

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 2011⁴; by Walker and Salt's work in 2006⁵; by Andrew Zolli's thinking on resilience, including his 2012 book by that name⁶; 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 Traits¹²⁻¹⁴



*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 occurrences.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.

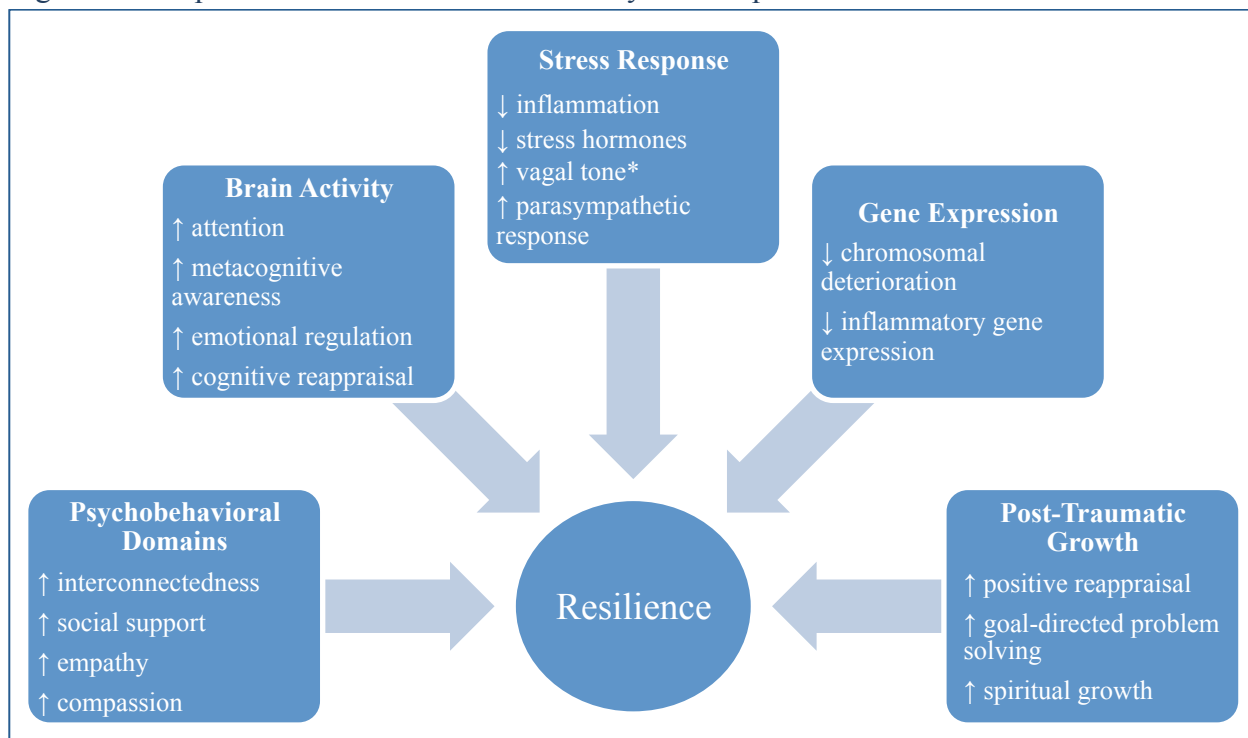
This is what is meant when the brain is described as “plastic”: that it can be changed by experience.⁹⁷ These experiences can be things that originate outside of our selves: a lecture on algebra, learning to play the violin, a rape, an attack during war. These experiences can also originate inside our 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.

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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 prosocial 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.

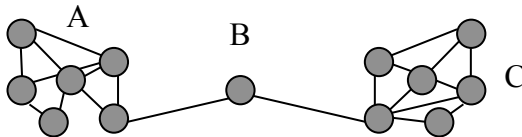
While it is perhaps the most well-known disorder that results from trauma, PTSD develops in less than 30% of people who are exposed to a traumatic event.²⁸⁷ The development of PTSD is associated with exposure to a single traumatic event, or to a series of events. The stress response to the trauma at 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

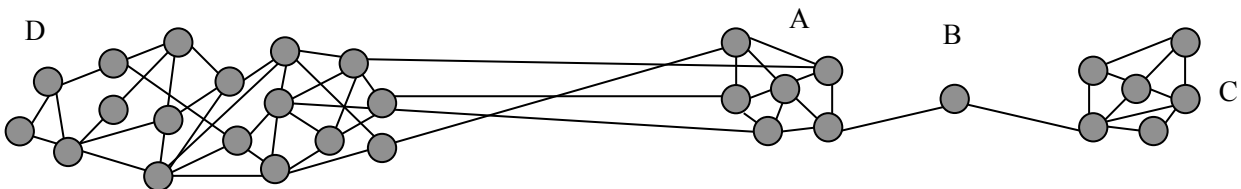
B. Modeling Community Resilience

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:



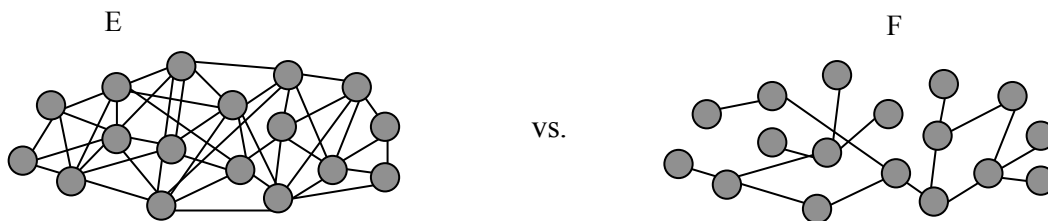
This type of social network provides support within the group and insulates the group from outside events and contagions. For example, in the example above where A and C represent two towns full of individuals, if influenza were spreading, the only point of contact between the two networks is the person, 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.



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.



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