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# Teaching Patients About How We Humans Deal With Stress

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## Introduction

This paper is broken down into two parts. Part One is to help give a therapist a story to tell to patients that will help open a discussion about how people can deal with stress in their busy and hectic lives. The story is based in science but told in a non threatening way to teach and encourage further discussion.

Part Two is an overview of the science of stress. It is meant to give the reader background information to compliment Part One.

So I hope you are sitting comfortably, let's begin...

I practice in a very conservative community. When talking with clients concerning how life stress influences people, I have to be careful not to inadvertently offend. My goal is to teach the science around stress and life without stepping on religious toes. I find it best to do this in the form of a story. In Part II we will go through a quick overview about the science of stress to help you stay up to date on the subject.



## Part I: The basic story

A long time ago, before cell phones and the internet, even before television or the invention of the radio, people spent time together. It was so long ago that there were no cities, nor towns not even little villages. Back then people spent time together as large extended families. Back then there were no schools, the way we think of schools, or employment in the way we think of having a career or a job.

Back then people spent time worrying about being noticed by bigger animals, especially animals with big teeth. Back then their job was to survive and teach their children how to survive.

I want you to think about this for a second. We humans are only so strong—we don't have large teeth or powerful jaws, we can't run very fast and we definitely can't easily fight off a large scary wild predator that wants us for dinner. We tend not to think about this much, but our ancestors were probably seen as pretty tasty lunches and dinners.

Even back then we humans were not completely useless at protecting ourselves. We tended to stay in small groups and we learned to make weapons out of branches and rocks. We also had the ability to learn from each other. We were, and still are, good at watching and copying a good idea. We were good at working together for the protection of the group.

### **One other thing we had was a big brain**

Our big brain allowed us to communicate and learn. Scientists have learned that our bigger brain developed, over a long period of time, on top of our existing brain. This

is important, because without the existing brain, often called the reptile brain, we would not have been able to grow our bigger brain.

### **Let's look at life back then**

On this day in the story of our ancestors, a small group of people is foraging for food in the woodlands. It is a group of as many as 20 people gathering food to bring back to the whole group.

All of a sudden, there is a large cracking sound of a branch breaking. Here is where the story gets interesting. The group of human foragers freezes for a split second, listening for more information. Is it Uncle Joe coming to help find food, or is it a large tiger looking for dinner for her family?

A little girl of maybe 8 or 9 is closest to the surprising noise. Let's look at what is going on inside her mind. How did she react to the noise?

We know first she froze, her eyes got big, and even the pupils of her eyes opened fully. The hair on the back of her neck stood up, but seeing she doesn't have any actual hair there, she simply got goose bumps. The skin on her scalp pulled back slightly and the muscles of her face pulled back, her lips separated and curved up—letting her teeth show. Her ears were working overtime attempting to hear the slightest information. Is it Uncle Joe or a hungry tiger?

The little girl takes a deep breath. Her shoulders are back, and her chest is as round as possible. She is no match for a hungry tiger, but she has to at least try to look dangerous. Or is it best to stay perfectly still hoping not to get noticed? Which is the right thing to do?

The little girl's insides are preparing to run or fight. Her brain is sending emergency chemical messengers throughout her body. It has only been seconds but her brain is signaling her heart to pump faster. "We need more blood in the arms and legs," the brain screams. "We will need to fight or run, either way let's get more oxygen rich blood to the arms and legs!"

The brain signals the stomach to stop digesting, "There's no time for that nutrition stuff now, we're in danger." The brain sends the blood from her gut to her arms and legs.

At this point the little girl is breathing very quickly. Her blood pressure is through the roof and her brain is sending special orders to her circulatory system to keep the blood pressure high. "We have to make sure the oxygen and the glucose get to the arms and legs." The little girl has never even heard the words "oxygen" or "glucose", but her brain is taking care of all that automatically.

### **It is interesting what is going on inside the little girl**

The muscles of the little girl's arms and legs use oxygen and glucose to make energy. The oxygen is breathed in. The more oxygen the little girl needs the faster she must breathe.

Glucose (glu•cose) is the basic packet of energy used by the human body. The little girl eats food and her body extracts the glucose from it. Glucose is pretty easy to find in nature, and the sweeter the food, usually the more glucose it contains. If this little

girl needs to fight or run, she will not be able to stop for a snack, in fact as we learned earlier, her brain has already started to shut down her whole digestive system.

In the little girl's muscles and liver she has a type of energy storage called *glycogen (gly-co-gen)*. Glycogen is a large group of glucose energy packets formed into branches. In an emergency, the little girl's body can quickly break these branches apart and get the energy she needs.<sup>1</sup>

## **The little girl's brain is controlling the whole show**

As soon as the brain hears the crack of the branch, it jumps into emergency mode. The little girl's brain reacts to the possible danger by sending chemical messengers throughout her body. The chemical messengers have very large names that are more like sentences, so I like thinking of them altogether as Tiger Juice. When the little girl's brain thinks that it may be lunch for a tiger, it orders Tiger Juice to be squirted into the blood stream. The goal is to stay alive.

## **Tiger Juice**

Tiger Juice is amazing. It sends directions to lots of different parts of the body, and within seconds, the body does what it is told.

One thing that I find amazing about Tiger Juice is how it effects the brain. It is personal to each of us. You have probably heard about this. It is often called the "*fight or flight response*". This is an old term, more and more psychotherapists really think of it as the *freeze, flight, fight or fright response*.<sup>2</sup> This is definitely a mouthful, but it more accurately depicts the process that humans go through when they feel endangered. First, we freeze and quickly gather information through all of our senses. Then we try to escape the danger; we take flight. If we can't escape, we fight to protect ourselves, or we go into fright, we totally shutdown and become motionless. Scientists call this type of fright *tonic immobility*. Tonic immobility is a natural state of paralysis that may occur when one is in overwhelming danger. It is often called "playing possum" or "playing dead".

For some people, Tiger Juice makes them prone to fight while others are prone to fright. What is cool about this is that you and I don't have any say about this whole thing. The brain takes over by pumping Tiger Juice and we simply react. That is why it is called a response. In psychology this type of response is outside of the person's initial control, like flinching at an unexpected loud noise.

When it comes to how a person reacts to fear, no one knows for sure how they will respond. And there is a good reason for this. If every human that sees a tiger runs away, always follows the exact same escape pattern, 3 steps left, 6 steps to the right, then 9 steps to the left, we would become predictable. In no time tigers would be talking smack about us. "Hey Mustafa, you go scare that chubby human over there and I'll go wait for him to run by that rock way over there. I think these people should be called 'meals on wheels'." Predators are smart and fast, if we became easy to catch, we would've all been dinner.

Tiger Juice makes us think randomly. Our thoughts just go everywhere. This is good for running or fighting. We never really run away the same way twice. Even when

we stand and fight, we punch, kick, and bite all crazy like. We become hard to deal with. If we are really hard to deal with, hopefully the tiger will go find another species to dine on.

### **Our insides are affected**

This may be a little gross, but we might not even hold our pee and poop well when we are really scared. The Tiger Juice tells the bladder and the bowels, “Get rid of everything, we are in a fight for our lives. We don’t have enough energy to carry all that waste around!” If you just ate, you may even give back your meal. Again, no sense in keeping the kitchen open if the house is on fire! We don’t have time to digest, we have to survive!

### **The human brain is old**

I tell you this story because the brain is very powerful. But, the human brain is also stuck in its ways. What I mean by this is that the brain doesn’t know the difference between reality and fantasy. Please, let me explain. I am personally afraid of heights. Most of the time it is no big deal. I don’t do a lot of tree climbing or vine swinging. But on a regular basis I will be at the movies, sitting in a comfortable chair with my drink, and enjoying my popcorn, when WHAM!!! I’m being thrown off a cliff or out of a window! I hate that. I feel it deep inside and it is not a good feeling. In reality, I was not just thrown off a cliff. But my brain is not good at telling the difference between reality and movie magic.

Think about my *feeling* for a moment. I’m calmly sitting in a theater then... all of a sudden, Tiger Juice. My brain is acting as if I’m really falling out of the 23<sup>rd</sup> story window. Wow. My brain doesn’t really know me. I wouldn’t even get close to a second story window. My feeling of falling was real to my brain. My brain thought I was in danger because of a scene in the movie.

### **Our brains get easily tricked into thinking that we are in real physical danger**

Recently in my office Mary told me,

I have constant feelings of tightness in my chest. On a regular basis at night my legs ache and I seem to be getting frequent headaches. I’m feeling grumpy all the time and little things make me want to lash out or go and cry. I’m worried that I am becoming forgetful. I’m missing appointments and even flaking on friends and my kids.

I asked her as delicately as I could, “Having problems with your digestion?”  
“Yes, how did you know? I have diarrhea a few times a week. I’m constantly worried that I may be getting stomach cancer or something.”  
“How about your sleep?” I asked.

“I’m able to get to sleep, but I tend to wake up and can’t get back to sleep. Some nights I wake up and I’m all sweaty. I feel tired all the time. I worry that I may be getting a brain tumor or something,” Mary said.

I continued, “When you feel stressed or anxious, where do you feel it?”

“Often I have a tightness in my chest, sometimes it is like an elephant is sitting on my chest,” Mary looked worried. “It happens a lot at work. I told my doctor about it and he suggested medication, I don’t want to take medication. But I don’t want a heart attack either. I had a stress test and the doctor said that my heart was fine. Then he sent me to you.”

The medical doctor was concerned about Mary’s stress level.

## **Let’s look at what is going on with Mary**

Mary is a department manager in a large corporation. She has 5 subordinate employees and 3 direct bosses that she sees almost every workday.

Mary is sitting at her desk and a boss walks by and looks at her for a moment. Mary notices the look and feels the tension. “Oh, what now!” she thinks to herself. “He better not want me to work overtime, I have to get the kids to soccer, and I have to get gas just so I can pick up the kids, and I have to get snacks...”

Mary’s brain also noticed the boss’s look. “Was it an attack? Was he looking past me? What is going on?” The Tiger Juices starts to flow. Remember, the brain doesn’t know the difference between a real attack or a social misunderstanding. When under attack the brain only knows freeze, flight, fight or fright!

The boss walks over to Mary and says, “Mary, I’m sure you won’t mind, you understand, we have to get the Thompson bid out tonight and...”

Mary has been in this situation a lot lately. Her husband has been a jerk, the kids have been bickering constantly, and the boss just doesn’t understand. “I can’t,” Mary screams! “I have soccer and gas!” Then she runs off to the lady’s room red faced and breathing like a marathon runner.

### **What just happened?**

When we are just going through our day and feeling ok about stuff, the brain is producing Calm Juice. Calm Juice is the opposite of Tiger Juice and the brain never puts Calm Juice and Tiger Juice out into the system at the same time. You only get one at a time. Think of it as if you were stepping on the brake and the gas in your car at the same time. That would be a waste.

When Calm Juice is out, people feel content and safe. More Calm Juice and they feel even more content and safe. Even more Calm Juice is the feeling of happiness and amazement flowing through your body.

When Tiger Juice hits the system, we feel endangered, uncertain, and fearful.

When Mary’s boss looked at her, Mary’s brain pumped Tiger Juice into her system and picked up Calm Juice. Mary felt as if she was being attacked by the boss. Her logical self knew she was not being attacked, but remember her brain doesn’t know the difference between reality and fantasy. Her brain detected potential danger and did

its job—protect Mary at all costs. When Tiger Juice comes out, logic is taken off line. Logic belongs to the thinking state brought on by Calm Juice.

### **Prolonged stress is dangerous.**

As Mary felt the pressure of her life boil over, all the bodily changes that Tiger Juice ignites kicked into action. Tiger Juice is very hard on the body. It puts the blood pressure way up, it stops digestion, and it forces the gut's blood towards the extremities. Pushing all that blood is a lot of work for the heart. But, it's life or death, so it's worth the wear and tear on the body. However, we do not live in the wild where we may get into danger every now and then. We live in our communities where we can trigger Tiger Juice many times per day. We get cut off in traffic, Tiger Juice. We get growled at by our teenager, Tiger Juice. The thought of our bills, taxes and... well you get the point... more Tiger Juice. All these life stressors lead to Tiger Juice coursing through our veins.

If you are being chased by a tiger, your heart will pump frantically. This pounding will cause damage to the muscle tissue that is your heart. After you survive the tiger scare, your heart muscle will heal. But, and this is a big but, what if you are feeling attacked by life's stress constantly throughout your day? Every day. Day in and day out. When does the small wear and tear of the heart muscle get to heal?

## **Stress is harmful**

Stress is a normal part of life. And its effects on each of us is dependent on many emotional and physical factors. What is stressful to one of us is relaxing to another. Some people seem more aware of the feelings of stress in their daily lives than others. These hyper-vigilant individuals seem more prone to the ill effects of stress. However, research has shown that excessive stress is harmful to everyone's physical and mental health.

### **Let's look at some of the common side effects of Tiger Juice on the body:**

Most of the symptoms discussed below occur over time. These symptoms are warning signs.

#### **Headaches**

- Tiger Juice causes the eyes to dilate. This allows in all the available light. Often this is too much light for the back of the eye.
- Tiger Juice causes the back of the neck to tighten, pulling the scalp back. This is often reported as "a tension headache" or "a stiff neck".

#### **Abdominal pain**

- Frequently the only symptom of anxiety (especially in a child)
- Diarrhea or frequent need to urinate are common side effects of Tiger Juice.

### **Dizziness/Hyperventilation**

- Often due to the movement of blood to the extremities and the vast increase in respiration.

### **Muscle tension/twitching or trembling**

- Tiger Juice makes the muscles work overtime. It keeps muscle tissue at the ready for freeze, flight, fight or fright. If a person cannot “work off” the Tiger Juice by working their muscles, they tend to have muscle pain, twitching, and trembling as the day goes on.
- It is common for muscle pain, twitching, and trembling to inhibit quality of sleep.

### **Rapid or irregular heart rate**

- Tiger Juice dramatically increases the pumping of the heart. This can trigger heart conditions due to clogging of the arteries.
- It is common for patients to report, “I feel like an elephant is sitting on my chest,” or “It’s like bands of steel are crushing around my chest.”
- Pain in the heart muscle can commonly be felt in other places on the body such as the upper back, left arm pit, left arm, and jaw.

### **Sweating**

- Tiger Juice causes the muscles in the body to work hard, this work causes heat. The body will try to cool itself by sweating.
- Often patients report feeling cold even though they are sweating.

### **Decreased concentration**

- Tiger Juice causes randomization of thoughts. This can make behaviors and thoughts unusual for the individual. Patients often report, “I don’t feel like myself,” “I can’t slow my thoughts down,” “I can’t remember stuff,” “I can’t make a choice.”
- Tiger Juice can make a person a confused dangerous driver.

### **Fatigue**

- After an incident of stress many people report overall body tiredness.
- Stress over time tends to cause sleep disturbances. Poor sleep often leads to feelings of being “worn out” or “lazy”.
- When a muscle is overworked it will lose its working efficiency. This is called muscle fatigue. Muscle that are kept constantly tensed (on guard) will quickly fatigue.

### **Irritability, including loss of temper**

- Tiger Juice will make most people short tempered. It is part of the freeze, flight, fight or fright response.
- Tiger Juice can make a person an angry driver, spouse, or parent.

### **Sexual problems**

- When the body feels endangered, Tiger Juice turns off all unnecessary bodily functions. It is not the time, when being chased by a tiger, to be thinking of love and building a family. Tiger Juice over time will lower one's sex drive as well as influence the normal hormonal monthly cycles in woman and sperm count in men.

### **Sleeping difficulties, including nightmares**

- Many patients report, "I can't get to sleep" or "I wake up a few hours after I go to sleep and can't get back to sleep."
- Some patients report vivid and scary nightmares while under long term stress.
- When Tiger Juice is in the blood stream, the brain is hyper vigilant, listening for signs of danger. This can dramatically decrease the quality and quantity of restful sleep.

### **Decrease in healing**

- Long term stress has been shown to change how people heal.
- One study showed that medical students healed slower during finals week than at other times.
- Another study showed that caregivers of family members with Alzheimer's disease healed slower than same aged adults that did not have the added stress of caring for an ill family member.
- The length of healing is important because open cuts are an invitation to infection. Longer healing time increases the likelihood of infection.

### **Stress kills**

Research shows that over time stress really does kill. Many years of Tiger Juice forcing the heart muscle to overwork, can lead to microscopic damage of the muscle tissue. This damage over time may lead to heart disease or a heart attack. Tiger Juice over time also adds to clogged arteries which lead to heart attack or stroke.

## **There is help**

It is possible to counter the negative effects of Tiger Juice on your body. Minor behavioral changes, along with a healthy diet and moderate exercise, can dramatically improve the quality and quantity of your life.

## **The tea pot story**

Many people think of stress and anxiety as hot water in a teapot. Some believe that if you stopper the teapot's spout and just hold on to your emotions you can survive life's ups and downs. Others believe that it is best to let off steam every now and then. This way the pressure never builds too much and you won't have to explode.

There is a third choice. Lower the flame under the teapot. Less heat produces less steam to either bottle up or let off. We all can lower the stress in our lives by controlling small parts of our world. I like to say, "I can't control the world but I have some control over my living room." We all need safe calm places to recoup. Small little corners of an out of control planet where we can recharge and prepare for going back out into the complicated and often stressful world.

It is also important to learn to control one's thoughts. To learn how to deal with life's problems versus simply reacting to them.



## Part II: The science of stress

Stated simply, the brain is the control center of the body. The brain controls voluntary and involuntary nervous systems. As the names imply one tends to be under our control while the other tends not to be. This is not exactly accurate. For example, when a martial artist works on deep breathing techniques while practicing gun takeaway procedures she is having some influence over her involuntary nervous system. When you resist passing gas in church you are taking some minor control of your involuntary nervous system.

From this point on we are going to focus on the involuntary nervous system that is actually called the *autonomic nervous system*. The autonomic nervous system controls the parts of us that we tend to think “just happen”. For example, blushing, nervous feelings, or bodily reactions that seem to happen during particular situations such as, sexual arousal or digestion<sup>3</sup>.

### The two parts of the autonomic nervous system

The autonomic nervous system has two major parts, the sympathetic and the parasympathetic nervous systems. The sympathetic and the parasympathetic nervous systems work in tandem. They work together but against each other. The sympathetic nervous system deals with emergencies and action while the parasympathetic nervous system is calming and relaxing. The old biology teacher’s joke is that the sympathetic

nervous system controls the 4 F's: flight, fight, fright, and sex. While the parasympathetic nervous system controls the daily bodily maintenance, digestion, and sleep. Like the gas and the brakes of a car, one makes you go, go, go, and one makes you slow down and stop. And like the gas pedal and brakes, they do not work at the same time. In fact, the sympathetic nervous system turns off the parasympathetic nervous system.

The brain has two major ways to send directions to all parts of the body. It can send messages by way of nerve pathways or by hormonal pathways.

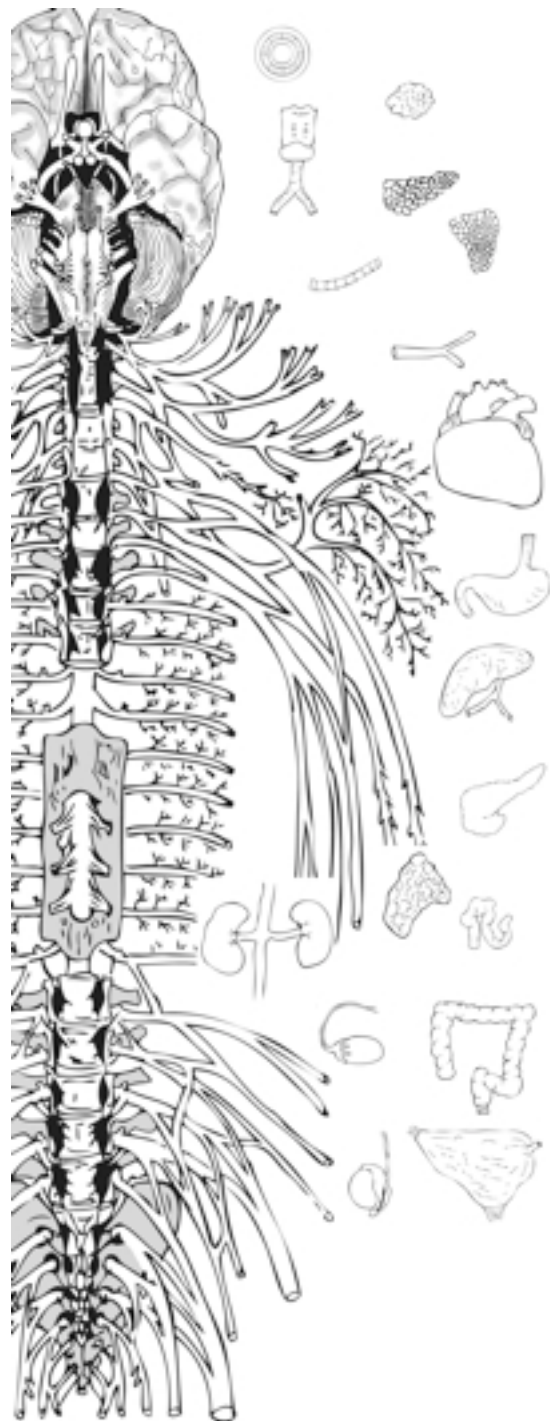
## Neurotransmitter or hormone

The nerve pathway is the first route that the brain can use to control the body as a response to a stressor. When a cell of the nervous system (a neuron) secretes a chemical transmitter into the minute gap between it and the next neuron this secretion is called a *neurotransmitter*. Hormones are messengers which are secreted by neurons or other cells directly into the blood stream. These messengers then spread throughout the body. Many glands in the body secrete hormones. Some of these glands are turned on by stressors while others are turned off.

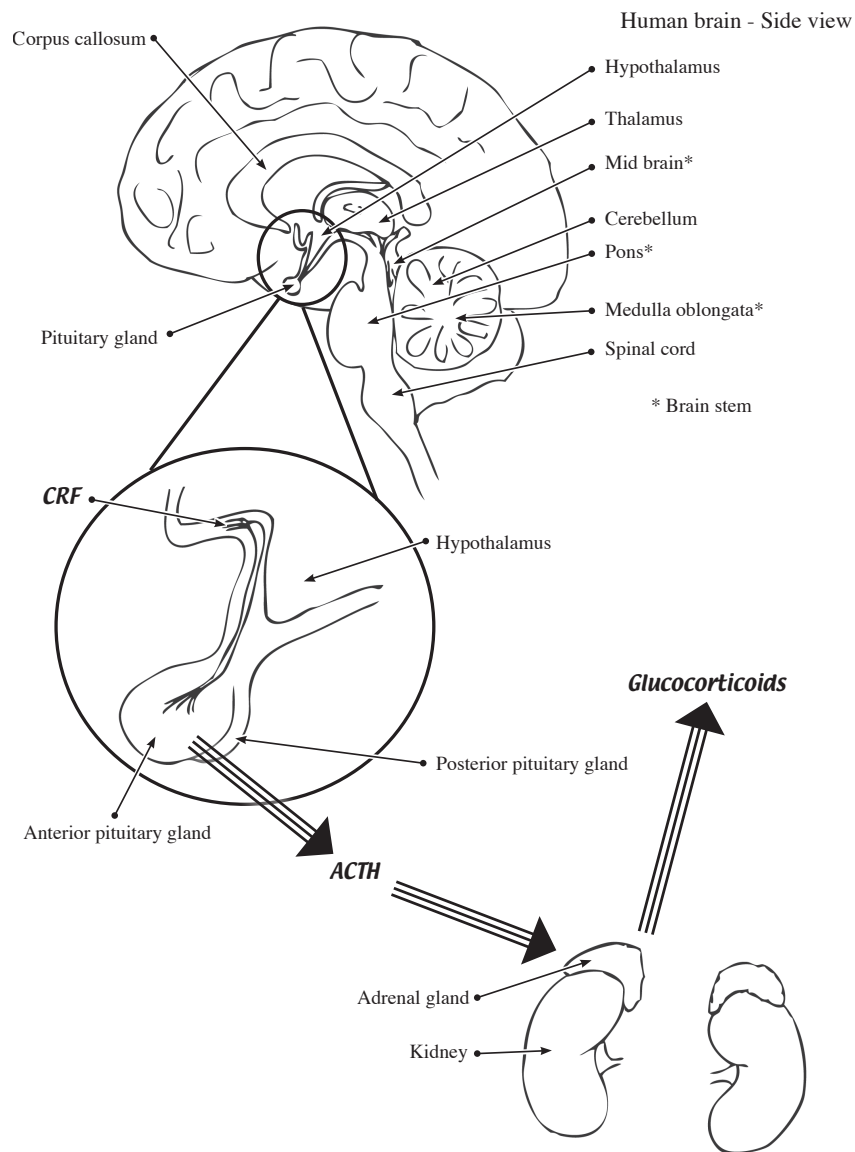
The physiological response to stress consists of an integrated pattern of endocrine (hormonal) and autonomic changes. This pattern seems to be conserved across mammalian species<sup>4</sup>.

Let's use our story of a tiger attack to show step-by-step how this event provokes our reactive freeze, flight, fight or fright response.

We see the tiger. Our optical (afferent) neuron sends along this image which is processed in our brain (control center); specifically, the amygdala, the almond-shaped groups of nuclei located deep within our medial temporal lobes processing certain emotional reactions. Our control center processes this image, evokes the emotional response, in this case fear, and releases *epinephrine* and *norepinephrine*—our first initiators of the freeze, flight, fight or fright mechanism. Epinephrine



and norepinephrine are responsible for increasing the heart rate, blood-glucose concentration, blood flow to skeletal muscles, and the brain's oxygen supply<sup>5</sup>. These are both hormones and neurotransmitters, and serve as positive feedback to the amygdala, further promoting its effects. The amygdala send new (afferent) impulses to the hypothalamus (our next control center), via action potential, for continued activation of the freeze, flight, fight or fright response. The hypothalamus, specifically the *hypothalamic paraventricular nucleus (PVN)* is the location of “command neurons” for cardiovascular defense reaction. The PVN activates the release of corticotropin releasing factor (CRF). CRF is a protein family of neuropeptides.<sup>6</sup> The major player in this family is called corticotropin-releasing hormone (CRH).



The CRH's main function is the synthesis of adrenocorticotrophic hormone (ACTH) by the anterior pituitary gland. Electrical stimulation of the dorsomedial hypothalamus (DMH) further provokes this defensive reaction, and neurons in the DMH play a crucial role in activation of neurons in the PVN; particularly, those responsible for recruitment of the hypothalamic-pituitary-adrenal (HPA) axis in some forms of stress<sup>7</sup>. Thus, the PVN represents a primary target for DMH efferent neurons, and activation of neurons in the DMH elevates circulating levels of ACTH. Through the hypothalamic-pituitary-adrenal (HPA) axis, ACTH stimulates the release of glucocorticoids, such as cortisol, from the adrenal gland. Cortisol's effects include an increase in blood sugar, suppression of inflammation of the immune system, and aid in fat and carbohydrate metabolism. In addition, epinephrine also promotes additional release of ACTH to further increase its effect on the adrenal cortex to produce even more cortisol.

Upon inspection, the intricacies of our freeze, flight, fight or fright response are quite remarkable. One visual image produced a single emotion, fear. This lone sensory input produced an array of efferent networks which promoted a downstream release of additional hormones and neurotransmitters. Furthermore, as the activation of various control centers proceeded, they subsequently served as a positive feedback mechanism for additional production and release of the various hormones and neurotransmitters involved in the freeze, flight, fight or fright response. Now, this may seem great, our body provided us the means to escape our predator! However, chronic reactions to stress are subject to various disease states: hypertension<sup>8</sup>, cardiac arrhythmias and myocardial infarction<sup>9</sup>, gastrointestinal motility disorders and gastric or duodenal ulcer formation<sup>10</sup>, and increased susceptibility to infection<sup>11</sup>. Remember, epinephrine and norepinephrine increased cardiac output and blood pressure, but prolonged releases of these hormones have consequences on our body (hypertension and heart failure). Also, the activation of the sympathetic nervous system means the override of the non-essential processes of the parasympathetic nervous system such as those responsible for our regular gastrointestinal digestion. Thus, gastrointestinal motility disorders as well as ulcer formation are common.

Lastly, the glucocorticoid, cortisol, suppresses the immune system, leading to a weaker immune response. By decreasing our immune response we are consequently increasing our susceptibility to infection. It becomes evident that a healthy lifestyle entails the successful management of stress.

As described previously, the intricacies of our endocrine system and the sequential physiological response can be activated by an increase in a single hormone. The amplification of this hormone triggers a series of biological responses by several downstream pathways.<sup>12</sup>

## Homeostasis and Allostasis

Homeostasis refers to an idea that there is a single "balanced state" that the body is in for optimal health and growth. For example, a normal healthy human body has a temperature of 98.6 °F or a resting heart rate of X beats per minute. Values such as 98.6 or X are quite meaningless. Many factors influence a general term such as

*normal*. Are we talking about the normal resting heart rate of a couch potato or an Olympic swimmer?

The concept of homeostasis gives us a starting point for our discussion.<sup>13</sup> But, because of the complexities of the human animal, we also need to discuss allostasis.

Allostasis means maintaining homeostasis (stability) through change. We can now ask the question, “What is normal for a person during a tiger attack, or more specifically, *What is the allostatic load of a person during a tiger attack?* The concept of allostatic load refers to the repeated turning on or turning off of stress responses.<sup>14 15</sup>

In exquisite studies on baboons, Robert Sapolsky has shown that lower ranking males have significantly higher levels of glucocorticoids in their bloodstream than dominant males. His research has shown that this higher level of glucocorticoids is due to the constant emotional stress subordinate animals are under in the hierarchy of the baboon troop. Long term stress for lower ranking animals seems to make them prone to physical illness, mental health issues and premature death.<sup>16 17</sup>

The process of psychological stress and one’s feelings, emotional attachments, and even organizational position, has also been studied in humans.<sup>18</sup>

## The Whitehall study

Whitehall is a road in the Westminster district of London, England. It is a main artery running from Parliament Square north to Charing Cross. Whitehall Road is banked with Her Majesty's Government buildings housing primary United Kingdom (UK) government departments and ministries. Whitehall is the standard metonym for all things UK government.

The UK Civil Service conducted numerous studies on the health and welfare of UK governmental employees starting in 1967. They showed some surprising aspects of allostasis in the real world of working UK civil servants. These studies are called, in total, the Whitehall Studies.

According to the Whitehall studies, “The circumstances in which people live and work are not just critical for perceived well-being, but they are major influences on health.”<sup>19</sup> The study states:

The Whitehall studies have dispelled two myths. The first is that people in high status jobs have higher risks of heart disease. The second is that the gradient of health in industrialized societies is simply a matter of poor health for the disadvantaged and good health for everyone else.

The Whitehall studies found, along with studies from Europe and Australia, that a person’s position in the social hierarchy influences their mortality. These studies show that there is a social gradient for most diseases that lead to death in industrialized nations.

## **On the job stress**

It is commonly believed that job stress leads to disease and premature death. The Whitehall studies showed that this belief is too simplistic. They state:

A way of thinking about stress at work that more closely accords with people's experience is that it results from an imbalance between the psychological demands of work on the one hand and the degree of control over work on the other. Many jobs involve high demands. It is not demands themselves that are the major cause of illness although high demands are independently associated with ill health. It is the combination of high demand and low control.

This view takes into account the allostatic load concept touched upon earlier. The researchers found that individuals with low control of their workday tended to have higher incidents of work absences due to sickness, mental health issues, heart disease, and lower back pain. Social gradient accounted for increase in mental and physical health problems accounting for lost work days due to stress. According to The Health and Safety Executive (UK) reports *it is the number one cause of lost time at work and estimates that in 2002 there were 13.4 million days lost from work because of stress.*

## **A supportive work environment**

The Whitehall studies showed that work place support was a necessity for increasing workers physical as well as mental health.

We found that good levels of work social supports had a protective effect on mental health and reduced the risk of spells of sickness absence. Lack of support from supervisors and unclear or inconsistent information was associated with a two-fold increased risk of poor general mental health. Similarly, a lack of support from colleagues was also associated with worse mental health.

Similar findings have been found in smaller studies around the world.

## **In closing**

Our physical and emotion health is intertwined with how our brain deals with emotional stress. From the instantaneous fear of hearing a potential predator sneaking up on us in the woods, to the methodical stress reaction of our emotional turmoil in our chaotic industrial society—our brain's orchestration of nerves and hormones influence how we live day to day, and for how long. Over time, our reaction to real or perceived stress is directly correlated to our diseases and our eventual mortality.



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## POSTTEST

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## End Notes

1 Fight or flight: Walter Bradford Cannon was the American physiologist who, in the early 20th century, first coined the term “fight-or-flight” response. He described his theory as an animal’s reaction to threats which, through the SNS, primes the animal for fighting or fleeing (Walter Bradford Cannon (1929). Bodily changes in pain, hunger, fear, and rage. New York: Appleton-Century-Crofts.)

<sup>2</sup> Does "Fight or Flight" Need Updating? Bracha, H. Stefan, Ralston, Tyler C., Matsukawa, Jennifer M., Williams, Andrew E., Bracha, Adam S, Psychosomatics 2004 45: 448-449

3 The enteric nervous system is a subdivision of the autonomic nervous system that directly controls the gastrointestinal system.

4 McDowall et al., 2006 L.M. McDowall, J. Horiuchi, S. Killinger and R.A.L. Dampney, Modulation of the baroreceptor reflex by the dorsomedial hypothalamic nucleus and perifornical area, Am. J. Physiol. Regul. Integr. Comp. Physiol. 290 (2006), pp. R1020–R1026.

5 Tanaka M, et al. (2000). Noradrenaline systems in the hypothalamus, amygdala and locus coeruleus are involved in the provocation of anxiety: basic studies. European Journal of Pharmacology Volume 405, Issues 1-3, 29 September 2000, Pages 397-406

<sup>6</sup> This protein family includes corticotropin-releasing hormone, urotensin-I, urocortin and savaging.

7 Ter Horst GJ, Luiten PGM. The projections of the dorsomedial hypothalamic nucleus in the rat. Brain Res Bull 1986;16:231-48.

8 Folkow B. Psychosocial and central nervous influences in primary hypertension. Circulation 1987;76:110-9.

9 Meerson FZ. Stress-induced arrhythmic disease of the heart (Parts I and II). Clin Cardiol 1994;17:362-71, 422-6.

10 Fossey MD, Lydiard RB. Anxiety and the gastrointestinal system. Psychiat Med 1990;8:175-86.

11 Kiecolt-Glaser JK, Glaser R. Psychoneuroimmunology and health consequences: date and shared mechanisms. Psychosom Med 1995;57:269-74.

12 For example, the PVN regulates the release of CRH by activating certain efferent neurons in the endocrine response to stress, and the amygdala is an established component of the neural circuitry mediating the stress response. A time-course study on rats was conducted to obtain information on the effects of stress on the amygdala and PVN neurons responsible for the synthesis of CRH. They questioned whether a period of stress increased CRH mRNA (proteins encoding the transcription of CRH) levels. CRH mRNA levels in the amygdala and PVN were both increased in response to stress.\* In the amygdala, mRNA levels were measured an hour after the stressor and it was an observable increase of 83% from homeostatic baseline. These levels remained at approximately 40% above baseline three hours after the rat's exposure to stress. In the PVN, CRH mRNA content were measured at 120% above baseline an hour after the stressor and remained significantly elevated around 100% above baseline three hours later. In both case, stress-induced increases in CRH mRNA in the amygdala and PVN, and only after 48 hours did CRH mRNA levels return to homeostatic baseline.\* Although this study only calculated the increase of a single hormone of the stress response, the implications seem staggering. As I've discussed, CRH causes the release of ACTH which triggers the adrenal cortex to secrete cortisol as well as promote secretion of epinephrine and norepinephrine which further increases the concentration of CRH. Combining the PVN and amygdala, the increase of production of CRH mRNA totaled 203% above baseline an hour after stress, and only after 48 hours did the activation of these mRNA return to baseline levels. By this quantitative analysis, the deleterious effects of prolonged stress exposure are apparent; for a single stressor is conducting drastic hormonal and physiological changes well above our homeostatic baseline and the rats' bodies try to regulate these increased levels for no fewer than 48 hours.

\* Kalin, NH, Takahashi, LK and Chen, FL, 1994. Restraint stress increases corticotropin-releasing hormone mRNA content in the amygdala and paraventricular nucleus. *Brain Res* 656, pp. 182–185.

13 Sterling, P. and J. Eyer. Allostasis: A New Paradigm to Explain Arousal Pathology. In Fisher, S. and J. Reason, eds. *Handbook of Life Stress, Cognition and Health*. New York, John Wiley & Sons. 1988, 629-649. Notes: Chapter Num: 34.

14 McEwen, B. S. Protective and Damaging Effects of Stress Mediators. *New England J. Med.* 338: 171-179, 1998.

15 McEwen, B. S. and E. Stellar. Stress and the Individual: Mechanisms leading to disease. *Archives of Internal Medicine* 153: 2093-2101, 1993.

16 Sapolsky, R. M. Why Stress Is Bad for Your Brain, *Science* 9 August 1996: 273 (5276), 749-750.

17 Sapolsky R. Social Status and Health in Humans and Other Animals. *Annual Review Of Anthropology* [serial online]. October 2004;33(1):393-418.

18 Sapolsky, R. M. Sympathy for the CEO. *Science*, 333 (6040), 2001:293-294.

19 Work Stress and Health: the Whitehall II study, Published by Public and Commercial Services Union on behalf of Council of Civil Service Unions/Cabinet Office, 2004, [http://www.ucl.ac.uk/whitehallII/pdf/Whitehallbooklet\\_1\\_.pdf](http://www.ucl.ac.uk/whitehallII/pdf/Whitehallbooklet_1_.pdf)



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