

Deep Resilience

“Stress is not a state of mind... it's measurable and dangerous, and humans can't seem to find their off-switch.” Robert Sapolsky Stanford Professor Primatologist and expert on stress author of *Why Zebras Don't Get Ulcers*

Pillar One: Maintaining Balance: Stress Response

Switzerland

*I was 17 living in Zurich, Switzerland, as an exchange student. I was spending an entire year away from home on an American Field Service scholarship. My thin frame was taking on weight. I was hungry all the time. I now had acne. I either could not sleep or slept too much. Looking at photos of myself from that time I am unrecognizable. My face looks like I am storing nuts in my cheeks I am so much fatter. What happened to my ballerina body?? What happened to *me*? Logic might tell you “Swiss chocolate is to blame, obviously!” **Logic would be wrong.***

This chapter of Deep Resilience is the story of the Stress Response and why stress matters. By understanding how the stress response works the reader will have a deeper understanding of one of our body's elegant feedback systems. It works constantly to maintain balance and homeostasis and keep everything running smoothly. However, just as with many feedback systems, though it aims to help us, it can also go awry and end up hurting us.

By considering the stress response we see a potent tool in Dr. One's medicine bag for measuring and maintaining balance. It shows how if “man is machine” he is a very complex one at that. The stress response also beautifully illustrates healthy hormesis in action. And finally, by keeping stress under control we improve mood, immunity, pain, inflammation and longevity. So the stress response demonstrates the concept that it all spins together thus optimizing deep resilience.

Furthermore, there are two popular sayings that need to be examined here. One is that “Stress Kills”. The other is one says “whatever doesn't kill you makes your stronger”. Both of these are misleading, and we'll look at why.

<p>By measuring the stress response, we make the <i>invisible</i> resilience sought by Doctor One <i>visible</i>.</p>
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Components of the Stress Response: Fast and Slow

There are two key aspects to the stress response, which is our body's response to attack. The autonomic nervous system and the hypothalamic-pituitary-adrenal axis. Robert Sapolsky describes the autonomic nervous system instantaneous response is likened to handing out machine guns. The hypothalamic-pituitary-adrenal axis is more like building aircraft carriers for the long haul.

Autonomic Nervous System: Fast Stress Response

The autonomic nervous system is, in a sense, "automatic". It does its work without our mind's input; it is an involuntary process. The sympathetic nervous system, the fight-and-flight is a primitive reflex, our savior when under acute attack. Restorative, longer-term concerns of the parasympathetic nervous system are put on hold in order to live another day.

Sympathetic Branch of the Autonomic Nervous System

The sympathetic part or fight-and-flight of the autonomic nervous system is the branch that leads to adrenaline and contrary its name, is not prone to taking the time for sympathy. It is fight or run for your life. This is a hardwired innate response that gives you that racing heart at the unexpected bark of a nearby dog, or at the threat of a fall, or at a testy conversation with your boss. It gives you butterflies in your stomach and cold hands when having to speak in public. By stimulating rapid heartbeat, dilated pupils, higher blood pressure we are enabled to flee or stay and fight. Energy resources pour into muscles and away from digestion or immune function. Fighting off a cold and digesting lunch can wait until you are safely up that tree.

Case study TC

TC was a young mother with 3 children under the age of four. She was hale and hearty. She was an athlete, a writer, educated, energetic and fun. But she was having panic attacks when driving on freeways and worse when having to cross a bridge. She had tried cognitive behavioral therapy to no avail. She did not want to take tranquilizers. She was quite worried. She could not live with the problem. She did not let herself be disabled by it, but it was taxing and scary. She needed to know that she could drive anywhere she wanted, she had to work. She knew that this fear was nonsense. But it was taking over her life. She came to my clinic and her case turned into a longer and more interesting story.

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But first, let us consider the other part of the autonomic nervous system.

Parasympathetic Branch of the Autonomic Nervous System

Parasympathetic activity is characterized by resting and digesting. This arm of the autonomic nervous system is essential for building and restoring, healing, and sleeping. It relies on the lengthy vagus nerve that is responsible for digestion and other restorative processes. The vagus nerve extends from the brain's medulla to the intestines and is involved in heart, gastrointestinal, immune, and endocrine functions. The vagus has tentacles everywhere, indeed its name is from the Latin for *wandering*. The words vagrant and vagabond are from the same root. Its sensing fibers detect a wide array of inputs. It recognizes pressure, pain, stretch, temperature, chemicals, osmotic pressure, and inflammation. The “gut feelings” that one experiences may well rely on these primitive inputs that bypass the brain. Because of this tight association between vagal activity and these vast unconscious inputs, the gut is called “the second brain”. The vagus is not only involved in the homeostasis of the digestive tract, but the generation of heart and respiratory rhythms.

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Hypothalamic-Pituitary-Adrenal axis: Slow Stress Response

Mechanisms of hypothalamic-pituitary-adrenal axis, a long complicated name for the slower aspect of the stress response, has cortisol, a steroid hormone, as its main agent. The secretion of cortisol is mainly controlled by three inter-communicating regions of the body; the hypothalamus in the brain, the pituitary gland and the adrenal gland hence the hypothalamic-pituitary-adrenal axis. You need only remember that

it is a hormone driven response. It is slower to act. Cortisol is released from the adrenal gland after the release of adrenaline and stays around longer. Cortisol binds to almost all cells of the body and leads to a decrease in immune response and alterations in glucose metabolism and other effects whose aim is to increase energy resources to fend off attack. The effect of cortisol is to stimulate fat and carbohydrate metabolism for fast sources of energy. And in turn it stimulates insulin release to maintain blood sugar levels. The end result of these actions in humans when prolonged, can be an increase in appetite and increased cravings for sweet, high fat and salty foods. The combined effect can lead to weight gain as a means of survival. Cortisol also leads to insomnia because it is a main driver of diurnal rhythms. It can spike at night, resulting in disturbed sleep. Also, it can exacerbate many skin conditions, but especially acne.

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Measuring cortisol would be one way to monitor the stress response, and indeed, many studies on stress include cortisol as a biomarker. But it is part of the slow response. A more dynamic means to measure stress would include the fast system, or autonomic nervous system.

Heart Rate Variability: Measuring Autonomic Balance

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“If the pattern of the heartbeat becomes regular as the tapping of a woodpecker or the dripping of rain from the roof, the patient will be dead in four days.” Wang-Shu Ho third century

Heart Rate Variability Analysis

When I first started my practice in acupuncture, I had a nagging question in the back of my mind. ***How had acupuncture cured my allergies?*** At the time, the prevailing hypothesis was that acupuncture worked through a process called “gating” whereby needles occupied nerve endings so that pain impulses could not reach the brain. But gating could not explain why my allergies disappeared with acupuncture.

By pure chance I heard a talk by Stanford Professor Primatologist Robert Sapolsky who had recently published his book “Why Zebras Don’t Get Ulcers”ⁱ. Sapolsky’s talk centered on the adverse effects of stress on many of the body’s functions, among them the immune system. This piqued my interest. After some searching, I found a monitoring method called heart rate variability which uses computer analysis of the variation of heart rate with breathing to measure the balance between the sympathetic and parasympathetic nervous systems. As you can see from the featured quote at the start of this section, the ancients knew the significance of heart rate variability in the context of health. The internal physics of the lungs expanding against the heart within its pericardium, as well as the innervation of the heart via the vagus plus the input of adrenaline makes this variability a complex measurement and follows rules of complexity science.

Through measuring these subtle forces on the heart, we can infer the overall balance in the autonomic nervous system which, in turn, affects the body’s many feedback systems.

Variability within certain bounds, is a sign of health in the system. Variability decreases with age, injury, stress, or depression. What makes the heart more human, the lovely variability, becomes more machinelike with challenges to the body. The real advantage as a clinician is that heart rate variability is a monitor that can be used at the bedside. We can get a snapshot of autonomic balance, or stress levels at a point in time, but we can also monitor heart rate variability over a period of time to, say, see the effect of a treatment or intervention over months.

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If man is a machine, he is a very complex one, a sophisticated collection of feedback systems aimed at maintaining homeostasis.

Case of TC continued

I treated TC with an acupuncture regimen for a common TCM condition that goes by the cunning name “running piglet.” In this syndrome, the patient exhibits gastric distress followed by a rapid heart rate and then discomfort and a sense of closing of the throat. This is not atypical for a panic attack. After 3 treatments she was showing rapid and remarkable improvement leading to a reduction of her panic attacks. She had dramatic and decisive success. She continued regular treatment, and then tapered off since her improvement was long-lasting. She remained free of panic attacks. How had this happened? What had the acupuncture needles done?

Her heart rate variability data provided one of the keys to the puzzle of acupuncture and stress, and perhaps how it had helped TC.

Decrease in Stress Response Correlates with Positive Clinical Response

My new heart rate variability monitoring system was in place when I treated TC. I measured her heart rate variability during acupuncture treatment with needling and then while she was resting with needles in. I was simply looking for patterns not knowing what I would find. It was an “aha!” moment when I noticed that all TC’s heart rate variability tracings showed a characteristic trend of a spike in her sympathetic fight-and-flight output with needling but then a subsequent decline below baseline. In other words, her result showed a decrease in autonomic nervous system stress response on the table after needling. When I compared TC to other patients, this pronounced decrease in autonomic nervous system stress response after needling was characteristic of patients who responded clinically to acupuncture treatment. Patients who did not respond

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promptly to treatment, did not show this stress response decrease after needling.

I wrote up this observationⁱⁱ and even though it was not a controlled nor blinded study the Journal of Medical Acupuncture was kind enough to publish it. Within months a German acupuncture study showed similar findings. In a group of migraine patientsⁱⁱⁱ the ones showing decreased fight-and-flight with acupuncture also had a reduction in their migraines. These studies and others prompted intense interest in the role of the autonomic nervous system in physiology of acupuncture research community.

Pillar Two: Hormetic Stressor to Increase Resilience

The transient increase in stress levels with needling, shows the body's reaction to needling which, we now know, sets off a series of cascades of reaction in the autonomic nervous system, in pain circuits, in immune responses, and in other homeostatic systems. Studies show that this minor challenge with acupuncture needles, leads to a decrease in stress and an increase in resilience. In this context, resilience means toughness in the face of a physiologic or emotional challenge. It is difficult to know how long this resilience might last after treatment, whether it is days or hours. We have some clues from animal studies.

Two recent studies looked at the effect of acupuncture on the stress response and startle reactions in beagles and in horses. Beagles treated with acupuncture were then challenged with a recording of thunder. The acupuncture not only reduced the spike in sympathetic activity fight-and-flight compared to control, but also decreased their physical reactions of hiding, restlessness, bolting and running around. Another study was done on horses showing that acupuncture attenuated the spike in sympathetic activity fight-and-flight upon a startle challenge (opening an umbrella near the horses' heads). These findings are quite remarkable and give us a key to Dr. One's strategy for maintaining balance in his patients. Regularly treat with acupuncture and you can stabilize this autonomic response and limit spiraling out of control.

We know these fight-and-flight reactions to challenges when they occur in humans can lead to impaired performance, poor judgment, or lead to a hypervigilant, fragile state. A study was done in athletes and they found that

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acupuncture before an event led to less anxiety and improved confidence and performance^{iv}.

Again, how is this possible? How can this minor intervention of needling lead to such a profound bodily change? It is because of the leverage of the elegant feedback systems of radical prevention that the good Dr. One knows. More is not always more, and small changes can lead to outsized results, as any good complexity scientist knows.

Acupuncture and stress response over time

We see that acupuncture in beagles, horses and (human) athletes can stabilize the body for minutes to hours after treatment. But what about a longer period over weeks to months? Because blood pressure is measurable by conventional means, Dr. Brenda Golianu and I studied heart rate variability over time in hypertensive patients^v. We found that blood pressure and sympathetic activity flight-and fight decreased over weeks to months in patients who were acupuncture responders. Mehta's group at UCLA subsequently confirmed these findings in patients with coronary artery disease showing a decrease in fight-and-flight over months with consistent acupuncture. They also showed a parallel decrease in biomarkers for coronary artery disease^{vi}. **This is more significant than one might think.** It is more significant because of the way our feedback systems work. If you can take away even one medication for hypertension in a patient, there is likely to be improvement in a patient's life from a decrease in side effects. In addition, lowering stress levels has positive effects on virtually every system in the body. You can set into motion a virtuous cycle leading to better mood, more exercise, a sense of control. A useful trick in Dr. One's doctor bag.

Short term stress as a healthy hormetic

Recent studies show that short term increases (minutes to hours) in sympathetic activity flight-and-flight can be good for the system. A type of hormetic. Indeed, there are studies that look at the heart rate variability levels for performance in flow states. An elevation in sympathetic activity can help achieve flow and higher performance^{vii}. During a recent podcast stress researcher Andrew Huberman^{viii}, a neuroscientist, said that adding a sense of a deadline or urgency can increase sympathetic tone or autonomic nervous

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system stress response. Interestingly he says that this increase might make you want to “get out and do something” leading to a type of restlessness. If you can manage to channel that stress and reinterpret it as excitement and keep working, you can harness this short-term increase in stress to become more productive and even achieve flow¹. Some level of sympathetic overdrive can be helpful in retaining memories and learned material also.

²Complexity Science for Measuring Resilience

This modern HRV, empowered by complexity science and computer processing power may become a way to measure results and treat for healing and prevention. We can use the hormetic of acupuncture to calm the body, to keep it from reacting so we can go back to resting and digesting rather than fighting and fleeing from phantoms.

Pillar 3: It all spins together

But what about the third pillar of Dr. One? How does this all spin together? How can this work for prevention? We have seen some clues but let us go back to our case studies to reflect.

Mind affects body and body affects mind: Two Stories of Modern Stress

“There is nothing either good or bad but thinking makes it so.” Hamlet by William Shakespeare

Mind Affecting Body : Switzerland

Given this understanding of a chronic stress response, my sudden transformation from a thin dancer, to a heavier, acne ridden, insomniac makes a lot more sense. The basic facts of the situation sound idyllic. A kid is

¹ A remedy for low energy sometimes can be to move, breathe, or, in general, get the body moving. Dr. Huberman recommends breathing in on the count of 5 hold for the count of 5 then exhale on 2 and hold for 2, then repeat.

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transplanted to a beautiful, prosperous city for a year in northern Europe and gains weight and has skin troubles. It must have been the swiss chocolate or sausages that led to her new self. Right? But let us consider in more depth. You take a teenager, still a child in many respects, who has only known one reality, her family, home and friends in Northern California, (radical Berkeley, no less) a far cry from the reserved reality of Zurich, Switzerland. Whatever its attributes, Zurich is still a foreign environment, with no familiar family, no friends, but more importantly no meaningful way to communicate. Instead of a large, integrated, raucous public high school she was now in a buttoned up all-girls school. She looks dramatically different from her classmates, a stranger in a strange land.

Consider also this was decades before cell phones or internet. The goal of American Field Service exchange was total immersion to ensure that the student got the most out of the experience. So, no phone calls, packages, funds from home allowed, only letters. And though that teenager desperately wants friends and music and fun, she cannot speak. Not only does she not know German (5 years of French, thank you very much) but her peers speak Swiss German, yet another language, when not in class. As a result, to her classmates she sounds like a backwards child. She cannot understand their jokes and it is impossible to convince them of how cool she is. She is alone and homesick and starving and seeking food and desperate to learn German.

As a result, to her classmates she sounds like a backwards child. She cannot understand their jokes and it is impossible to convince them of how cool she is.

But of course, there was no prehistoric threat, no threat of bodily harm nor danger. No war, no famine, no violence. What we have is a teenager transported to a civilized city with no cares in the world, whose whole body spins out of control because of the *interpretation* of her experience.

But consider that, as humans, we are tribal. An expulsion from the tribe meant death to our primitive selves. It is not surprising that fear of ridicule or ostracism is so deeply ingrained in our nervous systems. She was a fish out of

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water. Her new life requires constant studying, learning German, trying to survive, to show that she is not foreign, not other. And this does not last a weekend, this is a full year. The body reacts, and the stress does not relent and goes into a chronic state.

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Teenage Angst is Real

To be fair to my teenage self, teenagers suffer terribly from this phantom stress of being uncool, of being shunned, of not belonging and it can lead to the ultimate spinning out of control, suicide being a top killer of teens. Horrifically we have added to our stress in some cases, especially for young people, with the 24 hour a day internet and social media where comparisons do not even stop at home. Just when you need to have great quality sleep to perform in school and everyday challenges, the overabundance of cortisol and adrenaline can wreck that too, so it can degrade your mood even more. **Which is partly the point here. In the modern “first world”, many of our threats are virtual.** Obviously not all, by any means. But the point of my Switzerland story, is that threats, even phantom ones, can really do a number on our systems. Humans are unique in this. This is why the landmark book by Robert Sapolsky called “Why Zebras Don’t Get Ulcers” had such an impact on popular thought.

In retrospect, I have no doubt that I had elevated cortisol. So take this safest of safe situations I was in, and extrapolate to the plight of refugees, or teenage army recruits, or young people in precarious neighborhoods here in the U.S. and you can see how stress can affect everything and cause spinning out of control .

What Doesn’t Kill Does **NOT** Always Make You Stronger

In my own case, I was lucky. I started to feel better in the last month of my Swiss stay, my skin cleared, knowing I would soon be home. The physical changes I experienced were transitory. The experience perhaps made me stronger. Unfortunately, for people who live in poverty or in war torn

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countries, the stress is not transitory. The stress can do lasting damage. That struggling against adversity, the trope that “what kills you makes you stronger”, is not the case when it is relentless. In fact, the stress affects parts of the brain that lead to poor wiring that then leads to even more stress. This is the bleak conclusion of the stress research community who are becoming vocal in drawing attention to this dire situation in disadvantaged communities. They loudly advocate for measures to alleviate the pronounced inequality in the U.S. that that can have lasting adverse effects on young lives.

Body Affects the Mind

How do we explain TC’s prompt response to treatment? As with many patients with panic attacks, it is often unconscious body reactions that generate an exaggerated fight-and-flight response. It may be the downside of our “second brain” the gut, that senses something without our awareness. Once the attack starts, however, the mind leaps into action to try to find an explanation. “I’m dying. I’m going to die.” The experience is so vivid, so intense, for the person that it can be impossible to talk themselves down. They can end up in the Emergency Room with thoughts perpetuating the distress. Going forward, the patient will then fear being triggered, so that just worrying about a triggering event can cause a full-blown panic attack.

In TC’s case the acupuncture might simply have calmed her body, perhaps in a similar manner to the beagles, the horses, and the athletes. By treating with acupuncture, the body becomes sturdier and more resilient, so it has fewer unconscious fight-and-flight reactions. This is the dominion of Dr. One. This is radical prevention.

It would be helpful to have a way to show this type of resilience. So even in the absence of symptoms to track, you could measure progress or its opposite. This is another potential role for heart rate variability, and one that might have been embraced by the ancient Dr. One.

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Measuring Resilience: Radical Prevention

Studies correlating HRV with overall health and well-being and even likelihood of contracting “noncommunicable disease” suggest that HRV may correlate with resilience. This makes sense from the standpoint of complexity science. In the Introduction to Deep Resilience we discussed the new role of complexity science in understanding physiology.

In a task force on the use of Complexity Science in the context of Complementary and Alternative medicine, the value was described this way:

“Complexity-based tools may present a revolutionary bridge between qualitative and quantitative measures. Terms such as adaptability, robustness, or health were previously considered qualitative terms and thus were quantitatively intractable. ...complexity science offers a conceptual framework that reflects reality better. In the real world, small inputs can have large effects, processes are dynamic, interactive effects can span across many temporal and spatial scales, and transformations from one state to another can happen gradually or precipitously.

The authors go on to discuss heart rate variability specifically.

“Because heart rate is dynamically balanced through many elements, including the autonomic nervous system, respiration, hormones, and other physiologic systems, the heart theoretically should be responsive to, and exhibit increased complexity across, multiple time scales in concert with fluctuations in these elements. The temporal changes of a variable therefore may contain hidden information that is useful for describing the overall system. This capacity to capture the global state of a system or an individual suggests these complexity-based measures may act as surrogates for concepts that were traditionally difficult to measure but considered important for Complementary and Alternative Medicine (CAM) research (e.g., “health” and “adaptability”).

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HRV as measure of Resilience and Health

Self-rated health.

A research group looked at heart rate variability and correlated it with other biomarkers of health such as inflammatory markers. They conclude,

“Investigating the associations of self-rated health: heart rate variability is more strongly associated than inflammatory and other frequently used biomarkers in a cross sectional occupational sample. We showed that a global measure of self-rated health is associated with Heart Rate Variability, and that all measures of Autonomic Nervous System function were significantly more strongly associated with self-rated health than any other biomarker. The current study supports the hypothesis that the extent of brain-body communication, as indexed by Heart Rate Variability, is associated with self-rated health”.

Overall well-being

The authors of another recent study of Heart rate variability say
HRV

“has emerged as a physiological indicator for emotional regulation and psychological well-being. In clinical populations of either depression or anxiety, Heart Rate Variability was lower compared to controls. In non-clinical populations of either depression or anxiety, Heart Rate Variability was found to be lower [indicating higher fight-and-flight] in those who reported more depression or anxiety symptoms. Heart Rate Variability.”^{ixx}

Other Authors look at using heart rate variability as a public health predictor of non-communicable disease^{xi}

This article points out the tight association of parasympathetic activity, rest-and-digest, with ability to mitigate the behavioral factors that contribute to the global burden of diseases which are the big killers. Cardiovascular disease, cancer and lung disease all have some behavioral component. By increasing HRV, or parasympathetic activity, you reduce this risk and improve the prognosis for global burden of disease. This group advocates monitoring HRV

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and implementing vagal nerve stimulation as a therapy, though acupuncture can achieve similar ends.

“Global burden of diseases (GBD) includes non-communicable conditions such as cardiovascular diseases, cancer and chronic obstructive pulmonary disease. These share important behavioral risk factors (e.g., smoking, diet) and pathophysiological contributing factors (oxidative stress, inflammation and excessive sympathetic activity). This article wishes to introduce to medicine and public health a new paradigm to predict, understand, prevent and possibly treat such diseases based on the science of neuro-immunology and specifically by focusing on vagal neuro-modulation. Vagal nerve activity is related to frontal brain activity which regulates unhealthy lifestyle behaviors. Epidemiologically, high vagal activity, indexed by greater heart rate variability, independently predicts reduced risk of Global burden of diseases and better prognosis in Global burden of diseases. Biologically, the vagus nerve inhibits oxidative stress, inflammation and sympathetic activity (and associated hypoxia). Epidemiologically, high vagal activity, indexed by greater heart rate variability (HRV), independently predicts reduced risk of GBD and better prognosis in GBD. Biologically, the vagus nerve inhibits oxidative stress, inflammation and sympathetic activity (and associated hypoxia). Finally, current non-invasive methods exist to activate this nerve for neuro-

Epidemiologically, high vagal activity, indexed by greater heart rate variability (HRV), independently predicts reduced risk of Global Burden of Disease and better prognosis in Global Burden of Diseases.

modulation, and have promising clinical effects. Indeed, preliminary evidence exists for the beneficial effects of vagal nerve activation in diabetes, stroke, myocardial infarction and possibly cancer. Thus, we propose to routinely implement measurement of HRV to predict such GBD in populations, and to test in randomized controlled trials effects of non-invasive vagal nerve activation on prevention and treatment of GBD, reflecting possible neuro-modulation of health.

Radical Prevention or the Prevention of the future.

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HRV is a modern tool to monitor an ancient concept of balance which can foster deep resilience. Through measuring these subtle forces on the heart, we can infer the overall balance in the autonomic nervous system which exerts its effects on the body's many feedback systems. Because of the tight mind/body connection, this leads to an overall health described as wellbeing.

In considering the powerful nature of nonlinear responses where small inputs can lead to outsized results, as we have done in this chapter, consider a corollary in Malcolm Gladwell's book *Tipping Point*. One of the facts he points out is that epidemics and viral marketing are nonlinear, complex phenomena. He makes the case that typical advertising is "loudness". The concept in advertising is that "more is more" and lots of repetition is the name of the game. Loudness, he says, is a limited strategy because there is so much ambient noise. The name of the new game is to find ways to leverage a nonlinear mechanism in messaging, using concepts such as "virality", "stickiness" etc.... I see acupuncture and other nonlinear health solutions similarly. There will always be a role for medications, joint replacements, trauma surgery. But the "moon shot" here is to be able to trigger and harness our own feedback systems, avoid harm and help it all spin together. By learning better, smarter ways to do this we stay tougher and more resilient. In the longevity chapter we covered some of the ways to introduce healthy hormetic habits such as fasting, cold and heat challenges and exercise.

Because challenges in modern life are many (pollutants, upheaval, food contamination, epidemics), rather than finding individual means to counter each and every challenge, we foster tough resilience in the individual and enter into the prevention of the future.

We need to study acupuncture to evaluate ways to make it more effective. We are getting there, and the potential could be substantial. It may be that "more is more", in that more frequent acupuncture would help stabilize the system more. But it may be the case that other qualities may be more important, just as in the case of Gladwell's marketing example. This may be where biomonitors like heart rate variability are well suited to developing and measuring a new kind of resilience and to recognize better treatment strategies. Because challenges in modern life are many (pollutants, upheaval, food contamination and

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epidemics), rather finding individual means to counter each and every challenge, we foster tough resilience in the individual and enter into the prevention of the future.

It all spins together. In this chapter we have looked at how the stress response can affect the mind/body interaction as an example. By decreasing fight-and-flight response you affect multiple systems in the body, from immunity and inflammation to mood and pain. These conditions do not sound life threatening, but keep in mind that all of these play a role in the big killers ie cancer, and heart disease. We will be revisiting this most crucial feedback system in the coming chapters to see how all systems spin together. How can we best keep them from spinning out of control? Dr. One's principles will show us the way.

Photos follow.



Summer before leaving for Switzerland

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Summer before Switzerland

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10 months into Switzerland stay, May

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ⁱ *Why Zebras Don't Get Ulcers*, Robert Sapolsky, W.H. Freeman and Co. 1998 USA

ⁱⁱⁱ K Sparrow [Analysis of heart rate variability in acupuncture practice: can it improve outcomes?](#) *Med Acupunct.* 2007 Mar;19(1):286-290

ⁱⁱⁱ Migraine paper from...

^{iv} <https://ksparrowmd.com/acupuncture-decreases-competitive-anxiety-prior-to-a-competition-in-young-athletes-a-randomized-controlled-trial-pilot-study/>

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^v Sparrow K, Golianu B. Does Acupuncture Reduce Stress Over Time? A Clinical Heart Rate Variability Study in Hypertensive Patients. *Med Acupunct.* 2014 Oct 1;26(5):286-294. doi: 10.1089/acu.2014.1050. PMID: 25352944; PMCID: PMC4203477.

^{vi} UCLA study Mehta PK, Polk DM, Zhang X, Li N, Painovich J, Kothawade K, Kirschner J, Qiao Y, Ma X, Chen YD, Brantman A, Shufelt C, Minissian M, Merz CN. A randomized controlled trial of acupuncture in stable ischemic heart disease patients. *Int J Cardiol.* 2014 Sep 20;176(2):367-74. doi: 10.1016/j.ijcard.2014.07.011. Epub 2014 Jul 11. PMID: 25103909; PMCID: PMC4160354.

^{vii} Study on flow

^{viii} Joe Rogan Episode 1513 with Dr. Andrew Huberman. Stanford Neuroscientist

^{ix} <https://ksparrowmd.com/hrv-and-wellbeing/>

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^{xi} Gidron Y, Deschepper R, De Couck M, Thayer JF, Velkeniers B. The Vagus Nerve Can Predict and Possibly Modulate Non-Communicable Chronic Diseases: Introducing a Neuroimmunological Paradigm to Public Health. *J Clin Med.* 2018;7(10):371. Published 2018 Oct 19. doi:10.3390/jcm7100371