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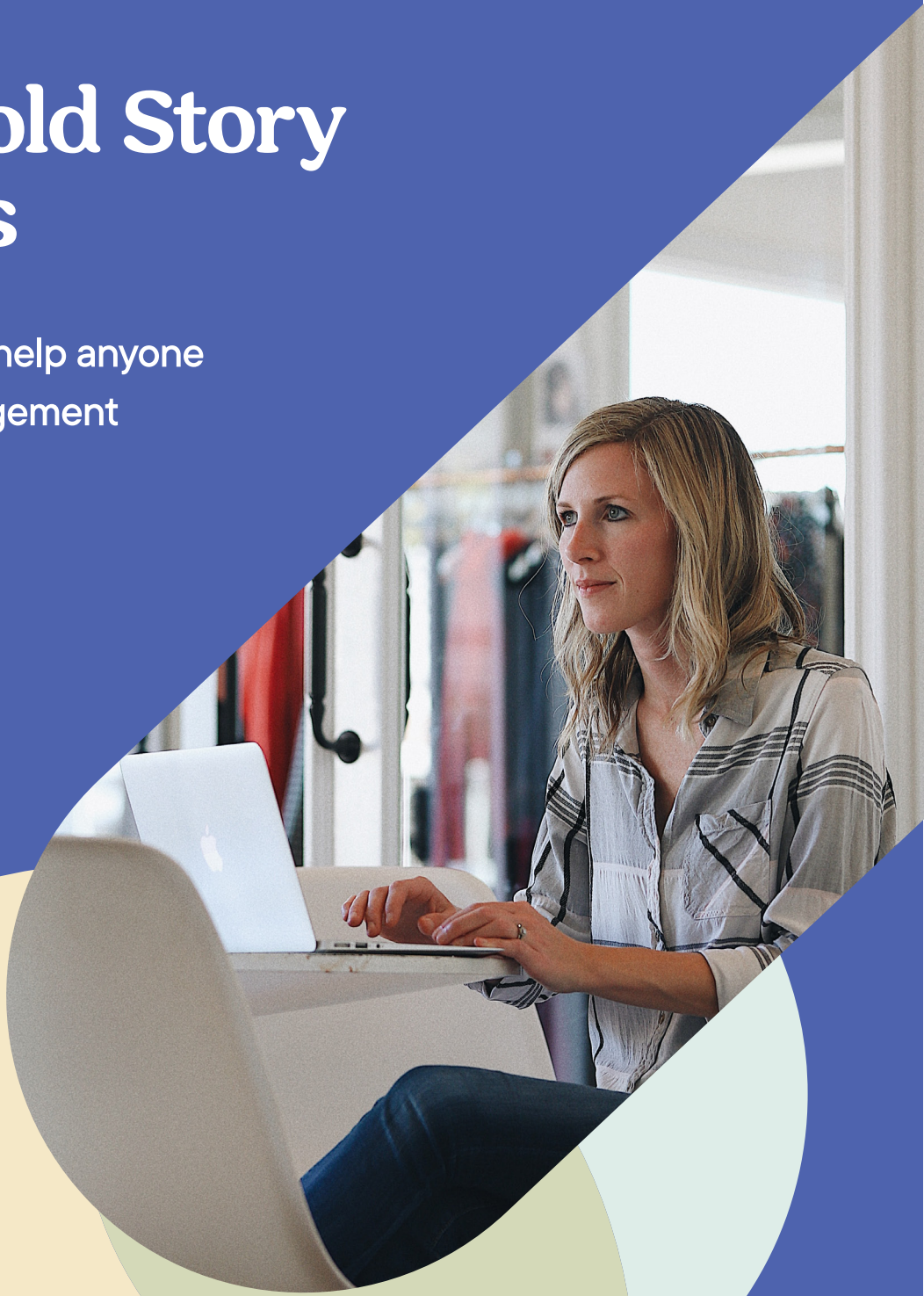
# The Untold Story of Stress

14 practical tools to help anyone master stress management



# Overview

We all know stress is bad for us, right? It turns out that the stress story is far more complex and interesting than we've been led to believe. This Well Excel resource focuses on unexpected aspects of this tale, in particular, that:

1. stress can be good for us,
2. there are unexpected links between stress and disease, and
3. we have far greater control over our stress response than we think.

We unpack the underlying biological mechanisms of stress so you can better understand when to apply stress-boosting strategies (as counterintuitive as this sounds), and how to hit the brakes. This resource provides 14 practical tools drawing on the latest findings in neurobiology to help you master stress.

## About Well Excel

Well Excel is an industry leading platform that enhances worker mental wellbeing and competence through expert education and science-backed resources.

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# Introduction

## Stress

What exactly is stress? It is our body's reaction to perceived danger. Stress is a physiological (biological) mechanism triggered by fear that prepares us to fight, run away or freeze. In other words, stress allows us to mount a 'fight-flight-or-freeze' response to threats. All animals experience stress reactions (le Roux, 2015).

Stress is a hard-wired, automatic and involuntary reaction which means we can't stop it from happening once a threat is perceived. However, as we will see later in the resource, there are tools, strategies and protocols that we can use to **turn off** the physiological response after it has been activated. These brakes, too, are a hard-wired feature of our biology.

## Stressors

Scientists call the threats that trigger our stress reaction **stressors**. Throughout this resource, whenever we use the term 'stress', we mean the stress response. Causes of stress will be referred to as stressors.

Stressors can be physical (biological) or psychosocial. Examples of physical stressors include hunger, temperature extremes, injury, pain, sleep deprivation, bacteria and viruses.

| THREAT | DESCRIPTION |
|---|---|
| Novelty | A new experience |
| Unpredictability | An event we have no way of knowing would happen |
| Threat to the Ego | Someone questioning our competence |
| Sense of Control | A situation where we feel we have little or no control |

Figure 1. Stress ingredients (Centre for Studies on Human Stress (CSHS), 2019).

Psychosocial stressors are situations or people we perceive to be negative. They represent threats to our psychological state (e.g. self-worth or mental wellbeing) or social status (Scott, 2020, 2021b). Psychosocial stressors are NUTS: Novel, Unpredictable, Threatening to the ego or devoid of a Sense of control (Figure 1). Examples include job demands, relationship conflicts and a hectic schedule.

Psychosocial stressors tend to be subjective; a threat to one of us may be perceived as a challenge to another. This is because we have different past experiences, personality traits, genes, mental and physical resources, and current physiological states (Oken et al., 2015).

Tool #1

## Eliminate stressors

1. In your personal life, are there any people, situations or tasks that you could simply drop? For example, are there high-drama friendships that you could distance yourself from? Household chores you could ditch? Regular commitments you could cancel?

2. Now consider stressors you could eliminate from your professional life. This tool is particularly relevant if you are a manager and can delegate, but also applies if you are an employee with a great leader. Recall the subjectivity of stressors; what you find stressful could be appealing to a colleague. Over time it may be possible for workloads to be reallocated to capitalize on everyone's strengths, enhancing a sense of control and minimizing threats to ego.

## The stress response is generic

The stress response is generic meaning that the same biological system deals with all types of stressors, regardless of their type. Experiencing something new or unexpected (even if exciting), criticism from our boss, conflict with our partner, uncertainty about our job, workload pressures, an impending exam, heavy traffic, extreme cold and physical danger all activate the same biological processes.

Have you heard that the stress response is an ancient system designed to help us escape from saber-toothed tigers? That it's a negative and unfortunate carryover we no longer need but somehow haven't been able to eliminate? Stanford neurobiologist Andrew Huberman, who researches the biology of stress, calls this the "falsely narrow animal attack narrative" (Huberman, 2021a).

Huberman argues that the idea our stress system was designed to escape predators is a misunderstanding. In prehistoric times partners still cheated, loved ones died and tribe members disappeared without explanation. Psychosocial stressors such as worry and grief have always been part of the human experience (Huberman, 2021a). Therefore, a generic stress system that is activated by both physical and psychosocial stressors is not an evolutionary artefact.

Let's now take a closer look at the biology of the stress response. Once we are familiar with the processes, we will be in a better position to understand the upsides and downsides of stress, and to make accurate judgments about strategies that are likely to be effective for stress management.

# The biological mechanisms of stress

## The defense cascade

> "Evolution has endowed all humans with a continuum of innate, hard-wired, automatically activated defense behaviors, termed the **defense cascade** [Figure 2]. **Arousal** is the first step in activating the defense cascade; **flight or fight** is an active defense response for dealing with threat; **freezing** is a flight-or-fight response put on hold; **tonic immobility** and **collapsed immobility** are responses of last resort to inescapable threat, when active defense responses have failed" (Kozlowska et al., 2015).

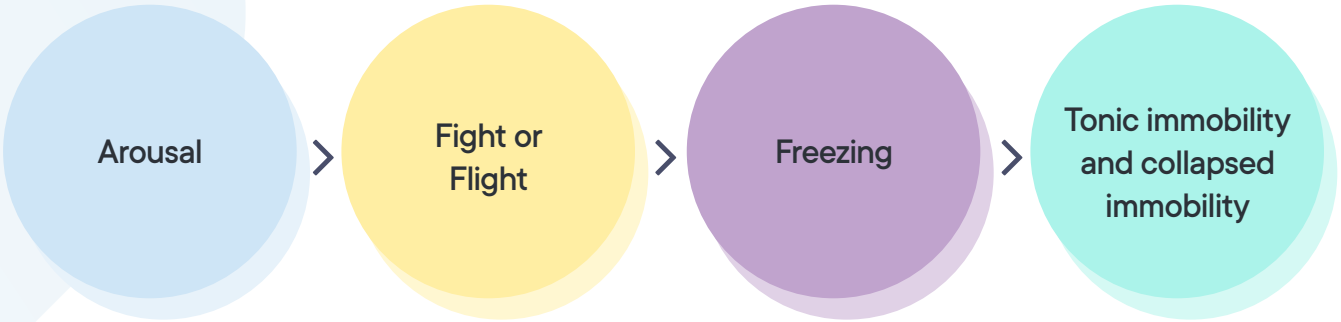



Figure 2. The defense cascade (Kozlowska et al., 2015).

Stress is a neurochemical state meaning it involves both nerves and chemicals released by endocrine organs (hormones) and the nervous system (neurotransmitters). There are three main mechanisms that drive the responses in the defense cascade.

# Autonomic Nervous System (ANS)

The autonomic nervous system (ANS) controls processes that are unconscious such as blood pressure, heart rate, respiration, digestion, metabolism, the production of body fluids (tears, saliva and sweat), body temperature, urination, defecation and aspects of our emotional state (Cherry, 2020).

The ANS is divided into branches called the sympathetic nervous system (SNS) and the parasympathetic nervous system (PSNS). The two systems have opposing actions (Figure 3) and generally act in a complementary manner, i.e., increasing one results in a decrease of the other. Because the PSNS is dominant most of the time, we are generally in a 'feed-and-breed' / 'rest-and-digest' mode (pink functions in Figure 3).

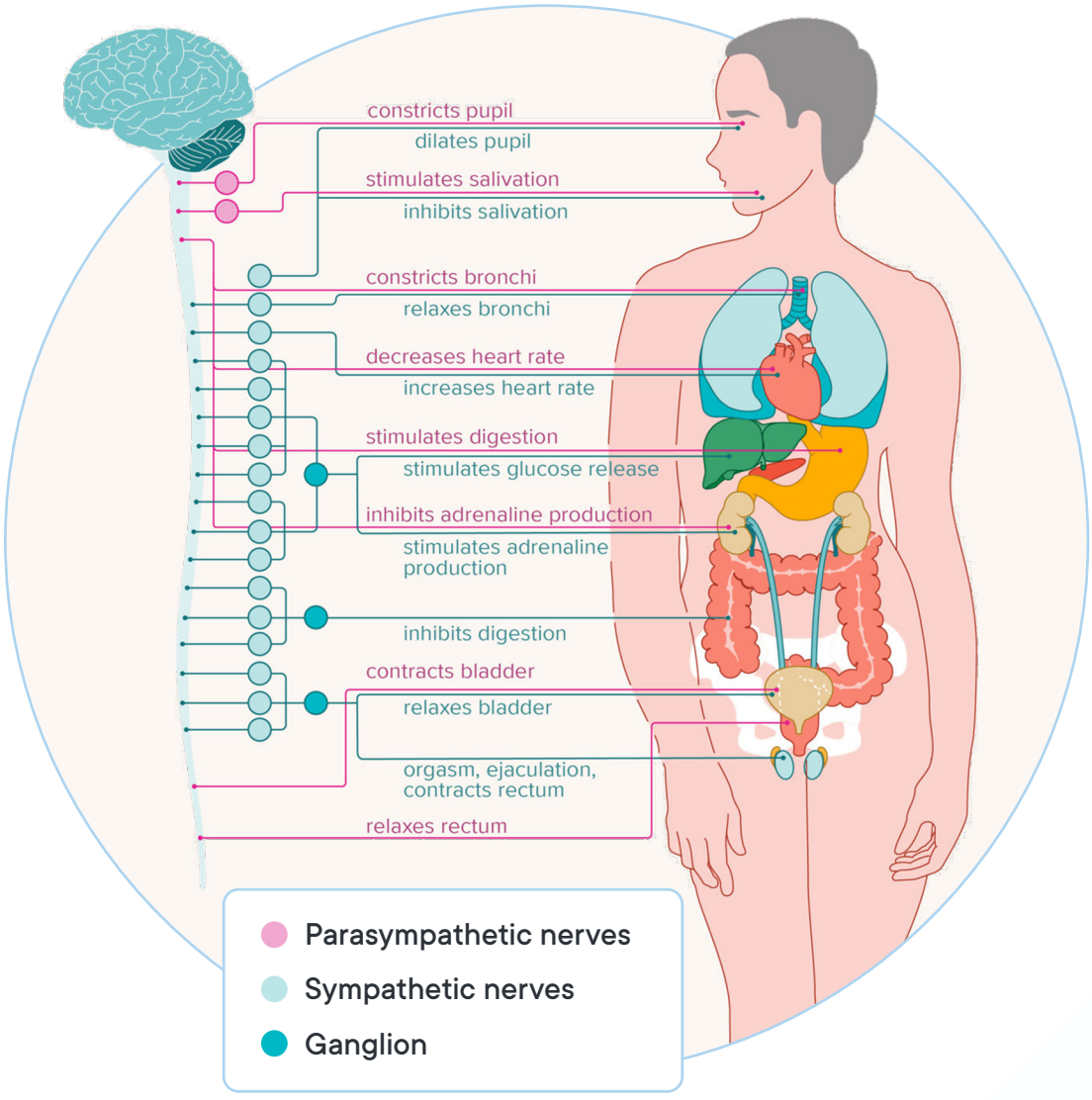



Figure 3. Autonomic nervous system (Sabogal, 2020).

## Arousal: SNS


The hypothalamus is a brain region that functions as a control center, communicating with the body through the nerves of the ANS. When we perceive fear the emotional center of our brain, the amygdala, sends a distress signal to the hypothalamus (Figure 4). The hypothalamus then activates the SNS by sending signals down the spinal cord and into the body through the autonomic nerves. This causes the release of norepinephrine (also known as noradrenaline) at many sites. Stimulation of the SNS also causes the release of norepinephrine in the brain (Vogel & Schwabe, 2016).

The autonomic nerve signals in the body further stimulate the adrenal glands, a part of the endocrine (hormone) system, to release epinephrine (adrenaline) into the bloodstream where it circulates to many organs.

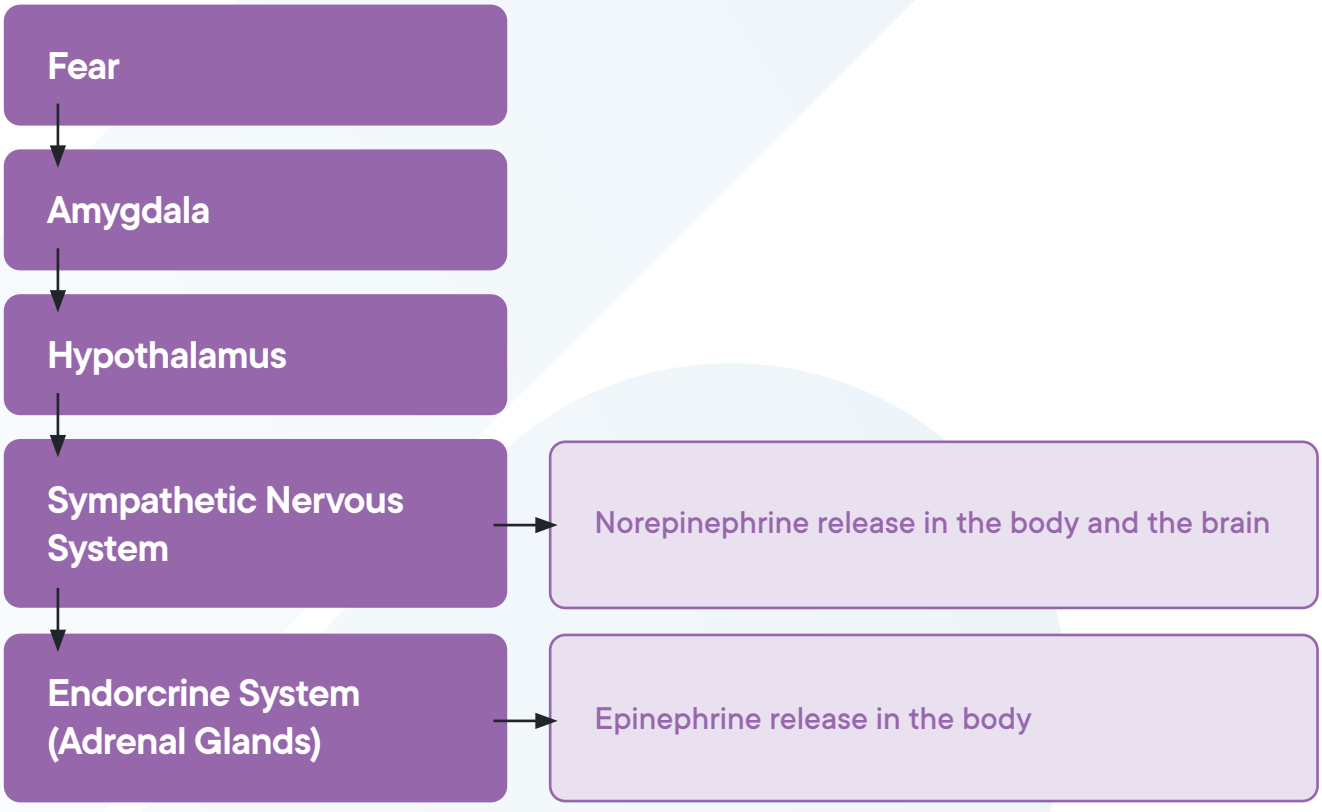



Figure 4. Release of norepinephrine and epinephrine by the sympathetic nervous system.

The SNS is the gas pedal in the stress response. Its purpose is to ensure our survival in the face of emergencies. Increased SNS activity leads to decreased PSNS activity. Functions that are not critical to the here-and-now such as digestion and producing reproductive cells are turned off.

Reflection Questions

**Imagine you're walking late at night. You suddenly become aware you're being followed.**

1. What physical changes would take place in your body?
2. How quickly would these changes occur?

Norepinephrine and epinephrine cause a wide range of physiological effects (Figure 5).

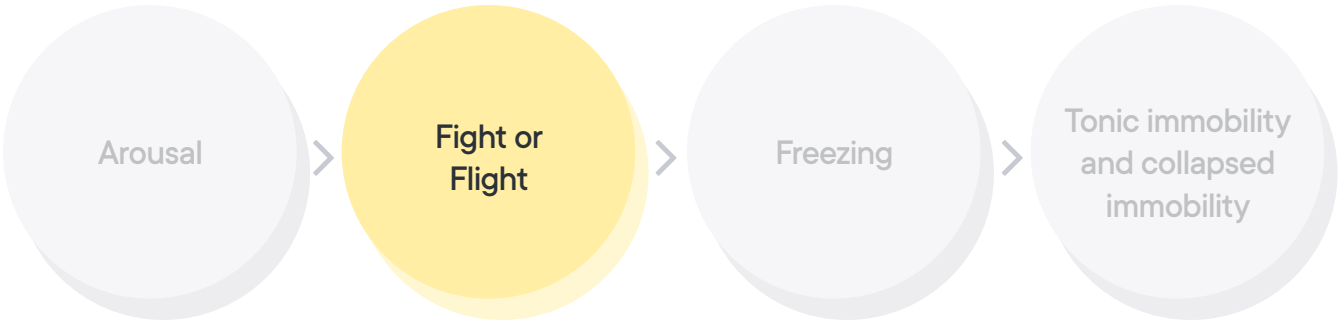

Figure 5. Physiological effects of norepinephrine and epinephrine (image adapted from Wikipedia, 2022).

These changes mobilize us to either fight or escape the source of the danger (Cherry, 2019; Frothingham, 2021; Harvard Health Publishing, 2020; Lyons, 2021; Nunez, 2020; Shmerling, 2020):

- We become extremely alert and our thoughts race. This quicker thinking helps us evaluate our environment and make rapid decisions.
- Blood sugar (glucose) and fats are released into the bloodstream to supply energy.
- Our heart begins to beat harder and faster, our airways widen, and we breathe more quickly and deeply. As a result, extra oxygen is delivered to the brain, muscles and vital organs.
- Our muscles tense in preparation for action which can cause trembling.
- We may get a knot or butterflies in our stomach and a dry, 'cotton' mouth as blood flow is diverted from the digestive system to the muscles.
- Our skin becomes pale and cool as blood flow to the body surface (a non-vital area) is reduced. This also limits bleeding in the case of injury.
- Sweat glands, particularly on the face, palms, soles of our feet and armpits, activate. The combination of cool and wet skin feels 'clammy'.
- We may experience a temporary hearing loss (auditory exclusion) due to a noisy increase in blood flow in the ears.
- Our pupils dilate to allow in more light. This helps us see what is in front of us more clearly but limits our peripheral vision. We experience this as tunnel vision.
- The bladder relaxes which prevents us from urinating.
- Our sensitivity to pain decreases (helpful if we sustain an injury).
- We may have goosebumps caused by activation of skin muscles that make our hair follicles stand up, like frightened animals 'puffing up' their fur.
- Our emotions can range from agitation and anger through to rage in fight mode, and worry, fear through to terror in flight mode.

All of these changes happen incredibly quickly, in less than a second, before our brain's visual centers have even fully processed the scene (Harvard Health Publishing, 2020; MacCormick, 2020). Hence the familiar expression, "adrenaline (epinephrine) rush".

# Fight-or-flight: The SNS + HPA axis




If the threat continues for more than a few seconds, we move to the next stage of the defense cascade: fight-or-flight. A second biological mechanism of the stress response kicks in, the hypothalamic-pituitary-adrenal (HPA) axis.

The hypothalamus releases corticotropin releasing hormone (CRH). Which stimulates the master gland in the brain called the pituitary to release adrenocorticotropic hormone (ACTH). ACTH travels through the bloodstream to the adrenal glands where it causes the release of cortisol (Figure 6). Cortisol levels peak around 20-30 mins after the onset of stress (Vogel & Schwabe, 2016).

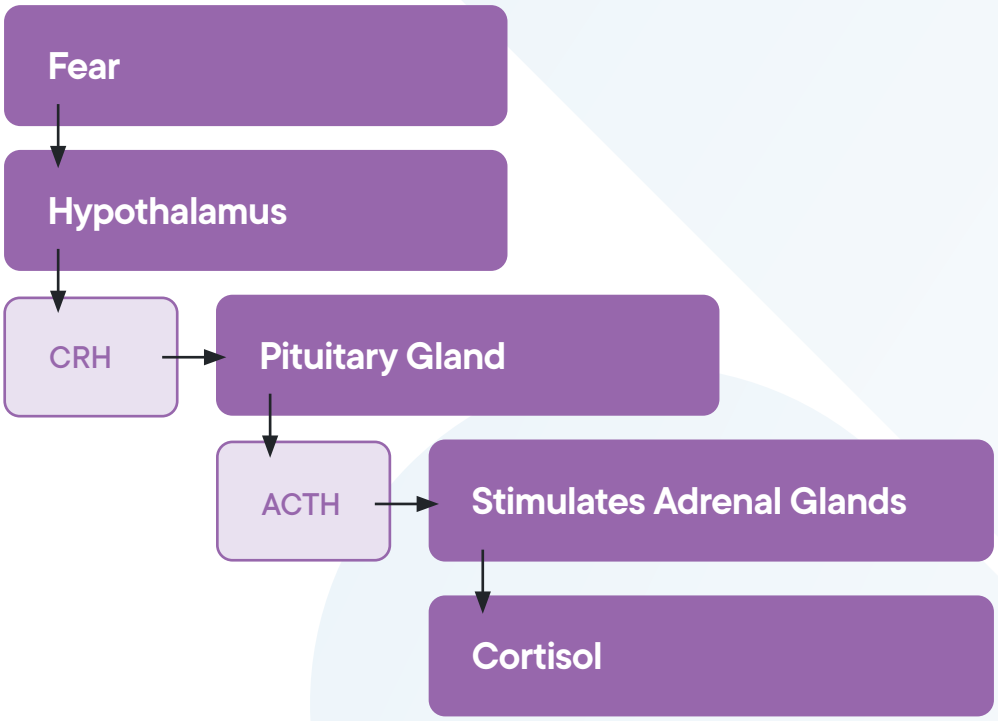
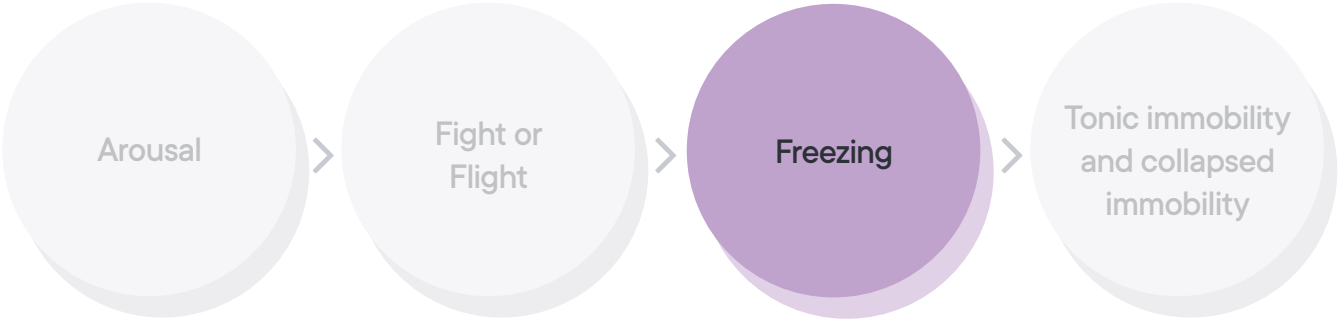



Figure 6. Release of cortisol by the HPA axis.

Cortisol affects most cells of the body and can also enter the brain where it affects cognition (thinking) and behavior (Vogel & Schwabe, 2016). Cortisol's functions include (Bancos, 2022; Better Health Channel, 2021):

- Mental alertness.
- Stimulating the breakdown of protein and fat to glucose to boost blood sugar levels and blocking the uptake of glucose into tissues other than the brain. These actions increase the energy available for fight-or-flight.
- Helping to maintain blood pressure.
- Reducing inflammation.
- Contributing to the function of the immune system.
- Assisting with memory formation.

## Freezing: SNS + HPA axis + PSNS




If a perceived threat escalates from dangerous to life-threatening, the stress response resembles something akin to a 'pile on': the sympathetic nervous system and the HPA axis remain activated, but the vagus nerve (parasympathetic nervous system) also becomes involved. Vagal activation causes a slowing of the heart rate that leads to immobilization. So, rather than fighting or fleeing, we freeze.

The freeze response has been called "fight-or-flight on hold", meaning we can move from a freeze back to fight-or-flight. It has been suggested that the purpose of a freeze, typically only a few seconds, is to allow time for conscious processing. For this reason, it is also called attentive immobility, meaning a highly alert but frozen state (Kozlowska et al., 2015).

## Shutdown (tonic immobility and collapsed immobility): PSNS


Tonic and collapsed immobility are shutdown states in response to inescapable, life-threatening danger. They are associated with trauma such as sexual assaults, war, plane and car crashes, and attacks by wild animals (Kozlowska et al., 2015).

Tonic immobility causes our body to become paralyzed, our heart and breathing rates to slow and our faces to become expressionless. We may find it difficult to think and speak. Emotionally this state can feel like dissociation, numbness, being trapped or an out-of-body experience (Puder, n.d.). Our body releases natural pain killers called endogenous opiates that produce a sense of well-being, mitigating the intensity of subjective fear (Kozlowska et al., 2015).

Collapsed immobility involves a physical collapse and a change in consciousness that can range from compromised to blacking out (Complextrauma.org, 2021).

These shutdowns occur because the SNS and HPA axis go offline. A parasympathetic surge causes our heart to slow down or even to flatline making shutdowns not only a response to life-threatening danger, but life-threatening in themselves.

## Business as usual: dominant PNS

When we feel safe and there is no threat in sight, epinephrine, norepinephrine and cortisol levels fall. Our ANS shifts to rest and recovery mode with the parasympathetic mode predominating. While the SNS system is the gas pedal in the stress response, the PSNS acts as a brake to calm the body down.

The parasympathetic nervous system operates the “business as usual”, basic functions of our body. Our heart rate slows, our blood pressure drops, breathing becomes slower and deeper, digestion resumes, and our sexual response become more active. Back to ‘rest-and-digest’ / ‘feed and breed’ mode.

Now that we’ve unpacked the biological mechanisms underpinning the stress response, it’s time to address a major misunderstanding.

# Optimizing stress: Inverted U-model

When most of us think about stress, the association is that it's bad and needs to be eliminated. But Stanford neurobiologist Robert Sapolsky explains that "the ultimate goal of those studying stress is not to 'cure' us of it, but to **optimize** it (Sapolsky, 2015).

Stress is a hard-wired biological mechanism designed to get us moving, acting, and performing. It turns out that we **need** a certain amount of stress to perform whether that performance involves writing an email, running a race, sitting an exam or navigating through traffic. Of course, too much stress creates anxiety and impairs functioning, but there is a sweet spot where performance peaks.

The relationship between arousal (stress) and performance, called the Yerkes-Dodson Law, resembles an inverted U (Pietrangelo, 2020; Yerkes & Dodson, 1908). In Figure 7 we see that when stress is low, we feel tired, bored and unmotivated. Performance is, not surprisingly, weak. As stress increases, performance improves and peaks as inactivity gives way to energy, alertness and motivation. As arousal increases further, performance becomes impaired as we move into fatigue (energy depletion), overload and anxiety. These changes reflect the physiological effects of epinephrine and cortisol at low, optimal and excess levels.

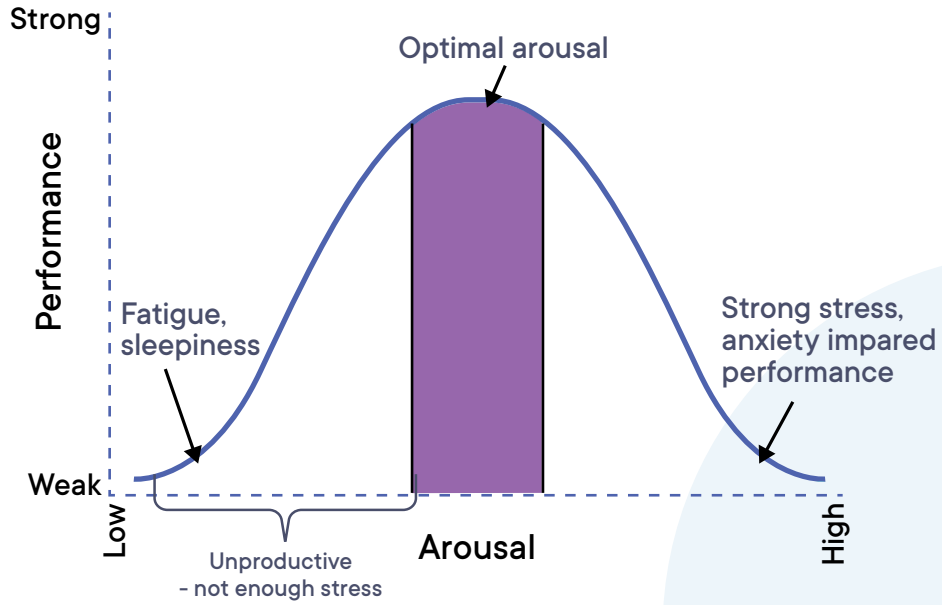



Figure 7. The Yerkes-Dodson Law describes the relationship between arousal (stress) and performance (Shorts in Psychology, 2018).

We can't stay at the top of the U-curve permanently. It is normal, and by design, that we will have fluctuations in epinephrine and cortisol throughout the day, with peaks when we experience events that are unpleasant to us. The stress response is our body's way of monitoring daily challenges and helping us adapt to them (Epstein, 2020). However, rest and recovery are required following periods of high arousal.

## Intensity and duration

> "...the response to stress depends on the nature, intensity and duration of a stressor" (Sapolsky, 2015)

We all understand that severe stress is detrimental. But what the Yerkes-Dodson law tells us is that mild-to-moderate stress is beneficial: intensity matters. This mirrors what we learned about stress from the defense cascade. At the right levels (arousal, fight-or-flight), the stress response is a highly effective form of mobilizing us into action. But, when the response is excessive (freeze, tonic and collapsed immobility), it's counterproductive.

The right amount of arousal for peak performance varies from person to person, changes over time for each individual, and depends on the task (Smith, 2020). Therefore, optimization requires personal experimentation.

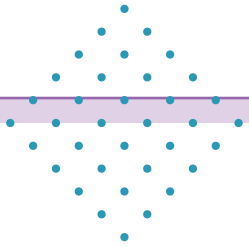
In addition to the intensity of the stressor being important, duration also plays a role. Transient (short-term, acute) stress is helpful whereas ongoing (long-term, chronic) stress is problematic. Neuroendocrinology pioneer Bruce McEwen coined the term "allostatic load" to describe the problems that are caused when stress systems designed to help us survive become overworked. His research led to the understanding that stress hormone effects are biphasic (have two phases); they are protective in the short-term but potentially damaging in the long-term (McEwen, 2013).

Tool #2

## Change your stress mindset

Because most of us believe stress is bad for us, researchers have identified a new phenomenon of “meta stress” where people report feeling stressed about feeling stressed (Brady et al., 2018)!

Yes, chronic stress needs to be avoided, but if you believe stress is universally bad, it’s time to change your mindset: short-term stress is good for you. View it as a way to enhance outcomes (Crum et al., 2020).



## Practical Exercise

1. What time of the day do you tend to feel most alert and energized? If you are unsure, monitor your energy throughout the day for the next few days.

2. Do you organize your workday to capitalize on your natural peaks and valleys of energy? For example, if you are more alert in the mornings, do you block out this time to work on demanding tasks that require a lot of energy and focus? Or, like most people, are you in the habit of reading and responding to emails (a less demanding task) first thing in the morning?

3. If your workday is not organized around your natural peaks and valleys of energy, there are two options for increasing your work performance:

    a. Rearrange your daily schedule (something you may or may not have much control over), and/or

    b. Use tools to temporarily boost your stress (arousal) to provide short bursts of energy, motivation and focus.

In the next section we will take a look at the upsides of acute stress and tools to turn the stress response on. In the final section of the resource, we will explore how to turn the stress response off.

# The upsides of stress

It should be clear from our discussion of the defense cascade that one way stress is good for us is that it helps us escape danger. But in what other scenarios might stress be positive? In this section we will explore the benefits of short-term stress in relation to (1) performance anxiety, (2) procrastination and motivation, (3) learning, and (4) an unexpected impact on immune function.

## Performance Excitement rather than Performance Anxiety

Our discussion of the stress response so far has focused on threats, danger and fear. But when else do we experience sweaty palms, a racing heart and a dry mouth? When we are excited.

It turns out that feeling scared and being excited both trigger the stress response. They are both states of high arousal in which epinephrine and cortisol surge; the only difference is that we associate excitement with positive emotions (Khazan, 2016).

Harvard Business School professor Alison Wood Brooks has studied how people perform in anxiety-provoking situations such as singing in public or giving a speech. What she discovered was that most people try to calm themselves down, an approach she says is entirely wrong (Brooks, 2014). Being calm in the body, with the parasympathetic nervous system predominating, represents a state of low arousal which we know is not helpful for performance.

Brooks found that it is easier for our brains to make the leap from negative high-arousal (feeling scared, nervous or anxious) to positive high-arousal (feeling excited), than to go from negative high-arousal to positive low-arousal (calm) states (Khazan, 2016). This brings us to our next two tools.

Tool #3

## Cognitive reappraisal

The technique Brooks used in her research was a cognitive strategy called anxiety reappraisal; she directed people in her studies to say either “I feel nervous” or “I feel excited” prior to their performance. Those in the excitement group objectively did a better job.

This technique didn’t actually lower feelings of nervousness or reduce heart rate because the stress response was still active, but the reframing meant that the stress enhanced performance rather than diminished it. Brooks recommends we ditch the slogan “Keep Calm and Carry On” and replace it with “Get Amped and Don’t Screw Up”.

Cognitive reappraisal has been widely studied as an approach to regulate stress. If telling yourself that you’re excited doesn’t appeal, another version of this method is to say “I have what it takes to manage this (fill-in-the-blank)” (Crum et al., 2020). Recall that one of the reasons psychosocial stressors are subjective is that people have different mental resources. By deciding you can cope with a situation, it is possible to alter your perception of it as a threat and therefore exercise some control over whether a stress response is triggered. This is an example of using your psychology to alter your biology.

Tool #4

## Mind-body disconnection

Huberman explains that what you want to achieve is, surprisingly, mind-body **disconnection** (Huberman, 2021d). Activation of the sympathetic nervous system creates a flood of epinephrine in the body. However, epinephrine cannot cross the blood-brain-barrier. This leads to a sense of agitation in the body while the mind remains calm. If your cognition (thinking) joins the party through thoughts such as “this is bad” or “this shouldn’t be happening”, then your brain will release its own supply of norepinephrine and further the sense of anxiety.

Creating this mind-body disconnection involves learning to tolerate the bodily sensations of stress. It takes practice. If you do meditation or yoga, you may be familiar with observing physical sensations without judgment. Over time you will become accustomed to the somatic discomfort and may even eagerly anticipate the stress response for the energy and alertness it brings. In the interim, Tool #3 offers a cognitive trick to deal with the uneasy feelings the fight-or-flight response generates. Tool #11 describes another practice to achieve the same effect.

## Procrastination and Motivation

Procrastination is a great example of the Yerkes-Dodson principle in action. When a deadline is far away, we are in a state of low arousal. We have no motivation to act. But as the deadline draws closer, our fight-or-flight response kicks in and suddenly we are highly productive.

When viewed through the lens of the biology of stress, procrastination makes total sense. The problem is that it may not leave us sufficient time to complete novel, challenging or lengthy tasks. In these situations, it can be helpful to know how to intentionally turn our stress response on rather than waiting for it to happen naturally. Let's now consider three tools to do this.

Tool #5

## Wim Hof Breathing Exercises

Wim Hof is a Dutch extreme athlete with an impressive list of physical feats including climbing Mount Kilimanjaro and Mount Everest in shorts, holding the Guinness World Record for the longest swim under ice, and running a marathon in the Namib desert without drinking (Learn, 2018).

Hof has developed a resource that involves deliberately inducing the stress response for short periods using physical stressors. There are three components to the Wim Hof Method (WHM): breathing and physical exercises, cold therapy and meditation.

Wim Hof breathing is similar to Tummo breathing, a component of an ancient meditation technique practiced by Tibetan Buddhist monks (Kozhevnikov et al., 2013). In research conducted by a Dutch university medical center, Hof's breathing technique was shown to produce large increases in circulating epinephrine levels (Kox et al., 2014).

Wim Hof breathing is a cyclic breathing protocol that consists of 25-30 rounds of rapid, deep breaths to induce hyperventilation followed by periods of retention (breath holding). To learn the technique in 15 minutes, follow the written procedure, video demonstration or download the app (Hof, 2019; Wim Hof Method, n.d.-c, n.d.-d). Pay particular attention to the safety instructions (Hof, 2017). The technique can lead to lightheadedness or fainting so should never be practiced in water or while driving.

Tool #6

## Cold therapy

Wim Hof earned the nickname “The Iceman” because of his ability to withstand freezing temperatures. A second pillar of the Wim Hof Method is cold therapy in the form of cold showers or ice baths. Hof notes that you will hate cold therapy to begin with but will grow to enjoy it.

To learn the protocol, click here, then click on the “Cold Therapy” menu on the left (Wim Hof Method, n.d.-a). Alternatively, sign up for a course on the Wim Hof website (there are free and paid options). Note that this technique is not appropriate to perform while sick or burned out, or with certain medical conditions outlined in the “Is this method for everybody?” FAQ (General section).

Tool #7

## High Intensity Interval Training (HIIT) or High Intensity Interval Exercise (HIIE)

HIIE protocols vary considerably but typically involve repeated brief sprinting at an all-out intensity immediately followed by low intensity exercise or rest. HIIT has been found to lead to elevated levels of epinephrine and cortisol, and is thus another technique for intentionally activating the acute stress response (Boutcher, 2011). There are many ways to perform HIIT workouts; spend some time online now to find one that is suitable for you.

# Learning

Up to this point we have focused mostly on the effects of stress on the body. But the stress response also has a profound effect on the brain. Processes related to learning such as attention and memory formation are impacted by norepinephrine and cortisol. This is not surprising when we consider that emotionally arousing and traumatic events are very easily remembered. If you've ever wondered about nootropics (also known as 'cognitive enhancers') like Adderall (Brody, 2019), we need look no further than to our body's own 'smart drugs' - norepinephrine and cortisol.

Earlier we discussed the nuances of intensity and duration in the stress story. It's time now to consider a further nuance - that of timing, i.e., temporal effects. It turns out that the timing of the stress response in relation to learning is quite complex.

Learning involves different stages of memory formation known as encoding, consolidation, retrieval and updating. Encoding is what most of think of as studying. Consolidation involves the conversion of a short-term memory into a long-term one (Squire et al., 2015). Retrieval refers to our ability to recall what's been learned and updating means altering existing memories.

As we can see from Figure 8, learning is enhanced by stress immediately before, during or just after a period of studying. It appears that this effect on encoding is stronger for emotional rather than neutral learning material (Payne et al., 2006).

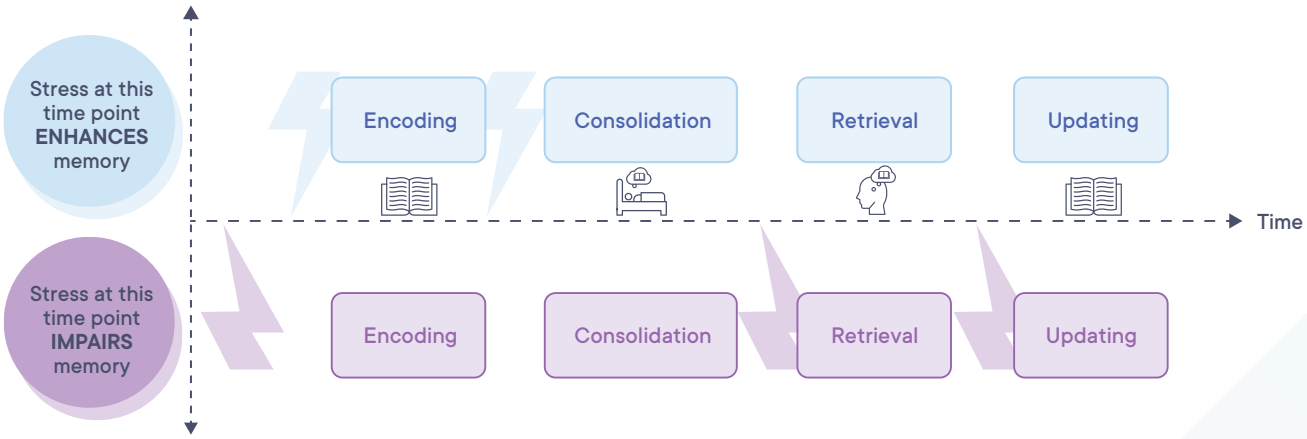



Figure 8. The effects of stress on memory depend on the temporal proximity between the stressful event and the memory process (Vogel & Schwabe, 2016).

If the stress response happens too early (30 minutes before learning), memory is impaired (Vogel & Schwabe, 2016). Consolidation is enhanced by a good night's sleep. Retrieval is harmed by a stress response immediately prior, as is updating.

Tool #8

## Learning protocol

Knowledge of the temporal effects of our stress chemicals has allowed researchers to design effective protocols for studying and sitting exams (Huberman, 2021c; Vogel & Schwabe, 2016):

- **Pre- and post-study stress:** temporarily turn on the stress response. Tools #5, #6 and #7 are some of the options.
- **Study session:** study for 90 minutes. According to Huberman, this is the optimal length of a study session taking into account the duration of action of epinephrine, norepinephrine and cortisol, along with the importance of not prolonging the stress response (Huberman, 2021d).
- **Sleep:** Get a good night's sleep after studying. (For more information about sleep, refer to our "*Secrets of Sleep*" resource.)
- **Pre-exam preparation:** Use calming strategies immediately prior to an exam. Test taking relies heavily on retrieval which is adversely affected by stress.

To learn more about the science of stress and learning protocols, particularly the impact on the rewiring of the brain (called neuroplasticity) necessary for memory formation, click here.

## Unexpected link to disease: immune function

It has long been known that inflammation is a core feature of autoimmune diseases such as rheumatoid arthritis and inflammatory bowel disease. However, inflammation is now believed to play a major role in common chronic illnesses including heart disease, cancer, diabetes, asthma and Alzheimer's disease (Zelman, 2020). The link between stress and disease is unexpected because most of us have only heard (the bad) half of the story: that chronic stress increases inflammation. But, as for performance anxiety, procrastination and learning, it turns out that acute stress can have a positive effect.

Until quite recently scientists did not believe that the autonomic nervous system could be voluntarily activated (Kox et al., 2014). It is our system for controlling **automatic** responses after all. It was also biomedical dogma that our immune system could not be voluntarily influenced. However, there is now substantial evidence that it is possible to intentionally activate the sympathetic nervous system (Tools #5, #6 and #7) which has led scientists to ask whether voluntary activation of the immune system might also be possible.

Researchers have developed a variety of methods to probe the workings of the immune system (Fullerton et al., 2016). One test involves injecting animals or people with a bacterial toxin called LPS. This causes an acute inflammatory response due to the release of cytokines from immune cells. If people are subsequently injected with epinephrine, this inflammatory response is significantly reduced.

In the 2014 Dutch study of the Wim Hof Method mentioned earlier, 2 groups of participants were injected with LPS (Kox et al., 2014). One group had been trained for 10 days in Wim Hof breathing, cold therapy and meditation practices. The other group received no training. As previously described, the trained group recorded substantial increases in epinephrine levels. Their inflammatory responses (flu-like symptoms such as fever, nausea, headaches and muscle aches) were significantly less than the untrained group, mirroring what was known about epinephrine's effect on inflammation.

This research is remarkable for two reasons. First, it showed for the first time that immune system function can be voluntarily altered, essentially on-demand. And second, the authors suggested that intentionally engaging the stress response to produce this beneficial effect on the immune system might be useful to treat the most significant illnesses of our time: inflammatory conditions.

Tool #9

## Immune protocol

The next time you feel a throat tickle, use one of the tools to turn on the stress response. This will turn the volume down on immune symptoms related to inflammation (Huberman, 2021d).

# Mastering stress

## Real-time tools for turning off the stress response

We've already explored three tools (#5, #6 and #7) for consciously turning on the stress response, hitting the gas pedal. It turns out that the braking mechanism, also hard-wired into our biology, can be consciously controlled too.

Huberman says that while there are many proven strategies for managing chronic stress, they often require learning, practice and time 'off-line'. Those that involve controlling the mind, like yoga, mindfulness and meditation, can also be difficult to perform when we are in a heightened state. He argues that when we need to reduce the intensity or duration of the stress response quickly, while still engaging in life, we need "real-time tools" targeting the body (Huberman, 2021a). Rapid response strategies have a direct line to the calming branch of the autonomic nervous system, the parasympathetic nervous system. They have the added bonus of being effective for sleep.

Tool #10

### Physiological sigh

When you inhale, your diaphragm muscle moves down, your heart gets temporarily bigger and the blood within the heart moves more slowly. The nerves in the heart's pacemaker (sinoatrial node) send a signal to the brain that the blood is moving slowly. Your brain responds with a little jolt of sympathetic activation to speed up the heart rate. When you exhale, the converse process happens resulting in the vagus nerve of the parasympathetic nervous system being stimulated, and the heart slows down.

Huberman says, “You can immediately take control of the diaphragm. So breathing represents a bridge between the conscious and unconscious control of the body” (Wapner, 2020). What determines whether sympathetic or parasympathetic activity predominates is the relative lengths of the breaths; if your inhalations are longer, the SNS will promote the stress response. If your exhales are longer, the PSNS will activate the brakes and promote a calming response.

There are many different ‘extended exhale’ breathing techniques, but Huberman recommends the ‘physiological sigh’ because it is quick to perform (Huberman, 2021a). The method involves a double inhale to helps the air sacs of the lung reinflate after stress, followed by a long exhale. The process is repeated a few times.

What also activates the parasympathetic nervous system? Eating. The vagus nerve is bidirectional, meaning it is both a detection system in the body that sends signals to the brain, and a response system that sends signals in the other direction. As your stomach fills, sensors trigger the vagus nerve. The brain responds by sending signals back along the vagus nerve to commence digestion. But because the vagus nerve branches off to many other parts of the body (vagus means wandering in Latin), other physiological effects associated with ‘rest-and-digest’, ‘feed-and-breed’ are triggered. So, if you’re in the habit of stress eating to feel calm, try the physiological sigh instead.

To see Huberman demonstrating the technique, view this video (Huberman, 2021b).

Tool #11

## Panoramic vision

Recall that the stress response causes tunnel vision. As panoramic vision is the opposite, it activates the parasympathetic nervous system. To change your vision, keep your head still and dilate your gaze so you can see above, below and to your sides, far into the periphery. This tool can be used to keep your mind calm while your body is agitated during an intentionally induced stress response. But aren't your eyes part of your body? Actually, no! Your eyes are brain tissue (Wapner, 2020). To watch Andrew Huberman explain this technique, click here (Ferriss, 2021).

## Stress inoculation

How we respond to the stressors we face is a key determinant of health and wellbeing (Crum et al., 2020). Optimizing stress is not primarily about eliminating stressors, what most people would call reducing stress. Instead, it's about learning to **regulate our stress** response and thus **adapting** to threats and adversities (Guidi et al., 2021; Huberman, 2021a). To buffer life events without feeling overwhelmed we need to **practice intentionally approaching stress** rather than avoiding it (Crum et al., 2020). This means knowing how to turn our stress response on and off on-demand. Huberman calls this approach to mastering stress 'stress inoculation'.

Tool #12

## Habits

The key to building long-term resilience to stress is having a regular practice of inducing short-term stress. The Wim Hof Method involves breathing exercises, cold therapy and meditation, ideally performed daily. Huberman suggests an alternative is to select one protocol that you know you can perform at least a few times a week (Huberman, 2021a).

Forming new habits is difficult for many people. Our resource, "*The Science of Productive Habits*" will show you how to get started and develop a habit that sticks. The key to consistency is starting small.

## Biopsychosocial model

For many years doctors subscribed to a 'biomedical model' of illness. They believed that health was the result of purely biological factors such as age, genes, immunity, hormones, etc. But around forty years ago, psychiatrist and internist George Engel (1977) proposed a radical rethink called the 'biopsychosocial model'. Engel's theory introduced two paradigm-shifting ways of thinking into Western medicine, that: (1) our thoughts and behaviors influence health, i.e., there **is** a mind-body (psychological-biological) connection, and (2) our health is also impacted by our social environment (the social-biological connection). This leads us to our final two tools, meditation and social support.

We've established that our psychology plays a role in how we perceive threats. Cognitive reappraisal is one psychological technique to regulate our stress response. Meditation is another.

Mindfulness Based Stress Reduction (MBSR) is an 8-week resource combining meditation and yoga developed by Dr Jon Kabat-Zinn. Researchers at Georgetown University studied the effects of MBSR on the stress responses of patients with generalized anxiety disorder by subjecting them to the Trier Social Stress Test (TSST). This test is known to stimulate the immune system resulting in inflammation. Compared with a group that received traditional stress management training, patients in the MBSR group produced less hormonal (ACTH) and immunological (inflammatory) stress markers after the social stress. This demonstrates that meditation enhances biological resilience to stressors (Hoge et al., 2018). This MBSR research is consistent with the Dutch study described earlier evaluating the benefits of the Wim Hof Method, which also included meditation, on immune function (Kox et al., 2014).

Tool #13

## Meditation

There are many ways to practice meditation. To learn MBSR, click here (Mindfulness Training, n.d.). The headspace app is another useful resource (headspace, n.d.). The Wim Hof website offers both free and paid courses that include meditation practices (Wim Hof Method, n.d.-b).

Tool #14

## Social support

Research shows that healthy relationships can reduce stress and improve your overall health (Harandi et al., 2017). For more information about how to create social support in your life, read this article by Dr Elizabeth Scott (2021a).

# Conclusion

This resource dispelled a number of misunderstandings including stress is bad for our health and that we have no control over it. Fourteen tools based on recent neurobiological research were provided to help you master stress.

# Takeaways

**Stress** is a physiological mechanism triggered by fear that prepares us to fight, run away or freeze.

Threats that trigger our stress response are called **stressors**. They can be physical or psychosocial. Our stress response is generic meaning one system reacts to all types of stressors.

Our responses to danger are hard-wired and automatic. The **defense cascade** represents the continuum: arousal, fight-or-flight, freeze, tonic and collapsed immobility.

Our **fight-or-flight response** involves the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis. The major chemicals involved in the stress response are epinephrine, norepinephrine and cortisol.

Our de-stress mechanism is also hard-wired. It's called the **parasympathetic nervous system (PSNS)** and it is the dominant system most of the time. The PSNS controls functions involved in feeding and breeding, resting and digesting. The vagus nerve is the main nerve that is activated during the calming response that follows a fight-flight-or-freeze episode.

Stress needs to be **optimized**, not cured. Short bursts of stress at the right intensity are needed to function in everyday life.

We can voluntarily **turn our stress response on** using hyperventilation breathing exercises, cold showers and ice baths, and high intensity interval training.

We can **turn our stress response off** by activating the parasympathetic nervous system using extended exhale breathing and panoramic vision.

The key to **mastering stress long term** is developing a habit to practice dealing with intentionally induced stress regularly.

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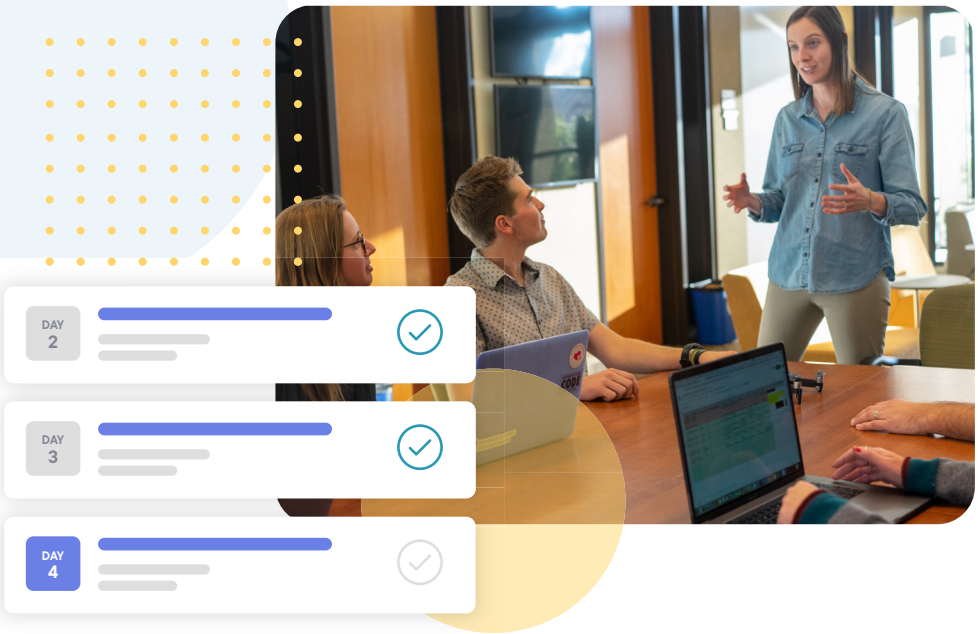


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