Many people have asked me why I have become so involved in the work against pornography. I became very concerned because of the sexually-explicit images that seemed to inundate many public places I took my children to.

I investigated the current laws and found there were already standards that were blatantly disregarded. Quite frankly, the current laws were not worth the paper they were written on. The pornography industry rolled over them with unchecked boldness.

I sought for answers concerning why these laws were so innocuous. I found that what prosecutors have to prove is nearly impossible. The language is very ambiguous and requires the image to be "offensive to prevailing standards in the adult community" and that there be no "serious artistic or literary value." It quickly became clear that someone could find artistic value in any filth, and who sets the standards in the adult community? Over time, prosecution has stopped even trying to enforce the current laws, much to the satisfaction of the pornography industry.

A new approach must be taken. The approach is not to base the laws on someone's view of morality, but on science. The existing *material harmful to minors* statute has been modified so there are now two ways to meet the necessary criteria. The first is to prove the existing ambiguous requirements, which has been nothing but a failure in the past. The second is to prove, through science, that pornography causes developmental, emotional, and mental harm.

The standards that must be met for public display to a minor, are exactly the same as are already on the books. The only change is the ability to prosecute using science and the physiological harm pornography causes. These standards would apply equally to all businesses, not based on the capricious whim of changing moral vogues.

A common defense that will be used against enforcing any kind of standard is that it is their right to display pornographic images. One must remember that there are prerequisites to qualifying for a right. If this were not the case then any behavior could be claimed as a right. One such requirement is that a right does not injure or come at the expense of another. The fact that pornography is undeniably proven to inhibit optimal brain development immediately disqualifies any claim to a right.

One of the basic principles upon which this country was founded was the concept of federalism. Federalism is the natural autonomy, and therefore check, that states are meant to have on the federal government. Along with this comes states' rights and the ability of individual states to govern a variety of topics as best suits its residents. The amount of protection a state wants to afford a child in regards to

pornography is considered part of a state's jurisdiction. Utah should assert its sovereignty with confidence and decide that enforcing standards in regard to the pornography industry and innocent exposure to minors, is something Utah not only has the right to do, but an obligation to do. If Massachusetts can implement its own health care, Utah can certainly decide to check the pornography industry.

There are a mammoth number of regulations concerning virtually every aspect of business. I had a lady recently tell me she tried to turn a historic house into a business for five years, but the city would not approve it. At the dental office I work at, there are regulations as to the kind of sign we can have. We wanted to hang a small sign from our railing to announce we were open on Saturdays and we had to get a special permit from the city. To act as if every aspect of advertising but the sexually-explicit kind can be monitored, is ludicrous. The double standard is insufferable and exists only because of the copious amounts of money made at the expense of individuals, families, and communities.

The time has come that Utah take the lead in standing up to the pornography industry and let them know Utah will be a place that children are protected. They will not roll through our communities unopposed. They will follow our laws that were enacted through due process. They are not above rules just because they have bottomless resources to intimidate with.

I have a friend who escaped from communist Czechoslovakia when he was eighteen. His country has since become the Czech Republic. He recently went home to visit his family. He told me how much pornography has inundated every aspect of the culture. Total control has been replaced with no control. I told my friend that they will find themselves equally oppressed under no protective boundaries to ensure stability as they were under communism.

We have an opportunity to hamper the momentum of the pornography industry. If we do nothing, this evil empire will continue to grow and our children will be raised in an increasingly hostile environment. Surely, years from now lament will be expressed that something had not been done sooner.

As the gatekeepers to society I earnestly implore every legislator to read the information that is presented in this report and work together to truly leave society stronger than we found it.

Sincerely,

Jennifer Brown

The Physiological Effects of Innocent Exposure to Soft-core Pornography on the Developing Brain

Dr. Jennifer Brown

Executive Summary

- Gateway, or soft-core pornography, is defined as sexually-explicit images that are found ubiquitously in advertising, and at retailers. It is considered gateway pornography because it often leads to the use of more hard-core pornography.

- The prefrontal cortex is unique to humans. It helps control wants and desires. It overrides immediate gratification and augments self-control. It is required for goal setting, moral judgment, planning, analysis, and emotional regulation. Its ability to function decreases in response to gateway pornography.

- The latency period refers to ages 6-12 in which sexual inundation has proven to be developmentally damaging because the emotional maturity of this age group is not resilient enough to handle exposure to sexual themes.

- The basal ganglia is involved in more reflexive, instinctive behavior. It enhances impulsivity and decreases critical thinking. The basal ganglia works more efficiently in response to gateway pornography.

- The hippocampus is responsible for learning and memory, particularly recalling facts and events. This area of the brain is very vulnerable to the effects of gateway pornography.

- When a minor views soft-core pornography, they undergo a form of stress, known as the fight-or-flight response. Stress is considered any change in normal body functioning when at rest.

- The neurotransmitters released in response to soft-core pornography are dopamine and norepinephrine.

- Emotionally charged images cause the prefrontal cortex to go "offline." The prefrontal cortex is very vulnerable to the neurotransmitters released in response to stress.

- The basal ganglia functions more efficiently in response to the neurotransmitters released from sexually-explicit images. This causes the viewer to become more impulsive and less able to critically think.

- The hormones released in response to soft-core pornography are cortisol, norepinephrine, and testosterone.

- Cortisol, the stress hormone, causes decreased functioning of the prefrontal cortex. Chronically elevated levels of cortisol are directly linked to depression and other mood disorders.

- Norepinephrine causes a very alert state as well as "flash bulb" memories.

- For males, testosterone causes an increased sex drive and an increase in violence and aggressiveness.

- The ability of the brain to change in response to environmental stimuli is known as neuroadaptation or neuroplasticity.

- Neurons are brain cells. They can undergo synaptic pruning (retraction) or budding (growth) in response to external stimuli. Neuronal circuits that have been used frequently will be strengthened and less-used connections will be removed.

- An adolescent brain is very adaptable. Experiences literally determine which neuronal paths will be strengthened and which will be reduced. Soft-core pornography strengthens the basal ganglia and weakens the prefrontal cortex.

- Adolescents constantly exposed to adult images have more dominant basal ganglias. This leads to compulsiveness, increased violence and aggression, difficulty linking consequences with choices, loss of will power, loss of natural sympathy and empathy for others, self-centeredness, and they are much more likely to engage in addictive behaviors.

- Dopamine is responsible for feelings of pleasure all the way up to euphoria. Dopamine has the unique ability to cause craving or wanting.

- Dopamine is very important for proper functioning of the brain and is necessary for normal cognition. Disruption of the dopamine system, through chronic over-stimulation, is directly linked to symptoms of attention deficit hyperactivity disorder (ADHD).

- The adolescent dopamine system is in overdrive. A sexual image will cause more dopamine to be released in a teenager than in an adult man.

- Gateway pornography affects the brain the way illegal drugs do. Both entities exploit the dopamine system.

- Next to infancy, adolescence is the most critical period of brain organization. A developing brain is much more susceptible to the hormones and neurotransmitters released in response to soft-core pornography.

- Stress pathways are heightened during adolescence. An image that activates the stress cascade of hormones would result in more hormone release in a minor than in an adult.

- Steroid hormones (cortisol and testosterone) play a critical role in brain development. These hormones literally direct which neurons stay and which neurons undergo programmed cell death. An abundance of steroid hormones is detrimental to the development of the prefrontal cortex.

- In adolescents, the dopamine and stress pathways are overactive, which means an adolescent will release more hormone than an adult would in response to the same image.

- Manipulating the levels of cortisol, testosterone, and dopamine, as a consequence of the inundation of sexual images, has very real consequences on brain development. Hormones are the engineers of the brain. Augmented levels of hormones **will** change the way the brain develops.

- Females internalize sexual images and compare them to themselves. This often leads to body objectification. Body objectification teaches young girls to view themselves as nothing more than an object. Body objectification is directly linked to anxiety, depression, and eating disorders.

- The basis of many psychiatric disorders is an imbalance between the prefrontal cortex and the basal ganglia/limbic system; the reasoning center of the brain and the emotional center. These include ADHD, anxiety, depression, and mood disorders like bipolar. Subtle changes in the brain from constant exposure to sexualized images can cause a manifestation of these disorders.

CHILDREN ARE BEING RAISED IN A HYPER-SEXUALIZED ENVIRONMENT

In our modern world, children and teens are exposed to a variety of influences. There are numerous sexually explicit images that bombard this age group. Even vigilant parents find it impossible to go to the grocery store or the mall without their children experiencing innocent exposure to gateway pornography. Gateway, or soft-core, pornography are images that often lead curious minds to want to explore further. It is ubiquitously displayed on billboards, magazine covers at the checkout of a grocery store, and on advertisements found in display windows at department stores, just to name a few. This environment that children currently grow up in is man-made. Throughout the majority of world history, these blatant sexual images were not openly displayed.

If one thinks back to the 1800's and the time of the pioneers, there were certainly not these visual influences inundating youth. Even just three or four decades ago, things were a lot different than they are now. This raises the question: Does it matter? Does this artificial, sexualized environment kids are being raised in make a difference? Does it affect them positively or negatively? Are they at a disadvantage compared to kids raised in a more neutral environment? Does it affect the very development of their brains?

There are recent studies and techniques for analyzing the brain that have given us an incredible insight into the development of the maturing brain and the influence of constant exposure to sexualized images.

FIGHT OR FLIGHT RESPONSE

When children are shopping with their mothers, and they see a sexually explicit image, their bodies undergo a form of stress, also known as the fight-or-flight response. Stress can be considered any deviation from normal body functioning when at rest. This is the same reaction that a minor would have to any situation where he or she felt out of control, or was exposed to material they were not mature enough to understand. Dr. Judith Reisman, who is an expert on pornography, testified before Congress and explained how pornography activates the fight-or-flight response, triggering an instant, involuntary, and lasting biochemical trail; emotionally arousing images imprint and alter the brain. Dr. Reisman declares that, "pornographic images neurochemically blitz our brains [48]."

Even children, who cannot yet read, can instantly decode and experience images [61]. "Every second 100 million messages bombard the brain carrying information from the body's senses. Only a few of these are heeded by the conscious mind. Only the most important, or exciting, sense information gets through. This suggests why pornography has such an impact on people, young and old [60]." Children and adolescents are particularly susceptible to the physiological effects of pornography.

"The stress of viewing sexually explicit images at an early age could be seen as a neurobiological event mediating the reactions exhibited by many teens in the form of emotional and addictive symptoms [9]."

The brain and the body are in two-way communication via the autonomic nervous system (fight-or-flight response), **small changes** in these systems can **accumulate** over time [123]. What happens in the brain when the fight-or-flight response occurs? What are the changes that can

actually occur in the brain over time? Let's get into the details of the events that take place when viewing sexually explicit material.

Different regions of the brain perform different functions. There are certain areas that are important to understand for our topic.

LIMBIC SYSTEM-AMYGDALA

The limbic system has been referred to as the emotional center of the brain. It establishes emotional states. There are several sub-regions, but the one that is most important to us is the amygdala. It is responsible for signaling to other brain areas in response to emotionally significant visual stimuli, like gateway pornography [36]. The amygdala can immediately activate the prefrontal cortex, or bypass the prefrontal cortex and activate the basal ganglia. The amygdala works more efficiently under stress or emotionally driven situations [32,117].

LIMBIC SYSTEM-HIPPOCAMPUS

The hippocampus is also part of the limbic system, but unlike the amygdala it functions less efficiently under stress [117,123]. This brain region is involved in learning and memory [115,123]. More specifically, the hippocampus plays a critical role in explicit memory, which is concerned with facts and events [127]. Behavioral flexibility, or the ability to adapt to changing conditions, is also dependent upon proper hippocampus functioning [116].

BASAL GANGLIA

The basal ganglia is responsible not only for emotional functions, but also voluntary motor control that is involved in more instinctive, reflexive reactions. The functioning of the basal ganglia is augmented in response to stress [2,32,45].

In a normal functioning brain, the basal ganglia should be under the control of the prefrontal cortex. The prefrontal cortex keeps in check the impulsive, immediate gratification kind of behavior the basal ganglia produces. Some of the important sub-regions are the ventral tegmental area (VTA) and the nucleus accumbens (NA). The VTA provides dopamine to the NA in response to emotionally salient or arousing images. Increased efficacy of the VTA-NA pathway provides an intense emotional high [45]. Several illicit drugs, including cocaine and methamphetamines, also affect this area of the brain [45,47].

PREFRONTAL CORTEX

The prefrontal cortex is unique to humans [1,50]. It plays a role in assessing and analyzing our response to emotional stimulation. Many people assume brain function deals with constant activation. In a properly working brain, inhibition is just as important as activation. The prefrontal cortex could be considered the braking system of the brain. "The prefrontal cortex has long been associated with impulse control [105]." It gives us the ability to be in control of emotions. We are not animals that mechanically respond to specific rewards like food and mating. As humans we have the beautiful ability to control ourselves. We can ascertain risks associated with decisions, make a long-term goal, and have the ability to achieve it [1,19,32,43]. It truly sets us apart from the rest of the animal kingdom. The prefrontal cortex does not finish maturing until the early twenties [50]. It is the brain region that is most susceptible to stress [2].

THE PHYSIOLOGICAL RESPONSE TO GATEWAY PORNOGRAPHY

The eyes initially pick up the visual stimulation of gateway pornography. That stimulation is then sent to the amgydala of the limbic system. If the stimulation were neutral in nature, the prefrontal cortex would almost simultaneously be stimulated. Like an orchestra, the prefrontal cortex is the conductor, and other areas of the brain are the different instruments. With the conductor functioning properly, the instruments know when to activate and when they should be resting. It all comes together as a beautiful "brain" orchestra. When the visual stimulant is emotionally packed, the amygdala will leave the prefrontal cortex out and activate the basal ganglia. Our orchestra is now out-of-tune. A region of the brain not capable of conducting has replaced the rightful conductor. The basal ganglia is now in charge.

With the prefrontal cortex down, the child resorts to more primitive behavior with natural inhibitions dulled [1,45]. "The amygdala can take control over what we do even as the thinking brain, the prefrontal cortex, is coming to a decision…when impulsive feeling overrides the rational…fear sends urgent messages to every part of the brain: it triggers the secretion of the body's flight-or-fight response [62]." People are much more impulsive, easily distracted, exhibit poor planning, hyperactivity, and lose natural sympathy and empathy for other people [1,45,53,55]. They have a hard time evaluating long-term consequences and are driven by immediate gratification.

In a study reported in *Neuroimage* it was found that the amygdala was able to respond to stimuli associated with bodily arousal outside of conscious awareness. Activation of the amydala using subliminal paradigms, provides robust evidence that specific arousal systems in the brain can be activated outside of conscious awareness [132]. This underlines the fact that even young children who may not understand images they see, respond by the cascade of events outlined above. As children and teens walk through malls and are exposed to a variety of stimulating pictures, even if they aren't fully concentrating on those images, the activation of the amygdala and subsequent stress response does indeed occur. As this happens over and over again the mind is subtly changed and rewired.

As a society we definitely don't want a lot of basal ganglia-dominant people in our midst. They have higher crime rates, higher recklessness, and a much harder time weathering through the everyday stresses that accompany being loyal to a spouse and children.

LATENCY PERIOD

Latency period refers to a span of years during development when exposure to sexually explicit material can be harmful due to the inability of the child to comprehend sexuality. The latency period is considered ages 6 to 12. In a study reported in *Sexual Addiction and Compulsivity,* it was reported that latency-age exposure to sexually explicit material **did in fact** predict later sexual dysfunction and online sexual behavior [9]. Their hypothesis was based on the theory that the latency period is a period of necessary repression of sexual desires and that disruption of this developmental period through inundation of adult images can **damage development** [9]. The study did indeed corroborate their hypothesis and further solidified the need of children to be protected from sexual inundation. Does childhood need to be an age of innocence? The answer is **YES,** without any hesitation or doubt. Children need to be spared sexual inundation for optimal development. Children and their parents have the right to demand an environment of ideal emotional and physiological development.

CORTISOL CAN DIRECTLY REDUCE FUNCTIONING OF THE PREFRONTAL CORTEX

Let's go into more detail about the response to gateway pornography in the brain. The amygdala is activated in response to emotionally charged images [36,125], and then activates the stress pathways in the hypothalamus and brain stem [2,30,45,123]. The hypothalamus releases the hormone CRH, which causes the pituitary to release ACTH. ACTH then activates the adrenal cortex to release the hormone cortisol. Cortisol is considered the "stress" hormone and it is one of the hormones released in response to soft-core pornography. Research shows that cortisol can directly reduce the functioning of the prefrontal cortex by blocking transporters that clear dopamine and norepinephrine, thereby indirectly increasing these neurotransmitters [2]. The prefrontal cortex is very sensitive to the environment of neurotransmitters. Brief exposure to cortisol during 10 days was found to result in marked reduction of the neuronal complexity in the prefrontal cortex, causing less efficient information transmission [129]. Chronic elevated levels of cortisol induce neural reorganization of the prefrontal cortex, which may contribute to the onset of neuropsychiatric conditions [42].

CHRONICALLY ELEVATED LEVELS OF CORTISOL CAN DIMINISH SEROTONIN

Prolonged periods of elevated baseline levels of cortisol attenuate serotonin efficacy in the hippocampus region of the brain [113,114,129]. Reduced functioning of serotonin is coupled with many emotional disorders including depression and anxiety. Elevated cortisol levels have consistently been linked with depressive illness [128,129].

CHRONICALLY ELEVATED LEVELS OF CORTISOL DIMINISH HIPPOCAMPUS FUNCTIONING

The hippocampus has abundant glucocorticoid receptors and is very sensitive to the stress hormone cortisol [115,123,127]. The hippocampus is particularly prone to structural plasticity or adaptation. Cortisol and stress suppress neurogenesis and cause neurons to retract [115,116,117,123,129]. Chronic stress can have detrimental effects on proper hippocampus functioning. The wear and tear produced by repeated stress can result in permanent damage to the hippocampus [115]. It is important to note that large amounts of cortisol are not required to cause structural changes in the hippocampus. Animal models have shown that periodic stress responses over a period of three weeks were sufficient to cause neural retraction [115,117,129]. Elevated levels of cortisol are accompanied by hippocampal atrophy [128]. Remember that the hippocampus is responsible for the type of memory connected to facts and events [127]. Think of how important this area of the brain is for retaining information at school. Certainly, continual inundation of minors to adult images during critical developmental periods is adequate to negatively affect the hippocampus.

NOREPINEPHRINE

In addition to cortisol secretion, the hypothalamus stimulates the sympathetic division of the autonomic nervous system (ANS) [126]. The ANS stimulates the adrenal medulla to secrete norepinephrine. Systemic release of norepinephrine causes increased heart rate, increased respiratory rate, pupil dilation and rapid breakdown of glycogen into glucose [62]. Glucose is then converted into ATP, which gives the body energy. In short, a very alert state is created. Norepinephrine also causes "flash bulb," or deeply ingrained memories [3,118,122]. Events leading to norepinephrine release generally create strong and enduring memories [120]. To test

the fact that the stress pathway is activated in response to gateway pornography, drive down the street and notice if sexually arousing billboards are more ingrained in your memory, compared to other neutral advertising. It is norepinephrine, from the stress response, that is responsible for this memory retention. Another tragic consequence to the immature brain is the storage of sexualized images, impossible to erase, that can be recalled at any time.

INFLUX OF NEUROTRANSMITTERS CAUSES PREFRONTAL CORTEX TO CRASH

When the amygdala is activated, it causes release of neurotransmitters in the brain [27,45,114]. Neurotransmitters are released even in response to mild stress [55]. Neurons are brain cells. Neurotransmitters allow communication between neurons. The amygdala causes the release of norepinephrine (NE) and dopamine (DA) [43,45]. Point of clarification: norepinephrine can be a hormone or a neurotransmitter. The release of these neurotransmitters is normal and the brain must have them to function [27,32,43]. The important thing to understand is that too much or too little can cause the brain to misfire. Neutral visual images, like looking at a sunset, cause proper amounts of norepinephrine and dopamine to be released.

The prefrontal cortex is very sensitive to the levels of neurotransmitters [41,53]. Small changes in neurotransmitter levels can produce large changes in function. The prefrontal cortex is very susceptible to environmental insults [41,53]. Looking at a sunset would cause proper activation of the prefrontal cortex. It assumes its role as the conductor of the brain orchestra. Large amounts of norepinephrine and dopamine cause the prefrontal cortex to crash and the basal ganglia to function more efficiently [2,32,43]. "The prefrontal cortex is exquisitely sensitive to the detrimental effects of stress. In some cases, even **mild uncontrollable** stressors may lead to compromised cognitive abilities, including deficits in working memory, cognitive flexibility, and emotional control [114]." Sexually explicit material causes the amygdala to dump large amounts of norepinephrine and dopamine into the prefrontal cortex [27,43,51]. "The patterns of norepinephrine and dopamine release in the prefrontal cortex are directly related to **arousal state** and **environmental** conditions [53]."

THE BASAL GANGLIA WORKS MORE EFFICIENTLY WHEN BOMBARDED WITH NEUROTRANSMITTERS

Several studies have shown that the prefrontal cortex shuts down with too much neurotransmitter, while the basal ganglia begins to work more efficiently and is more than happy to usurp the role of conductor [2,43,51,53]. High levels of norepinephrine and dopamine enhance amygdala function [32]. With the basal ganglia in charge, the individual becomes more impulsive and driven by immediate gratification. They essentially become more like animals, motivated by reward stimulation. "Thus, during stress, orchestration of the brain's response patterns switches from slow, thoughtful PFC regulation to the reflexive and rapid emotional responses of the amygdala and related subcortical structures [2]." "High levels of catecholamines (dopamine and norepinephrine) released in the prefrontal cortex during stress exposure, markedly impairs working memory (cognitive) function, through network collapse and suppression of prefrontal cortex cell firing [27]."

ELEVATED TESTOSTERONE CAUSES OVER-ACTIVE SEXUAL DRIVE

There is yet another hormone released in response to gateway pornography that occurs with males. The hypothalamus secretes GnRH, which activates the pituitary. The pituitary then releases LH, which activates the testes to secrete testosterone. As with all hormones, normal levels of testosterone are necessary to the body. Higher than average levels of testosterone, caused by the unnatural images boys are constantly exposed to, has consequences. "This increase in testosterone feeds back to the brain, enhancing sexual anticipation and preparing the brain for further sexual stimuli.

Pornography [including soft-core or gateway], crafts a brain that is constantly generating testosterone and heightens sexual desire [3]." Increased testosterone results in increased capacity of a social stimulus to elicit urges for sexual approach [24]. Young boy's brains are being conditioned to want premarital sex. They are not unvirtuous, but the environment they are raised in trains their brain to view girls as sexual objects. Instead of helping boys to focus on school, sports, and musical instruments, they are victims to their hyper sex-drives where sex is first and foremost on their minds. This leads to devastatingly high levels of promiscuity, which increases the spread of STDs, and causes more children to be born out-of-wedlock to young men who are in no way ready to assume the responsible role of father.

ELEVATED TESTOSTERONE IS LINKED TO INCREASED AGGRESSION AND VIOLENCE IN MALES

Elevated testosterone is also linked to increased aggressiveness and violence [20,23,24,25]. A study of 4,462 men linked high testosterone levels with delinquency, substance abuse and a tendency toward excessive aggressive behavior [111]. A study performed on 692 male inmates found that prisoners who committed violent or sexual crimes had higher levels of testosterone [111]. An additional study found that delinquent college students had raised levels of testosterone when compared with similar counterparts [111]. Testosterone levels are linked to amygdala responsiveness [119,130]. Testosterone reduces the regulatory control from the cortex over the amygdala [130]. Since the amygdala is the emotional part of the brain, testosterone makes males more emotional. Males generally reflect emotionality through aggression and violence.

THE BRAIN IS VERY FLEXIBLE

We have now reviewed the physiological effects of innocent exposure to gateway pornography. There is much more than meets the eye. In recent years there has been a paradigm shift among the neuroscience community. The brain was once considered to be inflexible. It was thought that the brain did not change in response to environmental cues. The brain was preprogrammed for specific developmental paths and did not alter its course.

Recently, science has unequivocally confirmed that the brain is extremely flexible. Some areas are much more dynamic than others. The brain stem that controls breathing and heart rate is quite rigid. Obviously, constant changes there would be detrimental to good health. Any guesses on which area of the brain has been found to be the most susceptible to change? The answer is the prefrontal cortex. The portion of the brain that is responsible for our greatest potential is also the most vulnerable to negative influences like gateway pornography. One author eloquently described various areas of the brain as "exquisitely sensitive to prolonged stress exposure [114]."

A common misunderstanding is that once the image is gone the brain immediately readjusts itself back to normal: The prefrontal cortex kicks right back in and the basal ganglia becomes inhibited. The brain can jump right back into math homework or playing the piano, and no permanent damage is done. In reality, stimuli the brain receives influences the pattern of neuron wiring. The problem with our environment is that the exposures are ever increasing both in quantity and intensity.

TYPICAL SCENARIO OF A TEENAGE BOY

Take an average child or teen and recreate a typical Saturday for him. In our scenario we will name our 12-year-old boy Tom. One Saturday morning, Tom's dad asks him if he will run to the store with him to pick up hamburgers for grilling that night. Tom gets out of bed and eats breakfast. While eating he watches three commercials that all use sexually explicit images to sell their products. He gets in the car to drive to the store. On the way to the store he sees two sexually explicit billboards, one is advertising plastic surgery and the other is for the latest fashion being sold at a local department store. He and his dad arrive at the store. They pick up the burgers and some other groceries for his mom. At the checkout Tom sees three magazine covers that would all be considered gateway pornography. On the drive home, they pass another sexually explicit billboard. On the way into the driveway they stop and grab the mail. The mail contains two mailers with very sexually explicit material for local stores at the mall. Tom goes inside and hangs out with his mom for a while, as she gets some salads ready for the BBQ. He starts getting bored and decides he will turn the television on. He sees four more sexually explicit images in just the hour he watches T.V. As the day wears on, his cousins and aunt and uncle come over for the BBQ. His 16-year-old cousin brings a popular CD she just bought. Tom looks at the cover and is exposed yet again to emotionally charged images that cause activation of the amygdala and basal ganglia and quiet the prefrontal cortex.

This is obviously a hypothetical scenario, but not an unrealistic one. If adults are wondering how often this chorus of hormones and neurotransmitters is being released in their children's brains they should start counting. The vast majority of adults would be shocked by the tremendous amount of exposure children and teens are subjected to every day, because we have become so accustomed to the environment we live in.

Back to the topic of the brain's ability to change in response to the stimulants it receives. Another term for this is neuroplasticity or neuroadaptation. The residual effects on the brain from adult images are alarming and they are real.

HOW DOES THE BRAIN LITERALLY CHANGE IN RESPONSE TO ENVIRONMENTAL STIMULI?

The brain is made up of neurons, which are brain cells. Neurons have a cell body and dendrites that protrude out of the cell body. Dendrites could be thought of as information grabbers. They "grab" information from the adjacent neuron. The cell body also has an axon that protrudes from it. The axon propagates the information then branches into synaptic terminals. It is between the synaptic terminals from one neuron and the dendrites of the next neuron that neurotransmitters are used for communication. Neurons have the ability for incredible changes in response to stimuli. Dendritic pruning describes dendrites disappearing on a cell body. Dendritic budding refers to dendrites growing on a cell body. A neurons anatomy can literally change, based on the

level of activation. Where dendrites once were, they are now gone; where there was only a smooth surface, now a dendrite has popped out. The body is truly miraculous!

Repeated activation of a specific collection of neurons will actually strengthen the connection among those neurons, which will make them function more efficiently [63]. As amygdala-basal ganglia connections are continually stimulated in response to gateway pornography, these connections in the brain are literally strengthened. This is unfortunate because the prefrontal cortex has diminished control over these more primitive brain structures.

Gateway pornography activates dopamine neurons. "Studies over the past decade or so have revealed that synapses on DA (dopamine) neurons themselves also undergo activity/experience-dependent modification in their strength [96]." This statement from the publication *Neuroscience* indicates that dopamine neurons undergo budding in response to experience; further evidence that environmental influences do indeed manipulate the brain.

A MATURING BRAIN IS MUCH MORE VULNERABLE TO NEURAL ADAPTATION

A brain that is growing and maturing is much more vulnerable to neuroplasticity than an adult brain is. Not only can dendrites undergo pruning and budding, entire neurons can also go through death (apoptosis) and birth (neurogenesis). In humans the prefrontal cortex normally lags behind the development of the limbic system and basal ganglia. This explains why teenagers are generally more emotional and impulsive. It leaves the prefrontal cortex very vulnerable because development takes longer. The old adage, if you don't use it you will lose it, is very applicable to the brain [42]. For the prefrontal cortex to develop properly, it must be used to being in charge of the other brain structures. If several times a day the prefrontal cortex is put out of commission because of exposure to sexually explicit material, it begins to accept its role as only a member of the "brain" orchestra instead of the actual conductor! Neural circuits literally develop based on how often they are used. "It is important to keep in mind that the brain is very malleable or "plastic," and that its development is affected by experience as well as biology. Both synaptic pruning and myelination are influenced by experience, such that repeated activation of a specific set of neurons, as a result of engaging in a particular behavior, will actually strengthen the connection among those neurons and cause them to function more efficiently [63]."

We don't want the amygdala – basal ganglia connections strengthened, at the expense of the prefrontal cortex, by viewing soft-core pornography. "The 'law of strength' finds pictorial pornography reflexively and mechanically restructuring the brain [62]." If the route between the amygdala and the basal ganglia is activated much more frequently, then in a more neutral environment, the basal ganglia will become more dominant than it would have otherwise. Educational psychologist Jane Haley notes, "Large areas of uncommitted brain tissue can be molded…to the demands of a particular environment [62]."

THE PREFRONTAL CORTEX PERFORMS LESS EFFICIENTLY IN REPONSE TO CHRONIC STRESS

In a study conducted on rats, it was found that chronic stress [i.e. hormones released from gateway pornography], reduced dendritic material by 20% and dendritic branching by 11% in the prefrontal cortex [26]. Their results corroborated several other similar studies [26,2]. "The prefrontal cortex seems to be particularly sensitive to architectural changes induced by chronic stress compared with other brain regions. Dendrites in the prefrontal cortex begin to change after

only one week of stress or possibly even a single exposure. Chronic stress during brain development or in childhood may have a *particularly large effect* on prefrontal cortex structure and function in adulthood [2]." "Chronic stress exposure induces architectural changes that arise from dendritic retraction in the prefrontal cortex [32]."

THE AMYGDALA AND BASAL GANGLIA PERFORM MORE EFFICIENTLY IN RESPONSE TO CHRONIC STRESS

The amygdala and basal ganglia are affected oppositely of the prefrontal cortex in response to chronic stress. "Chronic stress appears to expand the intricate web of connections among neurons in our lower emotional centers, whereas the areas engaged in flexible sustained reasoning start to shrivel [51]." The fact that stress hormones can cause that drastic of a reduction in the synaptic abilities of the prefrontal cortex and enhance synaptic abilities in the basal ganglia is astounding! It should be a wake-up call to society, that small, but consistent amounts of stress hormones from gateway pornography do truly change the structure of a brain. Stress is nothing more than a specific release of hormones by the body. It is this very release of hormones that is caused by innocent exposure to sexual images!

ENHANCED AMYGDALA FUNCTIONING PERSISTED EVEN AFTER CHRONIC STRESS WAS REMOVED

A study published in *Neuroscience* found mice that were exposed to chronic stress for ten days and then placed in a stress free environment for 21 days still had enhanced amygdala functioning and subsequently increased anxiety [112]. The point was clearly made that there are substantial changes that take place in the brain even after ten days of chronic stress and the changes did not reverse after double that time frame. One can't help but think of the changes that take place in a developing brain over years of continual exposure to chronic stress in the form of soft-core pornography.

THE ADOLESCENT BRAIN IS VERY ADAPTABLE

In adolescents, an unusually large amount of neural pruning takes place; "the most frequently used connections are strengthened and preserved, while synapses which have shown scarce activation degenerate [18]." Vulnerability to psychiatric disorders increases during this time [58]. A perturbed prefrontal cortex is linked to numerous mental problems. In adolescence, reductions in cortical regions indicate synaptic pruning, reductions are made to energy consuming connections that do not transmit information efficiently, based on experience [105]. What neurons go and which stay are determined by the amount of use. This is an alarming thought if the prefrontal connections are weakened due to constant exposure to sexualized images. The brain is literally different than it would have been. A different brain is developed, with a diminished prefrontal cortex and a more dominant basal ganglia, which puts minors at risk for mental and emotional problems.

Consider an athlete who only did exercises that would strengthen his biceps, but did nothing to build up the triceps. The athlete would have arms that were out of proportion. The biceps would be more dominant than they should be. This is exactly what happens to the brain when artificial stimulants, like soft-core pornography, bulk up the basal ganglia and cause the brain to be out of proportion.

Neuroplasticity, or the ability of the brain to change, takes place on two different levels. The larger level is when whole neurons go through death or formation. The more intricate level is when neuronal dendrites go through pruning and budding. In the prefrontal cortex, there are neuroadaptations that take place between the dendrites of dopamine neurons and serotonin neurons. Serotonin is another important neurotransmitter that the prefrontal cortex uses. Most people recognize the name, because reduced levels of serotonin cause depression and anxiety. The most common drugs used to treat these conditions are called SSRIs (selective serotonin reuptake inhibitors). These drugs prevent the uptake, or loss, of serotonin at the synaptic junction of neurons in the brain.

DOPAMINE IS ANTAGONISTIC TO SEROTONIN

It was mentioned earlier that dopamine is released in response to gateway pornography. Dopamine is responsible for making people feel good and crave more of something. In the study of mice, the dopamine centers in the brains of mice were set up to electrical stimulation. It was found that the mice preferred activating the stimulation over eating or drinking, to the point of starvation [44]. That gives readers an idea of how desirable dopamine release is. Relatively new research is illuminating just how susceptible the dopamine neurons are to adaptation within the prefrontal cortex [4]. In a normally functioning prefrontal cortex, proper amounts of dopamine and serotonin are interacting [49]. As frequent exposures to sexually explicit material occur, the amygdala continues to dump large amounts of dopamine into the prefrontal cortex.

In a study on synaptic junctions in frogs, it was found that the number of dendrites increased to accommodate for the amount of neurotransmitter dumped into the synapse [4]. In the prefrontal cortex, serotonin and dopamine are used to perform tasks [27]. As the dopamine neurons expand, in response to higher levels, they begin to encroach onto areas of the cortex that are dependent on serotonin for optimal functioning.

Think of an average neuron as a spider at rest. As neuronal dendrites expand and grow, think of the spider spreading out some of its legs in response to a possible meal. The spider looks much larger now, and its legs more dominant. Likewise, the neuron now covers more territory than it did before.

There is an interesting relationship between serotonin and dopamine. The two neurotransmitters have a reciprocal effect on behavior. Where dopamine is a stimulator [58], serotonin is widely considered to inhibit [49,58]. "Measures of decreased brain serotonin activity are associated with impulsive behaviors…[105]." Serotonin, certainly helps keep dopamine "in check' so to speak [4,5,58] But, if the two are competing for functional space on a neuron, dopamine will win [3,4].

Another way to remember this is that "dopamine dominates." Although they have a reciprocal effect on behavior, if the two go head to head for the function of a single neuron, dopamine will win. As dopamine increases its dominance in the prefrontal cortex, due to neuronal plasticity, the natural checks-and-balances built into the brain between the serotonin and dopamine system is eroded [28]. As mentioned earlier, decreased levels of serotonin are directly linked to depression and anxiety [33,46,64].

DOPAMINE HAS THE UNIQUE ABILITY TO CAUSE CRAVING

Dopamine is unique in that it has the ability to cause craving or wanting [82,93,100]. When an innocent young man is exposed to sexualized images, his normal physiological response will evoke pleasure and the desire for more. Gateway pornography plants the seeds of desire and the motivation to seek out more adult images. It is unfair to dangle these images in front of youth who do not have the ability to control their emotions the way someone with a developed prefrontal cortex does.

When a minor views an adult-image dopamine is released in the nucleus accumbens, which is considered the pleasure center of the brain located in the basal ganglia [65,81,88,95,105]. This also occurs in response to illegal drugs and natural addictions. An interesting study published in *Nature,* demonstrated the level of dopamine released in the striatum while playing a video game was similar to an intravenous injection of the illegal drugs amphetamine or methylphenidate as recorded by positron emission tomography [84]. This study proved the point that natural rewards are just as powerful and release comparable dopamine to illegal drugs. Certainly, adult images viewed by adolescents have a powerful effect on dopamine emission.

DOPAMINE DISRUPTION IS LINKED TO ADHD

There is much more to dopamine than craving. Dopamine is critical for proper functioning of the brain. The development of the dopamine system is very sensitive and **excessive activation** can lead to long- term functional changes [114]. Disruption of the dopamine system is directly linked to a variety of neurological conditions including attention deficit hyperactivity disorder (ADHD) [66,68,69,70,71,80,89]. The level of dopamine in the basal ganglia, more specifically the ventral striatum, affects cognition and impulsivity [82]. This begs the question, does chronic exploitation of the dopamine system affect the brain. The answer is unequivocally, YES.

Over several years there have been numerous studies performed on different aspects of the dopamine system. An interesting phenomenon has been discovered. Although initial exposure to pornography causes an increase in extracellular dopamine, chronic over stimulation of dopamine neurons actually leads to **decreased** extracellular dopamine [76,77,83,87,102]. This is referred to as the Dopamine Depletion Hypothesis [73]. The baseline level of dopamine is less in someone who is putting unnatural demands on their dopamine neurons. "Chronic elevation of dopamine neural firing in the nucleus accumbens (pleasure center of brain), induced by strong stimulants among rodents and nonhuman primates **down-regulates** dopamine activity [114]." A person who has disrupted their dopamine system due to over stimulation is trying to "get straight" rather then to "get a high"[94].

Why do diminished levels of dopamine over time matter? Lower levels of dopamine are directly linked to the symptoms of ADHD [98,108,114]. *Neuropsychological Review* states, "multiple theories of ADHD have been proposed, but one that has stood the test of time is the dopamine deficient theory [98]." The article goes on to discuss different environmental causes that result in dopamine deficiency. One of the causes is gene-environmental interaction that may cause damage or adaptation to dopamine neurons [98]. This is precisely what chronic stimulation of dopamine neurons in response to soft-core pornography does. A detailed explanation of exactly how this happens will be given shortly. ADHD is characterized by inattention, hyperactivity, and impulsivity [66,67,89,101].

DOPAMINE LEVELS CAN BE MEASURED BY DOPAMINE TRANSPORTER (DAT)

A way that levels of dopamine can be measured in the ventral striatum is by the density of the dopamine transporter (DAT). DAT clears dopamine from the space between the neurons. DAT causes dopamine to be taken back into the neuron and repackaged, ready to be released again when the neuron is next stimulated [68]. DAT is up regulated in response to increased extracellular dopamine and down regulated in response to decreased extracullar levels [74,75,98]. An example of this is the brain of a patient with Parkinson's disease. This disease has greatly reduced dopamine levels and DAT is down regulated accordingly [68].

REDUCED DAT IS DIRECTLY LINKED TO IMPULSIVITY AND HYPERACTIVITY

The level of DAT is directly linked to behavior. "DAT regulation also plays a role in DA-related disorders, such as ADHD [90]." The *European Journal of Neuroscience* printed a study about mice that had DAT genetically disrupted and found they exhibited locomotor hyperactivity [86]. A corroborating study reported in *Psychopharmacology* reported that mice that were genetically manipulated to remove DAT proteins exhibited compulsive-like behaviors, hyperactivity, and inattention [69]. Yet another study performed on mice and DAT in *Neuropsychopharmacology* concluded that mice with reduced DAT exhibited traits indicative of "risk-taking behavior, ADHD, and drug abuse [103]."

WHY DOES CHRONIC STIMULATION OF THE DOPAMINE SYSTEM LEAD TO REDUCED DOPAMINE, DAT, AND SYMPTOMS OF ADHD?

When dopamine is released, it begins to break down in the cleft between the two neurons. These compounds are then transported back into the neuron by DAT, where they are repackaged as dopamine and put into dopamine terminals, ready to be released again. Some of dopamine's breakdown components generate free radicals. In normal amounts, the cell can handle the free radicals. It is thought that the cumulative toxic effect of free radicals in larger amounts can cause damage to the neuron, therefore reducing its ability to release dopamine upon future stimulation [72,109,110]. This damage is directed toward dopamine terminals [79,102,107,109,110]. The terminals are a holding area for dopamine in the cell. If this area is damaged the amount of dopamine will be reduced.

Another factor contributing to the reduced dopamine may be an unrealistic demand placed on the recycling capabilities of the neuron. Excess dopamine is simply lost extracellulary because the cell cannot keep up with the demand [73].

There is an abundance of research implicating over-stimulation of the dopamine neurons causing long-term nerve damage that results in lower levels of dopamine and DAT [74,99,102,107]. Illegal drugs or natural stimulation, like pornography, can cause over-activation of the dopamine system. For a child or teen, soft-core pornography is ample stimulus to activate the dopamine cascade. A person that has damaged their dopamine system actually feels worse than normal when he is not being stimulated, because their baseline level of dopamine dips below average amounts [73,87]. This dopamine depletion is linked to the serious drive to want more of the stimulant and is tied to the symptoms of inattention, hyperactivity, and impulsiveness.

Dopamine is directly tied to mental cognition. *The European Journal of Neuroscience* stated, "Reduced striatum dopamine levels have been shown to impair cognitive flexibility [91]." A

study reported in *The Neuroscientist* found that the drug bromocriptine, used to increase extracellular levels of dopamine, improved cognitive control in high-impulsive subjects [82]. As dopamine is reduced, DAT is reduced to lessen the amount of dopamine removed from the synapse. The frequency that the dopamine neurons fire is one of the non-genetic determinants of DAT abundance [97].

Children can be born with inherently different levels of DAT. Those born with reduced levels are at a higher risk for ADHD. DAT can also be manipulated after birth, based on the firing rate of dopamine neurons and the amount of extracellular dopamine released. This non-genetic factor demands careful protection for minors from images that will exploit the dopamine system and ultimately lead to lower DAT levels and subsequent symptoms of ADHD.

An article published in *The Journal of Biomedicine and Biotechnology* studied people with Internet addiction disorders. It was found that DAT expression level in the striatum, were significantly decreased for those with internet addiction when compared with normal controls [107]. This is more evidence that non-drug manipulation of the dopamine system results in dopamine burnout, reduced extracellular dopamine, and lessened DAT. A study in *The New York Academy of Sciences* reported that "DAT plays an integral role in cognition, affect, behavioral reinforcement, and motor function, and DAT pathologies are suspected to contribute to disorders, such as … attention deficit hyperactivity disorder and addiction [85]."

An article in *Behavioral and Brain Functions* shared that damaging DAT with antibodies was associated with "long-term striatal impairment, hyperactivity, and reduced cognitive flexibility [92]." Another study found DAT diminished in patients with ADHD in two key brain regions responsible for reward and motivation [101]. Remember, these are the areas of the brain pornography targets.

A study reported in the Journal of Neuroscience found that when dopamine transmission was brought back to normal levels, the level of DAT did increase, but neuropsychological tests did **not** improve to the same extent [83]. This study provides evidence that manipulating the dopamine transmission in the brain has irreversible effects on mental performance, a devastating result to any young man who has his life ahead of him.

ADOLESCENT DOPAMINE SYSTEM IS OVERACTIVE

Dopamine-containing neurons are not only extremely adaptable, they are also found to be more abundant in early adolescence and undergo neuronal pruning with advanced maturity [25,58]. It is dopamine that is largely responsible for the pleasure, all the way up to euphoria, that is felt from exposure to sexualized images in males. Dopamine is also responsible for craving a repeated exposure [1,3,60]. One reason teenagers are infamous for their out-of-control hormones, is that they are even more susceptible to the pleasurable effects of a squirt of dopamine, because they have increased receptors for it [22,63]. "Increased receptors, support the notion that limbic and striatal [part of basal ganglia] dopamine systems may be in a state of overdrive during adolescence [58]." The dopamine system develops more quickly then the inhibitory serotonin system [105].

Illegal drugs can have both aversive and rewarding effects on humans. It is found in adolescents that the balance is tipped clearly toward reward [106]. It is also found in teens that the amount of

dopamine released in response to illegal drugs is augmented when compared with adults [106]." Both drugs and pornography affect the exact same areas of the brain.

"Addictive disorders identified in adults most commonly have onset in adolescence or young adulthood [105]." The reason is that teens are more vulnerable to dopamine exploitation. Society is basically conditioning people's brains to want more pornography. As overactive neurons release dopamine, dopamine-containing neurons undergo adaptations to increase their domain. Society is literally training an entire generation of male adolescents to seek out pornographic images and begin their journey of actual addiction.

GATEWAY PORNOGRAPHY CAUSES IDENTICAL HORMONE RELEASE AS ILLEGAL DRUGS

There is an undeniable cascade of hormones and neurotransmitters released in response to innocent exposure of sexually explicit images. The proof is irrefutable. Science has unequivocally proven these hormonal releases. What people must understand is that these are the same physiological entities released in response to illegal drugs. People are not addicted directly to the drug, but to the release of their own internal hormones. It is the physiological response to those drugs that the addict craves. Dopamine can be considered the 'feel good' neurotransmitter. The more dopamine released the higher the level of euphoria. All potential addictions, both drug, or non-drug, involve release of dopamine. "As far as the brain is concerned, a reward is a reward, regardless of weather it comes from a chemical or an experience [62]."

The Journal of Neuropharmacology reported that "Natural rewards [like soft-core pornography], are capable of inducing neural and behavioral plasticity in ways analogous to drug addiction [29]." The publication *Brain* stated "Monetary and sexual stimuli, all elicit the same patterns of striatal activation as drugs of abuse [104]."

"Pornography is not like a drug, it **is an endogenously processed poly drug,** providing intense sensory rewards [62]." Vanderbilt University psychiatrist Peter Martin's brain research, found brain activity experienced in sexual arousal "looks like that accompanying drug consumption [62]." Imagine a mother went into a grocery store and found a sign that read "cocaine on sale." This scenario seems absolutely ludicrous. The sad truth is that gateway pornography is abundantly displayed and releases the same internal hormones that illegal drugs do.

DIFFERENCE BETWEEN EXPOSURE TO BOYS VS. GIRLS

Although the affect of exposure on boys and girls has many similarities, there are some important differences. One study showed males and females distorted body images and used MRI brain scans to determine which areas of the brain were most active. The women showed activity in the prefrontal cortex and the limbic system. The males bypassed the prefrontal cortex and used areas of the brain crucial for identification of objects and spatial location [14].

Males are more stimulated by visual images [60], and view the person in the picture as an object. He can emotionally separate himself from the image. When a female sees the same image, her prefrontal cortex is not immediately bypassed. She is able to analyze, internalize, and ultimately compare the image to herself. When her analysis is complete, she comes up short. The prefrontal cortex then activates the amygdala, through a neural network implicated in anxiety [6,8]. With

the amygdala now activated, the stress pathways are followed, resulting in systemic release of cortisol and norepinephrine and reduced functioning of the prefrontal cortex.

"Research has suggested that young girls begin to internalize messages from the media regarding their body as young as the age of 7 years [10]."

A study in *The Journal of Neuroimage* found 18 healthy young women, who did not report any link to eating disorders, and scanned their brains as they viewed sexually explicit images. The results showed that the stronger the amygdala activation, the higher their level of anxiety. The study concluded by confirming, "at a neurobiological level, the existence of substantial body dissatisfaction in a sub-group of non eating disordered women [8]." There are almost no females who are spared the vicious cycle of hormone release and anxiety, in response to images that are impossible to live up to.

GIRLS INTERNALIZE AND COMPARE THEMSELVES TO IMAGE

If we return to the initial process of internalization of the image that occurs in girls, we find the basis for body dissatisfaction and body objectification. The former refers to general displeasure in one's appearance, while the latter refers to girls viewing themselves as nothing more than objects. Objectification theory claims that within a culture infused with sexualized representations of women, girls are taught to treat themselves as sexual objects [10]." Body objectification is particularly dangerous because intelligence, personality, and talents are completely disregarded. It teaches that girls are to be viewed as sexual objects. All other traits mean nothing.

There have been several studies linking body objectification and dissatisfaction with anxiety, depression, and eating disorders [7,8,10,11,12,13,14,15,16]. "Brain networks associated with anxiety, induced by self comparison to slim images, may be involved in the genesis of body dissatisfaction and hence with vulnerability to eating disorders [8]." In 2006 The American Psychological Association formed the Task Force on the Sexualization of Girls. They were charged with elucidating the consequences of the sexualization of girls. The results included: body shame, anxiety, body dissatisfaction, depression, eating disorders, reduced physical and sexual health, and disrupted attention to tasks and learning [9].

A study from the *Journal of Applied Social Psychology* found that increased consumption of music television, which is argued to be the most egregious of objectifying media, increased depression, anxiety, dieting, decreased body-esteem and math confidence [10]. "Girls' exposure to the televised sexual objectification of women, cultivates a particular view of the self, a view that emphasizes the importance of physical appearance. As such, it is possible that, after viewing a media genre that is replete with images of hypersexualized and objectified female bodies, girls begin to view themselves as objects whose value is based on appearance [10]."

A study in *The Journal of Adolescent Health* reported that body dissatisfaction is also a predictor for reported suicide attempts in adolescence, and this correlation is significantly greater for females than for males [12]. Another study found the same outcomes regarding depression, anxiety, and decreased self-esteem, but they noted that race and socioeconomic status were not factors [13].

This highlights the fact that self-objectification has no bias, all races and economic classes of girls fall victim. *The Journal of Developmental Psychology* reported on a study that also linked body dissatisfaction with unnecessary plastic surgery [16].

The tragedy is that young girls should be enjoying this valuable time in their lives; by focusing on musical, artistic, and scholastic goals. Instead, many become preoccupied with attaining a body size that is not realistic and subsequently, they have higher incidences of depression, anxiety, eating disorders, and lower academic performance. They fall short of their potential.

NEXT TO INFANCY, ADOLESCENCE IS THE MOST CRITICAL PERIOD OF BRAIN ORGANIZATION

When something is developing it is much more susceptible to manipulation for good or bad. A good example of this is taken from the Chinese culture where small feet were greatly prized. Girls used to have their feet bound to prevent natural development and growth. Could the same results have been achieved if mature women had bound their feet? Of course not, the critical time to manipulate the outcome had already passed. The brain is also much more vulnerable during growth. "Children's brains are structurally and anatomically sculpted in response to visual stimuli [50]." Many people don't realize that next to infants, the most organizational brain growth occurs during adolescence [17,18, 20, 21,22]. "Profound neuronal rewiring takes place during adolescence [22]."

Adolescence can be understood as a unique opportunity in which the changes taking place in the brain affect the individual throughout his or her entire adult life. These brain changes set the stage for behavioral adult patterns [18,20]. "A window of neural and behavioral plasticity may close at the end of the adolescent period [20]." During the teen years there is an over abundance of hormones and a lack of inhibitory control from the prefrontal cortex. Combine this with the innate ability of the teenage brain to undergo neuroplasticity and adolescents can be viewed as a time of great opportunity and great risk. "The adolescent brain is clearly more plastic then the adult brain in response to insult [22]." Exposure to any form of pornography places adolescents at risk.

There is normal neuronal pruning that takes place during adolescence, particularly in the prefrontal cortex. The brain actually forms more neurons than it can accommodate and weeding out those nerve cells that have been underused takes place in adolescence [24,42].

Think of a sculptor. When he begins to carve, he starts with a block of marble, larger than his final statue will need. He then goes about expertly removing areas that are not needed. This is exactly what the brain does. There are an abundance of neurons that develop, and those neurons that have been underused will die [50]. If the prefrontal cortex has been bypassed several times a day by sexually explicit material, then more of those neurons will be sloughed off, than otherwise would have been. Adolescence is a window of opportunity to help mold the brain for optimal functioning. Unfortunately, the inundation of sexual influences is doing just the opposite, and subtly changing the brain to perform at a sub par level.

THE AMYGDALA IS OVER RESPONSIVE IN ADOLESCENT YEARS

Because the prefrontal cortex takes well into the twenties to fully mature, there is an enhanced response of the amygdala during adolescence to sexually explicit images. The prefrontal cortex

functions as the emotional brakes of the brain. "It is particularly difficult for youth to maintain cognitive control in the face of emotionally charged or incentive-laden distractors [25]." Amygdala signaling during the teenage years is disproportionately strong when compared to adults [18,19,24,25]. It is literally more difficult for teenagers to control their emotions and their responses to adult images. The late maturing prefrontal cortex causes enhanced sensitivity to environmental cues without appropriate behavioral inhibition [25,19].

STRESS PATHWAYS ARE HEIGHTENED DURING ADOLESCENCE

Research indicates that during adolescence the neural responses for the stress pathway are augmented [17,19,21,24]. Adolescence is characterized by a prolonged activation in response to stressors as compared to adulthood, which may render ongoing development of the brain vulnerable [21]. During the juvenile period the stress response lasts considerably longer than adults due to immature control regions of the brain [131]. Adolescents may be at a greater risk for the deleterious effects of chronic stress as compared to adults [21]. The effects of stressors on adolescents are different than adults [21]. This is extremely relevant to our topic. If gateway pornography activates the stress pathways, and these pathways are super sensitive during adolescence, and if the brain is particularly vulnerable to hormonal changes during this highly organizational time, then we have a big problem for the teenage brain! Talk about adding insult to injury.

Exposure to short-term stressors during juvenility resulted in impaired coping responses when faced with stressors in adulthood, resembling both anxious and depressive symptoms [131]. When youth are bombarded with images that elicit the stress response over and over there are long-term consequences, including decreased ability to cope with stressors as adults.

The normal stress response would be detrimental enough for a changing brain, but add a heightened stress response and the stakes are raised!

A teenage boy has an increased release of cortisol (the stress hormone), as compared to his dad, when viewing the same sexualized image. Cortisol impairs functioning of the prefrontal cortex, and chronic stress, or hypercortisolemia, induces dendritic reorganization in the prefrontal cortex [42]. Heightened levels of cortisol on the developing brain are also related to permanent changes in cognitive performance [21], or our ability to critically think.

Several studies indicate that high levels of cortisol are a predictor for subsequent adolescent disorders. "Among adolescents the onset and persistence of depression is linked with cortisol hypersecretion [17]." The article just quoted cited four other scientific articles to substantiate the link between increased cortisol secretion and depression. If one stops and considers that cortisol is secreted every time a boy or girl views gateway pornography, and hypersecretion of cortisol is causative of adolescent disorders and decreased critical thinking, it is mind-boggling to consider the environment we are raising children in!

STEROID HORMONES (CORTISOL AND TESTOSTERONE) PLAY A CRITICAL ROLE IN BRAIN DEVELOPEMENT

CORTISOL

Cortisol has a direct role in brain development and neural plasticity [18, 21,22]. It is one of the primary hormones released in response to sexually explicit material and plays a key role in determining which neurons stay and which neurons die. One must remember that the areas of the brain that cortisol favors are the emotional centers and not the higher reasoning centers. "The incidence of exogenous factors [like soft-core pornography] in this brain/hormone dynamic could affect the organization processes which take place in adolescence and may generate **alterations in brain organization,** and could manifest themselves as behavioral disorders in adult life [18]." Cortisol is very important for appropriate maturation of neuronal precursors into fully developed neurons [129]. "Glucocorticoids (cortisol) are hormones that influence ongoing brain development and **program future behavioral and psychological responses** [21]." **Steroid-dependent** organization of neural circuits is a fundamental feature of adolescent brain development that results in structural changes that determine **adult behavioral** responses to hormones and sensory stimuli [22].

In a study cited in *Pharmacology, Biochemistry and Behavior*, adolescent rats were exposed to stressors, and then given cognitive tests as adult rats. The rats that were stressed all tested inferior to controls, and those exposed earlier in adolescents showed a greater decline in cognitive abilities. This showed that stress during adolescents led to impaired performance on cognitive tests [21]. This again highlights the fact that adolescence is a very critical and vulnerable time of brain development that affects adult functioning. Teens need to be protected from influences that impair optimal brain development, like soft-core pornography.

Some of the most serious psychiatric disorders have their roots in adolescent neuromaturation [17]. Adolescents should be viewed as a critical window of brain development where environmental influences, like gateway pornography, can augment hormones and affect neural circuitry, thus causing permanent consequences through adulthood.

TESTOSTERONE

We have just discussed the effects of cortisol on the developing brain. Now let's turn our attention to testosterone. Boys secrete testosterone when they are exposed to a sexualized image. Testosterone is considered a gonadal hormone or a steroid hormone. "Gonadal hormones shape adolescent brain development via their ability to organize neural circuits … and exert global and long-lasting influences on adult behavior [20]." Testosterone literally organizes neural circuits during adolescence that will stay with them through adulthood [20, 22,25,42,52]. Testosterone is responsible for organizational changes in the brain that include myelination, neural pruning, and apoptosis (cell death) [18]. The effect of testosterone on the maturing brain predicts agonistic behaviors as an adult [20]. Agonistic means: aggressive, defensive, or combative. Higher than average levels of testosterone are linked with increased violent and aggressive behavior [20,23,24,25].

Higher basal levels of testosterone correspond to an increased volume in the amygdala, implicated in emotional processing [22,25,42]. An overactive amygdala makes a person more emotional; this shows in males by more aggression. Remember that the amygdala is part of the

limbic system. It is activated in response to emotionally charged images, and it directly controls whether the prefrontal cortex is activated or bypassed in favor of the basal ganglia. An overdeveloped amygdala favors the basal ganglia. It is now proven that higher levels of testosterone lead to an overdeveloped amygdala, thus reducing prefrontal cortex functioning!

The brain developed in the teenage years, through the influence of testosterone, will affect an individual's behavior throughout their entire adult life! Life is already difficult to navigate. The sexual inundation of boys is making it that much more difficult for them to control their behavior, resist violence and crime, and be a patient and nurturing husband and father.

The other key effect of testosterone is the revved up sex-drive it produces [3,50]. Teenage boys saturated with testosterone spend less time concentrating on school and more time interpreting any communication from a female as sexual innuendos [3,24,25]. The blatant expression of sexually explicit material, through testosterone release, dulls natural inhibitions a healthy brain contains in regards to behavior and sexual promiscuity.

CORTISOL AND TESTOSTERONE PLAY A KEY ROLE IN BRAIN DEVELOPMENT

The most important information to take away from the preceding two sections is that cortisol and testosterone actually give organizational instructions to the brain during adolescence. Both of these hormones are released from exposure to gateway pornography. Subtle changes in these hormones cause different instructions to be given to the brain, resulting in different brain organization. Organizational hormones can impact both normal and **atypical** trajectories of brain development [17,19].

GATEWAY PORNOGRAPHY CAUSES A DOMINANT BASAL GANGLIA

After a myriad of innocent exposures to gateway pornography, we now have teenagers walking around with a more dominant basal ganglia and an under developed prefrontal cortex. This paradigm causes impulsiveness, loss of empathy and sympathy for others, seeking of immediate gratification, and difficulty placing consequences with decisions. It also causes a decreased ability to set long-term goals and have the patience to achieve them. In such a competitive world, what a terrible disadvantage we are giving to so many young people. In many cases the difference is subtle, but it begs the question: What more could they have been?

PSYCHIATRIC CONDITIONS ARE LINKED TO A DOMINANT AMYGDALA AND BASAL GANGLIA AND A WEAKENED PREFRONTAL CORTEX

The most alarming evidence that research has elucidated is the link between dominant basal ganglia, weaker prefrontal cortex and psychiatric conditions [24,19,34]. Ultimately, the DNA in nerve cells undergoes changes in response to chronic exposure to sexual images. These are the same manifestations seen in mental illnesses [1]. "An imbalance in amygdala-prefrontal cortex coupling has been implicated in the pathophysiology of psychiatric illnesses (mood and anxiety disorders) [19];" this author cited *eight* other articles to corroborate this link. "Both **environmental** [like soft-core pornography] and genetic factors can exacerbate the imbalance between limbic and control regions [of the brain][19]." Recent research has established that most chronic mental illnesses have their **roots in childhood** [6]. Childhood is the time when the brain is most vulnerable and the links between brain cells are either being strengthened or entirely abandoned.

"There is accumulating evidence, that repeated exposure to stressful situations-particularly when these are **unpredictable, uncontrollable and/or taking place at vulnerable periods in life** can introduce an added risk for psychopathology [129]."

Not only is there a general change in behavior, in some cases this rewiring of the brain leads to actual diagnosis of medical conditions such as ADHD, anxiety, depression, and mood disorders like bipolar. The prefrontal cortex provides inhibition of the more emotional centers of the brain. With this area functioning at a sub par level, the brain is like a racing car with deficient brakes.

The Journal of Neuroscience published a study on the effects of chronic stress. The results of the study stated that the neuroplasticity that resulted from chronic stress hormones provide direct evidence that prefrontal dendritic remodeling may contribute to symptoms of depression and anxiety [26]. Mood disorders are all linked by deficient activity in the prefrontal cortex and over activity in limbic and basal ganglia regions [1]. The prefrontal cortex is the stabilizer of the brain. It helps even out our moods and emotions. A weakly wired prefrontal cortex leads to more emotionality, including anxiety and depression. A deficient prefrontal cortex is exactly the result of constant exposure to gateway pornography!

ATTENTION DEFICIT HYPERACTIVE DISORDER (ADHD)

ADHD is associated with subnormal activation of the prefrontal cortex, according to MRI brain scans, and underdeveloped inhibitory control [35,41]. "The attention operations of the prefrontal cortex are those most commonly afflicted in ADHD [41]." ADHD lacks impulse control, which in healthy brains is supplied by the prefrontal cortex, and has weakened prefrontal circuits [41]. "The hallmark symptoms of ADHD, impaired behavioral inhibition, increased motor activity, and inattention, arise from disruptions in circuits regulating attention and action [the prefrontal cortex] [53]." Excessive release of neurotransmitters, produce structural changes in the prefrontal cortex comparable to those born with ADHD [53]. Behavioral problems in children can arise from prefrontal cortex dysfunction caused by exposure to a stressful environment (like the inundation of sexualized images) [55]. Whether brain dysfunction is genetic, or the prefrontal cortex is weakened over time as a result of chronic exposure to sexually explicit images, the results are equally devastating.

DEPRESSION DISORDERS

Vulnerability to depression and depression disorder is found in individuals with hypoactivation of the prefrontal cortex and hyperactivation of the amygdala [40,45,121]. "Mood disorders such as depression are accompanied by changes in the structure and function of the prefrontal cortex and amygdala [121]." "Increasing evidence indicates that there is a strong correlation between *depression and cognitive impairments* (decreased prefrontal cortex functioning) [31]." "The brain's prefrontal cortex has abnormally decreased activity in individuals with bipolar and unipolar depression. This area is strongly linked to the neurotransmitter systems (dopamine and norepinephrine) thought to be important in regulating mood [57]."

Studies consistently show that major depressive disorder is consistently linked with elevated amygdala activity [40,45,54,56,121]. Major depressive symptoms are repeatedly found in hyperactivation of the hypothalamus and elevated release of the hormone CRF [59]. CRF is released in response to amygdala activation of the hypothalamus. CRF is part of the stress cascade activated by exposure to sexually explicit material.

The Journal of Neuroimage reported on a study that concluded that repeated stress and glucocorticoid (cortisol) secretion, result in the neuroplastic changes seen in bipolar disorder [37]. This study is saying that the architectural changes seen in the brain in bipolar, can be emulated with chronic stress and cortisol secretion! These are the same hormones released every time a minor is exposed to sexually salient images. Bipolar is also associated with a hyperactive amygdala [38]; a hyperactive amygdala is a consequence of chronic exposure to hormonally-charged images.

ANXIETY

An imbalance in the development of the prefrontal cortex and basal ganglia cause emotional reactivity. Emotionally reactive people have a hard time controlling their behavior; their emotions are always getting the best of them, so to speak. Again, this reactivity can be caused from the weakening of the prefrontal cortex as a consequence of the inundation of sexual images. If this emotional reactivity is not suppressed, it is directly linked to anxiety [19]. The strength of the connectivity between the amygdala and the prefrontal cortex predicts levels of anxiety [25]. A more developed prefrontal cortex, with strong inhibitory connections with the amygdala, will reduce anxiety. Alterations in neuron transmission within the amygdala are closely associated with multiple stress and anxiety disorders [124,127]. The primary hypothesis emerging from neuroscience suggests that **early** developmental disruption of amygdala-PFC circuitry mediates the emergence of subsequent anxiety disorders [39]. Remember, soft-core pornography causes *reduced* inhibitory connections between the prefrontal cortex and amygdala. Anxiety is directly linked to an over active amygdala [6,39,127,129].

"Virtually all chronic adult mental illnesses are now thought to result from long-term perturbations in neural development [38]." Continual release of neurotransmitters and hormones, caused from an artificially sexual environment, would definitely cause long-term perturbations in neural development, and thus lead to mental illness.

IS THIS KIND OF BRAIN DAMAGE REVERSIBLE?

If one considers a sapling, only recently planted, with the trunk just beginning to grow crooked because of the wind, correction is still possible. With a stake and rope, the trunk can be straightened. Now consider a great oak that has weathered years of wind and has grown bent to the side. The trunk is thick and the branches mature. No amount of rope and stakes could correct the growth on this tree. The deviation is permanent. The brain is the same way. Initial miswiring can be corrected with activities that strengthen critical thinking, planning, and organizing, all of which bolster prefrontal cortex circuits. If the neuron circuits to the basal ganglia are fortified over years, and especially during the formative time of adolescence, the damage becomes permanent and cannot be corrected. "If not too far advanced, brain damage and loss of brain cells can be stopped and genetically rehabilitated. Prolonged negative stimulation may produce permanent results that can even be transferred to those yet unborn [1]."

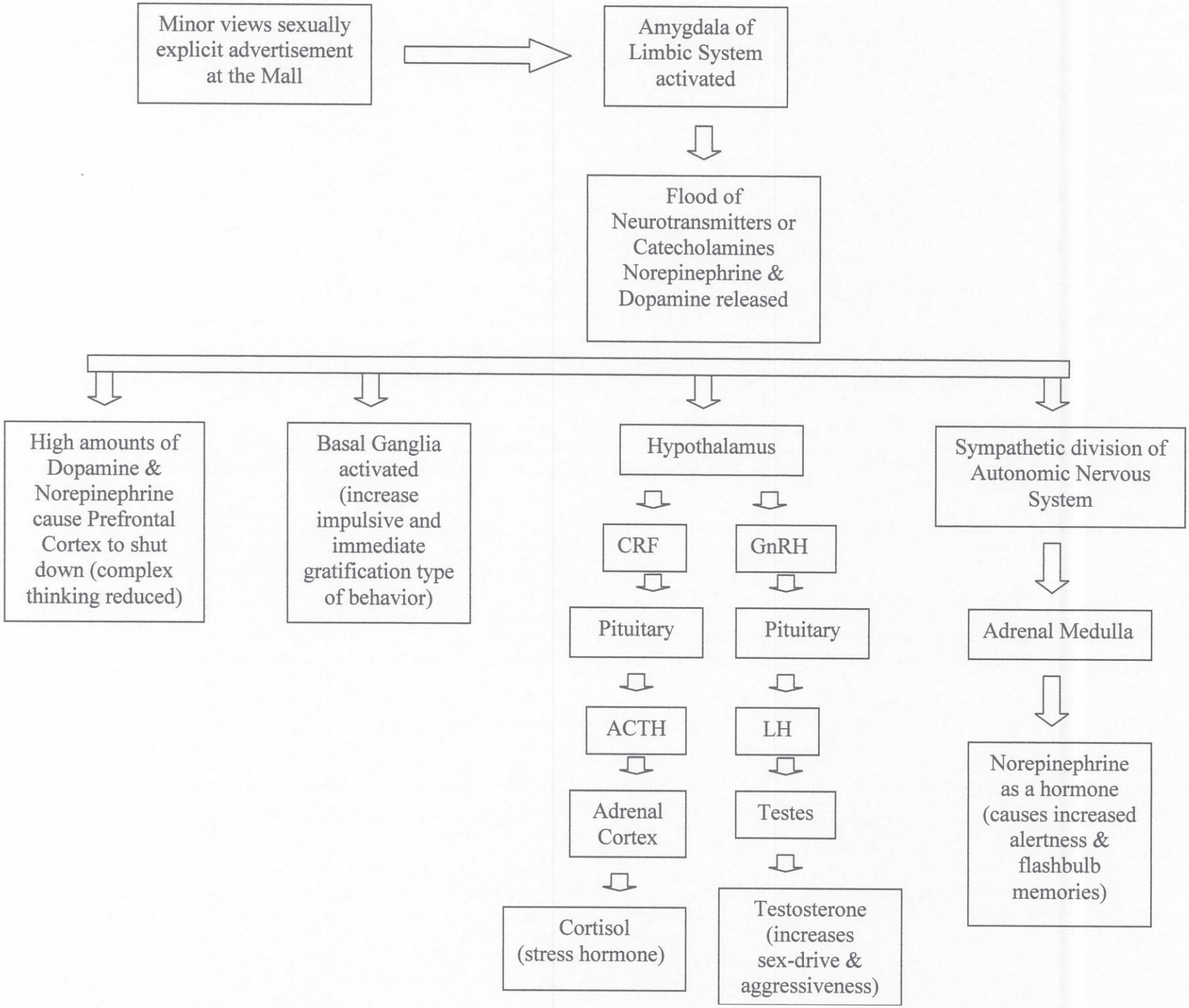
A SEXUALIZED ENVIRONMENT IS HARMFUL TO BRAIN DEVELOPMENT

The question of whether a sexualized environment is harmful to minors, has been unequivocally answered, YES! The immediate and long-term effects of chronic exposure to dopamine, norepinephrine, cortisol, and testosterone, literally changes brain structure. If someone were building a computer and extra wires were haphazardly added, would the computer work properly? If a chef were making a recipe and added extra eggs and flour would the product be the same? Of course not! If a brain is developing and extra hormones and neurotransmitters bombard it constantly, a different brain forms. At age two, a single neuron may have up to 10,000 connections with other neurons [63]; there is so much room for adaptation, for good or for harm. If even a minimal amount of synaptic connections are lost in the prefrontal cortex, the results have tremendous implications. If a teenager could study just a few more minutes a night, if a child could sit a little more still at school, if adolescents could exhibit a little more self-control, or if a young girl might have a little higher sense of self-worth, think of the potential; the "what ifs" are endless. Small improvements can add up to create a more stable and self-sufficient adult.

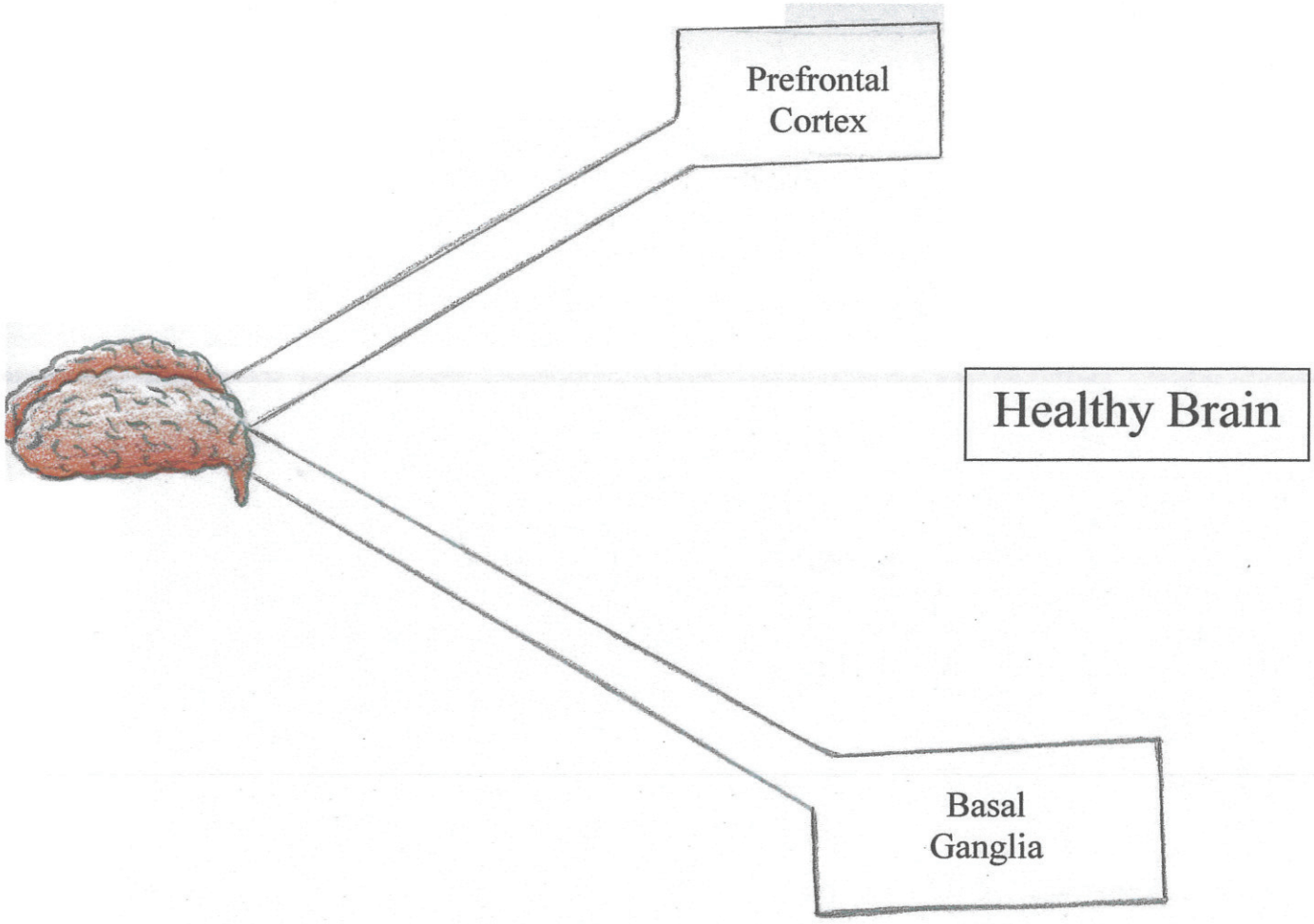
So much effort is exuded toward children breathing quality air, making sure children wear helmets when riding bikes, and vaccinations etc.; and yet, the most invidious and subtle destroyer of good brain circuits, soft-core pornography, asserts itself with confidence. A comparison can be made to the tobacco industry, which claimed for years, that nicotine was not addictive. Science finally advanced enough that the truth could no longer be disputed. The pornography industry is facing the same thing. For years, they too, have claimed there are no harmful effects on minors from a sexualized environment. Science has caught up and the evidence is irrefutable. Brain damage does indeed occur from chronic exposure to sexually blatant images.

Small, but consistent drops of water have the ability to produce the stunning architecture inside a cave. Small, but consistent amounts of hormones from sexualized images can likewise produce architectural changes inside a brain. Children have the right to grow up in an environment optimal for brain development. When they become adults, if they choose pornography, then that is their right to do so, but let them be a consenting adult and not a vulnerable child. The most painful reflection for parents, regarding a struggling teen or an unstable young-adult, is the thought of what could have been.

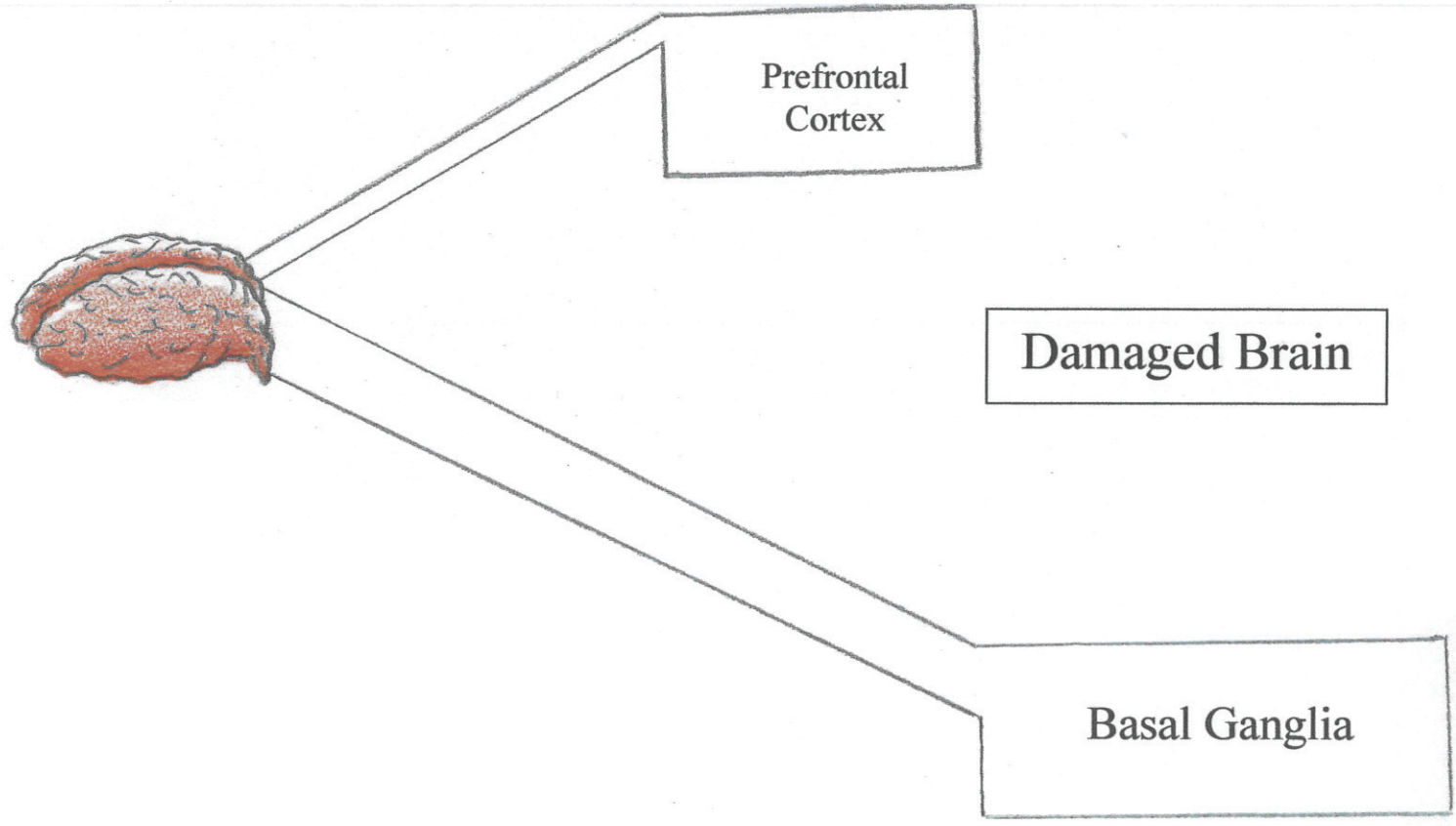
Physiologic Response of Brain to Sexually-Explicit Material

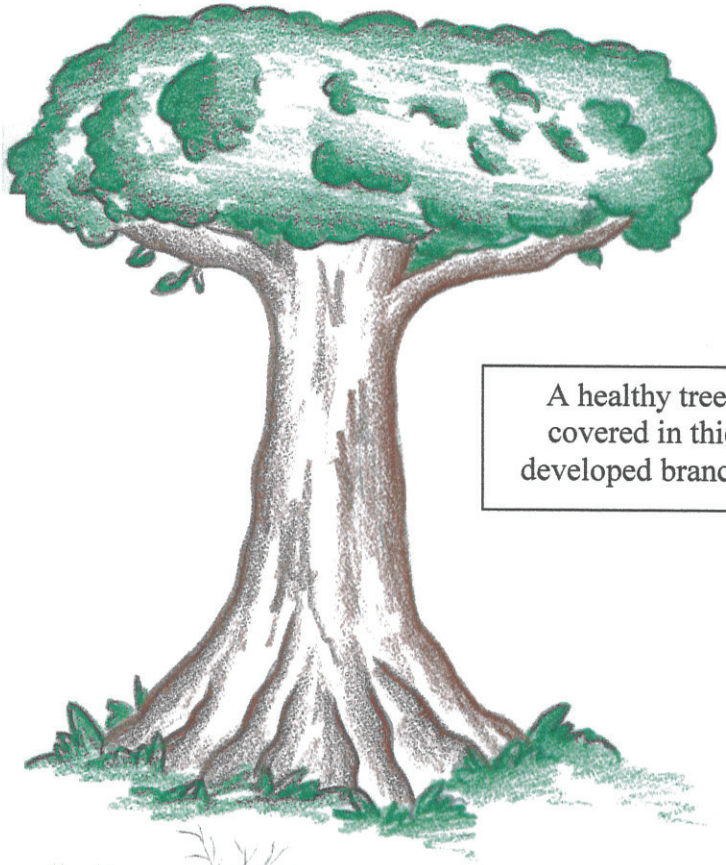


Physiologic Compound	Immediate Effects	Long-term Effects
Cortisol	Reduces functioning of the prefrontal cortex by clocking transporters that clear dopamine and norepinephrine.	Plays a key role in adolescent brain organization. Induces dendritic pruning in prefrontal cortex, resulting in permanently reduced functioning. Cortisol hypersecretion is linked with depression and other mood disorders.
Norepinephrine (hormone)	Increases heart rate and respiratory rate, causes pupil dilation, and increases breakdown of glycogen into glucose. Person is very alert.	Flash-bulb memories that are impossible to erase.
Dopamine	Large amounts cause prefrontal cortex to crash and basal ganglia to work more efficiently. Dopamine has a unique ability to cause cravings.	Chronic over-stimulation of dopamine system actually reduces baseline levels of dopamine. Reduced extracellular dopamine is directly linked to systems of attention deficit hyperactivity disorder (ADHD). Dopamine neurons are very adaptable. Increased dopamine causes dendritic budding of dopamine neurons in prefrontal cortex, which crowds out serotonin-containing neurons. Decreased serotonin causes mood instability.
Norepinephrine (neurostransmitter)	Large amounts cause prefrontal cortex to crash and basal ganglia to work more efficiently.	Induces dendritic pruning in prefrontal cortex, resulting in long-term reduction in prefrontal cortex function.
Testosterone	Increases sex drive.	Plays a key role in brain organization in adolescents. Hypersecretion of testosterone increases volume of amygdala-the emotional center of the brain. Increases aggressive and violent behavior, and reduces critical-thinking skills.

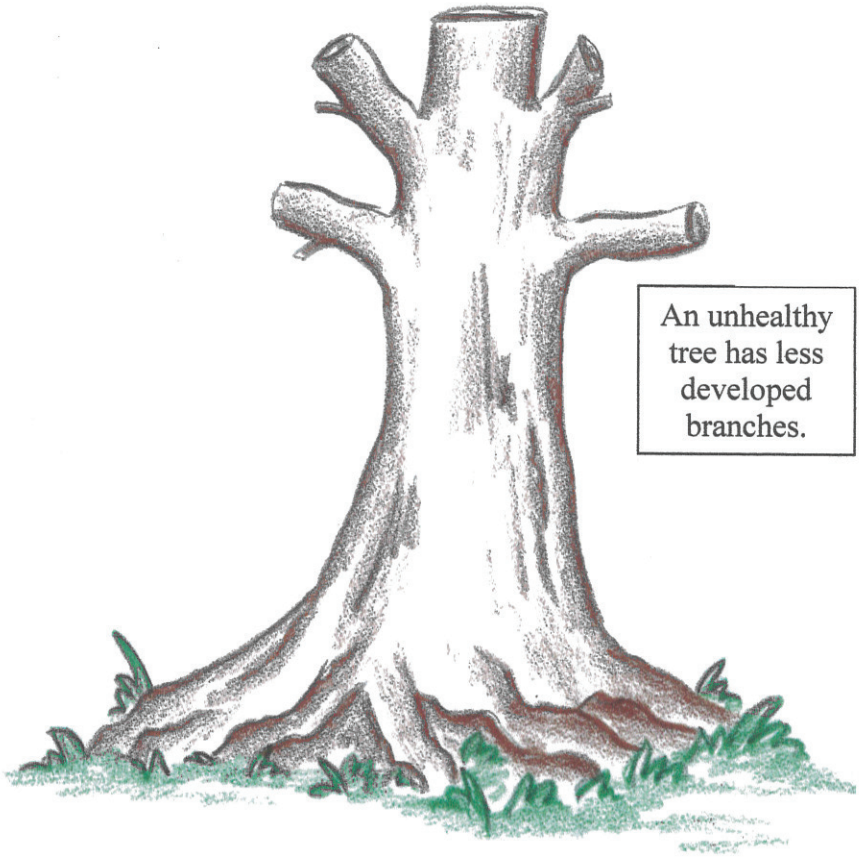


The inundation of sexually explicit material causes a restricted neural path to the Prefrontal Cortex and a strengthened neural path to the Basal Ganglia.

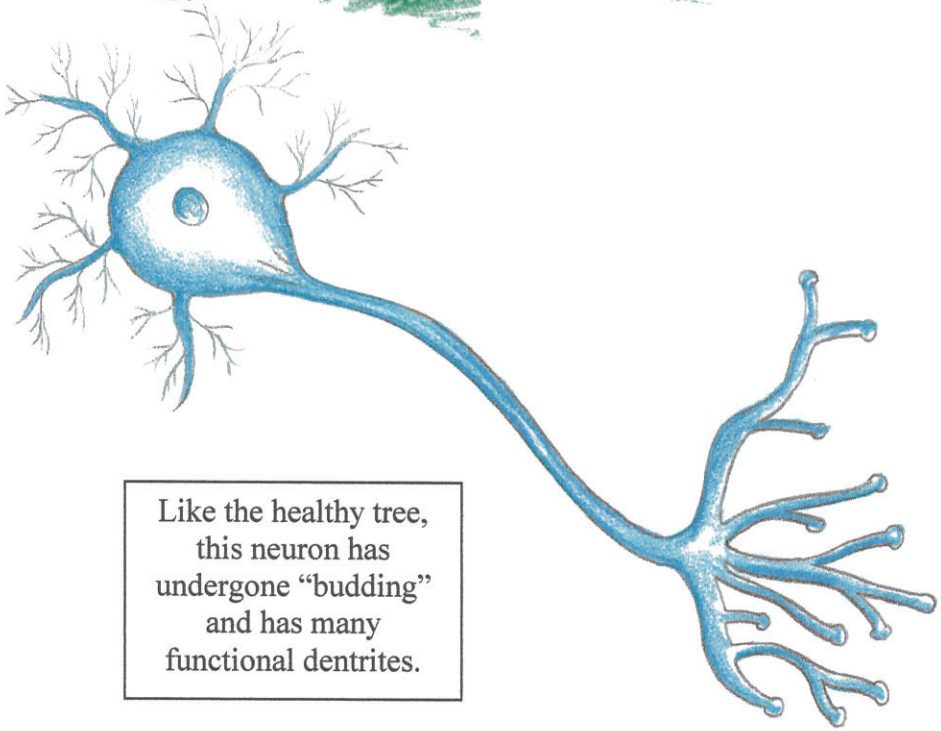




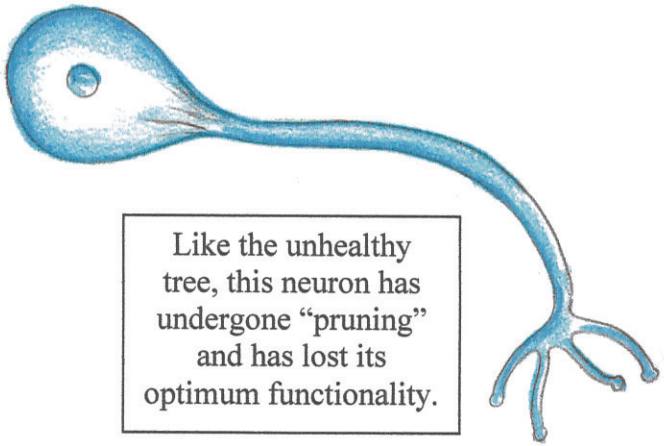
A healthy tree is covered in thick developed branches.



An unhealthy tree has less developed branches.

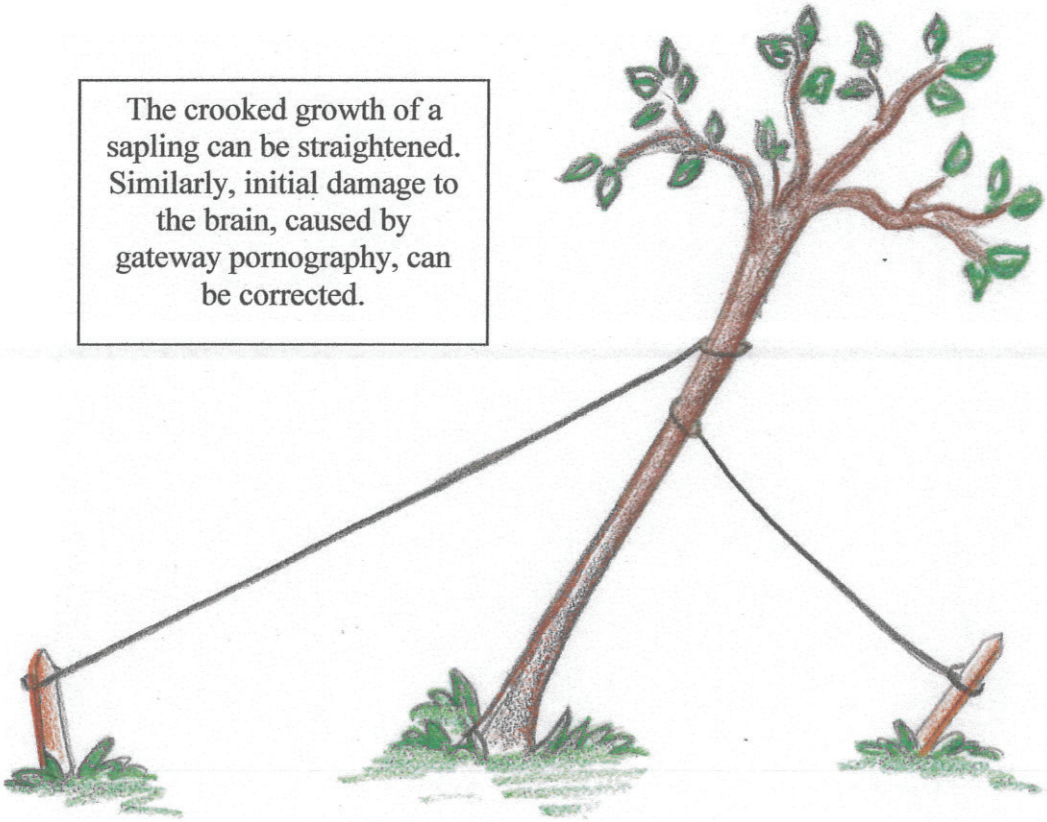


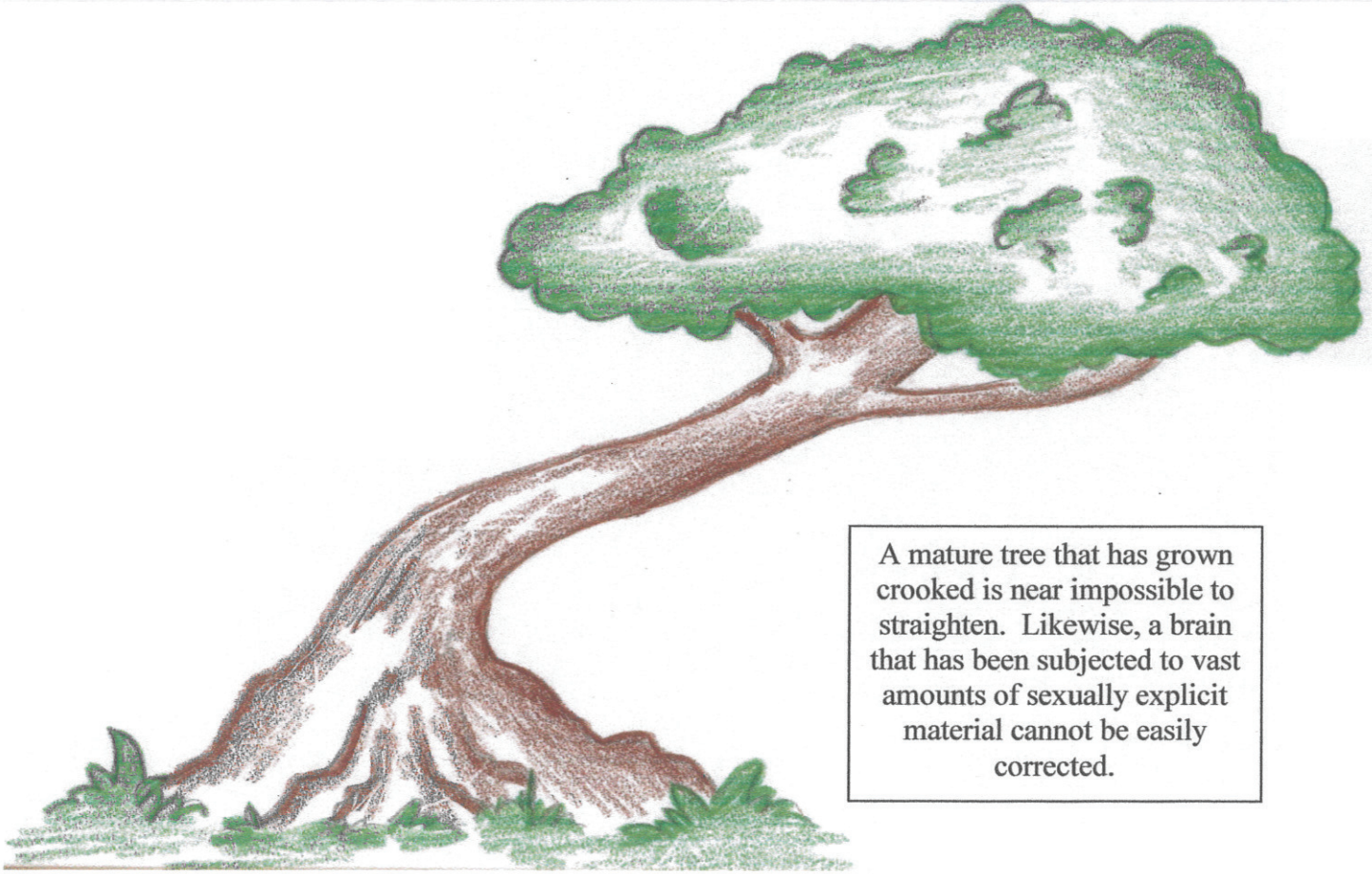
Like the healthy tree, this neuron has undergone "budding" and has many functional dentrites.



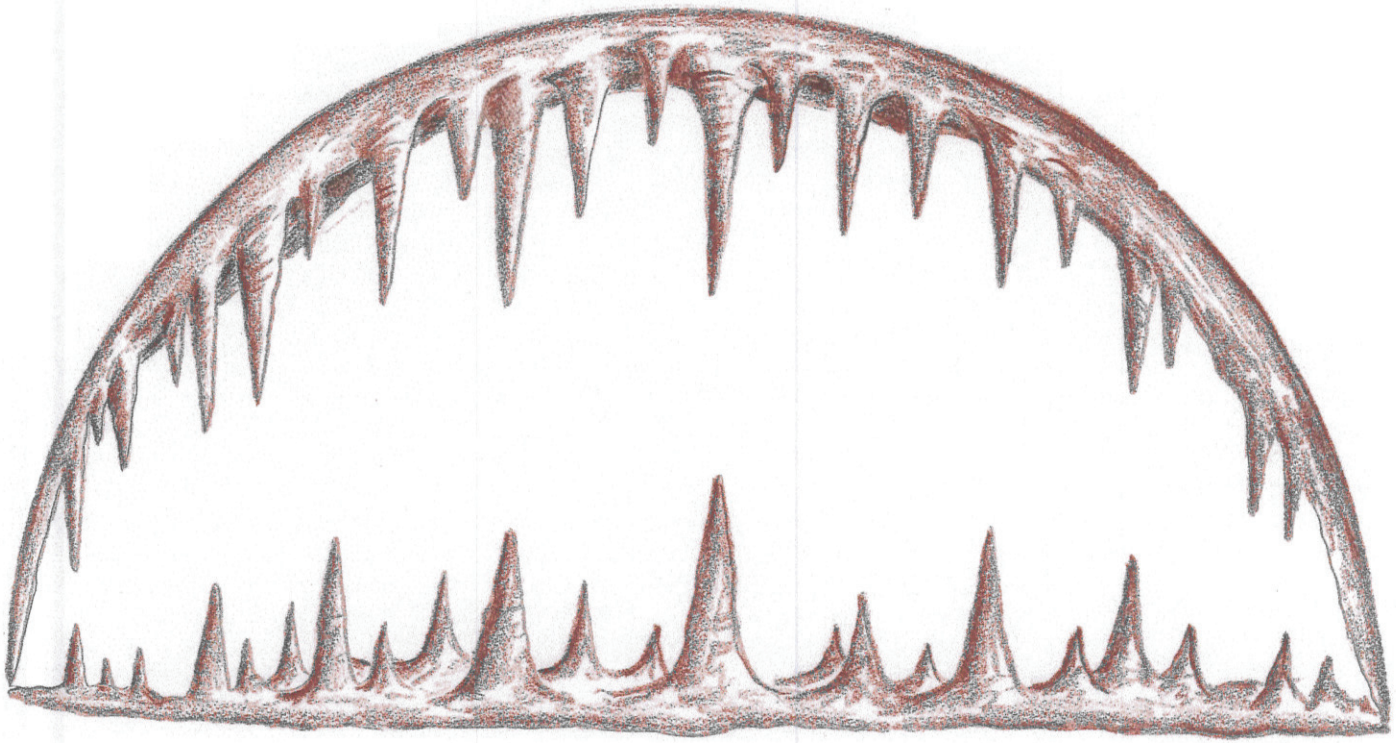
Like the unhealthy tree, this neuron has undergone "pruning" and has lost its optimum functionality.

The crooked growth of a sapling can be straightened. Similarly, initial damage to the brain, caused by gateway pornography, can be corrected.





A mature tree that has grown crooked is near impossible to straighten. Likewise, a brain that has been subjected to vast amounts of sexually explicit material cannot be easily corrected.



Seemingly insignificant drops of water form the stunning interior of a cave. Soft-core pornography appears insignificant, but just like the water droplets in a cave, it causes structural changes to the brain.

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