

# THE ROLE STRESS PLAYS IN BRAIN DEVELOPMENT

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What are the health effects of stress? How does childhood trauma lead to stress later in life? How does early life affection play into one's stress levels? This animation is an interpretation of the effects of stress, both long and short term. Stress can have a major effect on children's and teen's brain development. My goal is to express the feeling of stress in a visual and auditory experience. While stress is a natural part of being human, it can be extremely overwhelming in certain circumstances.

Each set of images in my animation is paired with sounds and each image shows a different facet of stress. One scene depicts a teapot on fire to represent nagging thoughts that something was left on or the door hasn't been locked. The ringing phone symbolizes the stress of the outside world and obligations. The last scene portrays a boy's tooth falling out, an example of stress dreams. Sound is also an important aspect of the work; I chose to layer the sounds to make the viewer feel stressed.

Shane Parker A

*In this paper I look into the effects of stress, both long and short term. I also look into the causes of long term stress on children. Some questions I explore are: What are the long term effects of stress? How does childhood trauma lead to stress in later life? How does early life affection play into stress levels? How does economic status relate to stress? What are the health effects of stress?*

Stress is something that everyone struggles with; it's often something that helps drive people, pushing them to finish their task. Sometimes stress can be overwhelming. When stress is left to build up, it can run your life. This is a problem that I struggle with. I am someone who procrastinates with everything I do, and leaving work for the last moment causes stress that I have a hard time handling. Another part of stress is fear; for example, I cannot ride on a rollercoaster for the sole reason that I become extremely stressed out about the ride's safety and become very fearful. Stress is a frequent reaction from our brains and it occurs often in our everyday lives, yet it is something we aren't really sure how to handle. Whether you're an extremely organized person who never procrastinates or someone with the opposite habits, stress is something we can never fully avoid.

When I was researching this topic, I watched a TED talk that has become fairly popular called "How to Make Stress your Friend" presented by Kelly McGonigal. McGonigal talks about how "For years I'd been telling people, stress makes you sick. It increases the risk of everything from the common cold to cardiovascular disease... But I've changed my mind about stress... The study that made me rethink my whole approach to stress... tracked 30,000 adults in the United States for 8 years, and they started by asking people, 'how much stress have you experienced in the last year?' They also asked, 'do you believe that stress is harmful for your health?' then they used public death records to find out who died... the people who experienced a lot of stress... had a 43% increased risk of dying, but that was only true for the people who also believed that stress was harmful for their health" (McGonigal, 2013). The problem is that people are scared of stress when, in fact, it is a way for the brain to signal when there's something going that should be worried about. She saw that stress is actually really good and, if you listen to stress, you can actually benefit from it. "People who experienced a lot of stress but did not view stress as harmful were no more likely to die. In fact, they had the lowest risk of dying... including people who had relatively little stress... The researchers that over the eight years they were tracking deaths 182,000 Americans died prematurely, not from stress, but from the belief that stress is bad for you" (McGonigal, 2013). She found that in this study it was more harmful to believe stress is bad, than actually having stress.

I agree with what she is saying, but other research I found shows that she wasn't completely correct. Yes, stress is a signal your brain sends when something is going on that needs to happen (like when you are being chased by someone with a knife or you have a final paper due), but even if you listen to stress it can still be harmful. When I looked into it more, I saw that stress is most harmful when it occurs in young children. During a child's development, it is very important that their brain fully developed.

### **Stress: Nature vs Nurture**

"Every year more than 1,000,000 children experience sexual or physical abuse or severe neglect. Individuals abused in childhood are at elevated risk of depression during adulthood. Women abused in childhood attempt suicide at greater frequency and report greater numbers of depression, anxiety, somatic, and substance-abuse symptoms than do women who have not experienced such abuse. Further, child abuse and neglect also independently elevate risk for stress-related illnesses including cardiac disease, peptic ulcer, autoimmune disease, diabetes mellitus, and lung disease" (Gillespie & Nemeroff, 2007). Charles F. Gillespie and Charles B. Nemeroff, the authors of the article Corticotropin-Releasing Factor and the Psychobiology of Early-Life Stress in the academic journal *Current Directions in Psychological Science*, have found that children in abusive environments need an adult figure who brings love and care to

their life. When there is an adult present during this crucial brain growth period, the same children who often have extreme stress and struggle with under/overdeveloped parts of their brain are able to manage their stress better and often don't end up with anxiety or depression. "Child abuse, neglect, or the loss of a parent during childhood are the most salient forms of early-life stress, including accidents, surgeries, protracted illness, war-or terrorism-related events, natural disasters, and chaotic or unstable family environments, are also equally significant traumatic events... For example, repeated brief separation of rat pups from their mothers is associated in adult animals with enhanced reactivity of... stress and increased activity of the... areas of the brain that facilitate adaptation to stress or threat. Similar studies showed that infant bonnet macaques whose mothers faced variable and unpredictable foraging conditions for food later demonstrated chronically elevated... [stress]... as adults. Thus, in two different species, the effects of early-life stress continue into adulthood in the form of persistent hyper-responsiveness environmental stress" (Gillespie & Nemeroff, 2007).

Moshe Szyf, an epigeneticist<sup>1</sup>, in his TED talk, "How early life experience is written into DNA," discusses a study that took rat mothers who showed signs of affection towards their babies and mothers who showed little to no affection. He studied the outcome of the baby rats. The researchers found that the rats who were raised with affection had a much lower level of stress, whereas the rats raised with little to no affection had a much higher level of stress. The outcome of this experiment was largely argued between being nature versus nurture. "When the rats, like humans, lick their pups in very different ways. Some mothers do a lot of that, some mothers do very little, most are in between... these pups when they become adults... long after their mother died, they are completely different animals. The animals that were licked and groomed heavily... are not stressed, they have different sexual behavior, they have a different way of living than those that were not treated as intensively her mother" (Szyf, 2017). Many people believed that the reason the rats had the level of stress they did was because of their genetics passed down from their parents, whereas others believed that it was the way they were raised that determined their outcome, not the genetics they were born with. To figure out the reasoning behind the rats' outcome, they did another experiment. This time, researchers took rats that were born from the affectionate mother and switched them with the unaffectionate mothers babies. They proceeded to watch the babies grow up under the care of the opposite mother. When the rats were adults, they studied them to see which litter had the higher stress levels. They found "It wasn't important what the gene you got from your mother, it was not the biological mother that defined this property of these rats it is the mother that took care of the pups. So how can this work?... Is it possible that mother is somehow reprogramming the gene of her offspring through her behavior... we found that there is a cascade of biochemical by which the licking and grooming of the care of the mother is translated to biochemical signals that go into the nucleus and into the DNA and program it differently" (Szyf, 2017). They also found that the rats raised by the unaffectionate mother but born from the affectionate mother had a much higher stress level, very similar to the rat's brain of the unaffectionate mother in the first study (Szyf, 2017). These studies proved what they found in economically insecure children; that with a caring adult in their lives, stress levels go down in early development, thereby allowing the child to live a lower

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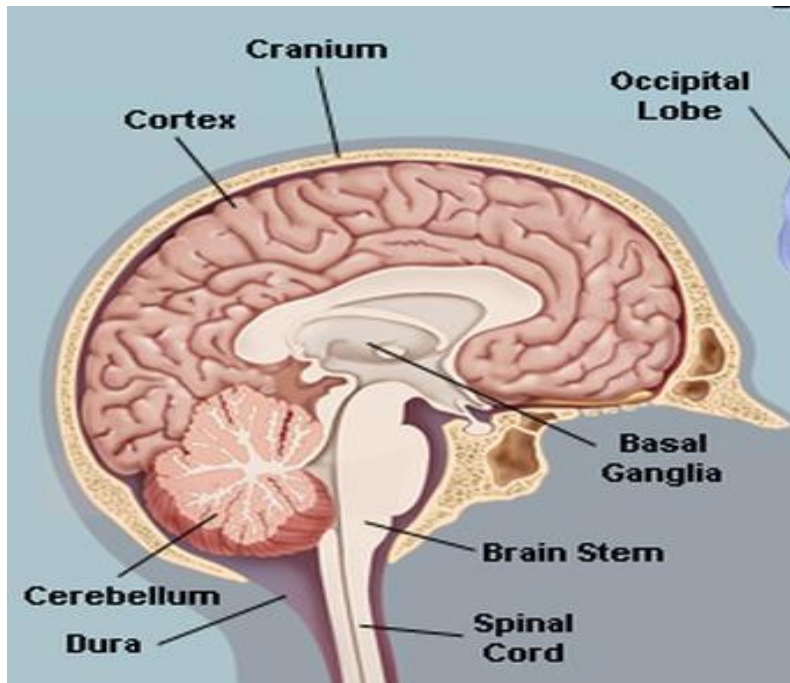
<sup>1</sup> Someone who studies changes in organisms caused by modification of gene expression rather than alteration of the genetic code itself

stress life. This leads many to believe that young children need an affectionate parental figure in their lives, to help to reduce the external stress inducing factors of their everyday lives.

It is obvious that children need environments that help them to thrive; they need a parent or adult in their life who can keep them stable. Nadine Burke Harris talks about her experience being a doctor bayview hunters point, a very poor underserved neighborhood in San Francisco, where a lot of children experienced trauma at a young age. These children experienced a lot of stress at a young age and it caused a lot of problems, like ADHD and other learning and behavioral problems. “ But when I actually did a thorough history and physical, what I found was that for most of my patients, I couldn’t make a diagnosis for ADHD. Most of the kids I was seeing had experienced such severe trauma, that it felt like something else was going on... One of the things they teach you in public health school s that if you're a doctor and you see 100 kids that all drink from the same well, and 98 of them develop diarrhea, you can go ahead and write that prescription for dose after dose after dose of antibiotics, or you can walk over and say ‘What the hell is in this well?’ Harris realized that she needed to get to the root of the problem rather than just diagnosing the kids; she realized that childhood trauma is something that doctors don’t consider as much as they should when they do a routine check up. Harris talks about all the problems children can have because of this early life trauma; trauma can cause heart disease, lung cancer, and can result in a shorter life span by sometimes twenty years. People who experienced early life trauma were more likely to develop diseases. “For hepatitis, two and half times. For depression, four and a half times. For suicidality, it was 12 times.” People with severe trauma “had triple the lifetime risk of lung cancer, and three and a half times the risk of ischemic heart disease, the number one killer in the United States of America” (Harris, 2015).

### **Why Your Brain Respond to Stress**

Nadine Burke Harris in her TED talk, “How Childhood Trauma Affects Health Across a Lifetime,” says that if you see a bear your heart beat will race, your blood pressure goes up, your pupils dilate and you are ready to fight or flee from that bear “and that is wonderful, if you’re in a forest, and there's a bear. But the problem is what happens when the bear comes home every night, and this system is activated over and over.” When young children are constantly going through this stress reaction, it causes problems with their health and development (Harris, 2015).



This part of your brain that produces the fight or flight reaction that Harris is referring to is the subcortical section of the brain. There are two main parts of the brain that make decisions: the cortex, which is the thinking, personality, logic part of the brain; and the subcortical, which is the cause for all of our instincts and primitive behavior. The subcortical brain is responsible for the reaction your body has to running; when you run, your heartbeat quickens and your airways expand. It is the cause for reactions you have no control over; you cannot decide whether or not [Subcortical Brain Structures]. (n.d.). Retrieved from <http://corticalbrain.com/neuroanatomy/home-content/Subcortical-Brain-Structures-The-corpus-striata-basal-ganglia-complex.php>

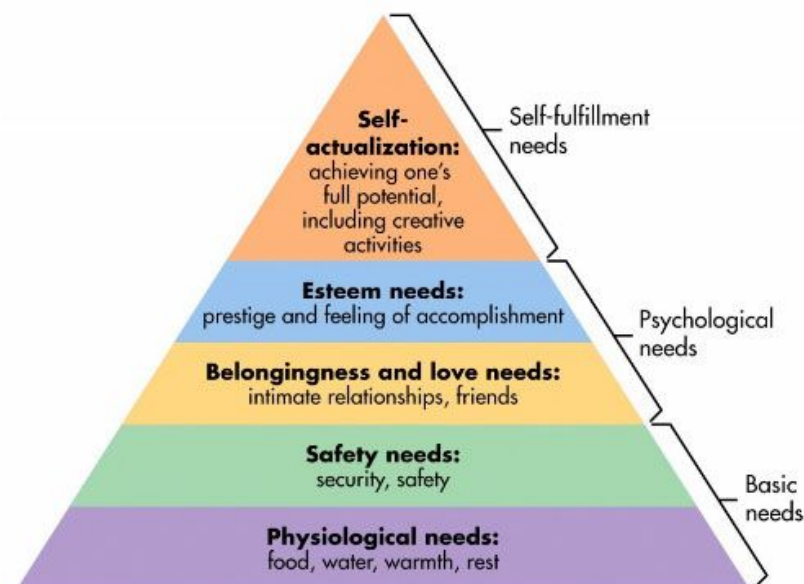
you want to have your heart race after you run. The cortex is the part of your brain that has knowledge and personality. It is the reason you know where you are when you travel somewhere and how you make logical decisions, but it doesn't think as fast as the primitive part of our brains. John Rigg, who studies the brains of veterans dealing with trauma, delivered a TED talk called "The Effect of Trauma on the Brain and How it Affects Behaviors." In this talk, he tells a story about a war veteran who went to a music concert. Rigg talks about how the veteran was fine with the crowd, but when they set fireworks off, the man immediately collapsed to the ground. This instinct is something that he learned from war. He realized after he had been on the ground for a moment that he had no reason to be lying there. But his subcortical part of his brain didn't know where he was or that he was at a concert; it only knew what to react to when hearing explosions. While he was reacting with his subcortical, his cortex was also reacting. His cortex realized where he was and what the fireworks were, but because the subcortical is faster, he didn't realize this until he was already on the ground, the subcortical is the cause for fight or flight reactions (Rigg, 2015).

### **Stress Relating to Economic Status**

Robert Sapolsky studies baboons, and how much stress they experience depending on their rank within the pack. One of his biggest observations is that the baboons that are higher in

the rank system experience a significantly less amount of stress than the baboons lower down in the ranks. The baboons higher up don't have to worry about what they're going to eat, if another baboon will kill them, or about their survival because they are high enough up that they have a secure spot in the pack. Whereas baboons on the lowest end of the ranks are malnourished because they eat last, and are constantly concerned about being killed by a baboon who is higher in rank than them. "The most striking thing we found was that, if you're a baboon, you don't want to be low ranking, because your health is going to be lousy, but what has become far clearer, and probably took a decade's worth of data, is the recognition that protection from stress-related disease is most powerfully grounded in social connectedness, and that's far more important than rank" (Sapolsky, 1994). Lower ranking baboons are constantly worried about their survival and their spot within the pack, but not because of ranking, because of their health and stress levels.. "If you live in a baboon troop in the Serengeti, you only have to work three hours a day for your calories, and predators don't mess with you much. What that means is you've got nine hours of free time every day to devote to generating psychological stress toward other animals in your troop. So the baboon is a wonderful model for living well enough and long enough to pay the price for all the social-stressor nonsense that they create for each other. They're just like us: They're not getting done in by predators and famines, they're getting done in by each other" (Sapolsky, 1994).

Similar to the connection between the ranking of baboons and their stress levels, in 2010 Daniel Kahneman and Angus Deaton studied the happiness of people relating to their yearly income; they found that the higher the economic status of a person, the happier they were, until they reached the income threshold of \$75,000 per year. At that point, the amount of money per year that people make does not increase their happiness levels and can even make them go down. One of the main reasons people of high economic status are able to experience more happiness is because their stress levels are lower due to them being in a secure place where they are not constantly worried about survival, similar to the baboons.



[Maslow's hierarchy of needs]. (n.d.). Retrieved from <https://www.simplypsychology.org/maslow.html>

Maslow's "Hierarchy of Needs", created by Abraham Harold Maslow an American psychologist, is another example of this happiness scale as it relates to specific needs and one's economic



status. Each level represents a certain amount of needs; at each level, one's happiness goes up. However, most people don't make it to the final level of self-fulfillment. In this way, it is also similar to the baboons because there is only one baboon free of stress -- the one baboon with the highest ranking -- and this baboon is able to be truly happy similar to how the hierarchy of needs shows. The problem is that many people are not economically secure enough to get to the top section of the triangle. They are not in a secure economical place and, if the situation is worse, it can also cause children to have early life stress, which can lead to a stress-filled life that sometimes causes extreme anxiety and depression.

## **Conclusion**

Stress is something that everyone struggles with and it can be hard to handle in certain situations. There is a lot of people in the United States, and around the world who experience a lifetime of extreme stress, often stemming from childhood trauma. Stress can cause problems with health and wellness, and is something that we often overlook. Obviously stress can be good, helping us to finish work, pushing us and giving us a boost of energy to give a presentation. But there are long term effects for long term stress. Nadine Burke Harris talks about how children who experience extreme stress in their earlier years tend to have symptoms of ADHD and other learning and health problems (Harris, 2015). Having more doctors and school nurses aware of these problems would help children to become aware of their increased risk to get these health problems. It would be extremely beneficial to have doctors do screenings to see if people experienced extreme stress and or trauma as a young child in order to see if they have an increased risk for certain diseases. I think that providing these medical screenings would help people with severe childhood stress become aware, and have help with what they are vulnerable to.

## Bibliography

Crnic, K. A., Greenberg, M. T., Ragozin, A. S., Robinson, N. M., & Basham, R. B. (1983). Effects of Stress and Social Support on Mothers and Premature and Full-Term Infants [PDF]. *Child Development*, 54(1), 209-217.

Gillespie, C. F., & Nemeroff, C. B. (2007). Corticotropin-Releasing Factor and the Psychobiology of Early-Life Stress [PDF]. *Current Directions in Psychological Science*, 16(2), 85-89.

[Maslow's hierarchy of needs]. (n.d.). Retrieved from <https://www.simplypsychology.org/maslow.html>

McLeod, S. (2007). Maslow's Hierarchy of Needs. Retrieved April 26, 2017, from Simply Psychology website: <https://www.simplypsychology.org/maslow.html>

Monroe, S. M., & Reid, M. W. (2009). Life Stress and Major Depression [PDF]. *Current Directions in Psychological Science*, 18(2), 68-72.

Sapolsky, R. (1994). *Why Zebras Don't Get Ulcers* (3rd ed.). New York, USA: Henry Holt and Company.

Sauders, L. R., & Verdin, E. (2009). Stress Response and Aging [PDF]. *New Series*, 323(5917), 1021-1022.

Smith, J. T., & Selye, H. (1997). Reducing the Negative Effects of Stress [PDF]. *The American Journal of Nursing*, 79(11), 1953-1955.

[Subcortical Brain Structures]. (n.d.). Retrieved from <http://corticalbrain.com/neuroanatomy/home-content/Subcortical-Brain-Structures-The-corpora-striata-basal-ganglia-complex.php>

TED. (2013, September 4). How to make stress your friend | Kelly McGonigal [Video file]. Retrieved from <https://www.youtube.com/watch?v=RcGyVTAoXEU>

TED. (2015, February 27). How childhood trauma affects health across a lifetime | Nadine Burke Harris [Video file]. Retrieved from <https://www.youtube.com/watch?v=95ovIJ3dsNk>

TED. (2017, April 20). How early life experience is written into DNA | Moshe Szyf [Video file]. Retrieved from <https://www.youtube.com/watch?v=38OUctzkT4Q>

TEDx Talks. (2015, March 20). The effect of trauma on the brain and how it affects behaviors | John Rigg | TEDxAugusta [Video file]. Retrieved from <https://www.youtube.com/watch?v=m9Pg4K1ZKws&t=221s>

Thompson, R. A. (2014). Stress and Child Development [PDF]. *The Future of Children, Helping Parents, Helping Children: Two- Generation Mechanisms*, 24(1), 41-59.