THE EFFECTS OF HUMAN SEX TRAFFICKING ON THE LIMBIC SYSTEM AND HYPOTHALAMIC PITUITARY ADRENAL AXIS

By

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Abstract

Human trafficking is a human rights crisis and victims of such crimes deal with life long issues that include anxiety disorders, panic disorders, substance abuse and post traumatic stress disorder. Human trafficking manifests itself in nearly every single country in the world. Sexual and labor trafficking are rampant among nearly every nation, but in this paper I will be looking only at trafficking in the United States, specifically sexual trafficking with female victims and how their experiences changed their limbic system and hypothalamic pituitary axis due to hypersecretion of glucocorticoids.

According to the United States National Human Trafficking Resource Center Data Breakdown report for the dates between January 1, 2015 and December 31, 2015. There were a total of 4,857 reported number of trafficking cases and of these 74.6% or 4,136 cases were of sexual trafficking, and 13.0% or 721 cases of labor trafficking. This same chapter mentioned that in the United States most slaves spend four to five years in bondage, and around 14,500 to 17,500 people are trafficked into the United States from overseas each year. Besides these thousands of people trafficked from out of the country there are also many slaves who are Native Americans (Bales and Soodalter). Some of these native-born Americans will end up in a trafficking situation due to deception, abduction, or in other cases it is voluntary. Cases vary from rebellious teenagers who ran away from home to meet a man they met online who ended up being a pimp; girls willingly entering into prostitution out of economic desperation, or others being forced into sexual trafficking to go to other countries. According to an article by Jennifer Lynne Musto she notes that the most visible trafficking victims are "...women who have been trafficked for the purposes of sexual exploitation." For this reason a great deal of legislation in the United States focuses on remedying trafficking situations for women in sexual trafficking.

In 2000 the U.S. Congress enacted the Victims of Trafficking and Violence Protection Act and this specifically outlined sex trafficking as,"' the recruitment, harboring, transportation, provision, or obtaining of a person for the purpose of a commercial sex act.'" (Muftic and Finn 2013). Furthermore, a commercial sex act is "'any sex act on account of which anything of value is given or received by any person,'" (Muftic and Finn 2013). Additionally there is a distinction between prostitution by

consenting adults (regardless of legal issues), child pornography, and sex trafficking (Muftic and Finn 2013). As of 2010 it was found that about 800,000 people are trafficked internationally and 80% of these people are women, of which 50% of the women are minors (Dovydaitis 2010). This means approximately 320,000 little girls from about 4 -5 years old to 17 years old are being manipulated and forced into sexual trafficking. In the past most resources have been devoted to saving trafficked victims and fewer to rehabilitating these trafficked girls from the trauma they have suffered. However, under the current administration it is unclear which how much funding Congress will delegate to and how much interest President Trump has in rehabilitating these victims. In this paper the physiological effects of trauma will be outlined focusing primarily on the limbic system and hypothalamic pituitary axis, and it will be evident that this is a solid basis to continue to provide resources to rehabilitate these victims.

Human trafficking is looked as both a heinous crime and a public health crisis. Women in the sex industry and marginalized populations including: migrant women, exploited women laborers, female domestic violence victims, often experience inadequate nutrition, dangerous working conditions, and will have a higher risk for exposure to infectious diseases (Muftic and Finn 2013). A common trend to note is that victimization and abuse often originates in childhood and does not stop there, most human trafficking victims have years of repeated intrusive trauma (Muftic and Finn 2013). That trauma is both physical and sexual violence and psychological destruction and this trauma has been well documented while the health outcomes have been mostly overlooked (Muftic and Finn 2013). There is a relative lack of knowledge of the health consequences for trafficked women, however there is extensive data on the sexually

transmitted infections (STI) and HIV/AIDS which these women are afflicted with and transmit (Muftic and Finn 2013). The five areas that domestic trafficking victims report a diminished health outcomes are physical health, mental health, co –occurring health issues, suicidal ideation, and addiction (Muftic and Finn 2013). Sex trafficking victims often acquire posttraumatic stress disorder (PTSD), anxiety and mood disorders, dissociative disorders, and substance related disorders (Muftic and Finn 2013). Poor physical health is also common and includes: back pain, memory difficulty, stomach pain, pelvic pain, gynecological infection, headaches and fatigue (Muftic and Finn 2013). It is also important to note that these women have little to no access to health care or social services so these afflictions are not immediately dealt with and can manifest to become very serious issues. Short term issues include injuries due to violent trauma such as broken bones, stab wounds, bruises, head injuries, oral and vaginal bleeding, sprains, contraction of major illnesses and STIs (Muftic and Finn 2013). Additionally many trafficked women become pregnant because no protection methods are used and there can be complications with gestation and delivery (Muftic and Finn 2013). Mental health consequences of trafficked women include; suicidal thoughts or attempts, feelings of anger, depression, inability to feel, sleep disorders, self – blame and guilt, easily startled, homicidal thoughts, lack of energy, panic disorder, neuroses, disassociation, paranoia and loss of appetite (Muftic and Finn 2013). A study looking at domestic and international trafficking victims, found that 100% of the domestic trafficking victims recounted psychological abuse, and 89.5% reported at least one mental health problem (Muftic and Finn 2013). The variables connected to diminishing mental health include length of time in sex work, and having an abusive pimp. Sex trafficking victims likely face mental

health issues for the rest of their lives and for this reason often turn to substance abuse due to their exposure to trauma.

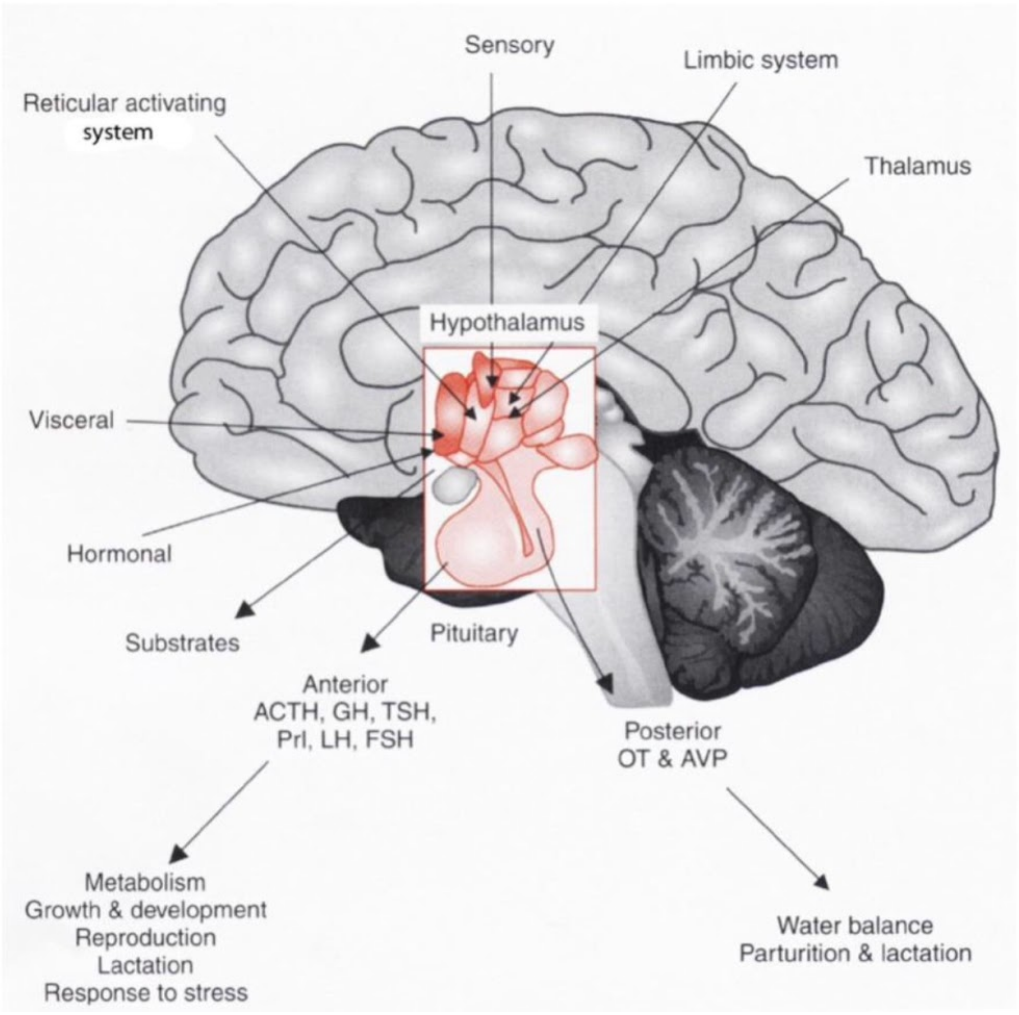
Many of the sex trafficking victims are minors, and their exposure to trauma at a young age makes them even more vulnerable Early exposure to trauma can result in even worse health outcomes than recent exposure to trauma (Muftic and Finn 2013). The definition of trauma, here is,"...experiencing homelessness, hunger, parental neglect, sexual abuse, physical abuse, or rape before age 18," (Muftic and Finn 2013). Many girls are trafficked at a young age; some as young as five or six years old and it is near impossible for them to escape this predicament. These children are forced into traumatic situations at such a young age that their overall health may be compromised for life and can be notably worse than the health outcome of women who were trafficked as adults. Research done on sex trafficked women in Israel concluded that early exposure to trauma related to prostitution resulted in poorer health outcomes, symptoms of depression, PTSD, and physical grievances (Muftic and Finn 2013). Child victims have worse health outcomes than those who are coerced at an older age, have more physical health problems, more frequent suicidal ideations and more addiction (Muftic and Finn 2013).

Additionally victims of multiple assaults, such as sex trafficking victims may have several negative health outcomes as opposed to others (Muftic and Finn 2013). Sex trafficking victims may not only have worse health outcomes but also may have more negative health outcomes than victims of sexual violence. Furthermore trafficked women usually do not refuse sex or negotiate for protections like condoms or access to healthcare (Muftic and Finn 2013). Biological factors such as greater areas of cervical ectopy will also increase the risk for HIV in women who are trafficked as minors (Muftic and Finn

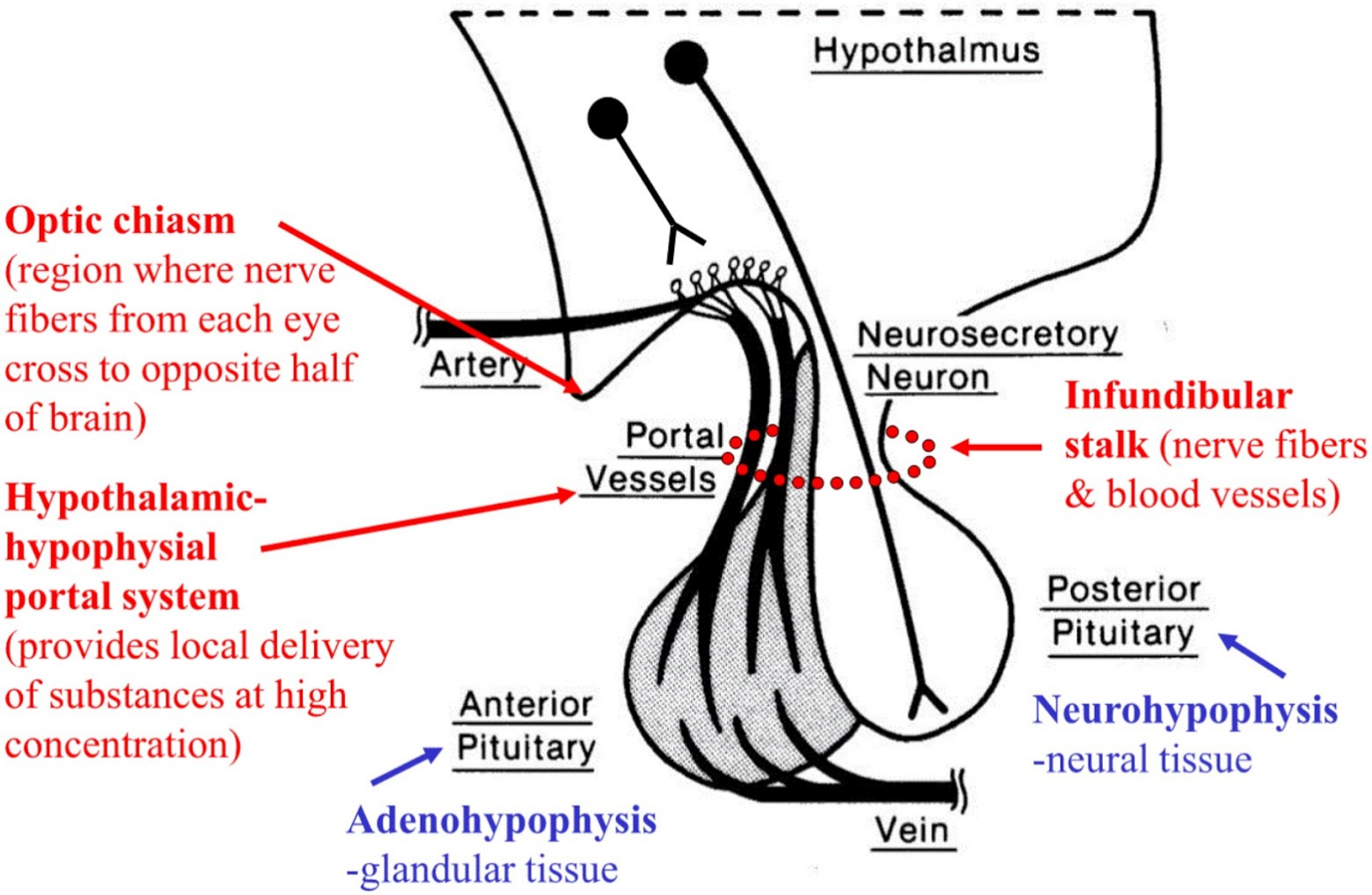
2013). This also helps explain why sex trafficking victims who escape trafficking often engage again in prostitution. It seems that their mental health is so damaged that they do not fit in anywhere else and they are not able to conform to their environment.

Most theories focus on the nature of the sex work and the level of exposure to trauma to explain poor health outcomes. An alternate theory proposes that the manner in which one enters sex work is the health determinant (Muftic and Finn 2013). The involvement of a pimp can have a huge impact on health outcomes, as pimps often use sexual violence to recruit women and women with abusive pimps will report physical health problems, mental health problems, co – occurring health issues (sexual, physical, and mental health issues) and suicidal ideations (Muftic and Finn 2013). Additionally those who are coerced, forced, and/or deceived into being a sex worker have worse health outcomes than those for whom deceit was not used initially (Muftic and Finn 2013). Trafficking involves several factors that will determine the level of stress in each situation, however the common factor is that every trafficking situation is extremely stressful and detrimental to the mental health of the victim. The constant stress in trafficking situations has several physiological repercussions and among these are changes to the hypothalamic pituitary adrenal axis and changes to the limbic system.

A main function of the hypothalamus is to maintain homeostasis, by controlling the release of hormones and other regulatory mechanisms. The interaction of the hypothalamus and pituitary gland is how many hormones get released into the systemic circulation and this will be the main focus in this paper. In addition, every figure shown in this section has been adapted from Dr. Randi Weinstein's endocrine physiology class at the University of Arizona.

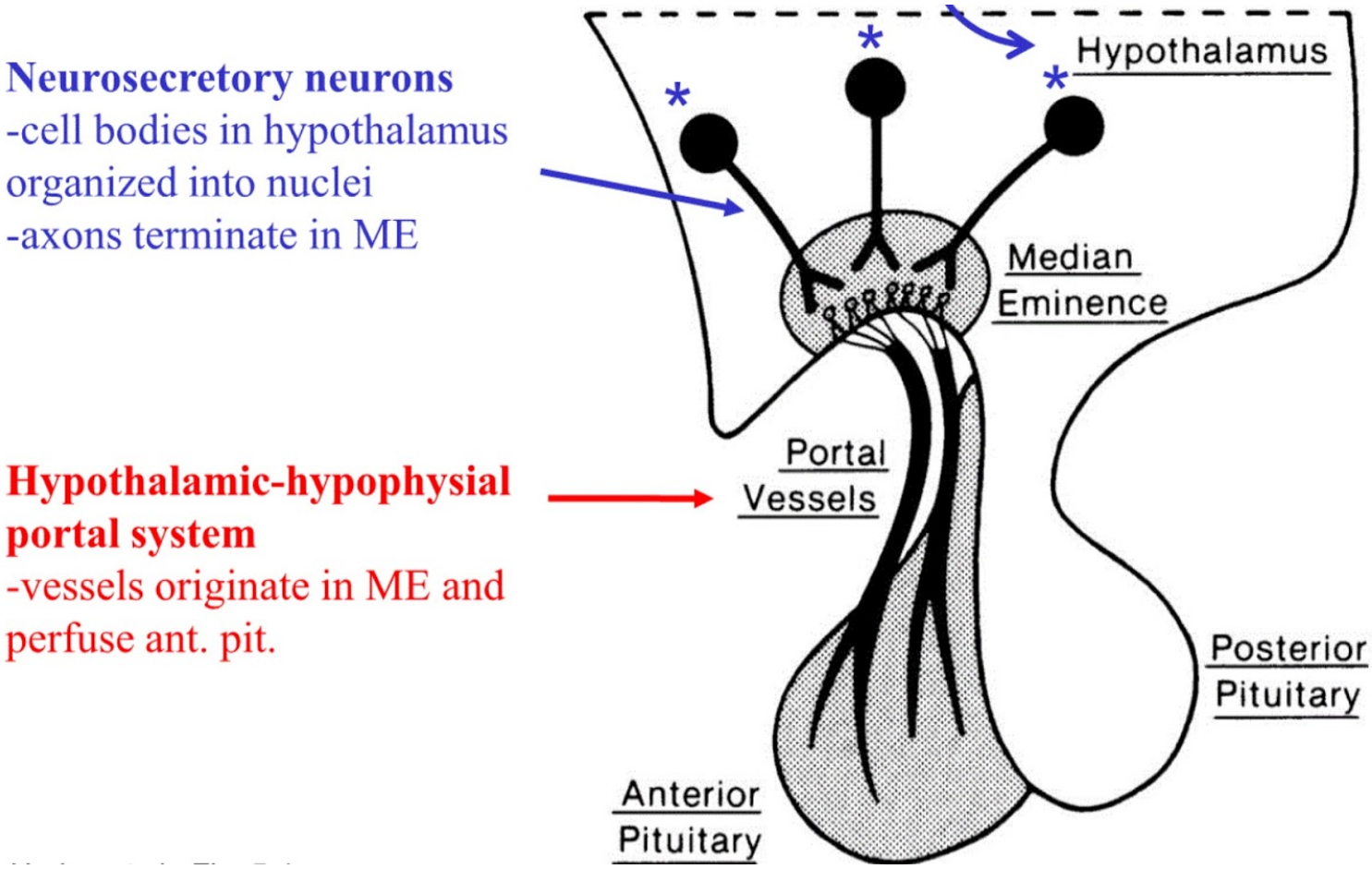


The hypothalamic pituitary adrenal axis is integral in the nervous system and limbic system interaction, an in depth description of its interplay is discussed in this section. The hypothalamus and pituitary gland communicate via the portal vessels and neurosecretory neurons (shown in the figure below) which is referred to as the hypothalamic hypophysial portal system (Weinstein).



The infundibular stalk is the anatomical connection with the hypothalamus and the pituitary gland and it consists of the portal blood vessels and the axons from neurosecretory neurons in the hypothalamus (Weinstein). The anterior pituitary gland is extremely glandular and is called the adenohypophysis, whereas the posterior pituitary has neural tissue that contains axons and is called the neurohypophysis (Weinstein). The hypothalamus has neurosecretory neurons which are cell bodies organized as nuclei, axons originate here and end at the median eminence. This structure is a highly vascular

area right before the infundibular stalk and blood vessels begin here and travel to the vascular anterior pituitary gland and finally empty into the bloodstream.



Glucocorticoids have daily rhythms that rely on the suprachiasmatic nucleus found in the hypothalamus; this specific nucleus controls the circadian rhythms of glucocorticoid hormones (Herman et al. 2005). If the suprachiasmatic nucleus develops lesions it will decrease the daily rhythmic fluctuations of corticosteroid levels (Herman et al. 2005). Glucocorticoid secretion is driven by internal factors that all center around the maintenance of homeostasis, and internal cues include cardiovascular, respiratory, and/or visceral stimuli (Herman et al. 2005). Additionally the hypothalamic pituitary

adrenal axis is extremely sensitive to trepidations of the external environment such as stress and other sensory stimuli, which then creates responses when nociceptive pathways are initiated. Stimuli can be processed by the suprachiasmatic nucleus and travel to the paraventricular nucleus through brain afferent neurons; these excitatory neurons are noradrenergic or adrenergic and promote paraventricular excitation, which releases corticotropin-releasing hormone (Herman et al. 2005). This hormone travels through the hypophyseal – portal system to an anterior pituitary gland cell called a corticotroph (Weinstein). The corticotroph is then stimulated through a G protein coupled receptor (GPCR) G_s pathway to release adrenocorticotropin releasing hormone which is derived from the proopiomelanocortin family of hormones.

Adrenocorticotropin releasing hormone is a secretagogue meaning "Its main function is regulation of hormone secretion by another gland," (Weinstein). Adrenocorticotropin releasing hormone will travel to the systemic circulation where it acts on cells in the adrenal cortex of the adrenal gland to stimulate another GPCR Gs receptor pathway to release the glucocorticoids cortisol, aldosterone, and androgens (Weinstein). The GPCR G_s receptor pathway stimulates adenylyl cyclase using adenosine triphosphate, which activates second messenger cyclic adenosine monophosphate that latches on to transcription factors in the cell and synthesizes more proopiomelanocortin and ACTH stores (Herman et al. 2005). This hypothalamic pituitary adrenal hormone loop that produces glucocorticoids is subject to negative feedback which can be fast, intermediate, and delayed (Herman et al. 2005). Fast feedback is sensitive to changes in glucocorticoid levels and independent of genomic actions (Herman et al. 2005). Intermediate and delayed negative feedbacks are both sensitive to genomic actions

however, and are differentiated based on stress, duration, and the effect that stress elicits (Herman et al. 2005). Delayed negative feedback on glucocorticoids is very likely arbitrated by endogenous glucocorticoid receptors in the hypothalamic pituitary adrenal axis, these receptors are moderating gene transcription through transcription factors or by binding cognate response elements (Herman et al. 2005). There are two known glucocorticoid receptors in the brain the glucocorticoid receptor and the mineralocorticoid receptor, the latter has a 5 – 10 fold greater affinity and is therefore more restricted (Herman et al. 2005). Pharmacological evidence supports that the glucocorticoid receptor has been shown to facilitate glucocorticoid feedback after stress is experienced and the mineralcorticoid receptor will adjust basal hypothalamic pituitary adrenal axis tone (Herman et al. 2005). These negative feedback mechanisms are integral in ensuring that the concentration and duration of action of glucocorticoids is kept within physiological limits.

The limbic system consists of many nuclei, two of which are the hippocampus and the amygdala. The amygdala and hippocampus are two medial temporal lobe structures and although they are related to two independent memory system they are able to interact (Phelps 2004). The hippocampus forms episodic memory based on emotionally significant events, and the amygdala can encode this short-term memory to be long term (Phelps 2004). In short, when emotionally significant events occur they allow the hippocampus and amygdala to work together to encode such events in long-term memory (Phelps 2004). The first stage of the amygdala and hippocampal interaction occurs when sensory cortical processing regions respond to stimuli; emotional stimuli involve a further response by the amygdala and are registered in episodic memory of the

hippocampus and then are given priority and encoded by the amygdala (Phelps 2004). The second stage is when the short-term hippocampal memory is stored, and the amygdala influences storage of the memory (Phelps 2004). At one point the recovery of those memories will no longer be dependent on the hippocampus, this process is referred to as consolidation (Phelps 2004). In a clinical research study done on patients, in a particular experiment stimuli were presented to the patients and the brain's response was measured using functional magnetic resonance imaging studies (fMRI) (Phelps 2004). These results showed that the amygdala and hippocampus do work together when emotional stimuli are involved (Phelps 2004). The hippocampus and amygdala also have unique roles in the integration of the hypothalamic pituitary adrenal axis (Herman et al, 2005).

The hippocampus tends to inhibit the hypothalamic pituitary adrenal axis (Herman et al. 2005). Hippocampal stimulation will reduce glucocorticoid secretions however this inhibition is region and stressor specific; in other words the hippocampus will only inhibit the hypothalamic pituitary adrenal axis in response to specific stressors (Herman et al. 2005). Conversely, the amygdala activates the HPA axis and this response is also specific to the stressor and region, and these stressors are; restraint, swimming, predator exposure, and social interaction (Herman et al. 2005). The central and medial amygdaloid nuclei have predominantly glucocorticoid receptors and fewer mineralocorticoid receptors; due to this the amygdala is considered a probable target for glucocorticoids (Herman et al. 2005). The connections between the limbic system and the hypothalamic pituitary axis is integral to understanding how high stress situations affect an individual subjected to a trafficking situation. An integral part in analyzing the effects

of trauma is dissecting how the body responds to stressors and this is important to understanding the state of a trafficking victim's body.

When a person is forced into a traumatic situation the body goes into "fight-or-flight" mode and the sympathetic nervous system plays a prominent role. This system increases secretions of the hormones epinephrine and norephinephrine, or more commonly known as adrenalin and noradrenalin and while these work quickly they have a short half life. However another major stress hormone is cortisol and has longer lasting effects (Klein 2013). The effects of these hormones include, among others suppressing the immune system, increasing blood pressure, increasing blood sugar (Klein 2013). This also affects the limbic system, which contains the hippocampus and the amygdala, and it can affect long-term memory. Being in a continuous state of fight or flight is detrimental to a human being because it affects physical, and mental health. In addition, if a person is in this stressful situation even a short period of time he or she can develop an anxiety disorder. An anxiety disorder can cause emotional distress in conjunction with physical symptoms of dizziness, insomnia, muscle aches, and somatization (Gelenberg 2000). Somatization is particularly intriguing event in which a person will have physical ailments and aches that are not due to physical causes but are physiological manifestations of their distressed mental state.

From a physiological standpoint stress can be seen as a "state" and this state may drive the body away from homeostasis, and therefore disrupt both the limbic system and the hypothalamic pituitary adrenal axis. It is plausible that gaging sensory stimuli for signs of risk or peril is a high-priority, ongoing task for the nervous system (Pruessner et al. 2008). The hippocampus, amygdala, hypothalamus, and pituitary gland all have

glucocorticoid and mineralocorticoid receptors. Cortisol levels are particularly high during stress and it is a glucocorticoid that has the potential to act on these receptors and disrupt the limbic system and hypothalamic pituitary adrenal axis. Hypothalamic pituitary adrenal axis dysfunction can be linked with diminished function of the hippocampus and amygdala and for this reason the structures are grouped together when stress is discussed (Herman et al. 2005). Additionally in a Positron Emission Tomography (PET) study it was found that psychosocial stress reduced cerebral flow in the network of limbic system structures (Pruessner et al. 2008). Furthermore PET scans showed that stress reduced both blood flow and neural activity in the limbic system and the hypothalamus, however deactivation of the hippocampus is specifically associated with cortisol stress response (Pruessner et al. 2008). An fMRI study suggested a linear relationship between hippocampal deactivation and hypothalamic pituitary adrenal axis activation, meaning as the hypothalamic pituitary adrenal axis is activated hippocampal deactivation increases (Pruessner et al. 2008). Initial stress exposure will inhibit the hippocampus however when glucocorticoids return to the central nervous system they will reactivate the hippocampus; this suggests that after stress glucocorticoids feed back into the brain to increase hippocampus function and inhibit any subsequent hypothalamic pituitary adrenal axis activity (Pruessner et al. 2008). The explanation for this can be that fear activates the limbic system and stress activates the hypothalamic pituitary adrenal axis, so the initial response to stress would activate the axis and deactivate the hypothalamus (Pruessner et al. 2008). It also was shown that hippocampal activation and deactivation was extremely dependent on cortisol levels (Pruessner et al. 2008).

Stress and plasticity in the limbic system is important to focus on. Glucocorticoids such as cortisol are the body's first response to stress and this initial response tends to suppress the hippocampus; however, sustained stress and/or exposure to glucocorticoids can potentially impair hippocampal dependent cognition and limbic function (Sapolsky 2003). Impaired performance of the hippocampus mostly represents damage of consolidation and/or retrieval of memories, or poor declarative memory (Sapolsky 2003). It has become evident through experimentation that when a human being is exposed to situations of persistent stress the hypothalamic pituitary adrenal axis shows "response 'habituation'" and "response 'facilitation,'" (Herman et al. 2005). Habituation is created when a homotypic stressor is consistently provided, over time this will lessen the glucocorticoid response to the stimulus (Herman et al. 2005). The hypothalamic pituitary adrenal axis habituation is heavily contingent on "…both the intensity and predictability of the stressful stimulus," (Herman et al. 2005). Facilitation is found only in chronically stressed animals (Herman et al. 2005). Many studies have shown that because stress releases such a high level of glucocorticoids it disrupts long term potentiation and primed burst potentiation, the latter being more sensitive to the effects of stress (Sapolsky 2003). And even more severe hypersecretion of glucocorticoids can even impair the hippocampus and/or shrink it in size; this is because it impairs the viability of hippocampal neurons (Sapolsky 2003). The hypothalamic pituitary adrenal axis may also undergo changes due to stress.

Stress causes neurochemical and molecular changes in the hypothalamic pituitary adrenal axis. Evidence suggests that stress will cause hypersecretion of corticotroping releasing factor, dehydroepiandrosterone, and vasopression (de Carvalho 2011). Another

finding is hyperactivity of the hypothalamic pituitary adrenal axis, this causes increased concentration of cortisol in bodily fluids which causes hypercortisolemia (de Carvalho 2011). This condition is linked to: depression, anorexia nervosa, obsessive – compulsive disorder, panic disorder, anxiety, chronic active alcoholism, and alcohol and narcotic withdrawal (de Carvalho 2011). Patients with posttraumatic stress disorders, and chronic fatigue syndrome also experience similar symptoms (de Carvalho 2011). The root of the issue is that stress causes impaired feedback inhibition of the hypothalamic pituitary adrenal axis and this causes a cascade of issues (de Carvalho 2011). Stress has overall negative effects on the hypothalamic pituitary adrenal axis and on the limbic system. Sex trafficking victims are in stressful situation everyday and undergo poor treatment and often live in squalid conditions.

Based on personal reports and scientific evidence of the negative effects of stress it is evident that trafficking victims often have life long afflictions that are extremely serious, and treatment is integral for moving towards a normal life. The Campaign to Rescue and Restore Victims of Human Trafficking has a list of clues that indicate someone is a trafficking victim these are; evidence of being controlled, evidence of an inability to move or leave a job, bruises and battering, fear of deportation, non – English speaking, recently brought to this country, and lack of immigration or identification documents (Dovydaitis 2010). Health care providers are also prefaced with the fact that these victims fear authority and are reluctant to divulge personal details (Dovydaitis 2010). When treating trafficked individuals immediate care is physical trauma, sexually transmitted infections, diagnosis of pregnancy, and suicide assessment (Dovydaitis 2010). Once these needs are met the role individual healthcare provider is essentially complete,

because non-immediate physical needs and emotional needs are considered long term treatment handled by an interdisciplinary team of health care professionals (Dovydaitis 2010). The National Human Trafficking Resource Center is a national referral line that assists a victim by finding resources and creating a safety plan (Dovydaitis 2010). A victim can pursue a certification process that is a segment of the Victims of Trafficking and Violence Protection Act, and certification will give the victim legal documentation to remain the United States and receive benefits (Dovydaitis 2010). Minors do not have to apply for certification and are automatically eligible (Dovydaitis 2010). Federally funded services for trafficking victims include; health care, translation, witness protection, legal representation, job training, transportation, and access to housing (Dovydaitis 2010). These rehabilitation resources are integral to a trafficking victim functioning in society, and their funding is under federal jurisdiction.

Under the Trump administration it is ambiguous what will happen to these rehabilitation programs. The Trafficking Victims Protection Action (TVPA) is a bill that has generally gotten bipartisan support in Congress, it strengthens the fight against trafficking and the main goals are "…protection, prosecution, and prevention" (Baig, 2018). The TVPA focuses on imposing penalties on traffickers, investigating a possible trafficking situation and obstructing attempts to traffic (Baig 2018). The TVPA has funding for anti – trafficking efforts, programs, education and appropriations and a T Visa for trafficking victims (Baig 2018). Under the Trump Administration the TVPA reauthorization bill has not yet passed, and this leaves a hole for thousands of people trafficked annually within the United States. Furthermore, President Trump has expressed support for a merit – based system that would allow only elite English – speaking

immigrants to obtain visas and stay in the United States (Baig 2018). The issue with this is that trafficking victims are often not among the elite and most – likely do not speak English, so if this legislation is pursued trafficking victim's placement is up for question as is the existence of a T visa. Speaker of the House Paul Ryan has vaguely addressed this issue in 2017 with this quote, "We want law enforcement to have every possible resource to protect our citizens. And we went to give real support – and a voice – to the victims of these awful crimes," (Marcos 2017). In 2017 bills were passed in order to train law enforcement on how to identify and combat human trafficking, and to direct the Justice Department on how to process cases with trafficking victims (Marcos 2017).

This administration is occupied with prosecuting traffickers and rescuing victims, however it is still unclear if the TVPA will be reauthorized so that the federal government continues to fund the rehabilitation services covered under this act for trafficking victims. Rehabilitation serves have been proven to work, the Department of Health and Human Services' Office of Refugee Resettlement and the Department of the Justice's Office on Violence Against Women and the Office for Victims of Crime are locally active organizations that receive federal funding to help trafficking victims (Shigekane 2007). Non –profit organizations and private organizations have also joined in providing counsel, case management, outreach, employment, and shelter to victims (Shigekane 2007). These organizations have proven that shelter provides stability, counseling helps ease a victim into working, and employment helps a victim finally be independent. In short, rehabilitation works. It is clear from the evidence provided that trafficking victims have severe mental, physical, and psychological damage and that rehabilitation services protected under TVPA deserve to be refunded if not expanded.

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