

# **The Brain and the Body**

*The Physiological Response That Occurs  
When We Experience Fear, Stress,  
Trauma and Critical Incidents*

Robert G. Yandow

May, 2022

## Introduction

I first became interested in how the brain and body react under stress when I took an active shooter instructor course through the Advanced Law Enforcement Rapid Response Training program (ALERRT) at the Texas State University. As a former police officer, I was very interested in the information about how the body responds under stress, the progression that we go through as an incident escalates and how, quite simply, we reach a point where, and I'm quoting here, we become "stupid", we just can't function. As time went on, I read more and more about stress and trauma. As usually happens, one thing that I was reading would lead me to something else and that would lead me to something else. I set about reading what I could, and as my interest grew, I decided that I just had to write about it as stress, trauma, fear, critical incidents and life itself impacts all of us. I found the information so helpful I wanted others to have the opportunity to, at least, learn the basics of how our brain operates and how the physiological response to stress and trauma affects us. I am convinced that learning the basic information can help us all prepare for the impacts of trauma and longer-term stress. Acute stress is the result of a single incident or event and while harmful, can potentially be just a blip as we may be able to move on when the event is over. Chronic, or long-term stress, on the other hand, is debilitating and can easily lead to emotional and physical problems.

This paper is not an academic paper, nor is it written to rigorous academic standards. It is my intent to provide an "explainer" that will hopefully be useful to those with an interest in learning about our brain and body and, more specifically, the physiological reaction to stress and trauma and how it affects us.

The paper, as written, contains five components, each of which could easily be the subject of its own white paper. The five components are: 1. The Brain, 2. The Stress Response (short and long versions), 3. Trauma, 4. Trauma and Adverse Childhood Events, and 5. Trauma, Stress and First Responders.

I have provided a listing of references that I found useful at the end of this paper. It is not a complete listing because I reached a point where I decided there was nothing to be gained by including everything that I read. I did not quote every

reference in the paper but they all played a part in my research and my understanding.

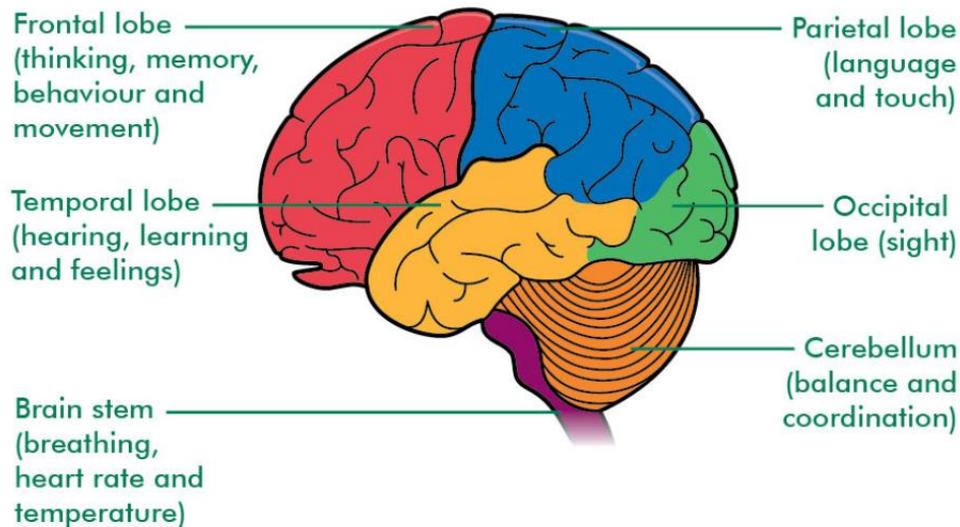
I hope you enjoy reading this paper and that it ultimately has some value for you. I tried to minimize the neuroscience-y information by providing a short version of the stress response, however there is simply no avoiding the science when describing brain function and physiological response. It is what it is, and to me, it is very compelling. I hope it is for you also.

## **The Brain**

The brain is a magnificent and complex organ that, when fully developed, will be a roughly three-pound mass of soft tissue housed within an approximate 11-pound head. As will be addressed further in this paper, portions of the brain are intact pre-birth with the majority of the brain developing through adolescence. The brain is not fully developed until approximately age 25 when that part of the prefrontal cortex regulating judgement and decision-making is finally fully developed. The brain contains some 85 billion neurons, the fundamental units that receive sensory input and subsequently send commands and other information throughout the body. Each neuron also contains an average of 7,000 connections or synapses.

The brain is comprised of two spheres (halves) which are connected by the corpus callosum, a c-shaped bundle of nerve fiber that allows the two spheres to communicate with one another. The spheres are typically referred to as left brain-right brain. The left-brain is believed to be the more analytical and logical side of the brain and the right-brain is believed to be the more creative, imaginative and intuitive side. It was once believed that each individual was either left-brained or right-brained and that each of us acted in accordance with our dominant side. Science has since determined that there is, in fact, no dominant side to our brain and the two spheres communicate and assist each other. Certainly, some of us will have tendencies towards more logical and analytical thinking and some of us will be more creative and visual in our thinking, however that no longer signifies dominance for either side of the brain. Science has also debunked the theory that “handedness”, i.e. being left handed or right handed is related to a dominant side of our brain.

Each sphere contains four lobes which are responsible for separate functions. The four lobes and their respective functions are shown below.



I would add to the illustration above that the **fontal lobe** is also responsible for high executive functions and emotional regulation; the **parietal lobe** is responsible for integrating sensory information; the **temporal lobe** is responsible for visual processing and recognizing languages; and the **occipital lobe** is the major visual processing center to include depth, distance and location.

Each sphere also contains structures known as the cortex, amygdala, thalamus, hypothalamus and hippocampus which will be defined below. These structures are integral to the body's stress/trauma response and each plays an important, but separate, role.

**Amygdala** -The brain's fear and anger center which has been referred to as the brain's smoke detector (van der Kolk 2014) and the brain's alarm center (Greenberg 2016).

**Thalamus** – The brain's sensory stimuli processing center which has been referred to as the brain's cook (van der Kolk) and the Grand Central Station of the brain (Pittman & Karle 2015).

**Hypothalamus** -The brain's operations manager responsible for initiating and coordinating the brain's hormonal response to stress (Greenberg)

**Hippocampus** – The brain’s memory and learning center as well as the brain’s biographer and memory bank. (Greenberg) (Burke-Harris 2018)

**Cerebral Cortex** – The entire outer top part of the brain. (the part that looks wrinkled) (UC Berkely Redwood Center for Theoretical Neuroscience (UCBRCTN)

**Neocortex** – The newer part of the cortex, maybe 90%. (UCBRCTN) 85% of the brain mass and 50% of the weight is from the cortex.

**Prefrontal Cortex** -The brain’s CEO (Van der Kolk 2014)) and seat of executive functioning. (Burke-Harris) The PFC is the rational part of your brain which can help reduce stress through complex thinking. (Greenberg) The PFC sits at the very front of brain behind the forehead.

The Triune (three-part) brain is built from the bottom up and develops level by level (van der Kolk 2014). The first level is the **reptilian or lizard brain**. The reptilian brain is the most primitive part of the brain and is intact when infants are born. It allows for automated physical reactions such as the fight-flight response and for certain bodily functions.

The second level is the **limbic system or mammalian brain**. This level is developed after birth and continues developing into adolescence. van der Kolk considers the limbic system to be the “emotional brain” and the heart of the central nervous system.

The third level is the **neocortex** which is known as the rational brain. The neocortex, in its role as the rational brain, can signal the amygdala and the other parts of the stress response system to return to normal when there is no actual danger or the danger has passed.

**Note** – The theory of the triune brain has been challenged by some researchers and neuroscientists. The challenge relates to the evolutionary aspect of the theory and the argument is that the brain did not develop in the three layers, rather there is one brain, not three, that engages in “body budgeting” of resources as physiological needs arise. (Lisa Feldman Barrett

2020). Whether there is a lizard brain, or a mammalian brain, or simply one brain, the body's physiological stress response is the same.

### **The Stress Response**

A basic understanding of the stress/trauma response system is important as this response is the beginning of what could be a short-term or very long-term reaction based on the nature and duration of the stress/trauma. More detailed discussion of various components of the stress/trauma response will occur later in this paper.

### **The Stress Response – Short Version**

Our brains are constantly monitoring what we see, hear, taste, touch and smell. When the brain receives information that it perceives as a threat, various parts of the brain communicate with each other which triggers a physiological response through our nervous system. The response starts in the **thalamus** which signals the **amygdala** and the **neocortex**. The amygdala, in turn, signals the **hypothalamus** which activates the **pituitary gland** and then the **adrenal gland**. This is known as the **HPA axis**. When this axis activated, hormones are released including **ephedrine (adrenaline)** and **cortisol** which is the primary stress hormone. These hormones alter the body's chemistry which results in resources being sent to those body functions that are necessary for survival and takes away resources from body functions that are not necessary for survival. Our breathing, heart rate and senses will all be affected.

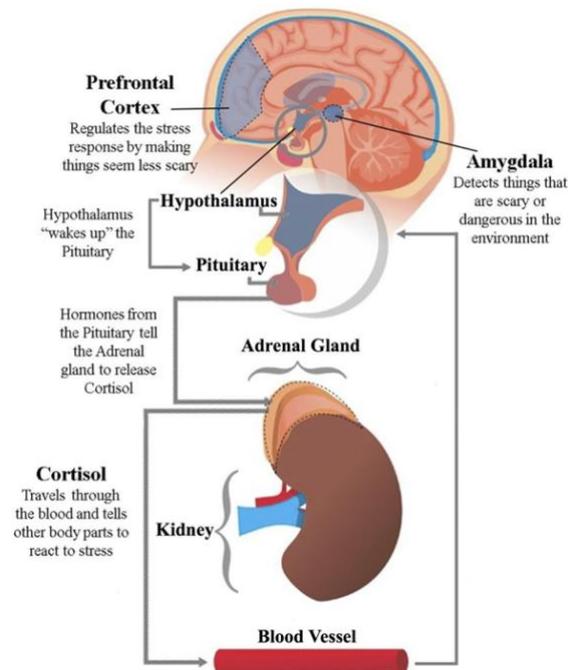
If our brain recognizes that there is not really any danger after all, the stress hormones will be minimized and our bodies will return to what is known as homeostasis, or balance. If the brain is not able to overcome the stress hormones because there is, in fact, real danger we will continue in full fight-flight mode. That is why we are able to perform feats that we might not normally be able to perform. We may be bigger, stronger and faster than normal; however, we will struggle with tasks that require our fine motor skills like tying our shoes or holding a pencil. If, over time, the brain cannot keep our physiological response and our nervous system from being "dysregulated" by the cascading stress hormones, we become overcome by the trauma and we will suffer physiological and emotional

trauma symptoms until we find a way to mitigate the impacts of the trauma and its source. If this short version satisfies what you are interested in learning, please feel free to skip to the trauma section.

### **The Stress Response – Long Version**

Our senses are constantly sending sensory information to our brain regarding everything that we see, hear, smell, taste or touch. The sensory information is received by the brain's **thalamus** which, in turn, sends the information along to the **neocortex** which, in turn, sends the information to the **amygdala**. If the thalamus senses a potentially dangerous situation however, the information is sent simultaneously to the neocortex and the amygdala. If the neocortex, through rational thinking, determines that there is no danger that information is sent to the amygdala and the stress response system is shut down. If, however, the neocortex recognizes danger and does not override the amygdala, the stress response system is initiated.

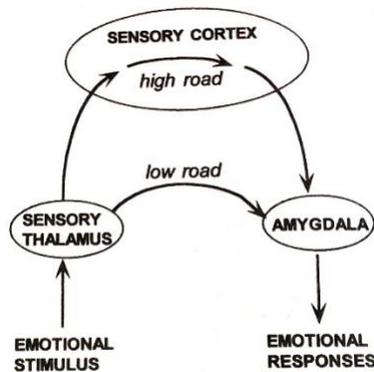
During the stress response the **amygdala** sends a signal to the **hypothalamus** which, in turn, initiates a response through the **autonomic nervous system (ANS)** to the **pituitary gland** and then to the **adrenal gland**. This is known as the **HPA-Axis**. This response results in the release of the hormones epinephrine (adrenaline) and nor-epinephrine along with cortisol which is known as the primary stress hormone. As will be discussed later, excessive or long-lasting cortisol in the system can have a very negative impact on the brain's ability to function normally. Sometimes the simplest explanation or illustration is the best so I have included the illustration below which is taken from an article in *Frontiers for Young Minds (2017)* entitled "Have No Fear, Your Brain is Here" written by Kylie Garber Bezdek and Eva H. Telzer. The article was written to help children understand their brain and their response to danger. The illustration reflects the basic response to perceived danger and what parts of the brain and body are involved.



Now that we have a basic understanding of the stress response system, let's take a closer look in a little more detail. Feel free to skip to the next section on trauma if the more in-depth neuroscience part is not your thing.

We know that the first part of the brain to be formed, the **reptilian or lizard brain**, is the most primitive part of the brain and it is responsible for the "fight-flight" response. We are born with this intact and we respond in this mode without thinking. It is an automated response and, in many cases, the response is overridden by the cortex, which is the rational brain. A simple example is being frightened by the sight of a snake on the sidewalk only to be relieved that it is really a piece of rope.

As you previously read, when the **thalamus** senses potential danger, a message is sent to the **amygdala** and to the **neocortex**. Neuroscientist Joseph LeDoux, in his book *The Emotional Brain* (1996), describes this as the low road (amygdala) and the high road (neocortex).

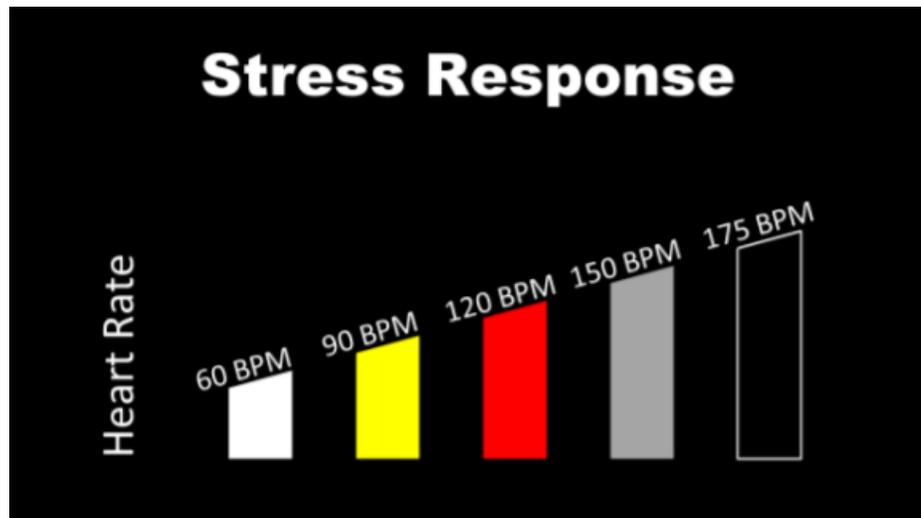


The low road, being the automated, primitive response signal, is very fast. According to LeDoux, in a study conducted in rats the signal to the amygdala was measured at twelve milliseconds, or twelve one-thousandths of a second. In comparison, the high road signal to the neocortex, or rational brain, while fast takes twice as long. The difference in time is a result of the neocortex processing the signal to determine if there is any information stored in the brain which would identify the signal as a threat. If the neocortex determines there is no threat the system will return to normal. If the neocortex determines that there is, in fact, a threat, this is when the stress response system activates and gets the party started.

The **amygdala**, the brain's fear and anger center which is located in the temporal lobe, immediately sends a message to the **hypothalamus** which, in turn, activates the **Autonomic Nervous System (ANS)** by sending signals to the adrenal glands. The ANS consists of the **Sympathetic Nervous System (SNS)** which acts like an accelerator and the **Parasympathetic Nervous System (PNS)** which acts like a brake when it is time to return the system to homeostasis.

These glands respond by pumping ephedrine (adrenaline) and norephedrine into the bloodstream resulting in increased heart rate, pulse and blood pressure while pushing blood to the muscles, heart and other vital organs. At the same time, epinephrine triggers the release of blood sugar (glucose) and fats from temporary storage sites in the body supplying increased energy (Harvard Health 2020). This results in resources being delivered to those areas of the body critical for survival and resources shut down to those areas not critical to survival. This will be discussed in more detail under the section on first responders, however during this process the body becomes optimized in terms of response capability

as we become bigger, stronger and faster. The graphic shown below, courtesy of the Advanced Law Enforcement Rapid Response Training program (ALERTT) at the Texas State University, illustrates the progression of the body response in terms of increased heart rate through different zones.



By way of brief explanation, the normal resting heart rate for most people is around 60 beats per minute (BPM). This is considered the **white zone**, or baseline. When we are faced with a disaster or critical incident, we go through what is known as the **Survival Arc** (Ripley 2008). The three phases, or stages, of the Survival Arc are **Denial – Deliberation – and Decisive Action**. As we move through these three stages, so does our stress response. As the stress response continues, our heart rate increases to 90 BPM which moves us into the **yellow zone**. At this point we are in a heightened state of awareness and our fine motor skills begin to deteriorate. The next stage in the progression is the **red zone** where our heart rate increases to 120 BPM and where, as stated above, our body becomes optimized in terms of physical response as we become bigger, stronger and faster. Our gross motor skills are at peak performance; however, our fine, or complex, motor skills have deteriorated to the point that we will have difficulty tying our shoes or unfastening a child from a stroller or baby carrier. As the event becomes more stressful, we move into the **gray zone** when our heart rate increases to 150 BPM. At this point our cognitive processing and auditory skills have deteriorated to the point that we develop tunnel vision, auditory exclusion and disassociation and our environment becomes overwhelming. Finally, we progress into the **black**

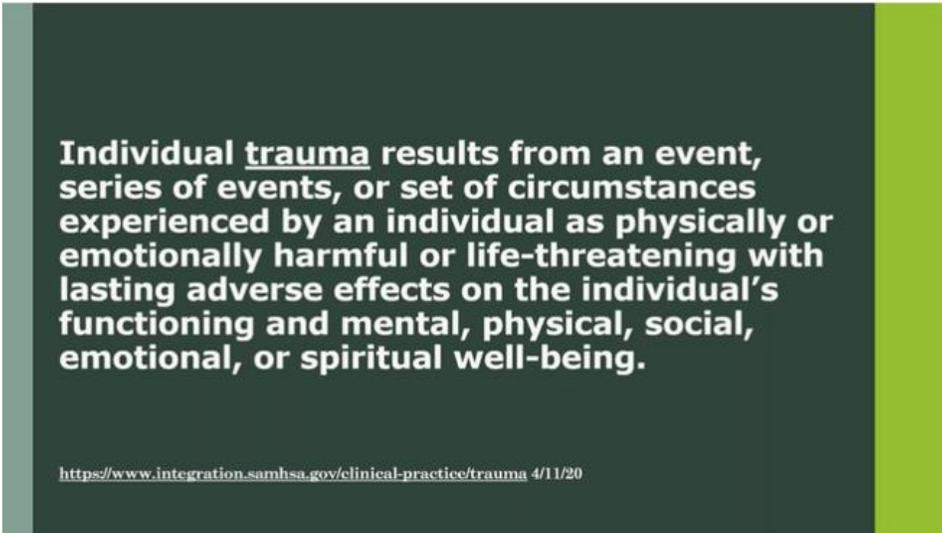
**zone** when our cognitive function becomes overloaded and we are, quite simply, unable to function.

On the heels of the initial surge of ephedrine the hypothalamus activates the Hypothalamus-Pituitary Gland-Adrenal Gland (HPA) Axis by releasing the CRH hormone which travels to the pituitary gland triggering the release of ACTH hormone. ACTH then travels to the adrenal gland which triggers the release of cortisol, the primary stress hormone (Harvard Health 2020). I will discuss the short-term and long-term effects of cortisol further in the section on Trauma, but for purposes of this discussion, cortisol acts in a similar manner to the other stress hormones such as epinephrine and norepinephrine. It raises blood pressure, heart rate and blood sugar levels to help the body adapt to the danger, however cortisol can stimulate the accumulation of fat and make us crave high fat and high sugar foods which can lead to weight gain if higher cortisol levels are not reduced. (Burke-Harris 2018).

This has been a very basic overview of the brain and the physiological results of brain response due to fear and stress stimuli. Now that we have discussed the stress response we will move on to an exploration of trauma; what it is, the many ways that it can affect us and the short-term and long-term effects of trauma.

## So, What is Trauma?

Every one of us has experienced trauma in our life, however the term trauma will typically mean different things to different people. Some will associate trauma with an incident or event that results in a physical injury (bodily trauma) while others associate trauma with an incident or event that affects them emotionally or mentally. For purposes of this paper, I will use the definition of trauma developed by the Substance Abuse and Mental Health Services Administration (SAMHSA), a branch of the U.S. Department of Health and Human Services as shown below:

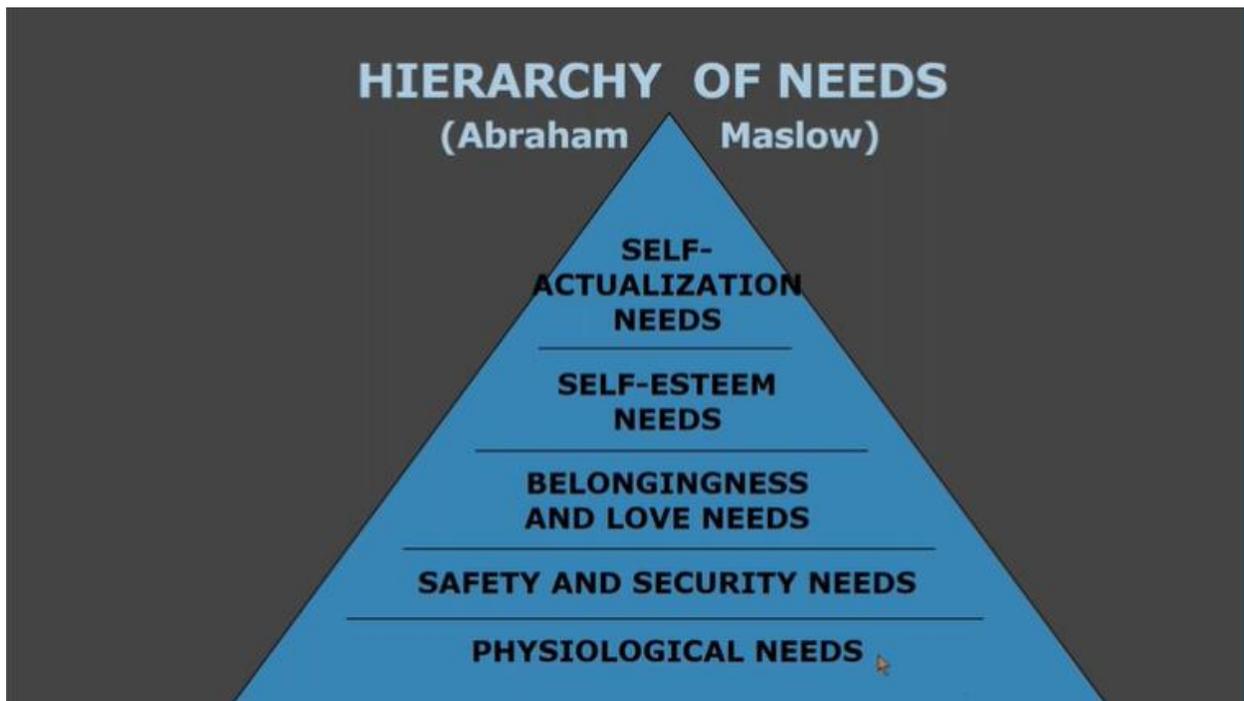


**Individual trauma results from an event, series of events, or set of circumstances experienced by an individual as physically or emotionally harmful or life-threatening with lasting adverse effects on the individual's functioning and mental, physical, social, emotional, or spiritual well-being.**

<https://www.integration.samhsa.gov/clinical-practice/trauma> 4/11/20

As you can see, trauma can affect us physically, emotionally, mentally, socially and spiritually. Although I will focus primarily on the emotional and mental aspects of trauma, it is important to recognize that a trauma response may be triggered as a result of physical violence which may be experienced directly or indirectly. The effect of a single traumatic event may be experienced for only a short period of time or the effect may last for the individual's lifetime. One determining factor with regard to the length of trauma's impact is the brain's **neuroplasticity**, or its ability to change, reorganize and rewire itself as well **allostatic load**, which is defined as the cumulative burden of chronic stress and life events (Karger). Bessel van der Kolk, who has done substantial work with

veterans with PTSD and is the author of *The Body Keeps the Score*, describes trauma this way- “Trauma results in a fundamental reorganization of the way mind and brain manage perceptions. It changes not only how we think and what we think about, but also our very capacity to think.” One thing that all trauma victims share is the belief that they are not safe and they cannot control what is happening. As you can see from the illustration of **Maslow’s Hierarchy of Needs**, safety and security needs are second only to physiological needs for us to survive. The physiological needs are necessary to keep us alive (breathing, eliminating waste, food and water etc.) We need to feel safe and secure in our lives in order to feel that we are in control. When we no longer feel safe due to trauma the effects can be overwhelming. An interesting comparison was made by Amanda Ripley in her 2008 book *The Unthinkable – Who Survives When Disaster Strikes – And Why*. Ripley was talking about resilience, the ability to recover from difficulty, and the comparison can be made to those able to recover from feeling the lack of safety and security - “Resilience is a precious skill. People who have it also tend to have three underlying advantages: a belief that they can influence life events; a tendency to find meaningful purpose in life’s turmoil; and a conviction that they can learn from both positive and negative experiences.”



At the outset, the impact of trauma on an individual is dependent on the **meaning and value** the individual places on the occurrence or event (Bowers 2021). Two people can experience the same event and have very different reactions, largely contingent upon any memories of similar events in their past and the individual's personality type. For example, two women are having lunch at a window table in a restaurant. As they are talking, a homeless man walks up to the window and exposes himself to the two women. One of the women begins to laugh hysterically and the second woman is so shocked she cannot speak. The first woman attaches no meaning or value to the incident while the second woman attaches significant meaning and value to the incident and will probably not want to sit at a window seat in a restaurant in the future for fear of a similar traumatic event occurring. Drawing from Ripley's discussion on resilience above, it is clear that one of the women is far more resilient than the other.

Not all trauma victims experience the trauma first hand. It is possible to experience what is known as **secondary trauma** as is reflected in the definition provided by SAMHSA below.

## **SECONDARY TRAUMA**

The consequences of indirect exposure to the details of a traumatic event through close contact with the direct victim. The symptoms are essentially similar to those of the survivor's Post Traumatic Stress Disorder symptoms.

Children often suffer from secondary trauma if they witness a family member being abused, have a family member incarcerated and/or suffering from addiction, their parents have divorced or a number of other experiences. Certain public safety positions such as child abuse investigators are also susceptible to secondary trauma based on the horrors they are exposed to every day.

The Substance Abuse and Mental Health Services Administration has provided a non-exclusive description of some of the various types of traumas along with the violence that can precede trauma as seen below.



Everyone of us has suffered from trauma at some point in our life and everyone of us has experienced the stress/trauma response as outlined previously in this paper. We all experience fear although we may not always realize it. As neuroscientist Joseph LeDoux put it “Fear is so fundamental. There are key environmental triggers that will turn it on and well-worked-out responses that help you cope with it” (Ripley 2008). LeDoux also stated in his 1996 book *The Emotional Brain*, “You can’t have a feeling of fear without the activation of the amygdala.” While LeDoux somewhat walked this statement back in his later book *Anxious* (2015), we have seen above how the amygdala initiates the stress/trauma response after receiving a message from the thalamus. Because the response is so lightening fast, we may react before realizing fear, however fear is

never far behind if the neocortex has not overridden the amygdala through a rational interpretation of the stimulus. There are, at times however, certain conditions when fear is not only recognized but embraced. In an article in the *New York Times* on February 5, 2022 titled “***I Admit it, I’m in Love with Fear***”, freestyle half-pipe and slopestyle skier Eileen Gu states “pretty much all of my excitement in life comes from my fear and adrenaline. Understanding my relationship with fear is the first step in figuring out who I am.” Gu falls into a category of personalities known as “sensation seekers”, a personality type that revels in putting themselves into potentially dangerous situations. These individuals typically have low cortisol levels and thrive in high-risk endeavors. Military special forces operators and police SWAT/ERT team members can also fall into this category.

So, let’s look a little closer at the actual trauma response. The first thing to know is that the characteristics of a trauma response are cognitive, emotional, physical and mental. That is, trauma affects the way we think, the way we feel, the way our body works and it affects our brain works (Bowers 2021). In his 2021 course *Trauma Informed Care* Duane Bowers, LPC describes what a traumatic response looks like. In the illustration below we can see all of the areas that are negatively impacted by a traumatic response. You may recognize some of them from traumatic encounters you have experienced in the past and/or from witnessing some of these characteristics in family or friends. The danger, of course, is when these characteristics do not go away and we cannot get our system back into homeostasis, which is the system’s equilibrium.

## HOW DOES A TRAUMATIC RESPONSE LOOK?

CONCENTRATION

MEMORY

LEARNING

REPETITIVE  
THINKING

ANGER

NEGATIVITY

HYPERVIGILANCE

SLEEP

IMMUNE SYSTEM

DISSOCIATION

DETACHMENT

DEPRESSION

Why do we experience these characteristics as a result of trauma? Let's get back to the brain's stress response as described earlier. We know that when the thalamus sends a sensory message to the amygdala via the "low road" and to the neocortex through the "high road", stress hormones are released via the autonomic nervous system through the HPA axis. Epinephrine (adrenaline) and norephedrine are released resulting in increased blood pressure, heart rate and increased blood sugar (glucose). Also released is cortisol, the primary stress hormone. If the neocortex is able to determine that the event is not dangerous via rational thinking and the event is short-lived, our system returns to homeostasis and all is well. If the neocortex is not able to recognize that the event is actually safe and the event is not short-lived, the stress hormones remain in our system which can lead to our inability to escape the trauma. Excess cortisol levels remaining in our system prevent normal brain function and can result in the amygdala overpowering other parts of the brain. The hippocampus, which is responsible for memory and learning, is one part of the brain that can control the amygdala (Bowers 2021). If, however, the cortisol levels reach excessive levels the cortisol can flood the hippocampus and shut it down which can take away our short-term, episodic and semantic memory, our ability to learn and our ability to concentrate. The effect of this action is that we are now looking at life through the eyes of the amygdala which is the fear and anger center, rather than through

the more rational part of the brain. We have lost the ability to reason and we are running in full fight-flight mode. If the hippocampus is shut down for any length of time the cells that die do not reproduce which can lead to shrinkage of the hippocampus. Remember, people experience trauma when they don't feel safe or secure and they don't feel in control. At this point, we are experiencing life negatively impacted by those areas outlined in the "How Does a Traumatic Response Look?" image above. We become hypervigilant, angry, and our world view can change drastically as we are unable to concentrate and focus. Remember, the trauma response impacts the way that the brain works. If the trauma is significant and it is not a short-term event, but rather an ongoing situation, excessive levels of cortisol will remain which will dictate how we function based on how we see the world.

Let's take a look at some real-world examples of trauma and, to start with, what has happened to us during the two-plus years of the COVID-19 pandemic.

Much has been written about the COVID-19 pandemic, both in terms of the public health effects and, more recently, about how mental health has deteriorated during the two-plus years since the pandemic started. According to an October 4, 2021 report authored by Jillian McKoy at the Boston University School of Medicine, depression rates tripled and symptoms intensive during the first year of COVID-19. The report went on to say that "people with lower incomes and who experienced multiple COVID-related stressors were more likely to feel the toll of the pandemic, as the socioeconomic inequities in mental health continue to widen." I think the key words here are "socioeconomic inequities" as those living in poverty or with no financial cushion had no options moving forward. Remember, trauma occurs when people do not feel safe and/or they do not feel like they are in control. The report went on to say that 32.8% of US adults experienced elevated depressive symptoms during 2021 compared to 27.8% of US adults during the early months of the pandemic.

During the pandemic period we also suffered from a series of other traumas. In an article appearing in *Nature Human Behavior* titled "*Coping with cascading collective traumas in the United States*", the authors describe how in the first 10 months of the pandemic, 40,000,000 Americans became unemployed, 215,000 people died and hospitals and public health workers became overwhelmed.

Added to that, the killings of Ahmaud Arbery, Breonna Taylor, Jacob Blake and George Floyd highlighted systemic racism which, **“primed by months of stay-at-home orders, absence of distractions, economic anxiety and easy access to gruesome videos-led directly to widespread multiracial protests, ongoing social unrest, increasing political divisiveness and violence in the streets.**

**Simultaneously, the US faced extreme weather events, including devastating hurricanes, record heatwaves and disastrous wildfires requiring evacuations made more complicated during an unrelenting pandemic that requires physical distancing. Together, the combination of medical, economic, racial and climate-based catastrophes highlights the need for attention to the meaning and implications of cumulative, compounding trauma exposure.”** Dr. Nadine Burke-Harris, former Surgeon General for the State of California, referred to the pandemic period as “probably the greatest collective trauma of our generation” and that “the health consequences of this pandemic will continue, even after the virus is contained.”

Other sources of trauma such as the January 6, 2021 insurrection at the US Capitol, increased domestic violence, increased gun-related deaths and guns on school campuses, bomb threats at Historically Black Colleges and Universities (HBCUs) children being unable to attend school to learn and benefit from the social impacts of being around other children all add to the cumulative and collective effects of trauma during the pandemic period. The internet with ubiquitous cell phones, tablets and computers, coupled with the 24-hour news cycle make it virtually impossible to escape the stress and trauma of everyday life which leads to the stress becoming chronic. The Mayo Clinic, in an undated article titled *Chronic Stress Puts Your Health at Risk* states that “The long-term activation of the stress response system and the overexposure to cortisol and other stress hormones that follow can disrupt almost all of your body’s processes. This puts you at increased risk of many health problems, including: **anxiety, depression, digestive problems, headaches, muscle tension and pain, heart disease, heart attack, high blood pressure, stroke, sleep problems, weight gain and memory and concentration impairment.** So, it is important to realize that the effects of trauma are not simply mental or emotional. Short-term trauma or stress will typically not impact us physically past the resolution of the cause, however long-term, chronic stress or unresolved trauma will eventually result in negative

physical symptoms which, along with the emotional trauma, will prevent us from returning to whatever our “normal” state is and put us at risk for serious health problems.

### **Post-Traumatic Stress Disorder**

The term Post-Traumatic Stress Disorder (PTSD) is often used to describe someone who has been exposed to a specific traumatic incident, or series of incidents. It is most often used appropriately but is sometimes used in a generic, cavalier, or perhaps uninformed, fashion to describe a short-term event that does not meet the criteria for a PTSD diagnosis.

PTSD was first accepted as a diagnosis by the American Psychiatric Association in 1980 when it was included in the *Diagnostic and Statistical Manual of Mental Disorders (DSM)*. Prior to the formal acceptance of the diagnosis, PTSD symptoms were most often associated with military veterans and war and were referred to as being “shell shocked” or suffering from “war neurosis”. Some experts estimate that 25% of soldiers who serve in war zones will ultimately develop PTSD (van der Kolk 2014). According to the guidebook *Understanding Mental Disorders – Your Guide to DSM-5* (2015) a companion guide to the 5<sup>th</sup> edition of the *DSM*, PTSD falls under a new category known as **Trauma and Stress Disorders**. In discussing the new category, the guide states that about 60% of men and 50% of women live through at least one traumatic event in their lifetime resulting in strong emotions that can subside with time. The guide goes on to say however, that “For some people, more lasting problems may occur for weeks, months, or years.” Remember, the impact of trauma on an individual depends on the meaning and value that the individual attaches to the incident or series of incidents. While there are varying statistics that report the percentage of people affected by PTSD (3.5% of US population according to the Anxiety and Depression Association of America – and 5-10% according to a 2015 report in *Nature Reviews*) all agree that women are more likely than men to develop PTSD.

The *DSM-5* makes clear that in order to qualify for a diagnosis of PTSD, the trauma must involve real or threatened death, severe injury or sexual assault (such as rape). Learning that a family member has died a natural death or viewing a tragic incident on television or the internet does not qualify for a diagnosis of PTSD. Military personnel serving in a war zone and emergency responders are

often affected by PTSD as are civilians directly impacted by serious trauma. In the section devoted to emergency responders, I will clarify how some personnel can develop PTSD without directly experiencing a traumatic incident.

Those individuals suffering from PTSD vary in how the PTSD affects them and how the symptoms will manifest. Some cannot help but continuously relive the traumatic event. Some are triggered by sights, sounds or smells. Some have feelings of helplessness, acute fear and anxiety and feelings of detachment. Some suffer from nightmares and cannot sleep through the night. However the symptoms and effects manifest, the result is that the individual's life is seriously and adversely impacted and they find it difficult to function.

I am not going to go into all of the details involved in a PTSD diagnosis but I am going to list the criteria that must be met. Each criteria has a listing of possible symptoms and, depending on the specific criteria, a certain number of the symptoms must be present in order to meet the criteria.

- **Being exposed to real or threatened death, severe injury or sexual assault**
- **Having symptoms of intrusion for at least one month or more after the traumatic event** (distressful memories that intrude into life, nightmares, flashbacks, negative physical response such as increased heart rate, dizziness or sweating)
- **Frequent avoidance of any reminder of the traumatic event**
- **Negative changes in beliefs and feelings for one month or more** (cannot recall some parts of the event, self-blame, lasting fear, anger, guilt or shame and detachment)
- **Two major changes in arousal (getting keyed up) for one month or more** (irritability, reckless or self-destructive behavior, hypervigilance, loss of focus and trouble sleeping)

The above description of criteria and the required manifestation of symptoms and effects under each criterion is a very limited discussion. There are many more examples and much more important detail available. For those interested in more information I would recommend the *DSM-5* guide referenced above.

The takeaway from the discussion on PTSD is that anyone can suffer from PTSD regardless of what you do in life. While military, law enforcement and other first

responders are more susceptible to PTSD due to their exposure to trauma, all it takes is one traumatic event for anyone to suffer from life-long effects of PTSD. As seen in the brief discussion above, the effects of PTSD make it impossible for someone to live a normal life. Whether it is flashbacks, nightmares, hypervigilance, anger, fear, guilt, physiological effects or recklessness and self-destructive behavior, we do not feel safe and in control. It is important to recall the impact of excessive and potentially destructive cortisol in our system based on trauma. When we cannot reduce the level of cortisol via the hippocampus or neocortex, we end up viewing the world through the lens of our amygdala which, as you now know, is the brain's fear and anger center. Absent some intervention to alleviate the cortisol level we simply cannot overcome its effects.

One final word about PTSD. All PTSD diagnoses start with a traumatic event or incident. I would like you to think about the trauma process in this way – put your arms straight up over your head with your hands about 2 ½ to 3 feet apart. You should now resemble a football official signifying a touchdown or a basketball official signifying a successful three-point shot. Your left hand signifies the traumatic event and your right hand signifies a PTSD diagnosis. Everything in-between your left hand and your right hand is the trauma response. I refer you to the slide shown below which was shown earlier. As you can see, the slide represents everything that we may go through and all of our functions that can be negatively impacted during the traumatic response which, again, is everything between the event and PTSD.

## HOW DOES A TRAUMATIC RESPONSE LOOK?

CONCENTRATION

MEMORY

LEARNING

REPETITIVE  
THINKING

ANGER

NEGATIVITY

HYPERVIGILANCE

SLEEP

IMMUNE SYSTEM

DISSOCIATION

DETACHMENT

DEPRESSION

### Adverse Childhood Experiences (ACES)

No discussion about trauma would be complete without looking at the impact of trauma on children, our most important resource. Many people have not been exposed to the fact that stress and trauma experienced by a woman during pregnancy can impact her unborn child. This is known as intergenerational trauma. If a woman in her third trimester suffers a trauma resulting in a release of excess cortisol, that excess cortisol can be passed along to the baby thereby impacting the development of the left frontal lobe of the infant in the womb. The result can be that the baby does not develop the ability to modulate the fear and anger center through the release of serotonin. If the baby is nurtured after birth the child can learn to modulate the fear and anger center, however if the baby is not adequately nurtured after birth the child will be unable to control the fear and anger center. (Bowers 2021)

ACES, as a concept, was relatively unknown prior to 1985. According to Dr. Nadine Burke-Harris in her book *The Deepest Well – Healing the Long-Term Effects of Childhood Trauma and Adversity* (2018), Dr. Vincent Felitti, a physician working at a Kaiser obesity clinic in San Diego started learning from his patients

that their obesity may be related to trauma suffered as a child. Starting with just two patients Felitti conducted a research project and presented his findings at an obesity conference in 1990. He was roundly criticized by most of the attendees, however David Williamson, an epidemiologist at the CDC thought that Felitti might be on the right track. They agreed that the 286 cases that Felitti had studied was not sufficient to prove the theory so a larger study was planned. Williamson introduced Felitti to Robert Anda, a physician epidemiologist at the CDC, and for the next two years Felitti and Anda researched the possible connection between childhood trauma and later physical and/or emotional problems as an adult. Finally, a study was designed and accepted by governing authorities. Between 1995-1997, 17,421 adults who were patients in the Kaiser Permanente healthcare system participated in the study. Each participant was asked to complete a questionnaire with ten categories related to what Felitti and Anda called “adverse childhood experiences.” The participants were asked if they had experienced any of the 10 categories prior to age 18. The ten categories were identified as:

- 1. Recurrent emotional abuse**
- 2. Recurrent physical abuse**
- 3. Sexual abuse through contact**
- 4. Physical neglect**
- 5. Emotional neglect**
- 6. Substance abuse in the household**
- 7. Mental illness in the household**
- 8. Mother treated violently**
- 9. Divorce or parental separation**
- 10. Criminal behavior in the household**

Each of the categories counted as one point, therefore the highest possible ACE score was ten. Using the data from the questionnaires, Felitti and Anda correlated the ACE scores with health-risk behaviors and health outcomes. While the technical data from the study can be quite dense, I will summarize some of

the relevant data points. The first thing to know about the study is that it showed a direct relationship between childhood adversity and negative adult health outcomes. Some of the highlights include:

- 67% of the respondents had at least one ACE
- 12.6% had four or more ACES
- If a respondent had one ACE, there was an 80% chance they would have another
- If a respondent had four or more ACES they were 2 ½ times more likely to suffer from COPD; 2 ½ times more likely to contract hepatitis; 4 ½ times more likely to suffer from depression and/or anxiety and 12 times more likely to have thoughts of suicidality.
- If a respondent had seven or more ACES they had triple the risk for lung cancer and 3 ½ time more likely to develop ischemic heart disease, the number one killer in the US.
- Those with one or more ACES are more likely to engage in high-risk behavior and even without high-risk behavior they are more likely to develop cancer or heart disease.
- ACES inhibit development of the pre-frontal cortex which translates to less impulse control and learning ability. There is also a measurable difference in the amygdala.

The correlation between childhood adversity and negative health outcomes has been well established. While there continues to be some detractors of the original study and additional studies have been/are being conducted. The underlying question and premise are sound. The scientific basis for the correlation between ACES and negative health outcomes is not complex. The basis is essentially the same as when we experience a stressful or traumatic event – **the activation of the hypothalamus-pituitary-adrenal axis (HPA Axis)**. Repeated activation of the stress response system in childhood will change from adaptive (life-saving) to maladaptive (health damaging). The continuous cascading of adrenaline and cortisol inhibits the developing immune and hormonal systems which, in turn, lead to the mental and physiological health problems during adolescence and adulthood.

## **First Responders**

I think we can all agree that first responders such as law enforcement, firefighters and emergency medical services personnel are exposed to far more stress, trauma and critical incidents than the average person. One estimate is that a first responder experiences an amount of stress and trauma in one month that is equal to what a “civilian”, or non-emergency responder, does in their lifetime. As a result, first responders face the continuous activation of their stress response system which, in turn, can place their health and mental wellness in jeopardy at times.

The stress response in first responders is no different than the stress response in the average citizen except that, as is the case with ACES, the stress and trauma does not go away, at least not for very long unless the stress and trauma are acknowledged and steps are taken to mitigate the cause and symptoms.

Being a first responder is an inherently dangerous endeavor. Police officers are faced with increasing threats not just from the traditional bad guys but from political unrest and cultural changes. Firefighters face danger each time they respond to a fire or rescue situation. EMTs and paramedics, once viewed as saviors, are now threatened and sometimes assaulted when responding to calls for assistance. Response during the pandemic put an enormous strain on emergency medical response personnel who were bombarded daily with call after call for someone sick with COVID-19 symptoms, thereby jeopardizing their own health. All of this creates a climate of potential danger each time a first responder answers a call for service and results in direct trauma.

The danger, however, does not always come from the outside, it comes from the inside as well. As mentioned above, the stress response in first responders is not a one-off and let’s move on. The first responder’s stress response system is in a continuous cycle of cascading stress hormones that never really leave their system. This occurs not only due to direct trauma, but from the effects of secondary trauma and compassion fatigue while experiencing the trauma of others. We want to help others and when we see others suffering physical or emotional trauma it adds to our stress and trauma. Some first responders can maintain an emotional detachment from secondary trauma but many cannot. For those that cannot, another person’s trauma becomes their own and adds to their

physiological and emotional load. (The cumulative burden of repeated and chronic stress that results in wear and tear on the body is known as allostatic load).

We know the basics of the stress response system; the amygdala signaling the hypothalamus which activates the autonomic nervous system and the HPA axis. This results in the release of norephedrine and cortisol which, during a short-term response, will be washed out and will return to normal levels. With first responders however, the stress hormones never really return to normal levels. The system becomes “dysregulated” when the hypothalamus and hippocampus cannot successfully control cortisol and, among other things, our immune system begins to break down. The result is that excess cortisol remains in the system which can overpower the hippocampus, the memory and learning center. When this happens, we are viewing our life through the lens of our amygdala, the fear and anger center. When you are a hammer, everything looks like a nail. When you are the amygdala, everything looks like a threat so we cannot escape the stress response activation. Because the immune system is overwhelmed, we become more susceptible to declining health, sickness and disease.

So, between the direct and secondary trauma, the continuous activation of the stress response system and excess cortisol in their systems, first responders can suffer from a long list of negative effects including:

- Exhaustion
- PTSD
- Depression
- Anxiety
- Hypervigilance
- Anger
- Detachment
- Dissociation
- Weight gain
- Memory Loss
- Loss of focus
- Depressed Immune System
- General Burnout

You will recognize these symptoms from the trauma response graphic shown earlier. Just like the analogy with your hands directly above your head with your left hand being a trauma and your right hand being PTSD, the effects above can be everything in between and they can ultimately lead to a diagnosis of PTSD.

I would like to briefly explain the effect of unexplained weight gain as it is common in first responders. It is, however, more prevalent in police officers. During the stress response, blood sugar and fats from temporary storage sites in the body are released into our system. The blood sugar is delivered to cells as energy, however when cortisol levels become excessive the cells do not accept the blood sugar so it just sits in the system. This can result in increased appetite for fatty foods. In conjunction with shift work when there may not be healthy food options available, officers tend to eat fast food and high sugar items. Additionally, when police officers work late-night shifts some officers may not acclimate well and they do not get enough quantitative and qualitative sleep. Poor sleeping habits also can lead to eating more fatty and sugary foods. The weight gain is typically reflected around the waist with some fatty deposits on the back between the shoulder blades. Without some reduction in stress levels and stress hormones, it is typically very difficult to lose the accumulated weight gain.

So, what is the actual impact of the increased stress and trauma suffered by first responders? In a study conducted by the Ruderman Family Foundation in 2018 the following data was presented: (The research included EMS and firefighters together as they are many times the same department. Again, this was 2018)

- **15-22% of firefighters and 35% of police officers suffered from PTSD as compared to 6.8% of the general population**
- **11% of firefighters and 9-31% of police officers suffered from depression as compared to 6.7% of the general population**
- **The suicide rate for firefighters was 18 per 100,000 population and 11-17 per 100,000 population compared to 13 per 100,000 in the general population**

More recent research, courtesy of the International Public Safety Association is reflected in the following:

- **20% of active firefighters are diagnosed with PTSD or PTSI (Post Traumatic Stress Injury)**
- **19% of law enforcement officers are diagnosed with PTSD or PTSI**
- **16% of active dispatchers and 911 operators are diagnosed with PTSD or PTSI**

Statistics related to first responder suicide and line of duty deaths in **2020** as reflected in the following:

- **171 law enforcement officers died by suicide**
- **264 law enforcement officers died in the line of duty**
- **113 firefighters died by suicide**
- **90 firefighters died in the line of duty, to include COVID-19 deaths**
- **3 EMTs/Paramedics died by suicide**
- **65 EMTs/Paramedics died in the line of duty, including COVID-19 deaths**
- **2% of dispatchers/911 operators died by suicide**

Additionally, a study by the Fraternal Order of Police (FOP) revealed that out of 8,000 officers surveyed:

- **79% of the officers had experienced critical stress**
- **69% indicated the critical stress had caused lingering emotional issues**

A couple of thoughts above these statistics –

- Dispatchers and 911 operators are, indeed, first responders. They do not respond to the scene of the emergency but they are the core of an integrated response. They have the added stress of coordinating all responding personnel and they are dealing with ALL of the emergencies. They simply do not receive enough recognition for the amount of stress and trauma they endure.
- While those serving in the military may not be considered first responders (I happen to believe that those serving in conflict zones are the tip of the first responder spear) military servicemen and women are very much subject to trauma and PTSD. **According to the National Center for PTSD, the number of veterans suffering from PTSD varies by service era, however it is believed that anywhere from 11% to 20% of veterans suffer from PTSD. Additionally, 23% of women serving in the military reported**

**suffering from the trauma of being sexually assaulted and 55% reported being sexually harassed.**

- **Active-duty military suicides have increased 40% since 2016**
- **Veterans are at a 50% higher risk for suicide over those who have not served.**
- **According to a study by the National Association for Mental Illness (NAMI), 19% of police officers and 29% of US troops suffer from PTSD. Think about those military veterans that become police officers in civilian life. They are already susceptible to, or actually suffer from, PTSD and are transitioning in to a job where PTSD is common. These veterans are now at increased risk of long-term chronic trauma.**
- **171 law enforcement officers died by suicide in 2020. It is believed that retired or former police officers actually commit suicide at a rate ten times that of active police officers.**

I don't think there is a more instructive illustration of police trauma, line-of-duty death or suicide than what occurred as a result of the January 6, 2021 insurrection at the United States Capitol. During the orchestrated attack, some 150 police officers were injured with one Capitol police officer dying as a result of the injuries sustained when he was assaulted by the rioters. Additionally, four police officers died by suicide after the attack; 2 US Capitol police officers and 2 Metropolitan (D.C.) police officers. The trauma suffered by all US Capitol police officers, Metropolitan police officers, National Guard members, US Capitol workers and political staffers and their families goes on to this day.

As a means to highlight real-world examples of first responders involved in life-or-death situations, and their physiological response during these situations, I am going to describe two incidents, both involving police officers. The first is an incident involving Lt. Jim Glennon of the Lombard Police Department in Illinois where a shoplifting suspect opened fire with a handgun as responding officers knocked on his door at a condominium complex. The second incident involves the police shooting of Daunte Wright by police officer Kim Potter in Brooklyn Center, Minnesota when Potter intended to deploy her taser and, instead, mistakenly shot Wright with her service weapon.

I first learned of the incident involving Glennon from an article written by Amanda Ripley entitled "*Your Brain in a Shootout*" which appeared on time.com. After reading the article I spoke with, now former, Lt. Glennon to learn more about what he did and did not recall about the shooting incident. Be advised that Glennon's recollection of the incident, as written, contains profanity which may be offensive to some. If so, I apologize for that. I decided to describe the incident exactly as Glennon recalled it as it is a real-life incident and the profanity is not gratuitous, but rather a reflection of what actually transpires during a tense, life-threatening situation.

On a fall day in September of 2004 Lt. Jim Glennon of the Lombard, Illinois Police Department was on his way to buy a diet coke when he decided to assist a young patrol officer with a shoplifting incident. The officer had graduated from the police academy, finished with field training and had been on his own for only a couple of weeks. The shoplifting incident had occurred at a liquor store and a license plate from the suspect's car led them to a condominium complex.

The officers arrived at the suspect's condominium and knocked on the door. After repeated tries with no response, the officers were about to leave to get a warrant when the condominium's door opened and the suspect began firing a black snub-nosed revolver. Glennon, a police academy trainer, immediately thought "Oh Shit, gun!" while recognizing that the revolver would only hold five or six rounds. Glennon turned hard to his left narrowly missing being shot and then began running, with his service weapon in his hand, down the hallway with a second officer to obtain cover.

As Glennon was running and hearing gunshots ringing out, he fell forward skinning his hands and his knees. Glennon picked himself up and began running again just as the officer with him fell, yelling that he had been shot. Glennon picked up the officer by his gun belt and dragged him down the rest of the hallway and around a corner. Glennon then turned to point his weapon at the suspect and all he had was his finger pointing down the hallway. Glennon had dropped his service weapon when he grabbed his colleague by the belt so he grabbed his injured colleague's weapon out of his holster.

Glennon pointed his weapon towards the suspect but could not fire because the young patrol officer was further down the hall and behind the suspect. Not

being able to shoot at the suspect, Glennon yelled at the young officer to “SHOOT THAT MOTHERFUCKER” but nothing happened. Glennon then called the officer’s name and screamed “THIS IS YOUR COMMANDING OFFICER – SHOOT THAT MOTHERFUCKER RIGHT NOW”. Glennon then heard two shots and shortly after the suspect threw his weapon into the hallway and surrendered. A few moments later a large group of police officers arrived and, according to Glennon, literally falling out of the elevator. The suspect was handcuffed, Glennon was checked for injuries and the injured officer was transported for treatment.

There are a number of points to be made about Glennon’s response to the shooting incident as well as the response by the young officer.

First, Glennon’s reaction to seeing the firearm was immediate and his quick reaction probably saved his life. While the thalamus was sending a message to the amygdala via the low road, the message was also being sent to the cortex via the high road. The cortex, being the rational part of the brain, recognized Glennon’s previous training regarding life threatening situations and he was able to move quickly rather than momentarily freeze.

Secondly, after the stress response system was activated via the HPA axis and the stress hormones were released, Glennon fell while trying to run down the hall away from the shooter. While Glennon’s heart rate at this point was probably in the “red zone” where his overall physical response is optimized, his fine motor skills had deteriorated and his feet could not keep up with the rest of his body. As Glennon said “I was a 48-year-old guy wearing 20 pounds of equipment” which made his coordination more difficult.

Third, while running down the hall to get away from the shooter, Glennon estimated the hall was 275 feet long and it seemed to take minutes to get to the end. The hallway was actually 79 feet and it only took seconds to reach the end. This indicates tunnel vision and time distortion which are common when the stress response accelerates through the autonomic nervous system.

Fourth, Glennon did not realize that he had dropped his service weapon when he stopped to grab his colleague that had been shot. As he recalled, he looked around the corner to point his weapon at the shooter and it was only his finger pointing down the hallway. This is the effect of the cortisol cascading through his system.

Fifth, despite numerous shots being fired and the air thick with the smell of gunpowder and smoke, Glennon did not recall any smell of gunpowder or the sight of smoke. This also, represents the distortion of senses during an emergency.

Sixth, during the incident Glennon felt strong and “amped up.” When sitting in an ambulance being checked out after the incident, Glennon began to shake which is an indicator that the brain recognizes the emergency is over and the stress hormones are returning to lower levels. This is typical when adrenaline and cortisol are being reduced. Also, remember that when the HPA axis is initiated, resources are sent to those areas of the body necessary for survival. In order to do that, resources must be taken away from those areas not critical for survival. The depletion of resources can also result in the body feeling weak.

Additionally, during the incident Glennon recalled that the young patrol officer fired two shots at the attacker moments before the attacker surrendered. Glennon asked the officer why he only fired two shots. The officer replied that during his firearms training he was instructed to fire two shots (known in police parlance as a “double tap”) and then holster his weapon. This is an excellent example of reinforced training providing a memory that can be extracted during a stress response thereby overriding the effects of excessive cortisol.

The second incident involves the shooting death of Daunte Wright by Brooklyn Center, Minnesota police officer Kim Potter. According to pretty much all those involved in this case, prosecution and defense alike, Potter did not intend to shoot Wright, but rather intended to deploy her electronic control device (ECD) also known as a Taser to control Wright. There have been approximately 20 documented cases where a police officer shot, and sometimes killed, a suspect when intending to deploy the ECD. Potter’s case, while not the most recent, received far more attention, publicity and news coverage than the others. Potter was convicted of manslaughter for the shooting and was sentenced to two years imprisonment. Potter will actually serve 16 months in custody and will serve the remainder on supervised release. I contacted Potter at the Minnesota Correctional Facility in Shakopee in hopes of discussing the shooting with her in order to gain insight into her physiological response during the incident. Potter

thanked me for reaching out but indicated that, at the current time, she could not discuss the incident.

Kim Potter was a 26-year veteran officer who had served her entire career as a patrol officer for the Brooklyn Center Police Department. Potter had never been promoted but it is unknown as to whether Potter simply did not want to be promoted or if she did not merit promotion in the eyes of the department. Potter had served as a training officer and, in fact, was training an officer the day the shooting occurred. Potter had also served as a member of the crisis negotiation team although she admitted at trial that she had never been in a crisis.

On April 11, 2021 the officer that Potter was training decided to pull over a vehicle because there was an air freshener hanging on the rear-view mirror and the registration tags had expired. Potter would later say that had she been alone she would not have stopped the vehicle for the minor infractions. Once the operator had been identified as Daunte Wright it was determined that there was an outstanding warrant for Wright for weapons possession.

Officers then attempted to arrest Wright and successfully put one handcuff on him before Wright broke free, walked around the front of his vehicle and entered his vehicle through the driver's door.

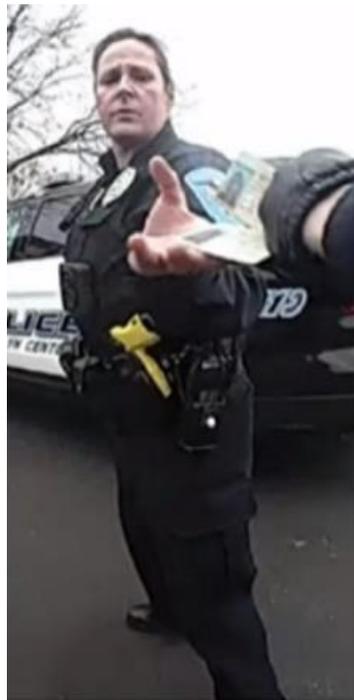
At this point there was a lot of yelling and three officers were attempting to control Wright. Potter yelled at Wright "I will tase you" and moments later Potter yelled "taser, taser, taser" which is the standard warning for other officers when a taser is going to be deployed. Seconds later Potter shot Wright with her Glock service weapon and then cried out "holy shit, I just shot him". Wright's vehicle then moved forward, later coming to rest against another vehicle.

There are a number of tactical issues surrounding this incident that added to an already stressful situation. There were multiple officers involved rather than one person taking charge and no one was taking charge and controlling Wright. Wright was able to get away from the officers, walk around the vehicle and get into the driver's seat. At this point the officer's response escalated as they had lost control of Wright and they were afraid he was going to take off. An already stressful situation got worse.

At the center of the incident now was Potter who warned that she was going to “tase” Wright as he was sitting in the car and then issued the advance warning to the other officers. It seemed clear to everyone that Potter was going to “tase” Wright, and then she shot him. Just how and why did that happen?

Let’s start with Potter’s stress response system. We know that a signal was sent from Potter’s thalamus to her amygdala via the “low road” and to Potter’s neocortex via the “high road”. The amygdala then signaled the hypothalamus which, in turn, initiated the HPA axis and epinephrine and cortisol were released. Potter is probably now in the upper ranges of the “red zone” or the “grey zone” where she experienced tunnel vision, auditory exclusion and dissociation.

Shown below is a photograph taken of Potter. The date is unknown but it is not the day of Wright’s shooting. You will note that Potter wears her taser on the left side of her belt and, although it cannot be seen in this photo, her service weapon on her right side of her belt.



This is the required positioning by the Brooklyn Center Police Department as well as most other police departments. The positioning is designed to prevent

exactly what happened when Potter shot Wright, confusing a taser with a firearm. Utilization of the taser, which is bright yellow, would require Potter to remove the taser with her left, or weak, hand because her firearm is located on the right side, her dominant or strong hand. So, the question is, if Potter was going to “tase” Wright why did she remove her firearm with her right hand when the Taser is located on the left hand side of her belt and would require her left hand?

A number of legal analysts and use of force experts weighed in on this and there was agreement among many that Potter’s reaction constituted a “slip and capture” error. This essentially means that you intend to do one thing but do another when you are under stress. For the most part, I agree with the speculation by the use of force experts.

When I described Lt. Jim Glennon’s response while being shot at, I referenced memories, or muscle memory, from his police training being the reason he was able to react just the way he had trained others and been trained himself. This, despite the different outcomes, may be exactly what happened with Potter.

For most law enforcement officers their firearm is their best friend. This is the way they are indoctrinated, and this is the way they are trained. Their firearm is the last line of defense to save their life and the lives of others. Law enforcement officers probably receive more firearms training than anything else. Most departments require, at minimum, a successful annual firearms qualification score in order to maintain certification and some require semi-annual, or quarterly, qualification. Due to the rigorous training requirements, law enforcement officers adopt their firearm as their number one option while they are in danger.

In contrast, those law enforcement agencies that provide Tasers, or other electronic control devices, do not typically have the same rigorous training requirements. Most agencies require an annual training class which may, or may not, include actual discharge or deployment of the device. This is primarily due to the cost of the equipment as cartridges are expensive. The Brooklyn Center Police Department requires “annual proficiency training” and the training includes “performing reaction-hand draws or cross-draws to reduce the possibility of accidentally drawing and firing a firearm.” It is not clear if the “proficiency training”

includes actual deployment of the weapon. Potter last received Taser training in March, 2021, the month before the Daunte Wright shooting.

After reviewing all of the publicly available information about the incident, it appears to me that Potter simply did not mentally absorb the important practical information regarding the Taser as a self-defense weapon nor did she reinforce the training internally. Whether this is a Brookly Center Police Department training issue or a Potter issue, I don't know.

During her court testimony, Potter said that she does not remember why she decided to use her taser and she has no idea why she pulled her firearm instead. According to Josh Campbell, a CNN legal analyst and former FBI agent, "Potter could not describe the basic details or function of a taser and she showed no interest in mastering a weapon she carried on behalf of the public."

As previously indicated, Potter was a 26-year veteran officer who had never been promoted either because she was not interested in being promoted or she did not merit promotion in the eyes of the department. For whatever reason Potter remained in the patrol officer position and my theory is that she became too comfortable in that position and did not have the ambition to stay current and maintain proficiency in all areas of modern policing. I believe Potter simply did not regard taser training as important as firearm training and, in fact, had never deployed her taser in the field. As a result, when Potter's HPA axis was activated and the stress hormones were cascading through her system, her amygdala overpowered both her hippocampus and her neocortex and while in full "fight-flight" mode she shot Wright. She may have thought that using the taser was appropriate, however her brain reverted to the only thing that was believed could save her.....her firearm. As a result, Daunte Wright was killed and Potter is incarcerated in the Shakopee Correctional Center.

The killing of Daunte Wright by Kim Potter is a tragedy. If there is to be any good that comes from this event, I hope police departments across the country will now emphasize the physiological science of policing to include the officer's response to fear, stress and trauma. I also hope that this event creates the opportunity to look, in retrospect, at the police shootings of unarmed people through the lens of what happens when police officers are placed under stress and have not been adequately trained with regard to how to anticipate that stress

and how to react accordingly. I also hope that police administrators, fire administrators and EMS administrators develop, or if already developed, reinforce programs designed to monitor employees/staff for signs of trauma and provide the means to assist with the trauma through appropriate assistance programs.

## **Recommendations**

After completing the first draft of this paper I sent it out to a diverse group of people soliciting their review and comment. During this process it was suggested to me that based on my research and experience, I should consider offering recommendations to individuals and organizations about preparing for the inevitable trauma or critical events that we will all face at some point in our lives. Toward that end, I offer the following:

### **For Individuals**

- Be aware of, and alert to, the physiological response that will occur when we experience a traumatic event. It will help you prepare for the inevitable.
- Be aware of, and alert to, the three phases of the *Survival Arc* as described by Amanda Ripley; Denial – Deliberation – Decisive Action. Our first reaction is typically one of denial (That can't be a gunshot, it must be a car backfiring). After we get past denial, we move into deliberating how to proceed. We are now dealing with the fight-flight response and we are subject to the physiological stress response. Finally, we move into taking decisive action. As you will remember, when we move through the various "zones" we can become bigger, faster and stronger but, at the same time, it becomes very difficult to perform fine motor functions.
- Become familiar with the concept of Run – Hide – Fight, also known as Avoid – Deny – Defend. These concepts are critical to survival during an active shooter event or other hostile event. While I did not speak to these concepts during the paper, your physiological response will be the same during these events and will influence how you react, and perhaps survive. The FBI and Department of Homeland Security have excellent resources for responding to these events.
- Think ahead about how you would respond in the event of a critical or traumatic event. The more you think about how to respond, the more your neocortex and hippocampus will have a basis for a rational response.

## **For Organizations** (Businesses, Non-Profits, Houses of Worship)

- Prepare your organization for the inevitable critical event such as an active shooter or other hostile event, disaster or other emergency. Understand how your employees/volunteers will react based on the physiological stress response.
- Develop an emergency plan for your organization, keeping in mind how your employees/volunteers will react under stress and trauma.
- Practice your emergency plan and then practice it some more. Reinforcement of the plan over time will create the opportunity for your staff to react in a more rational way as the brain relies on memories of the previous training experiences rather than going into full “fight-flight” mode.
- Learn from, and practice the lessons learned from the response by Morgan Stanley during the terrorist attack on 9-11. Rick Rescorla, the Director of Security for Morgan Stanley was an absolute taskmaster when it came to training Morgan Stanley employees on what to do if there was a terrorist attack on the twin towers in New York. After an attack in 1993, Rescorla was convinced terrorists would strike again. As a result of Rescorla’s insistence on constant reinforcement and training on the emergency plan, Morgan Stanley’s employees evacuated during the attack in a calm and methodical manner. The result was that most of Morgan Stanley’s employees survived that day because they did not panic, did not go into full “fight-flight” mode and were able to keep the cortisol levels in their systems to a manageable level. The neocortex and hippocampus prevailed.
- Knowing how the brain and body will respond during a critical event, and how employees/volunteers will react will provide an advantage during the event and will help save lives.
- Take steps to recognize the signs of stress and trauma in your staff. Ensure that your staff have options for dealing with the stress and trauma through professional assistance.

## **Conclusion**

I hope this paper has provided you, the reader, with some information that you did not have before. I hope it helps you to develop an understanding of why we react the way that we do and how our brain functions when we are exposed to trauma, stress, fear and critical incidents. Much of what I have written is based on the work of neuroscientists, researchers and training webinars. Some of what I have written is based on my personal experience with stress, trauma and critical incidents during my 24-year career in law enforcement. While there may be some disagreement among experts about certain aspects of brain development, the body's physiological response to trauma is generally accepted.

There are a few thoughts that I would like to leave you with:

- Fear – we all have it. We are all afraid of something and fear is to be expected when we are exposed to stress and trauma.
- The level of impact that trauma has on us is based on the meaning and value that we attach to each and every event.
- Trauma occurs when, in large part, we do not feel safe or in control.
- We do not have to directly experience a traumatic event in order to be affected. Secondary trauma has the same negative effect on us.
- We must do more to recognize and address the trauma inflicted upon our children, some of which is inflicted pre-birth when an expectant mother suffers a trauma.
- Although I did not discuss anxiety and depression a great deal, it is estimated that there are 40 million people in the US that suffer from some form of anxiety disorder and that over 32% of the US population suffers from some level of depression.

Finally, and after all this talk about stress and trauma, I encourage you to take measures to help you deal with trauma and stress. Whether through exercise, mindfulness, support groups, adopting a wellness attitude, maximizing sleep, good nutrition, socialization or simply getting outside into nature. Positive thinking never hurts either. I also want to recommend some reading that I found particularly enlightening:

- For those suffering from anxiety, or if someone you know suffers from anxiety, I recommend *Rewire Your Anxious Brain* by Catherine M. Pittman, PhD and Elizabeth M. Karle, MLIS
- For a practical guide to dealing with stress and the unhealthy stress response, I recommend *The Stress-Proof Brain* by Melanie Greenberg, PhD
- For those with an interest in childhood trauma and adverse childhood experiences, I recommend *The Deepest Well – Healing the Long-Term Effects of Childhood Trauma and Adversity* by Nadine Burke Harris, M.D.
- For those with a general interest in trauma, its effects and how we can heal from it, I recommend *Trauma – The Invisible Epidemic* by Paul Conti, M.D.

All four of these books are written for the lay person and offer practical information and guidance.

Thanks for taking the time to read this. Be safe and be well.

Rob Yandow is a retired police officer and a former city manager and public health official. Yandow is a graduate of the FBI National Academy and he currently serves as the national sector chief for the InfraGard Emergency Services Sector. Yandow also serves as a Fusion Liaison Officer with the West Virginia Fusion Center and as a member of the International Public Safety Association where he serves as a member of the Mental Health and Integrated Response sections. Yandow holds a Master of Public Administration degree from the University of Vermont. He can be reached at [rob.yandow@gmail.com](mailto:rob.yandow@gmail.com) or [ryandow@infragardnational.org](mailto:ryandow@infragardnational.org)

## References

- Pittman, C.M., and E.M. Karle. 2015. "Rewire Your Anxious Brain: How to Use the Neuroscience of Fear to End Anxiety, Panic and Worry." Oakland, CA: New Harbinger Publications.
- American Psychiatric Association, 2015. "*Understanding Mental Disorders: Your Guide to DSM-5.*" Arlington, VA: American Psychiatric Publishing.
- Heyman, M., J. Dill, R.E. Douglas, 2018. "The Ruderman White Paper on Mental Health and Suicide of First Responders." *Ruderman Family Foundation.*
- Ripley, Amanda. 2008. "The Unthinkable: Who Survives When Disaster Strikes- and Why." New York: Three Rivers Press.
- Van der Kolk, Bessel. "The Body Keeps the Score." 2014. New York: Penguin Books.
- Ciaraglia, J. April 13, 2021. "How Could a Gun be Mistaken for a Taser?" *USA Today*
- Ripley, Amanda. January 16, 2013. "Your Brain in a Shootout." *Time.com*
- Alfonseca, Kiara. April 15, 2021. "Daunte Wright Shooting: Other Officers Have Mistaken Their Guns for Stun Guns." *ABC News.*
- Siemaszko, Corky. April 13, 2021. "How a Veteran Officer Could Have Mistaken a Glock for a Taser in the Fatal Shooting of Daunte Wright." *NBC News.*
- Morgan, Amy. April 24, 2018. "Managing Fear and Panic Response." *Justice Clearinghouse.*
- Advanced Law Enforcement Rapid Response Training. "Disaster Response- The Background Science of How People Behave in High Stress Events." *Texas State University.*

Greenberg, Melanie. "The Stress-Proof Brain: Master Your Emotional Response to Stress Using Mindfulness & Neuroplasticity." Okland, CA. New Harbinger Publications.

Mayo Clinic Staff. July 8, 2021. "Chronic Stress Puts Your Health at Risk."  
*Mayoclinic.org*

LeDoux, J.E. 2015. "Anxious: Using the Brain to Understand and Treat Fear and Anxiety." New York. Penguin Books.

LeDoux, J.E. 1996. "The Emotional Brain: The Mysterious Underpinnings of Emotional Life." New York. Simon and Shuster.

Bowers, Duane. 2021. "Understanding Trauma and Trauma-Informed Care."  
*Justice Clearinghouse.*

Substance Abuse and Mental Health Services Administration. 2014. "SAMHSA'S Concept of Trauma and Guidance for a Trauma-Informed Approach." HHS Publication No. (SMA) 14-4884.

LeDoux, J.E. December 18, 2015. "Run-Hide-Fight is Not How Our Brains Work." *New York Times.*

Gopnick, Alison. December 11, 2021. "What Children Lose When Their Brains Develop Too Fast. *Wall Street Journal.*

Murphy, Kate. October 26, 2017. "Outsmarting Our Primitive Response to Fear."  
*New York Times.*

Bezdek, K.G., E.H. Telzer., December 20, 2017. "Have No Fear the Brain is Here."  
*Frontiers for Young Minds.*

National Center for Biotechnology, National Institute of Health. 2012. "Amygdala Volume Changes with Post Traumatic Stress Disorder in a Large Case-Controlled Veteran Group. 2012.

Taylor, G. May 1, 2019. "What is the Amygdala?" *Facty Health*.

Cuncic, Arlin. June 22, 2021. "Amygdala Hijack and the Fight of Flight Response." *Very Well Mind*

Australian National University. August 5, 2020. "Your Amygdala Gets Bigger if You're Anxious and Depressed." *Neuroscience News*.

Parrington, John. April 19, 2021. "What Can Neuroscience Tell Us About the Mind Of a Serial Killer." *Oxford University Press*.

Yehuda, R., C. Hoge, A. McFarlane. "Post-Traumatic Stress Disorder." 2015. *Nature Reviews*.

Pugle, Michelle. April 1, 2021. "The Anatomy of the Amygdala." *Very Well Health*.

Cohen Silver, R., E.A. Holman and D. R. Garfin. January, 2021. "Coping With Cascading Collective Traumas in the United States." *Nature Human Behavior*.

Iati, Marisa. December 24, 2021. "The Pandemic Has Caused Nearly Two Years of Collective Trauma: Many People Are Now Near a Breaking Point." *Washington Post*.

Rosenthal, M. June 10, 2020. "How Trauma Changes the Brain." *bostontrials.com*

Good Therapy. September 4, 2019. "Development of the Pre-Frontal Cortex." *goodtherapy.org*

Seladi-Sherman, J., June 23, 2018. "What Part of the Brain Controls Emotions?" *Healthline*

Pietrangelo, Ann. March 7, 2019. "Left-Brain v. Right-Brain-What Does This Mean Me?" *Healthline*.

Harvard Health. July 6, 2020. "Understanding the Stress Response." *Harvard*

*Health Publishing.*

Guidi, J., M. Lucente, N. Sonino and G.A. Fava. August 14, 2020. "Allostatic Load And It's Impact on Health-A Systematic Review." *Karger Journal*.

McLachlan, Stacey, December 21, 2021. "The Science of Habit-How to Rewire Your Brain." *Healthline*.

Woodsome, Kate. January 6, 2022. "The January 6 Mob Surged at Me-Then the Trauma Rushed In." *Washington Post*.

McKoy, Jillian. October 4, 2021. "Depression Rates Tripled and Symptoms Intensified During the First Year of COVID." *Boston University School of Public Health*.

Shevit Goldin, Deanna. January 7, 2022. "Understanding Chronic Brain Fog." *Psychology Today*

Golembiewski, Kate. January 11, 2022. "What the Two Halves of Your Brain (Don't) Say About You." *Discover Magazine*.

Hyman, Ira. July 27, 2021. "Can COVID Cause Brain Fog and Cognitive Deficits?" *Psychology Today*.

General Psychiatry. January, 2000. "Study of Aggressive Boys 7-12 Found Low Levels of Cortisol Compared to Non-Aggressive Boys Who Had Higher Levels Of Cortisol." *Archives of General Psychiatry*.

Scitech. January 13, 2022. Increased Myelin in Brain's Grey Matter Linked to Anxiety and PTSD." *SciTechDaily*.

Burke Harris, Nadine. 2018. "The Deepest Well-Healing the Long-Term Effects Of Childhood Trauma and Adversity." New York. Mariner Books.

Felliti, V.J., Winter 2002. "The Relationship Between Adverse Child Experiences And Adult Health: Turning Gold Into Lead." *The Permanente Journal*.

Sui, S.X., J.A. Pasco. September 24, 2020. "Obesity and Brain Function: The Brain-Body Crosstalk." *Menicina (Kauras)*

Reece, Hope. March 1, 2022. "What to Know About Pandemic-Driven PTSD." *Discover Magazine*.

Feldman Barrett, Lisa. 2020. "7 1/2 Lessons About the Brain." Boston. Houghton Mifflin Harcourt.

Conti, Paul. 2021. "Trauma. The Invisible Epidemic-How Trauma Works and How We Can Heal From It." Boulder, CO: Sounds True Publishing.

Grabmeier, Jeff. April 13, 2022. "Newborns' Brains Already Organized Into Functional Networks." *Medical Xpress*.

Mancella, Gabrielle. February 12, 2020. "How Too Much Stress Can Cause Weight Gain (And What to Do About it)." *Orlando Health*.

Tingley, Kim. March 4, 2022. "There's a Mental Health Crisis Among American Children, Why?" *New York Times*.

Gu, Eileen. 2022. "I admit It, I'm in Love With Fear." *New York Times*.