

The Science of Stress

BY JON SPAYDE | JUNE 2013



Understand how stress operates in your body — and how to build resilience.

Consider the car alarm.

You're trying to concentrate on a project that's due in less than two hours, and that horn has been beeping outside your window for the last five minutes. Its effects are impossible to ignore. Your heart rate is up. Your jaw is tight. Your stomach roils as the clock ticks toward the deadline. Though you are normally someone who walks miles to avoid an argument, you briefly contemplate throwing a brick through the windshield of that car in self-defense.

This is what stress feels like. And while moments like these are familiar to everyone, studies suggest that today these feelings have become the rule of our collective experience, rather than the exception.

When the American Psychological Association conducted its annual survey on stress in 2011, nearly a quarter of respondents reported their levels of stress as "extreme." Thirty-nine percent

said their stress had gone up in the past year, and 44 percent said it had increased in the past five years.

Respondents more or less agreed that chronic stress had a negative impact on their quality of life, and yet — despite the fact that most of us can easily identify what stress *feels* like — nearly a third of respondents said they believe stress is strictly psychological and has no impact on physical health.

Experts across medical disciplines agree that this is a dangerous misperception.

“The stress response is a normal adaptive coping response that evolved over hundreds of millions of years to help our ancestors avoid sticks and get carrots,” says Rick Hanson, PhD, a neuropsychologist and author of [*Buddha’s Brain: The Practical Neuroscience of Happiness, Love, and Wisdom*](#) (New Harbinger, 2009). “It’s natural. What’s also natural, though — and you see it in the wild — is that most stressful episodes are resolved quickly, one way or another. The natural biological, evolutionary blueprint is to have long periods of mellow recovery after bursts of stress.”

The problem, according to Hanson, is that “modern life exposes us to mild-to-moderate, but chronic, stress constantly — multitasking, juggling too many things, moving too quickly, being bombarded with stimulation.” In other words, we’re simply not designed to flee from predators for 10 hours a day with no breaks. But that is essentially what we do.

Roberta Lee, MD, vice chair of the Department of Integrative Medicine at Beth Israel Medical Center in New York City, calls the now-common condition of constant pressure “superstress.” In her book [*The Superstress Solution*](#) (Random House, 2010), she lists the variety of stressors many now take for granted: job dissatisfaction, overwork, inadequate salaries, not enough time with partners and family, noise pollution, lack of outdoor time, and “spiritual angst” prompted by a loss of meaning and purpose, as well as a loss of connection with others.

As Henry Emmons, MD, of the Penny George Institute for Health and Healing in Minneapolis, points out, “your body can’t differentiate between a saber-toothed tiger attack and a bad job review.” The nerve-and-hormone response is the same. And over time, the intensity of the stress response wears a body down.

Lee compares the effects of a near-constant cascade of stress hormones to revving an auto engine all day. “You’ve got your foot on the accelerator all the time, even when you’re resting,” she says, “and you’re overutilizing every element of your body, like you do with a car when you’re revving up an engine. You overuse the oil. You increase heat.”

The resulting physical symptoms range from annoying to debilitating. “What I mostly experience with patients in my practice is anxiety,” says Los Angeles–based naturopathic physician Holly Lucille, ND, RN, author of [*Creating and Maintaining Balance: A Woman’s Guide to Safe, Natural Hormone Health*](#) (Impakt Health, 2004). “When you’re overly stressed, you have a decrease in stress resistance — I call it ‘short-fuse syndrome.’”

This is when we start contemplating putting bricks through windshields. The following pages will explain the effects of such high-stress moments on different organs. It will also help you understand what you can do to cool those fires — and build a more stress-resilient body for the long haul.

Your Body Under Pressure

Here’s what happens to our organs and biochemistry when we’re stressed out . . .

The Brain

The stress response begins above your shoulders. The amygdala (a cluster of cell nuclei inside the temporal lobe that processes emotional data) sends a threat message to the hypothalamus, which in turn tells the sympathetic nervous system to protect you from attack. The nervous system increases heart rate, constricts some blood vessels and dilates others, slows down the intestines, inhibits digestive secretions, and prompts glands to flood the system with cortisol.

If this alarm is set off too often, it can do serious physical damage. “When too much cortisol is hitting the brain for an elevated amount of time,” Lucille says, “you start to create something called hippocampal brain damage, and the results of this are disturbed circadian rhythms: Your sleep-wake cycle is disturbed. You get moody, and you get memory loss, brain fog.”

The Pituitary Gland

Sometimes called the “master gland,” the pituitary controls most of the other glands in the body, regulating a host of functions including body temperature, thyroid activity and urine production (hence those sweaty palms and frequent bathroom trips when you’re nervous). During the stress

response, the pituitary produces adrenocorticotrophic hormone (ACTH), which prompts the adrenal glands to produce cortisol. Cortisol increases arterial blood pressure, pulling glucose and fat from body tissues into the bloodstream for energy, one reason appetite diminishes during acute stress.

The pituitary gland also releases thyroid-stimulating hormone, which stimulates the thyroid gland to produce thyroxine. Thyroxine increases the metabolic rate, raises blood-sugar levels, and increases respiration, heart rate and blood pressure — all essential to a quick burst of activity. But the metabolic boost from thyroxine uses up nutrients too quickly, so the body overuses B vitamins and excretes calming magnesium.

The Heart

Blood vessels constrict during the stress response, which makes it harder for the heart to pump blood. High blood pressure from constricted vessels and increased cortisol and thyroxine only exacerbates inflammation and arterial plaque buildup.

Additionally, fatty acids released into the bloodstream by cortisol can lead to overproduction of low-density cholesterol (LDL).

High-density cholesterol, or HDL, actually helps keep the circulatory system functioning and has powerful healing value. But, notes Lee, the so-called bad version, LDL, contributes to dangerous plaque buildup on arterial walls that have been inflamed by toxins and high blood sugar — common byproducts of stress eating.

And all this sets the stage for cardiac arrest, says Lee.

Adrenal glands

Upon detecting a threat, the hypothalamus signals the adrenal medulla (an autonomic-nervous-system node next to the adrenal glands) to secrete two hormones — adrenaline and noradrenaline — into the bloodstream. These increase heart rate and blood pressure. Blood is pumped to extremities and their muscles to help you run or go into battle, while gastrointestinal activity is reduced, producing the feeling of butterflies in the stomach. When this complex process is

repeated routinely with no time for recuperation, you start to feel both lethargic and wound up — tired but wired.

Chronic stress also wears out the adrenal glands by overusing their store of energizing adrenaline. According to Lee, this can lead to a condition that integrative and naturopathic doctors identify as “adrenal fatigue,” which can manifest as exhaustion, physical weakness, immune suppression, hormone imbalances, skin problems and depression. (To learn more about this condition, see ELmag.com/adrenal2011.)

Stomach and Intestines

The slowdown of the digestive process triggered by the sympathetic nervous system and the thyroid can prompt either overproduction or underproduction of digestive acids. Overproduction can lead to painful acid reflux (heartburn), while underproduction means your stomach has limited digestive power. Too little stomach acid can leave food in the system so long that it ferments rather than digests. This can produce bloating, create inflammation of the intestinal tissue and reduce the overall absorption of nutrients.

“If your bowel’s inflamed,” says Emmons, “you’re not getting nutrients out of the food you eat. You can eat really great food but still not benefit from it.”

Body Fat

While some people do lose weight under stress, research reveals that high levels of cortisol can also encourage weight gain in two ways:

(1) Cortisol amps up the appetite for quick energy (namely, carbohydrates and sugar), triggering cravings and overeating. (2) Cortisol also puts excess glucose in the bloodstream. When it’s not burned off through exercise (the equivalent of sprinting away from or fighting off the perceived attacker), it gets stored as fat in your body’s tissues.

That makes chronic stress a real enemy of overall fitness, Emmons points out. “You tend to gain weight because cortisol is making you want to eat more. But it’s also making you more likely to hold on to that food as fat, especially as abdominal fat.”

Reproductive system

Progesterone is a crucial hormone for fertility in women; it nourishes the lining of the uterus to support the implantation of an embryo and sustain a pregnancy. It's also a key ingredient in the creation of cortisol in the adrenal glands. When the body demands large amounts of cortisol, its total amount of progesterone can diminish, leading to low libido and possible infertility. (For more details about how stress affects your romantic and reproductive life, see ELmag.com/libido.)

The Aging Process

In 2004 a University of California, San Francisco research team reported that chronic stress may play a role in shortening telomeres, the tiny protein complexes at the ends of chromosomes that help protect genetic information as cells divide. As telomeres shorten, cells lose the ability to divide; they can also get confused about their mission and start to manifest serious ailments, from Parkinson's to heart disease. (Other studies have linked shortened telomeres with the onset of dementia.) While cell loss is an integral part of the aging process, chronic stress accelerates it by munching away at these protective proteins so they diminish faster than they would naturally.

Turning Down the Intensity

Short of winning the lottery and moving to a nice island with your favorite people (which would soon introduce anxieties associated with boredom), how does one actually reduce stress?

The first thing to remember, says Hanson, is that our emotional reaction to events initiates the stress response. "We need to make a distinction between events and our experience of them," he says. "An event that's highly stressful for some people is no big deal for others."

The key to lowering stress, according to Hanson, is to build resilience. Since we have only modest control over what happens to us, our best hope is to train ourselves to respond to stressful circumstances without triggering the alarm system every time. What follows are some of the building blocks for a more stress-resilient body. (For more on building resiliency, go to ELmag.com/resiliency.)

Rest

The best way to quiet the body-mind's stress response, and to support the recovery process, says

Lee, is “to relax and rest as deeply as you can — to rest as if you were on your best vacation ever.”

What does that sort of profound rest accomplish? It charges up the parasympathetic “rest-and-digest” system (the antithesis of the sympathetic “fight-or-flight” system), which powers the body’s reparative and digestive activities.

When deep rest is in short supply, you can still support parasympathetic activity by taking frequent short breaks — ideally every 90 to 120 minutes (see ELmag.com/takeabreak).

Finding ways to improve sleep quality is also vital, says Emmons. “This can include meditative practices, deep breathing, exercising early in the day, and getting seven or eight hours a night of sleep whenever possible. Naps can be helpful, too, if they’re short, 30 to 45 minutes. Any longer and your sleep cycles may be disrupted.”

Nutrition

A well-fed body is a resilient body — far better equipped to handle stress and to recover from hormonal floods.

Keeping sugar and flour to a minimum while eating plenty of healthy fats and good protein (grass-fed meats, fish, legumes, nuts) will help keep blood sugar on an even keel. This supports good energy, mental clarity and stable mood — all of which lead to more grace under pressure.

Lee advocates the Mediterranean diet, which includes plenty of legumes, greens and fish. She also likes that it promotes a proper balance of omega-3 and omega-6 fatty acids and soothes intestinal inflammation.

As for stress-busting supplements, many integrative doctors recommend taking a good-quality fish oil as well as a B-vitamin complex, since stress tends to deplete B-vitamin levels. Both have shown measurable effects in treating depression, another common byproduct of chronic stress

Meditation

Studies show that mindfulness meditation — becoming a calm observer of your own thoughts and emotions — stimulates the parasympathetic nervous system. “Meditation,” says Emmons, “is one way of sending signals [to your body’s stress-response system] that it’s OK to stand down.”

Hanson adds that meditation can also reduce frantic neurological activity in the amygdala, the alarm bell of the brain. Self-reflection (a fairly advanced activity, as far as brains are concerned) shifts activity to the neocortex, or “executive center.”

When the brain starts to rely more on the neocortex and less on the amygdala, it begins to strengthen new neural pathways that incline the brain away from reactivity and toward calmer, more constructive responses.

Exercise

We all need some kind of physical movement to stay stress-resilient, whether it’s walking, biking, doing Tai Chi or yoga or shooting hoops. Emmons notes that the stress response is inextricably connected to exercise — after all, it’s preparing us to run fast or fight hard — so “vigorous exercise helps to bring down adrenaline levels, while gentler exertion is good for lowering cortisol.” Lee points out that exercise also produces positive mood elevators (endorphins and serotonin) and breaks down cortisol in the bloodstream.

Positivity

In her book [*Positivity*](#) (Three Rivers Press, 2009), positive psychology researcher Barbara Fredrickson, PhD, notes that for individuals to flourish, they need a “positivity ratio” of three positive experiences to each negative one. In her second book, [*Love 2.0*](#) (Penguin Publishing, 2013), she explores how “micro-moments” of positive connection with others, even strangers, improve health and longevity. Her current study at the University of North Carolina is testing whether meditation with a deliberately positive element — like focused, caring attention on another person — reduces stress even more than mindfulness meditation.

Hanson describes similar studies showing that amygdala-based cell receptors for oxytocin (an amygdala-calming hormone) increase in number when we foster feelings of compassion.

This all illustrates what one might call the neurophysiology of positive connection. In a chronically stressed world, acts of love, compassion and connection can help mute or shut off the brain’s alarm system when we don’t need it. In the absence of these overstimulating hormones, we become calmer and healthier.

It seems that what we are really built to do is to treat ourselves and others well — not flee from tigers all day long.

On-the-Spot Stress Reduction

Here are some of our experts' favorite methods of de-stressing on the fly:

Walk It Off

“Walking is wonderful,” says Roberta Lee. “It improves your circulation, keeps your joints lubricated and builds stamina. Oh, and it’s a lightning-fast way to reduce stress.”

Exhale Longer

“Exhaling activates the parasympathetic wing of the nervous system, which is the natural antidote to the sympathetic fight-or-flight reaction wing,” says Rick Hanson. “The heart slows down a little when we exhale. Try three or more breaths in which the exhalation is twice as long as the inhalation.”

Pause

Holly Lucille says, “One of the things that I recommend to people in my practice is something called a ‘power pause.’ Before you turn on that stress-generating mobile device, or make that call, or pull whatever your stress trigger is, take a deep breath and make a really intentional pause.”

Tune Into Your Body

Engage your senses. “Particularly touch and smell,” Henry Emmons says. “A little gentle massage or some aromatherapy work very quickly for many people.”

Connect

Barbara Fredrickson purposely tries to “notice signs of good fortune [in the people I see around me]. Is this person smiling? I picture myself cheering her on or giving him an imaginary high-five. I’m often struck with how readily this shift in perspective will put a smile on my face and awaken my feelings of connection with others.”

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