

*In this TED-Ed lesson, Madhumita Murgia shows how chronic stress can affect brain size, its structure, and how it functions, right down to the level of your genes.*

### **TED-Ed Lesson Transcript**

Are you sleeping restlessly, feeling irritable or moody, forgetting little things, and feeling overwhelmed and isolated?

Don't worry. We've all been there. You're probably just stressed out.

Stress isn't always a bad thing. It can be handy for a burst of extra energy and focus, like when you're playing a competitive sport, or have to speak in public.

But when it's continuous, the kind most of us face day in and day out, it actually begins to change your brain.

Chronic stress, like being overworked or having arguments at home, can affect brain size, its structure, and how it functions, right down to the level of your genes.

Stress begins with something called **the hypothalamus pituitary adrenal axis**, a series of interactions between endocrine glands in the brain and on the kidney, which controls your body's reaction to stress.

When your brain detects a stressful situation, your HPA axis is instantly activated and releases a hormone called **cortisol**, which primes your body for instant action.

But high levels of cortisol over long periods of time wreak havoc on your brain. For example, chronic stress increases the activity level and number of neural connections in the amygdala, your brain's fear center.

And as levels of cortisol rise, electric signals in your **hippocampus**, the part of the brain associated with learning, memories, and stress control, deteriorate.

The hippocampus also inhibits the activity of the HPA axis. So when it weakens, so does your ability to control your stress. That's not all, though.

Cortisol can literally cause your brain to shrink in size. Too much of it results in the loss of synaptic connections between neurons and the shrinking of your prefrontal cortex, the part of your brain that regulates behaviors like concentration, decision-making, judgement, and social interaction.

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It also leads to fewer new brain cells being made in the hippocampus. This means chronic stress might make it harder for you to learn and remember things, and also set the stage for more serious mental problems, like [depression](#) and eventually [Alzheimer's disease](#).

The effects of stress may filter right down to your brain's DNA. An experiment showed that the amount of nurturing a mother rat provides its newborn baby plays a part in determining how that baby responds to stress later in life.

The pups of nurturing moms turned out less sensitive to stress because their brains developed more cortisol receptors, which stick to cortisol and dampen the stress response.

The pups of negligent moms had the opposite outcome, and so became more sensitive to stress throughout life. These are considered epigenetic changes, meaning that they effect which genes are expressed without

directly changing the genetic code. And these changes can be reversed if the moms are swapped.

But there's a surprising result. The epigenetic changes caused by one single mother rat were passed down to many generations of rats after her. In other words, the results of these actions were inheritable. It's not all bad news, though.

There are many ways to reverse what cortisol does to your stressed brain. The most powerful weapons are [exercise](#) and [meditation](#), which involves breathing deeply and being aware and focused on your surroundings. Both of these activities decrease your stress and increase the size of the hippocampus, thereby improving your memory.

So don't feel defeated by the pressures of daily life. Get in control of your stress before it takes control of you.

### **Resources for Further Reading:**

[From Stress to Resilience: Raphael Rose at TEDxManhattanBeach \(Transcript\)](#)

[Preetha ji: How to End Stress, Unhappiness and Anxiety to Live in a Beautiful State \(Transcript\)](#)

[How to Stay Calm When You Know You'll Be Stressed by Daniel Levitin \(Transcript\)](#)

ALSO READ: Dr. Cal Newport: Quit Social Media at TEDxTysons (Full Transcript)

[How to Make Stress Your Friend by Kelly McGonigal \(Transcript\)](#)



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