress: results from a randomized controlled trial. *Behav Ther*. 2012;43(2):365–80. doi:10.1016/j.beth.2011.08.006.

184. Bostanov V, Keune PM, Kotchoubey B, Hautzinger M. Event-related brain potentials reflect increased concentration ability after mindfulness-based cognitive therapy for depression: a randomized clinical trial. *Psychiatry Res*. 2012;199(3):174–80. doi:10.1016/j.psychres.2012.05.031.

185. Fennell MJ V. Depression, low self-esteem and mindfulness. *Behav Res Ther*. 2004;42(9):1053–67. doi:10.1016/j.brat.2004.03.002.

186. Teasdale JD. Metacognition, mindfulness and the modification of mood disorders. *Clin Psychol Psychother*. 1999;6(2):146–155. doi:10.1002/(SICI)1099-0879(199905)6:2<146::AID-CPP195>3.0.CO;2-E.

187. Zeidan F, Gordon NS, Merchant J, Goolkasian P. The effects of brief mindfulness meditation training on experimentally induced pain. *J Pain*. 2010;11(3):199–209.

188. Hutcherson CA, Seppala EM, Gross JJ. Loving-kindness meditation increases social connectedness. *Emotion*. 2008;8(5):720–724. doi:10.1037/a0013237.

189. Moore A, Gruber T, Derose J, Malinowski P. Regular, brief mindfulness meditation practice improves electrophysiological markers of attentional control. *Front Hum Neurosci*. 2012;6(18):10.

190. Klatt MD, Buckworth J, Malarkey WB. Effects of low-dose mindfulness-based stress reduction (MBSR-ld) on working adults. *Health Educ Behav*. 2009;36(3):601–14. doi:10.1177/1090198108317627.

191. Miller JJ, Fletcher K, Kabat-Zinn J. Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. *Gen Hosp Psychiatry*. 1995;17(3):192–200.

192. Carlson LE, Ursuliak Z, Goodey E, Angen M, Speca M. The effects of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients: 6-month follow-up. *Support Care Cancer*. 2001;9(2):112–123. doi:10.1007/s005200000206.

193. McEwen BS, Gianaros PJ. Stress- and allostasis-induced brain plasticity. *Annu Rev Med*. 2011;62:431–445.

194. Ganzel BL, Morris P a, Wethington E. Allostasis and the human brain: Integrating models of stress from the social and life sciences. *Psychol Rev*. 2010;117(1):134–74. doi:10.1037/a0017773.

195. Carmody J, Baer RA, Lykins EL, Olendzki N. An empirical study of the mechanisms of mindfulness in a mindfulness-based stress reduction program. *J Clin Psychol*. 2009;65(6):613–626. doi:10.1002/jclp.20579.

196. Abdef AM, Cde PG, Bdf AA, et al. Rapid stress reduction and anxiolysis among distressed women as a consequence of a three-month intensive yoga program. *Med Sci Monit*. 2005;11(12):555–562.

197. Pace TW Adame DD, Cole SP, Sivilli TI, Brown TD, Issa MJ, Raison CL. NLT. Effect of compassion meditation on neuroendocrine, innate immune and behavioral responses to psychosocial stress. *Psychoneuroendocrinology*. 2009;34(1):87–98.

198. Davidson RJ, Kabat-Zinn J, Schumacher J, et al. Alterations in brain and immune function produced by mindfulness meditation. *Psychosom Med*. 2003;65(4):564–570. doi:10.1097/01.PSY.0000077505.67574.E3.

199. Aschbacher K, Epel E, Wolkowitz OM, Prather AA, Puterman E, Dhabhar.F.S. Maintenance of a positive outlook during acute stress protects against pro-inflammatory reactivity and future depressive symptoms. *Brain, Behav Immun*. 2012;26:346–352.

200. Pace TWW, Negi LT, Adame DD, et al. Effect of compassion meditation on neuroendocrine, innate immune and behavioral responses to psychosocial stress. *Psychoneuroendocrinology*. 2009;34:87–98.

201. Reddy SD, Negi LT, Dodson-Lavelle B, et al. Cognitive-Based Compassion Training: A Promising Prevention Strategy for At-Risk Adolescents. *J Child Fam Stud*. 2012;22(2):219–230. doi:10.1007/s10826-012-9571-7.

202. Rosenkranz MA, Davidson RJ, Maccoon DG, Sheridan JF, Kalin NH, Lutz A. A comparison of mindfulness-based stress reduction and an active control in modulation of neurogenic inflammation. *Brain Behav Immun*. 2013;27(1):174–184.

203. Brand S, Holsboer-Trachsler E, Naranjo JR, Schmidt S. Influence of Mindfulness Practice on Cortisol and Sleep in Long-Term and Short-Term Meditators. *Neuropsychobiology*. 2012;65(3):109–118. doi:10.1159/000330362.

204. Reddy SD, Negi LT, Dodson-Lavelle B, et al. Cognitive-Based Compassion Training: A Promising Prevention Strategy for At-Risk Adolescents. *J Child Fam Stud*. 2012. doi:10.1007/s10826-012-9571-7.

205. Pace TWW, Negi LT, Sivilli TI, et al. Innate immune, neuroendocrine and behavioral responses to psychosocial stress do not predict subsequent compassion meditation practice time. *Psychoneuroendocrinology*. 2010;35(2):310–315. doi:10.1016/j.psyneuen.2009.06.008.

206. Pace TWW, Negi LT, Adame DD, et al. Effect of compassion meditation on neuroendocrine, innate immune and behavioral responses to psychosocial stress. *Psychoneuroendocrinology*. 2009;34(1):87–98. doi:10.1016/j.psyneuen.2008.08.011.

207. Carlson LE, Speca M, Faris P, Patel KD. One year pre-post intervention follow-up of psychological, immune, endocrine and blood pressure outcomes of mindfulness-based stress reduction (MBSR) in breast and prostate cancer outpatients. *Brain Behav Immun*. 2007;21(8):1038–49. doi:10.1016/j.bbi.2007.04.002.

208. Carlson LE, Speca M, Patel KD, Goodey E. Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate (DHEAS) and melatonin in breast and prostate cancer outpatients. *Psychoneuroendocrinology*. 2004;29(4):448–474. doi:10.1016/S0306-4530(03)00054-4.

209. Fang CY, Reibel DK, Longacre ML, Rosenzweig S, Campbell DE, Douglas SD. Enhanced Psychosocial Well-Being Following Participation in a Mindfulness-Based Stress Reduction Program Is Associated with Increased Natural Killer Cell Activity. *J Altern Complement Med*. 2010;16(5):531–538. doi:10.1089/acm.2009.0018.

210. Somerstein L. Together in a room to alleviate anxiety: Yoga breathing and psychotherapy. *Procedia - Soc Behav Sci*. 2010;5:267–271. doi:10.1016/j.sbspro.2010.07.086.

211. Kjellgren A, Bood SA, Axelsson K, Norlander T, Saatcioglu F. Wellness through a comprehensive yogic breathing program - a controlled pilot trial. *BMC Complement Altern Med*. 2007;7:43. doi:10.1186/1472-6882-7-43.

212. Sharma VK, Das S, Mondal S, Goswami U, Gandhi A. Effect of Sahaj Yoga on neuro-cognitive functions in patients suffering from major depression. *Indian J Physiol Pharmacol*. 2006;50(4):375–383.

213. Woolery A, Myers H, Sternlieb B, Zeltzer L, Instructor Y. A Yoga Intervention for Young Adults with Elevated Symptoms of Depression. *Altern Ther Health Med*. 2004;10(2):60–63.

214. Spinazzola J, Rhodes AM, Emerson D, Earle E, Monroe K. Application of Yoga in Residential Treatment of Traumatized Youth. *J Am Psychiatr Nurses Assoc*. 2011;17(6):431–44. doi:10.1177/1078390311418359.

215. Sparrowe BL. Transcending Trauma. *Yoga Int*. 2011;Fall:48–53, 89.

216. Vera FM, Manzaneque JM, Maldonado EF, et al. Subjective Sleep Quality and hormonal modulation in long-term yoga practitioners. *Biol Psychol*. 2009;81(3):164–168.

217. Madanmohan M. EFFECT OF YOGIC PRACTICES ON DIFFERENT SYSTEMS OF HUMAN BODY. *icyer.com*. 2008:1–14. Available at: http://icyer.com/documents/yogresearchMMT.pdf. Accessed January 30, 2014.

218. Levine AS, Balk JL. Yoga and Quality-of-Life Improvement in Patients with Breast Cancer: A Literature Review. *Int J Yoga Ther*. 2012;22:95–100.

219. Brown RP, Gerbarg PL. Sudarshan Kriya Yogic breathing in the treatment of stress, anxiety, and depression. Part II--clinical applications and guidelines. *J Altern Complement Med*. 2005;11(4):711–717.

220. Telles S, Singh N, Balkrishna A. Managing Mental Health Disorders Resulting from Trauma through Yoga: A Review. *Depress Res Treat*. 2012;2012. doi:10.1155/2012/401513.

221. Ross A, Friedmann E, Bevans M, Thomas S. Frequency of yoga practice predicts health: results of a national survey of yoga practitioners. *Evid Based Complement Alternat Med*. 2012;2012:983258. doi:10.1155/2012/983258.

222. Kodituwakku S, Lazar SW, Indic P, Chen Z, Brown EN, Barbieri R. Point process time-frequency analysis of dynamic respiratory patterns during meditation practice. *Med Biol Eng Comput*. 2012;50(3):261–75. doi:10.1007/s11517-012-0866-z.

223. Joo HM, Lee SJ, Chung YG, Shin IY. Effects of mindfulness based stress reduction program on depression, anxiety and stress in patients with aneurysmal subarachnoid hemorrhage. *J Korean Neurosurg Soc*. 2010;47(5):345–351. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2883054&tool=pmcentrez&rendertype=abstract.

224. Ditto B, Eclache M, Goldman N. Short-term autonomic and cardiovascular effects of mindfulness body scan meditation. *Ann Behav Med*. 2006;32(3):227–34. doi:10.1207/s15324796abm3203_9.

225. Porges SW. Origins and Conceptual Modes of Compassion at The Science of Compassion: Origins, Measures and Interventions. 2012. Available at: www.ccare.stanford.edu.

226. Borovikova L V, Ivanova S, Zhang M, et al. Vagus nerve stimulation attenuates the systemic inflammatory response to endotoxin. *Nature*. 2000;405(6785):458–62. doi:10.1038/35013070.

227. Epel ES, Blackburn EH, Lin J, et al. Accelerated telomere shortening in response to life stress. *Proc Natl Acad Sci USA*. 2004;101(49):17312–17315. doi:10.1073/pnas.0407162101.

228. Marchant J. Spit test offers guide to health. *Nat Int Wkly J Sci*. 2011. doi:doi:10.1038/news.2011.330.

229. Hoge E a, Chen MM, Orr E, et al. Loving-Kindness Meditation practice associated with longer telomeres in women. *Brain Behav Immun*. 2013;32:159–63. doi:10.1016/j.bbi.2013.04.005.

230. Jacobs TL, Epel ES, Lin J, et al. Intensive meditation training, immune cell telomerase activity, and psychological mediators. *Psychoneuroendocrinology*. 2011;36(5):644–681.

231. Kaliman P, Álvarez-López MJ, Cosín-Tomás M, Rosenkranz M a., Lutz A, Davidson RJ. Rapid changes in histone deacetylases and inflammatory gene expression in expert meditators. *Psychoneuroendocrinology*. 2014;40:96–107. doi:10.1016/j.psyneuen.2013.11.004.

232. Cole SW, Hawkley LC, Arevalo JM, Sung CY, Rose RM, Cacioppo JT. Social regulation of gene expression in human leukocytes. *Genome Biol*. 2007;8. doi:doi:10.1186/gb-2007-8-9-r189.

233. Creswell J, Irwin M, Burklund LJ, et al. Mindfulness-Based Stress Reduction training reduces loneliness and pro-inflammatory gene expression in older adults: A small randomized controlled trial. *Brain Behav Immun*. 2012;(July). Available at:

http://www.sciencedirect.com/science/article/pii/S0889159112001894 20. Accessed August 28, 2012.

234. Bhasin MK, Dusek J a, Chang B-H, et al. Relaxation response induces temporal transcriptome changes in energy metabolism, insulin secretion and inflammatory pathways. *PLoS One*. 2013;8(5):e62817. doi:10.1371/journal.pone.0062817.

235. Brooks D. What Our Words Tell Us. *The New York Times*. http://www.nytimes.com/2013/05/21/opinion/brooks-what-our-words-tell-us.html?emc=eta1&_r=0. Published May 20, 2013.

236. Kabat-Zinn J. *Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness*. New York, NY: Delacorte Press; 1990:453. Available at: http://www.amazon.com/Full-Catastrophe-Living-Jon-Kabat-Zinn/dp/0385298978. Accessed April 15, 2011.

237. Kabat-Zinn J, Wheeler E, Light T, et al. Influence of a mindfulness meditation-based stress reduction intervention on rates of skin clearing in patients with moderate to severe psoriasis undergoing phototherapy (UVB) and photochemotherapy (PUVA). *Psychosom Med*. 1998;60(5):625–32. Available at: http://www.ncbi.nlm.nih.gov/pubmed/9773769.

238. Carson JW, Carson KM, Gil KM, Baucom DH. Self-expansion as a mediator of relationship improvements in a mindfulness intervention. *J Marital Fam Ther*. 2007;33(4):517–28. doi:10.1111/j.1752-0606.2007.00035.x.

239. Singh NN, Singh SD, Sabaawi M, Myers RE, Wahler RG. Enhancing treatment team process through mindfulness-based mentoring in an inpatient psychiatric hospital. *Behav Modif*. 2006;30(4):423–41. doi:10.1177/0145445504272971.

240. Baijal S, Jha AP, Kiyonaga A, Singh R, Srinivasan N. The influence of concentrative meditation training on the development of attention networks during early adolescence. *Front Psychol*. 2011;2(153):12.

241. Singh N, Lancioni G. Adolescents with conduct disorder can be mindful of their aggressive behavior. *J Emot …*. 2007. Available at: http://ebx.sagepub.com/content/15/1/56.short. Accessed May 25, 2013.

242. Singh NN, Lancioni GE, Winton ASW, Adkins AD, Singh J, Singh AN. Mindfulness training assists individuals with moderate mental retardation to maintain their community placements. *Behav Modif*. 2007;31(6):800–14. doi:10.1177/0145445507300925.

243. Kang Y, Gray JR, Dovidio JF. The Nondiscriminating Heart: Lovingkindness Meditation Training Decreases Implicit Intergroup Bias. *J Exp Psychol Gen*. 2013. doi:10.1037/a0034150.

244. Fredrickson BL, Joiner T. Positive emotions trigger upward spirals toward emotional well-being. *Psychol Sci*. 2002;13(2):172–5. Available at: http://www.ncbi.nlm.nih.gov/pubmed/11934003.

245. Christakis N, Fowler J. *Connected*. New York: Little, Brown and Company; 2009.

246. Meiklejohn J, Phillips C, Freedman ML, et al. Integrating Mindfulness Training into K-12 Education: Fostering the Resilience of Teachers and Students. *Mindfulness (N Y)*. 2012;3(4):291–307. doi:10.1007/s12671-012-0094-5.

247. Huppert F a., Johnson DM. A controlled trial of mindfulness training in schools: The importance of practice for an impact on well-being. *J Posit Psychol*. 2010;5(4):264–274. doi:10.1080/17439761003794148.

248. The Garrison Institute Wellness Project. Available at: http://www.garrisoninstitute.org/transforming-trauma/project-archives/the-wellness-project. Accessed March 3, 2014.

249. Lattu K. *The Wellness Project: From domestic pilot to international program*. Garrison, NY; 2010.

250. Woodward C, Joseph S. Positive change processes and post-traumatic growth in people who have experienced childhood abuse: understanding vehicles of change. *Psychol Psychother*. 2003;76(Pt 3):267–83. doi:10.1348/147608303322362497.

251. Ryff Singer 1998 The contours of positive human health.pdf.

252. Singer B, Friedman E, Seeman T, Fava G a, Ryff CD. Protective environments and health status: cross-talk between human and animal studies. *Neurobiol Aging*. 2005;26 Suppl 1:113–8. doi:10.1016/j.neurobiolaging.2005.08.020.

253. Garland SN, Carlson LE, Cook S, Lansdell L, Speca M. A non-randomized comparison of mindfulness-based stress reduction and healing arts programs for facilitating post-traumatic growth and spirituality in cancer outpatients. *Support Care Cancer*. 2007;15(8):949–61. doi:10.1007/s00520-007-0280-5.

254. Folkman S. Positive Psychological States and Coping with Severe Stress. 1997;45(8):1207–1221.

255. Morrill EF, Brewer NT, Neill SCO, et al. The interaction of post-traumatic growth and post-traumatic stress symptoms in predicting depressive symptoms and quality of life. *Psychooncology*. 2008;17(January):948–953. doi:10.1002/pon.

256. The Road to Resilience. 2013:1–4. Available at: http://www.apa.org/helpcenter/road-resilience.aspx. Accessed September 23, 2013.

257. Snyder CR, Lopez SJ. *Positive Psychology*. SAGE Publications; 2007.

258. Chiesa A, Serretti A. Mindfulness-based stress reduction for stress management in healthy people: a review and meta-analysis. *J Altern Complement Med*. 2009;15(5):593–600. doi:10.1089/acm.2008.0495.

259. Tang Y-Y, Posner MI. Tools of the trade: theory and method in mindfulness neuroscience. *Soc Cogn Affect Neurosci*. 2013;8(1):118–20. doi:10.1093/scan/nss112.

260. Chiesa A, Serretti A. A systematic review of neurobiological and clinical features of mindfulness meditations. *Psychol Med*. 2010;40(8):1239–1252. doi:10.1017/S0033291709991747.

261. Masten AS. Global Perspectives on Resilience in Children and Youth. *Child Dev*. 2013;00(0):1–15. doi:10.1111/cdev.12205.

262. Sapienza JK, Masten AS. Understanding and promoting resilience in children and youth. *Curr Opin Psychiatry*. 2011;24:267–73. doi:10.1097/YCO.0b013e32834776a8.

263. Matousek RH, Dobkin PL, Pruessner JC. Cortisol as a marker for improvement in mindfulness-based stress reduction. *Complement Ther Clin Pract*. 2010;16(1):13–19. doi:10.1016/j.ctcp.2009.06.004.

264. O'Donovan A, Pantell MS, Puterman E, et al. Cumulative Inflammatory Load Is Associated with Short Leukocyte Telomere Length in the Health, Aging and Body Composition Study. *PLoS One*. 2011;6(5):e19687. doi:10.1371/journal.pone.0019687.

265. Herman JL. *Trauma and recovery*. New York: Basic Books; 1992.

266. Pervanidou P, Chrousos GP. Stress and obesity/metabolic syndrome in childhood and adolescence. *Int J Pediatr Obes*. 2011;6 Suppl 1(January):21–8. doi:10.3109/17477166.2011.615996.

267. Nishina M, Nishina K, Ohira T, Makino K, Iso H. Associations of psychological distress with metabolic syndrome among Japanese urban residents. *J Atheroscler Thromb*. 2011;18(5):396–402. Available at: http://www.ncbi.nlm.nih.gov/pubmed/21325777.

268. Porges SW. Orienting in a Defensive World. *Psychophysiology*. 1995;32:301–318.

269. Porges SW. The polyvagal theory: phylogenetic substrates of a social nervous system. *Int J Psychophysiol*. 2001;42(2):123–46. Available at: http://www.ncbi.nlm.nih.gov/pubmed/11587772.

270. Porges SW. The Polyvagal Perspective. *Biologica*. 2008;74(2):116–143.

271. Nesvold A, Fagerland MW, Davanger S, et al. Increased heart rate variability during nondirective meditation. *Eur J Prev Cardiol*. 2012;19(4):773–80. doi:10.1177/1741826711414625.

272. Steptoe A, Hamer M, Chida Y. The effects of acute psychological stress on circulating inflammatory factors in humans: a review and meta-analysis. *Brain Behav Immun*. 2007;21(7):901–12. doi:10.1016/j.bbi.2007.03.011.

273. Phelps E a, Anderson a K. Emotional memory: what does the amygdala do? *Curr Biol*. 1997;7(5):R311–4. Available at: http://www.ncbi.nlm.nih.gov/pubmed/9115384.

274. Glaser R, Kiecolt-Glaser JK. Chronic stress modulates the virus-specific immune response to latent herpes simplex virus type 1. *Ann Behav Med*. 1997;19(2):78–82. Available at: http://www.ncbi.nlm.nih.gov/pubmed/9603681.

275. Glaser R, Kiecolt-Glaser JK. Stress-associated immune modulation: relevance to viral infections and chronic fatigue syndrome. *Am J Med*. 1998;105(3A):35S–42S. Available at: http://www.ncbi.nlm.nih.gov/pubmed/9790480.

276. Ansara AJ, Nisly S a, Arif S a, Koehler JM, Nordmeyer ST. Aspirin dosing for the prevention and treatment of ischemic stroke: an indication-specific review of the literature. *Ann Pharmacother*. 2010;44(5):851–62. doi:10.1345/aph.1M346.

277. Berger JS, Brown DL, Becker RC. Low-dose aspirin in patients with stable cardiovascular disease: a meta-analysis. *Am J Med*. 2008;121(1):43–9. doi:10.1016/j.amjmed.2007.10.002.

278. McEwen BS. Brain on stress: how the social environment gets under the skin. *Proc Natl Acad Sci U S A*. 2012;109 Suppl :17180–17185. doi:10.1073/pnas.1121254109.

279. Gianaros PJ, Jennings JR, Sheu LK, Greer PJ, Kuller LH, Matthews K a. Prospective reports of chronic life stress predict decreased grey matter volume in the hippocampus. *Neuroimage*. 2007;35(2):795–803. doi:10.1016/j.neuroimage.2006.10.045.

280. Marsland AL, Gianaros PJ, Abramowitch SM, Manuck SB, Hariri AR. Interleukin-6 covaries inversely with hippocampal grey matter volume in middle-aged adults. *Biol Psychiatry*. 2008;64(6):484–90. doi:10.1016/j.biopsych.2008.04.016.

281. Erickson KI, Prakash RS, Voss MW, et al. Aerobic fitness is associated with hippocampal volume in elderly humans. *Hippocampus*. 2009;19(10):1030–9. doi:10.1002/hipo.20547.

282. Eriksson PS, Perfilieva E, Björk-Eriksson T, et al. Neurogenesis in the adult human hippocampus. *Nat Med*. 1998;4(11):1313–7. doi:10.1038/3305.

283. Rakic P. Young neurons for old brains? *Nat Neurosci*. 1998;1(8):645–7. doi:10.1038/3643.

284. Linares LO, Li M, Shrout PE, et al. The course of inattention and hyperactivity/impulsivity symptoms after foster placement. *Pediatrics*. 2010;125(3):e489–98. doi:10.1542/peds.2009-1285.

285. Klika JB, Herrenkohl TI. A review of developmental research on resilience in maltreated children. *Trauma Violence Abuse*. 2013;14(3):222–34. doi:10.1177/1524838013487808.

286. Karatsoreos IN, Karatoreos IN, McEwen BS. Annual Research Review: The neurobiology and physiology of resilience and adaptation across the life course. *J Child Psychol Psychiatry*. 2013;54(4):337–47. doi:10.1111/jcpp.12054.

287. *Post-traumatic stress disorder (PTSD) The management of PTSD in adults and children in primary and secondary care*. National Institute for Clinical Excellence; 2005:41.

288. Pace TWW, Heim CM. A short review on the psychoneuroimmunology of posttraumatic stress disorder: from risk factors to medical comorbidities. *Brain Behav Immun*. 2011;25(1):6–13. doi:10.1016/j.bbi.2010.10.003.

289. Rosenberg T. *Join the Club: How Peer Pressure Can Transform the World*. Kindle Edi. W.W. Norton & Company; 2011:432.

APPENDIX

A. Resilience and Stress

It is in the context of understanding how stress affects the body and the brain, and the systems that help us respond to stress—in adaptive or maladaptive ways—that we can understand the mechanisms of human resilience. When William Cannon and Hans Selye explicated the stress response, their theories were based in the context of reactions of the individual to mixed (physical and psychological) stressors, thus giving rise to the "fight or flight" response that occurs in response to a challenge, such as being attacked by a tiger.[19,20] Yet the most powerful stressors for humans in this day and age are almost exclusively psychological and experiential,[34] and Selye himself pointed out that: "Stress is not necessarily undesirable…The stress of failure, humiliation, or infection is detrimental; but that of exhilarating, creative, successful work is beneficial. The stress reaction, like energy consumption, may have good or bad effects."[20]

Short-term stressors can be energizing and optimizing, inspiring the psychological foundations of outstanding physical or musical performance, bolstering creativity, or enabling a heroic physical act. Single instances of extreme stress can also be deeply damaging. For example, post-traumatic stress disorder (PTSD) most often arises when safety and life are endangered by an overwhelming threat that an individual feels helpless to confront or overcome.[265] The consequences of a stressor for an individual are in large part determined by the context, by the individual's psychological state at the time of stressor challenge, how the situation is perceived and interpreted, and by their reaction.[34] Agency—whether the individual feels empowered and in control, or helpless and threatened—will contribute significantly to the psychological consequences of a stressful event.[37] The physical condition of an individual may contribute to this picture; stressful life events promote metabolic imbalances, and people who are in poor physical condition may be less likely to successfully negotiate psychological challenges.[266,267]

Physiological functioning and psychological functioning are closely linked within the stress response. Indeed, Bruce McEwen notes that there is a correlation between psychological and physiological reactivity: people who are psychologically reactive and fearful often have more intense physiological responses to stress, whereas those who are more psychologically "steady" have more stable (and less intense) physiological responses to stressors.[34] This calmer, more pro-social profile is also strongly linked to higher heart rate variability and vagal tone, both of which are associated with decreased mortality.[268–271] Thus there is considerable interest in promoting appropriate and congruent physiological and psychological responses to stress so that the body has adequate resources to maintain allostasis while avoiding excessive wear from over-activation of various components of the stress response.

More recent research, including the work of Lazarus and Folkman, has advanced Cannon's and Selye's initial work and enabled a more nuanced understanding of the effects of stressors

and the physiological and psychological ways that individuals respond to them.[33] To maintain body and mind in a state of healthy equilibrium—a state of allostasis—requires an efficient biological and psychological response to stressor exposure. An efficient response will turn on biological mediators of stress when needed, and then turn off the same mediators when they are no longer necessary. Appropriate "on-off" switching will permit the maintenance of allostasis with a minimum of resources, while also avoiding excessive exposure to biological mediators of the stress response, which can be damaging to long-term physical and mental health.[21]

The physical systems that regulate the human body and permit healthy allostasis include the hypothalamic-pituitary adrenal (HPA) axis, the autonomic nervous system (ANS), metabolic systems, and the immune system.[34] Each of these systems is a fundamental aspect of the stress response, and in the context of exposure to short-term stressors, each is normally adaptive and promotes our wellbeing and survival. However, if any component of the stress response is underactive or overactive, wear and tear on the body may result. Indeed, "allostatic load" occurs when these adaptive stress systems fail to shut off after responding to a stressor, or fail to activate properly when challenged by psychological stressors.[34]

The stress response includes a spike in circulating concentrations of the famous stress hormones: cortisol (produced by the HPA axis) and adrenaline (made by the sympathetic branch of the ANS). Both of these stress hormones help the body to deal with whatever short-term threat is at hand by making metabolic resources available and enhancing cognitive abilities.[22] Stressors also cause important changes in the immune system, primarily involving activation of the inflammatory immune system. Inflammation—consisting of migration of immune cells throughout the body as well as increased communication among immune cells using special molecules called cytokines[22,272]—is especially useful if a stressor involves some sort of physical injury and infection is a risk. By priming the inflammatory immune system, the stress response prepares the body in case of physical injury.

Among the many ways that the brain recognizes acute stressors, the amygdala is particularly important because of its role in evaluating emotionally charged events and in forming emotional memories.[273] The amygdala's activity is modulated by both the hippocampus (a structure central to memory) and the prefrontal cortex (responsible for attention and metacognitive awareness). These three brain areas form a network to detect environmental threats. In response to acute stressors, the amygdala triggers a response in the brain and body that includes the sympathetic nervous system and the HPA axis. Activation of the sympathetic response to stress is believed to trigger changes in immune system function, including the inflammatory immune response. This response is automatic, occurring largely outside of our conscious awareness, and is designed to protect us from harm.

As already mentioned, chronic activation of the biological responses to stress may become maladaptive and harmful. Indeed, chronic activation of the HPA axis and cortisol can undesirably affect metabolic and cognitive function, and may even lead to changes in how the cortisol response occurs in the context of subsequent acute stress.[23,24] Although immune function

for fighting off pathogens increases during short-term stress, evidence suggests that the same ability may be impaired by chronic activation.[32,274,275] Inflammation—useful for fighting off infection in the moments after exposure to acute stress—can also have important negative consequences. Considerable research suggests that chronic, unchecked inflammation contributes fundamentally to the development of a number of chronic medical conditions, including cardiovascular disease, metabolic syndrome and type 2 diabetes, and even psychiatric conditions like major depression.[25–30] Interestingly, commonly-used pharmacological treatments for these conditions were first recognized for their anti-inflammatory properties.[276,277]

Along with immune dysfunction, chronic stress has also recently been shown to have a negative impact on the healthy structure of DNA, involving the integrity of telomeres—regions of DNA that cap the ends of chromosomes. Telomeres protect DNA by preventing deterioration at the end of the strand, and by preventing one piece of DNA from fusing with another. Chronic stress exposure has been associated with reduced telomere length, and this is likely connected with chronic stress-associated immune changes.[31]

Studies in animal models and in humans clearly show that chronic stress exposure impacts brain function. One area of the brain that is particularly affected by stress is the hippocampus, which is important for remembering the context of events with a strong emotional bias. These memories are less reliable and accurate if hippocampal function is impaired, and may be colored with a threatening tone that might not have been perceived otherwise.[34] Repeated stress, lasting months and years, appears to be capable of killing neurons in the hippocampus. In stress-related disorders such as recurring depression and PTSD, the hippocampus is visibly atrophied.[32,34] Atrophy of the hippocampus has been observed in the context of repeated depression, as well as with chronic stress and inflammation and lack of physical activity.[278–281] Other brain areas, such as the pre-frontal cortex and the amygdala, also atrophy as a result of depressive illness.[32] Hippocampal atrophy and associated cognitive dysfunction (particularly associated with recurrent depressive illness and PTSD) is not entirely reversible. The only way to prevent impairment, therefore, is with interventions that protect from the stress-related effects of traumatic and recurrent events in the first place.[32]

Chronic stress not only manifests in negative physical consequences (e.g., psychosomatic symptoms, fatigue, irritability, gastrointestinal disorders) but also dysregulates the psychological stress response system itself. Burnout is not just a slangy term to describe the casually overworked. Burnout describes profoundly depleted psychological and psychosocial resources matched by a corresponding physiological profile in which the neuroendocrine and immune systems—having functioned on overdrive for too long in response to an environment of repeated, unrelenting stressors—literally "burn out" and are no longer capable of mounting an appropriate response to challenges. This accounts for the low levels of stress hormones observed in such individuals, who may perceive and experience the psychological burden of ongoing stress, but whose bodies are no longer capable of responding appropriately. The stress systems have given

up. Sometimes the individual gives up as well, exhibiting features of depressed mood and "learned helplessness."

The plasticity of the brain and regions fundamental to controlling the stress response, including the amygdala and hippocampus, makes the brain susceptible to the negative consequences of chronic stress, especially in childhood. Neurogenesis (the production of new neurons) can take place throughout life, but is deeply influenced by behavior and the environment.[282,283] For example, children who have experienced maltreatment exhibit altered secretion of cortisol and increased inflammation, and tend to be impulsive and have deficits in attention. However, these behavioral deficits are reversed when they are placed with warm and caring families, demonstrating that the negative impacts of chronic stress—including physiologic changes—are reversible in childhood.[28,284,285] Early life adversity can precipitate changes in the brain and body that alter the ability to deal with stress later in life,[286] yet the brain retains plasticity and the ability to mitigate these effects.[282,283] New cellular growth and "rewiring"—the formation of new connections and lessening activity of unused connections—continue throughout the lifespan.

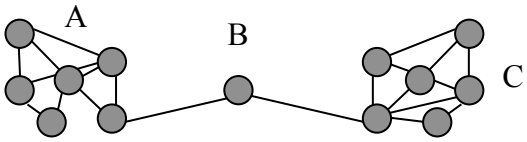
While it is perhaps the most well-known disorder that results from trauma, PTSD develops in less than 30% of people who are exposed to a traumatic event.[287] The development of PTSD is associated with exposure to a single traumatic event, or to a series of events. The stress response to the trauma at first involves a powerful cortisol and adrenaline response, as well as strong activation of the inflammatory immune system. Interestingly, although preliminary studies suggest that excessive sympathetic nervous system and inflammatory immune responses to a trauma may contribute to subsequent development of PTSD, attenuated or insufficient cortisol responses may also have the same effect. Given that the endocrine and the immune systems interact with one another extensively, some have posited that an imbalance between the inflammatory immune response relative to the cortisol response may be an important biological route to PTSD.[288] It may be that a lack of cortisol at the time of a trauma permits excessive inflammatory immune response. Both cortisol and immune cytokines are known to have powerful effects on the brain once released throughout the body, and a relative imbalance in the two may play a role in determining whether or not a traumatic event will result in PTSD.[288]

In the context of chronic stress, some have hypothesized that day-in, day-out wear and tear eventually "flips" the body toward illness or a new persistent state of dysfunction and imbalance. We have all seen this: a person experiences a number of significant stressors over a period of time—for example, the loss of a job, the death of a loved one, a significant illness—and seems to take it all in stride. Then a single, seemingly minor, event precipitates a physical and/or psychological crisis that takes him and others by surprise. In fact, all along, chronic stressors were consistently taxing his ability to cope, and his stress system was pushed dangerously close to a threshold where normal functioning could no longer be maintained. As we get closer to this threshold, which differs for each person, it takes less to push our stress systems into a new dysfunctional state. The "tipping point" stressor does not have to be a large one. More significant

is the accumulated effects of multiple mild and/or major stressors over time. This relationship between stress and illness underscores the importance of understanding the impact of cumulative stress in our lives. One way of maintaining resilience is to maintain a state well below the threshold that puts our stress system at risk of flipping into a dysregulated state.[17]

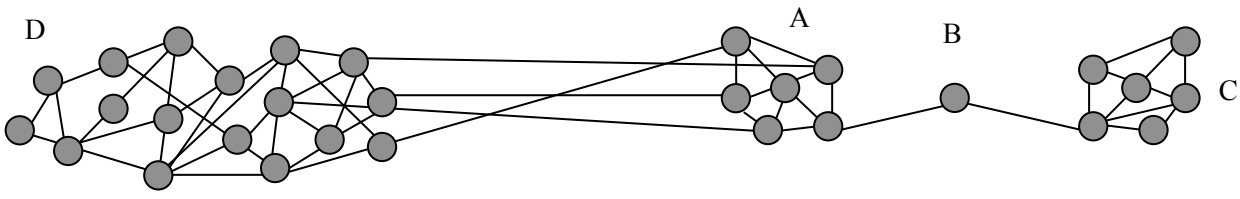
B. Modeling Community Resilience

In order to consider community, rather than individual, resilience we need to assess the way that individuals can be connected to each other. Current thinking is that social networks should be modular in order to insulate the larger network from an "infection" (real or theoretical) affecting one part of the group:



This type of social network provides support within the group and insulates the group from outside events and contagions. For example, in the example above where A and C represent two towns full of individuals, if influenza were spreading, the only point of contact between the two networks is the person, B. The towns are well insulated from each other, and the likelihood of the flu spreading from one town to the other is small.

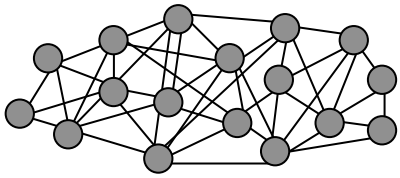
However, if a natural disaster, such as a hurricane, were to strike the larger geographical area in which these two towns are located, the relatively small size of the towns means that neither is likely to have the resources to withstand a large disruption, and their relative isolation prevents communication and assistance from flowing between them. If person B is incapacitated, the towns will be cut off from one another. Consider, also, the possibility that community A is connected to a larger metropolitan area, D:



Now B is the only link, not only between communities C and A, but also between communities C and D. Although undesirable factors (like the flu) will not spread easily to community C, neither will assistance.

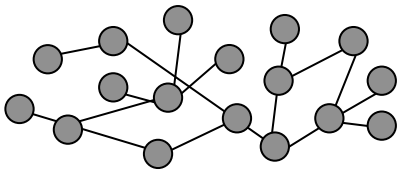
Rather than an illness, consider situations when it would be beneficial for something to spread through a network. For example, if we want to disseminate a given skill within a community, such as building individual's capacity for cognitive reappraisal (reinterpretation of a negative situation in a more positive light), then the more solid, trusting connections that exist between people, the more likely that information is to spread.[289] However, this type of network (e.g., community E below) requires a focus on reciprocal relationships and the willingness to live also with a degree of risk. The type of social network that will insulate more people from many catastrophic events (e.g., community F below) will also increase their risk in other events. For example, to survive climactic disruption, a community requires redundancies of function and strong, duplicative social ties (e.g., community E); information and assistance will flow swiftly through such a network, but so will disease.

E



vs.

F



It is not possible to construct a network in a way that ensures resilience against all threats, all of the time. The very ties that will be lifesaving in some situations will be a source of vulnerability in others. Weak ties among community members are every bit as important as strong ties, but if too many ties are too weak, people risk becoming severed from critical support during a crisis.[245]

Building resilient communities from *within*, rather than trying to impose a structure from the outside, empowers communities by allowing them to map their own strengths and determine where they should work to enhance resilience. Our thinking on the spread of resilient behaviors in social networks is informed by epidemiology and by efforts to apply epidemiological principles to stem violence. There are three key steps in using behavior change to interrupt the spread of a threat through a community. These steps are equally valid whether the contagion is biological (e.g., HIV) or social (e.g., violence)[6]:

- First: Interrupt the contagion;
- Second: Change the thinking of the most at-risk transmitters; and
- Third: Change the norms of the community as a whole.

Now let us shift the perspective: we want to infect a community with a particular contagion, in this case, resilient behaviors. This seems plausible; for example, emotions such as happiness can be tracked as they spread through social networks.[245] But in our model of spreading resilient behaviors, the order of the steps changes:

- First: Change the thinking of the most high-impact transmitters;
- Second: Start the contagion; and
- Third: Change the norms of the community as a whole.

A problem can appear monolithic and intractable but will yield to the right intervention that is capable of creating behavior change.[6] And a very reliable way of changing behavior is by tackling it one person at a time, through the influence of direct person-to-person contact. In order to successfully build the resilience of an entire community network, contemplative-based interventions could be targeted first to the individuals who are most central to the community, such as community leaders, however the community defines them (e.g., teachers, coaches, business owners, first responders). This approach harnesses connections between individuals—and people's natural tendency to model the behaviors of those closest to them—to transform communities.[289] Contemplative training builds perceived and actual social ties, and thus has the ability to improve resilience on an adaptive, systems level. Inoculating more and more members of the community with greater resilience, including more social ties and more positive emotions, will ultimately reduce the number of people who are marginalized at the fringes of social networks (e.g., within/between organizations), further fueling community ties and thus building resilience.