

The Effects of Stress on the Brain

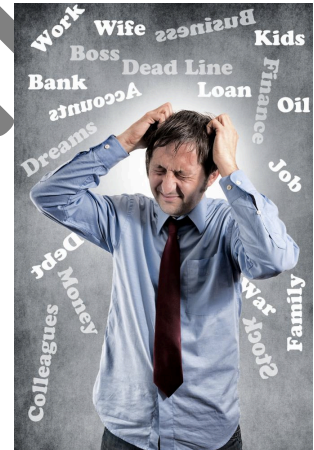


Can you recall feeling restless, having trouble sleeping, being irritated and moody? There was probably something exciting (good or bad) going on in your life that you were stressed about. Stress is literally a reaction of your body to a challenge – any challenge or demand at all. In daily life, people use the word stress to state that they feel overwhelmed and/or not in control. It is usually related to an unhealthy and undesirable state of mind. Whether this is true depends on the duration of the stress response.

Evolutionarily speaking, experiencing stress in the short-term (acute stress) was used to keep us alive. It causes a quick activation of the ‘flight-or-fight’ response which is very helpful in dangerous situations or when you need to



accomplish something challenging. Good examples of this are when you need to lift a car off your child or when you need to fight a bear. In both cases, many people experience what they feel to be superhuman strength. In reality, they are utilizing stress through the fight or flight reaction. But when you experience stress for too long it becomes chronic (long-term and recurring), and that causes numerous negative effects for you brain and body.



The journey of the stress hormones

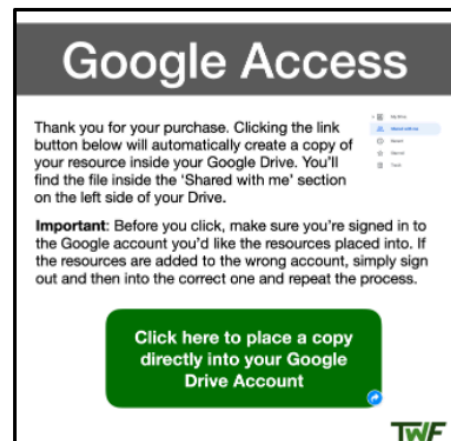
Some people refer to stress as an emotion (for example ‘I am feeling stressed’) that occurs when they are under a time pressure. For example: when they do not have the time to perform a task within the desired or given period of time. The stress itself is merely a physical phenomenon in your body that does not depend on an objective event such as time pressure. But the cause of that phenomenon is indeed related to the feeling of being overwhelmed. In general, the feeling that one person is not in control over the situation leads to a neurological stress response in the body (Lupien et al., 2007). This feeling of not being in control can be

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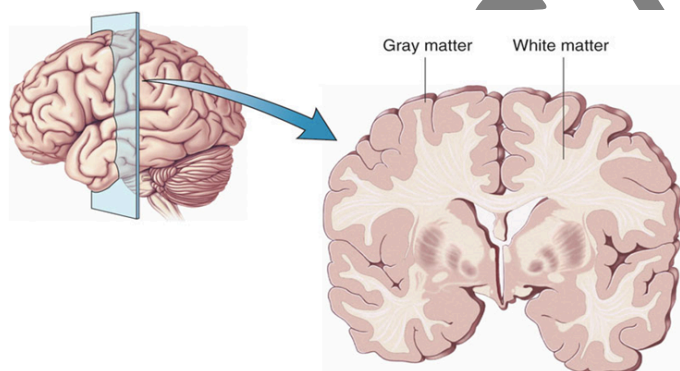
The overproduction of the stress hormones has three important consequences (Chetty et al., 2014; Davidson & McEwen, 2012).

1. It increases the activity in the **Amygdala** - the fear center of your brain. High levels of cortisol create a hard-wired pathway between the Amygdala and Hippocampus, which creates a brain that is in a constant state of 'flight-or-fight'. MRI scans show that the Amygdala increases in size in cases of chronic stress.
2. It lowers the activity in the **Hippocampus**. The Hippocampus is the center for learning, memorizing, handling emotions and stress control since it regulates the HPA axis activity. Stress lowers the development of new brain cells and MRI scans also show that some areas actually shrink.
3. It decreases the activity in the **Prefrontal Cortex**. This is the center of decision-making, concentration, judgment and social interaction. Some areas in the Prefrontal Cortex also shrink a little under continuous high levels of stress.

Grey and white are all that matter

Maybe the shrinking and growing of areas in the brain sound a bit odd. Although it can be argued that the brain is like a muscle, your head won't increase or decrease in size depending on the amount of exercise. Within the brain, it is all about activity. Let's dive a little deeper into how this works.

When people refer to the brain, they often talk about the 'grey matter'. This grey matter consists of densely packed nerve **cell bodies** (neurons) that do the thinking, computing, and decision-making. But all these cell bodies are connected with each other through **axons** (or network cables) that cover almost half of the brain volume. This communication network of axons has a distinctive light color and is therefore called 'white matter'. A consequence of continual exposure to stress hormones results in a decrease in the number of cell bodies. Some



of the existing ones die or show almost no activity and fewer new ones are made. The overall activity of the grey matters lowers and the same goes for the white matter. The axons die or become inactive, and fewer new axons are being developed. The decrease in cell bodies and axons within the Prefrontal Cortex and Hippocampus will result in problems with learning, memorizing, stress control and decision-making amongst other things.

How about the reverse button?

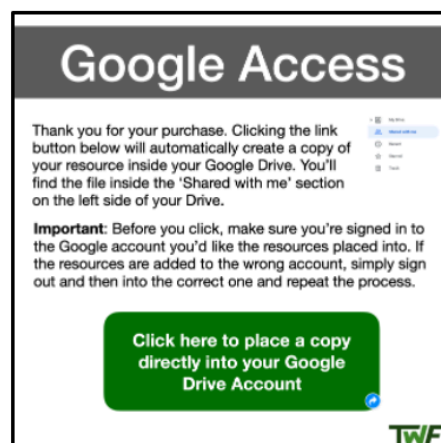
Many studies claim that the structure of the brain is largely determined during childhood. This means that young people who have been exposed to high levels of stress (for example because of too many radical changes, dangerous situations or a lack of nurturing) may develop life-long anxiety issues, mood disorders and/or learning difficulties (Hanson et al., 2015). Although most researchers agree with this statement, there is a growing amount of research about the activity in the grey and white matter that shows that the adult brain is actually able to change for the better if you work on reducing stress (Schlegel et al., 2012; Davidson & McEwen, 2012).

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Reading Comprehension Questions

1. Describe how your body can also benefit from stress.
2. What is, in general, the cause for releasing the stress hormones in your body?
3. Describe the HPA Axis.
4. What is
5. What
6. What is the difference between your white and grey matter?
7. What are
8. What can

Extension Question

9. Describe the vicious circle of the growing Amygdala and the experience of stress.
10. Describe

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