The Human Brain

Renew - Stress on the Brain

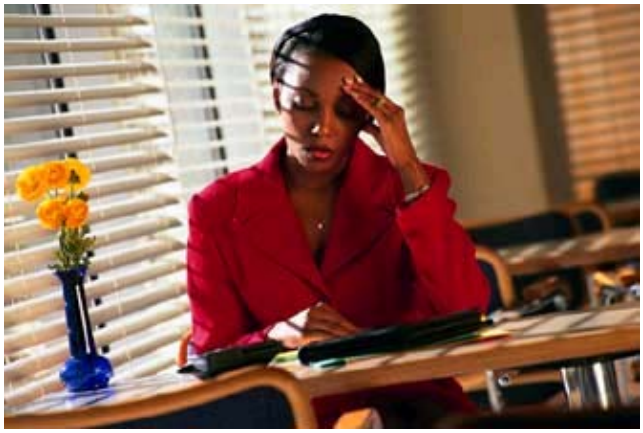
Those aggravating things that go wrong in the day and those irritating things that go bump in the night – disrupting routines and interrupting sleep – all have a cumulative effect on your brain, especially its ability to remember and learn.

As science gains greater insight into the consequences of stress on the brain, the picture that emerges is not a pretty one. A chronic overreaction to stress overloads the brain with powerful hormones that are intended only for short-term duty in emergency situations. Their cumulative effect damages and kills brain cells.

Stress on the Brain Topics:

How Your Brain Responds to Stress

Did you know that the emotional and physical responses you have to stress are set in motion by a series of chemical releases and reactions? Find out what is really going on inside your body and why not all stress is bad.



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“Attack of the Adrenals”-A Metabolic Story

The ambulance siren screams it’s warning to get out of the way. You can’t move your car because you’re stuck in a bumper-to-bumper traffic jam that reaches as far as the eye can see. There must be an accident up ahead. Meanwhile the road construction crew a few feet from your car is jack-hammering the pavement. You are about to enter the stress zone.

Inside your body the alert goes out.

"Attention all parasympathetic forces. Urgent. Adrenal gland missile silos mounted atop kidneys have just released chemical cortisol weapons of brain destruction. Mobilize all internal defenses. Launch immediate counter-calm hormones before hippocampus is hammered by cortisol."

Hormones rush to your adrenal glands to suppress the streaming cortisol on its way to your brain. Other hormones rush to your brain to round up all the remnants of cortisol missles that made it to your hippocampus. These hormones escort the cortisol remnants back to Kidneyland for a one-way ride on the Bladderhorn. You have now reached metabolic equilibrium, also known as homeostasis.

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Inside Homeostasis

When a danger finally passes or the perceived threat is over, your brain initiates a reverse course of action that releases a different bevy of biochemicals throughout your body. Attempting to bring you back into balance, your brain seeks the holy grail of "homeostasis," that elusive state of metabolic equilibrium

If either the one of the stimulating or tranquilizing chemical forces dominates the other without relief, then you will experience an on-going state of internal imbalance. This condition is known as stress. And it can have serious consequences for your brain cells.

topics

between the stimulating and the tranquilizing chemical forces in your body.

Parasympathetic and Sympathetic Nervous System

The sympathetic nervous system (SNS) turns on the fight or flight response. In contrast, the parasympathetic nervous system (PNS) promotes the relaxation response.

Like two tug-of-war teams skillfully supporting their rope with a minimum of tension, the SNS and PNS carefully maintain metabolic equilibrium by making adjustments whenever something disturbs this balance.

The strongmen on these teams are hormones, the chemical messengers produced by endocrine glands. Named after a Greek word meaning "to set in motion," hormones travel through the bloodstream to accelerate or suppress metabolic functions.

The trouble is that some stress hormones don't know when to quit pulling. They remain active in the brain for too long – injuring and even killing cells in the hippocampus, the area of your brain needed for memory and learning. Because of this hierarchical dominance of the SNS over the PNS, it often requires conscious effort to initiate your relaxation response and reestablish metabolic equilibrium.

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The Emotional Brain- Limbic System

The primary area of the brain that deals with stress is its limbic system. Because of its enormous influence on emotions and memory, the limbic system is often referred to as the emotional brain. It is also called the mammalian brain, because it emerged with the evolution with our warm-blooded relatives, and marked the beginning of social cooperation in the animal kingdom.

Whenever you perceive a threat, imminent or imagined, your limbic system immediately responds via your autonomic nervous system – the complex network of endocrine glands that automatically regulates metabolism.

The term "stress" is short for distress, a word evolved from Latin that means "to draw or pull apart." The Romans even used the term districtia to describe "a being torn asunder." When stressed-out, most of us can probably relate to this description.

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Distress Signals from Your Brain

Your sympathetic nervous system does an excellent job of rapidly preparing you to deal with what is perceived as a threat to your safety. Its hormones initiate several metabolic processes that best allow you to cope with

Other hormones shut down functions unnecessary during the emergency. Growth, reproduction, and the immune system all go on hold. Blood flow to the skin is reduced. That's why chronic stress leads to sexual dysfunction,

sudden danger.

Your adrenal glands release adrenaline (also known as epinephrine) and other hormones that increase breathing, heart rate, and blood pressure. This moves more oxygen-rich blood faster to the brain and to the muscles needed for fighting or fleeing. And, you have plenty of energy to do either, because adrenaline causes a rapid release of glucose and fatty acids into your bloodstream. Also, your senses become keener, your memory sharper, and you are less sensitive to pain.

increases your chances of getting sick, and often manifests as skin ailments.
With your mind and body in this temporary state of metabolic overdrive, you are now prepared to respond to a life-threatening situation.

topics

Getting Back to Normal

After a perceived danger has passed, your body then tries to return to normal. But this may not be so easy, and becomes even more difficult with age. Although the hyperactivating sympathetic nervous system jumps into action immediately, it is very slow to shut down and allow the tranquilizing parasympathetic nervous system to calm things down.

Once your stress response has been activated, the system wisely keeps you in a state of readiness.

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Stress is Not All Bad

Bear in mind that an appropriate stress response is a healthy and necessary part of life. One of the things it does is to release norepinephrine, one of the principal excitatory neurotransmitters. Norepinephrine is needed to create new memories. It improves mood. Problems feel more like challenges, which encourages creative thinking that stimulates your brain to grow new connections within itself.

Stress management is the key, not stress elimination. The challenge in this day and age is to not let the sympathetic nervous system stay chronically aroused. This may require knowledge of techniques that work to activate your relaxation response.

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Stress Activates Immune System-Study

Some kinds of acute stress are beneficial. For example, Ohio State University researchers found that stress from engaging in a memory task activated the immune system, whereas the stress from passively watching a violent video weakened immunity (as measured by salivary concentration of SIgA, a major immune factor).

Their results suggest that deadlines and challenges at work, even if annoying for a short time, could be a good thing that helps strengthen the body's defenses.[1]

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Stress Compromises the Blood-Brain Barrier

Stress can dramatically increase the ability of chemicals to pass through the blood-brain barrier. During the Gulf War, Israeli soldiers took a drug to protect themselves from chemical and biological weapons.

Normally, it should not have crossed the BBB, but scientists learned that the stress of war had somehow increased the permeability of the BBB. Nearly one-quarter of the soldiers complained of headaches, nausea, and dizziness – symptoms which occur only if the drug reaches the brain.

topics

The BBB (Blood Brain Barrier)

Permeating the human brain are 400 miles of blood vessels – providing nutrients, fuel, and oxygen, while removing waste and excess heat. The capillaries in this vascular system also comprise what is called the blood-brain barrier (BBB), a protective network unique to the central nervous system.

Present in all vertebrate brains, the BBB is laid down within the first trimester of human fetal life. Although far from perfect, it does shield neurons from some poisons, viruses, and other toxins in the bloodstream – as well as from unpredictable fluctuations in normal blood chemistry.

topics

Primary and Secondary BBB

The primary BBB is formed by cerebral capillaries that are different from those elsewhere in the body. Most capillary walls contain tiny openings called "slit pores" that permit molecules to diffuse easily into the surrounding tissue – somewhat like a soaker hose.

Cerebral capillaries do not have these clefts. They are lined with firmly connected endothelial cells, whose intercellular junctions are as tight as any in biology. Molecules must pass through cerebral capillary walls by active transport with certain carrier molecules, instead of through slit pores.

The secondary BBB surrounds the cerebral capillaries. It is composed of "glial" cells, the other family of brain cells that outnumber neurons by a factor of ten. Certain types of glial cells form a buffer between the brain's capillaries and its neurons. These support cells further obstruct toxins from the bloodstream, while regulating the correct flow of necessary nutrients.

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Stress and Noise

Sudden sound is an urgent wake-up call that alerts and activates the stress response – a biological alarm that affects the brain in powerful ways.

Because loud noise often heralds bad news, animals and humans have evolved a rapid response to audio stressors: the roar of a carnivore, the crack of a falling tree, the scream of a child. More recently:

the explosion of a weapon, the wail of a siren, the crash of the stock market.

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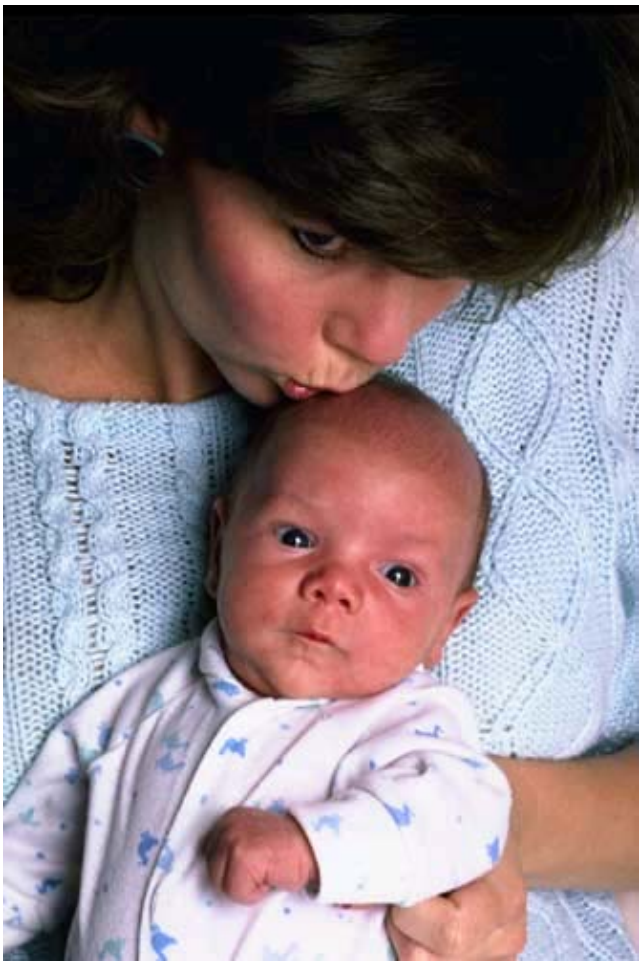
Our Startle Response to Noise

Human infants are all ears. They are very conscious of sound and focus on every word they hear, so they can learn to speak. Loud noises trigger a "startle response" – large movements of the baby's limbs and torso – even while in the womb. Until 18 months old, infants react strongly to distress sounds from other infants.

Crucial to survival, this instinctual reaction to noise enables us to go from a deep sleep to a quick sprint in a matter of seconds. . . or to do battle with surprising strength. Today, however, our stress response is getting knee-jerked around by all the bells and whistles of modern civilization. From the clatter and jar of diesels and dump trucks, to chest-thumping teenage car tunes, noise is almost impossible to block. It's very uncontrollability further adds to the stressful impact.



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Sudden Death from Noise

A disorder of the heart's electrical system, known as the Long QT Syndrome (LQTS), is a life-threatening disorder that can be triggered by a loud noise. In people with LQTS, the electrical recovery of their heart takes longer than normal after each heart beat.

Dr. G. Michael Vincent, an expert in LQTS, says this prolongation "renders patients vulnerable to a very fast, abnormal heart rhythm. . . no blood is pumped out from the heart, and the brain quickly becomes deprived of blood, causing the usual symptoms of

Acoustic stress – such as awakening because of a loud noise – can trigger an episode. Vincent notes that "symptoms usually occur during physical exertion or emotional excitement like anger, fear, or startle" Common examples of startle events include sudden noise, like sirens, the telephone, and the alarm clock.

LQTS is estimated to cause as many as 3,000 deaths in the U.S. each year – mostly in children and young adults – says Vincent, who founded the Sudden Arrhythmia Death

sudden loss of consciousness (syncope) and sudden death."

Syndromes Foundation (www.sads.org).

topics

Noise Stress and Brain Function-Study

Stress can exacerbate a number of psychiatric disorders, many of which are associated with the prefrontal cortex (PFC), the area of the brain unique to humans. A Yale University study looked at the effects of noise stress on brain function in monkeys. Results indicate that stress impairs PFC cognitive function through its influence on dopamine, a key neurotransmitter that's involved in many brain disorders, including ADHD and Parkinson's disease.

The researchers think that "stress may take the PFC 'off-line' to allow more habitual responses . . . to regulate behavior. This mechanism may have survival value, but may often be maladaptive in human society, contributing to the vulnerability of the PFC in many neuropsychiatric disorders."[2]

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Preconscious Response to Noise-Study

Because of the immediate need to respond to noise threats, the conscious mind is bypassed. It may not be fast enough to deal with a situation that could be a matter of life and death.

University College London researchers observed the process using functional MRI brain scans of human test subjects who had been stressed by an unpleasantly loud noise that was combined with visual images. Even when a fearful stimulus was present only at the unconscious level, the threat signal triggered activity in the attention center of the cerebral cortex, where the fear response is then channeled to other parts of the brain that prepare the body in the classic flight or fight reaction.

Lead researcher Jorge Armony said, "It makes perfect sense – you can't stop and think about certain things, you have to react."[3]

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Responding to Noise We Cannot Hear-Study

Even sounds you can't hear can have a powerful affect on your nervous system. One example is the "infrasound" in the roar of a tiger.

A tiger's intimidating roar has the power to paralyze animals. Even experienced human trainers are stunned. "We suspect that this is caused by the low frequencies and loudness of the sound," says Elizabeth von Muggenthaler, a bioacoustician from the Fauna Communications Research Institute in North Carolina. "Humans can hear frequencies from 20 hertz to 20,000 hertz, but whales, elephants, rhinos, and tigers can produce sounds below 20 hertz."

The shocking power of a tiger's roar is one example of how humans react to a sound they cannot detect with their ears. But what about all the noise generated by our modern world – including the multitude of ultrasounds whose frequencies are above 20,000 hertz and beyond our hearing range?

topics

Tiger Sound- Study

In the first study of its kind, von Muggenthaler and her colleagues recorded every growl, hiss, chuff, and roar of 24 tigers at the Carnivore Preservation Trust in Pittsboro, North Carolina, and the Riverbanks Zoological Park in Columbia, South Carolina. The bioacousticians found that tigers can create sounds at about 18 hertz, and when tigers roar they can create frequencies significantly below this.[4]

This unheard, low-pitched infrasound can travel long distances – permeating buildings, cutting through dense forests, and even passing through mountains.

topics

Low-Level Noise and Stress-Research

Not just loud or sudden noises provoke a stress response. Chronic low-level noise also negatively influences the brain and behavior. Whether from the road or in the office, low-intensity noise has a subtle yet insidious effect on our health and well-being.

According to Dr. Alice H. Suter, an audiologist at the National Institute for Occupational Safety and Health: "Included in noise-related problems are high blood pressure, peptic ulcers, cardiovascular deaths, strokes, suicides, degradation of the immune system,

Noise at home or school can affect children's ability to learn. Compared to kids from quieter neighborhoods, children living near airports or busy highways tend to have lower reading scores and develop language skills more slowly. Psychiatric hospitalizations are higher in noisy communities. Bad moods, lack of concentration, fatigue, and poor work performance can result from continual exposure to unpleasant noise.[5]

and impairment of learning. Noise is also associated with an increase in aggression and a decrease in cooperation."[6]

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Traffic Noise Increases Stress Hormones in Children-Study

Even everyday traffic noise can harm the health and well-being of children. In the first study to look at the non-auditory health effects of typical ambient community noise, it was shown that chronic low-level noise from local traffic raised levels of stress hormones in children, as well as their blood pressure and heart rates.

"We found that even low-level noise can be a stressor. It elevates psychophysiological factors and triggers more symptoms of anxiety and nervousness," says environmental psychologist Gary Evans of Cornell University, an international expert on environmental stress, such as noise, crowding, and air pollution.

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Details of the Noise and Children Study

Evans and his European colleagues analyzed data on 115 fourth-graders in Austria. Half the children lived in quiet areas – below 50 decibels (dB), the sound level of a clothes dryer or a quiet office. Half lived in a noisier residential area – above 60 dB, about the intensity of an average dishwasher or raised voices.

"We are really not looking at loud kinds of noise. They are typical levels found throughout neighborhoods in Europe," says Evans. The non-auditory effects of noise, however, appear to occur at levels far below those required to damage hearing.

The children in noisier neighborhoods experienced higher overnight levels of the stress hormone cortisol, marginally higher resting systolic blood pressure, and greater heart rate reactivity to a stress test – all signs of modestly elevated physiological stress.

Background noise had a significant effect on stress levels, said Lercher. Therefore, chronic exposure to nearby sounds from roads and train lines are a concern.

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Females at Higher Risk from Noise Stress-Study

When children have no control over prolonged exposure to noise, it can lead to "learned helplessness" syndrome – a condition linked to forms of depression and to poverty. "It's a pretty pervasive phenomenon," says Evans. He found that "girls exposed to the traffic noise

Women respond differently to loud noise, too. A study at Texas A&M University found that "women have a lower threshold to experience noise as stressful," according to psychologist Dr. Mary W. Meagher. "Our data suggest that women may be more sensitive to noise stress

become less motivated, presumably from the sense of helplessness that can develop from noise they couldn't control."

than men." (While the women in the study were more easily "frightened" by a loud unexpected noise, the men were only more "startled.")[7]

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Chronic Sources of Noise

Are you feeling stressed but don't know why? Could noise be the problem? Are you aware of the chronic sources of noise in your everyday environment?

Check these reports and studies to find out if noise may be effecting you.

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Noisy Neighborhoods a Nuisance-Reports

"The U.S. Census Bureau reports that Americans cite noise – more than crime, litter, traffic, or inefficient government – as the biggest problem affecting their neighborhoods. 138 million people are regularly exposed to noise levels labeled as excessive by the Environmental Protection Agency."[8]

British investigators found that a greater amount of neighborhood problems, including noise, was associated with residents being three times as likely to say their physical function was impaired and twice as likely to report poorer health. "What we think is happening is that neighborhood stress influences the biological processes that promote disease risk," said Dr. Andrew Steptoe of University College London.[9]

topics

Office Noise-Study

Gary Evans and environmental psychologists at Cornell found that low-level noise in open-style offices seems to result in higher levels of stress, and lower task motivation.

Forty experienced female clerical workers (average age 37) were assigned for three hours to either a quiet office or one with low-intensity office noise (including speech). The workers in the noisy office experienced significantly higher levels of stress (as measured by urinary epinephrine, a stress hormone), made 40% fewer attempts to solve an unsolvable puzzle, and made only half as many ergonomic adjustments to their workstations, compared to their colleagues in quiet offices.

Interestingly, however, the workers themselves did not report higher levels of stress in the noisy office.

"But just because people fail to report that environmental conditions are negative, we can't assume that there are no adverse impacts," Evans says.

"Our findings resemble those in studies of very noisy environments in that we found that realistic, open-office noise has modest but adverse effects on physiological stress and motivation," says Evans, and might contribute significantly to health problems such as heart disease (due to elevated levels of epinephrine) and musculoskeletal problems. "Even low levels of noise can have a potentially stressful

effect."[10]

topics

Workplace Toxic Noise-Statistics

10 million people have hearing loss because of "toxic noise" in the workplace. The Deafness Research Foundation defines toxic noise as any noise that can damage or destroy hearing. It is present in the workplace of approximately 30 million Americans.

Although preventable, toxic noise is the most common occupational disease and the second most self-reported occupational injury, says Elizabeth Foster, the director of the National Campaign for Hearing Health.[11]

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Stress and Memory

Chronic over-secretion of stress hormones adversely affects brain function, especially memory. Too much cortisol can prevent the brain from laying down a new memory, or from accessing already existing memories.

The renowned brain researcher, Robert M. Sapolsky, has shown that sustained stress can damage the hippocampus , the part of the limbic brain which is central to learning and memory. The culprits are "glucocorticoids," a class of steroid hormones secreted from the adrenal glands during stress. They are more commonly know as corticosteroids or cortisol .

During a perceived threat, the adrenal glands immediately release adrenalin. If the threat is severe or still persists after a couple of minutes, the adrenals then release cortisol. Once in the brain cortisol remains much longer than adrenalin, where it continues to affect brain cells.

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Cortisol Affects Memory Formation and Retrieval

Have you ever forgotten something during a stressful situation that you should have remembered? Cortisol also interferes with the function of neurotransmitters, the chemicals that brain cells use to communicate with each other.

Excessive cortisol can make it difficult to think or retrieve long-term memories. That's why people get befuddled and confused in a severe crisis. Their mind goes blank because "the lines are down." They can't remember where the fire exit is, for example.

topics

Why We Lose Our Memory

Stress hormones divert blood glucose to exercising muscles, therefore the amount of glucose – hence energy – that reaches the

That may be why some people can't remember a very traumatic event, and why short-term memory is usually the first casualty of

brain's hippocampus is diminished. This creates an energy crisis in the hippocampus which compromises its ability to create new memories.

age-related memory loss resulting from a lifetime of stress.

topics

Cortisol and Temporary Memory Loss-Study

In an animal study, rats were stressed by an electrical shock, and then made to go through a maze that they were already familiar with. When the shock was given either four hours before or two minutes before navigating the maze, the rats had no problem. But, when they were stressed by a shock 30 minutes before, the rats were unable to remember their way through the maze.

This time-dependent effect on memory performance correlates with the levels of circulating cortisol, which are highest at 30 minutes. The same thing happened when non-stressed rats were injected with cortisol. In contrast, when cortisol production was chemically suppressed, then there were no stress-induced effects on memory retrieval.

According to James McGaugh, director of the Center for the Neurobiology of Learning and Memory at the University of California, Irvine, "This effect only lasts for a couple of hours, so that the impairing effect in this case is a temporary impairment of retrieval. The memory is not lost. It is just inaccessible or less accessible for a period of time."[12]

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Cortisol and the Degenerative Cascade

Normally, in response to stress, the brain's hypothalamus secretes a hormone that causes the pituitary gland to secrete another hormone that causes the adrenals to secrete cortisol. When levels of cortisol rise to a certain level, several areas of the brain – especially the hippocampus – tell the hypothalamus to turn off the cortisol-producing mechanism. This is the proper feedback response.

The hippocampus, however, is the area most damaged by cortisol. In his book Brain Longevity, Dharma Singh Khalsa, M.D., describes how older people often have lost 20-25% of the cells in their hippocampus, so it cannot provide proper feedback to the hypothalamus, so cortisol continues to be secreted. This, in turn, causes more damage to the hippocampus, and even more cortisol production. Thus, a Catch-22 "degenerative cascade" begins, which can be very difficult to stop.

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Cortisol and Brain Degeneration-Study

Studies done by Dr. Robert M. Sapolsky, Professor of Neurology and Neurological Sciences at Stanford University, showed that lots of stress or exposure to cortisol accelerates the degeneration of the aging

And, because the hippocampus is part of the feedback mechanism that signals when to stop cortisol production, a damaged hippocampus causes cortisol levels to get out of control – further compromising memory and cognitive

hippocampus.

function. The cycle of degeneration then continues. (Perhaps similar to the deterioration of the pancreas-insulin feedback system.)

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Cortisol Levels During Human Aging-Study

The study was titled "Cortisol levels during human aging predict hippocampal atrophy and memory deficits". A third of the 60 volunteers, who were between ages 60 and 85, had chronically high cortisol levels, a problem that seems to be fairly common in older people.[13]

The size of the hippocampus averaged 14% smaller in one group and showed high and rising cortisol levels, compared to a group with moderate and decreasing levels. The small hippocampus group also did worse at remembering a path through a human maze and pictures they'd seen 24 hours earlier and – two tasks that use the hippocampus.

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Shrinking Hippocampus, Memory Loss, and Alzheimer's-Study

Using magnetic resonance imaging, Mayo Clinic researchers found that specific changes in the hippocampus were linked to changes in behavior associated with aging and Alzheimer's disease. "When certain parts of the hippocampus shrink or deteriorate, specific, related memory abilities are affected," says neurologist Ronald C. Petersen, the principal author of the study.

Furthermore, individuals with a shrunken hippocampus tend to progress more rapidly towards Alzheimer's.

"In earlier studies we were able to show that the volume of the hippocampus could help diagnose early Alzheimer's disease or help predict which patients may develop Alzheimer's disease in the future. Now we can look specifically at which part or parts of the hippocampus are affected and match that with particular memory functions which are impaired in that particular patient," says Dr. Petersen.[14]

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Long-Term Memory Retrieval Impaired by Stress-Study

In a 2000 human study, McGaugh and researchers at the University of Zurich asked 36 healthy adults to memorize 60 unrelated nouns that were displayed for four seconds each on a computer screen. Study participants were then tested to see if they could remember the words immediately after they learned the list, and then again, a day later.

Subjects took a tablet of cortisone (precursor of cortisol) or a placebo: either one hour before the initial word presentation; just after the word presentation; or one hour before the retention test. (Actual cortisol concentrations in saliva

Compared to the placebo, the cortisone pills impaired memory – but only when they were taken an hour before the recall test that was given on the next day. Therefore, high levels of this stress hormone impaired memory, but only when people tried to recall old, not recent, memories.

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were comparable to levels produced naturally in response to a major stressor.)

Building Memories-Neurogenesis-Study

IThe growth of new brain cells – a process called neurogenesis – is involved in new memory formation. Researchers at Princeton University report that, even in adulthood, thousands of hippocampal neurons were being generated per day.

In animal studies, the number of adult-generated neurons in the hippocampi of rats doubled after they performed specific behavioral tasks and training that involved associative learning. In contrast, tasks that did not require the hippocampus did not stimulate new cell growth.

"All of the species we examined showed evidence of substantial neurogenesis in adulthood," Princeton's Elizabeth Gould said. "These findings indicate that adult-generated hippocampal neurons are specifically affected by, and potentially involved in, associative memory formation."

topics

London Taxi Drivers and Bird Memory

London taxi drivers are renowned for their excellent memory in regard to spatial learning – their ability to navigate the vast network of London streets. It turns out they have enlarged hippocampi.[15]

Birds with a bigger hippocampus have a longer lasting memory for where they stored their food, compared to birds with a smaller hippocampus. (Their memory capacities were the same, though.) British researchers provided evidence that "the enlargement of the hippocampus in food-storing birds may enable these birds to increase the duration of time over which they can remember spatial information."[16]

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Gender Responses to Stress

One of the most basic behavioral differences between men and women is how they respond to stress. UCLA researchers found that men often react to stress with a "fight-or-flight" response, but women are more likely to manage their stress with a "tend-and-befriend" response.

Psychology professor and lead researcher Shelley E. Taylor points out that this stress response is seen in many species. Females respond to stressful conditions by protecting and nurturing their young (the "tend" response), and by seeking social contact and support from others – especially other females (the "befriend" response).

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This pattern is in sharp contrast to the fight-or-flight behavior, long considered the principal method both sexes used to cope with stress. Until government grant policies changed in 1995, "women were largely excluded in stress research," says Taylor, "because many researchers believed that monthly fluctuations in hormones created stress responses that varied too widely to be considered statistically valid."

Fight-or-flight vs. Befriending

Fight-or-flight means that, when confronted by stress, individuals either react with aggressive behavior – such as verbal conflict and more drastic actions – or withdraw or flee from the stressful situation.
"Befriending" methods include talking on the phone with relatives or friends, to such simple social contacts as asking for directions when lost. The "tending" pattern is especially apparent in the differences between fathers' and mothers' behaviors with their children after a stressful workday.

Professor Taylor elaborated: "When the typical father in the study came home after a stressful day at work, he responded to stress by wanting to be left alone, enjoying peace and quiet away from the stress of the office; when office-related stress was particularly acute, a typical response would be to react harshly or create conflict with his wife or children.

"When the typical mother in the study came home from work bearing stress, she was more likely to cope with her bad day by focusing her attention on nurturing her children.

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Men More At Risk from Stress

Men are more vulnerable to the adverse health effects of stress. Men are more likely than women to develop "certain stress-related disorders, including hypertension , aggressive behavior, or abuse of alcohol or hard drugs," Professor Taylor said. "Because the tend-and-befriend regulatory system may, in

"The tend-and-befriend pattern exhibited by women probably evolved through natural selection," says Taylor. "Thousands of generations ago, fleeing or fighting in stressful situations was not a good option for a female who was pregnant or taking care of offspring, and women who developed and maintained

some ways, protect women against stress, this biobehavioral pattern may provide insights into why women live an average of seven and a half years longer than men."

social alliances were better able to care for multiple offspring in stressful times."

topics

Hormones Explain Men and Women' Stress Responses-Study

Oxytocin, a hormone secreted in both men and women as a response to stress, has been shown to calm rats and humans, making them less anxious and more social. "Oxytocin has been studied largely for its role in childbirth. In several animal species, it leads to maternal behavior and to affiliation," Taylor said. Male hormones seem to reduce the effect of oxytocin, but the female hormone estrogen amplifies it.

The UCLA team's findings, were based on analysis of hundreds of biological and behavioral studies of response to stress by thousands of human and animal subjects.[17]

topics

Impact of Stress Studies

You already know that stress can effect your mood, but did you know it can increase the risk of stroke, hamper learning, suppress your growing network of brain neurons and weaken the protective blood-brain barrier? Did you know that we often respond to stress before we know it ? If this doesn't pique your curiosity, maybe you would like to know why salmon die right after they spawn. Whatever your interest, find the results of stress studies here.

topics

Brain Hormone Solves Salmon Death Mystery

Salmon amaze us with their spectacular leaps up waterfalls, in their single-minded quest to return and lay eggs in the freshwater stream of their birth. Then they die. But why? In his book, Why Zebras Don't Get Ulcers, Dr. Robert M. Sapolsky explains.

"If you catch salmon right after they spawn, just when they are looking a little green abound the gills, you find they have huge adrenal glands, peptic ulcers, and kidney lesions; their immune systems have collapsed, and they are teeming with parasites and infections.

"Moreover, the salmon have stupendously high glucocorticoid concentrations in their bloodstreams. When salmon spawn, regulation of their glucocorticoid secretion breaks down. Basically, the brain loses its ability to measure accurately the quantities of circulating hormones and keeps sending a signal to the adrenals to secrete more of them. Lots of glucocorticoids can certainly bring about all those diseases with which the salmon are festering.

"Is this glucocorticoid excess really responsible for their death? Yep. Take a salmon right after spawning, remove its adrenals, and it will live for a year afterward."

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Stress Hormones and Aging-Study

Elizabeth Gould, Researcher at Princeton University, notes that "levels of stress hormones rise with aging, and are very likely to be responsible for the decline in neurogenesis. (the formation of new neurons) The good news, though, is that the aging brain doesn't appear to lose the ability to generate new neurons," when you relieve the stress.[18]

In animal studies at the National Institutes of Neurological Disorders and Stroke, neuroscientists found that the production of neurons in the hippocampus continues throughout adulthood, but dramatically decreases in old age because of high levels of stress hormones produced by the adrenal glands.

When researchers removed the adrenal glands from aged rats, it led to the growth of new brain cells (neurogenesis) in the hippocampus, further suggesting that "decreased neurogenesis may contribute to age-related memory deficits associated with high corticosteroids, and that these deficits may be reversible."[19]

topics

Stress and Stroke-Study

A study that followed 2,303 Finnish middle-aged white men for 11 years reported that stress was linked to increased stroke risk. "We've found that exaggerated blood pressure reactions to stress are related to a greater risk of having a stroke," says the study's lead author Susan A. Everson, Ph.D., an epidemiologist at the University of Michigan.

The men who had above-average systolic blood pressure spikes (in anticipation of an exercise test) had a 72% greater risk of any stroke, compared to men with less reactive blood pressures. These men also had an 87% greater risk of ischemic stroke – those caused by blood clots rather than bursting of a brain vessel.

Everson says this study provides more evidence of mind-body connections in disease development. The body's sympathetic nervous system reacts to mental or emotional stress by increasing blood pressure, heart rate, and respiration – a reaction linked to the development of chronic high blood pressure and atherosclerosis, two known risk factors for stroke and heart disease.

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Stress Management and Stroke-Study

The inability to adapt to stressful situations can be associated with the incidence of stroke. Swedish researchers observed a three-time greater stroke risk in elderly men with high blood pressure who became most frustrated during a mental stress test designed to determine how well they adapt to a challenge.

The 238 men tested had to name as quickly as possible the actual color of words that were printed in a different color. For example, the word "yellow" was written in blue lettering.[20]

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Stress, Atherosclerosis, and Stroke-Study

When the large carotid arteries in the neck are damaged by atherosclerosis, blood flow to the brain can be impaired, which increases the risk of stroke. Researchers at the University of Southern California found a link between stress levels in men and carotid atherosclerosis.

In this 18-month study of 573 middle-aged utility company employees, men and women (aged 40 to 60) indicated how they perceived work-related stress. Thirty-six percent of the men with high levels of job-related stress had a buildup of plaque in their carotids, compared to 21% of the men with low levels. Lead researcher Dr. James H. Dwyer says the results "suggest that men with greater work-related stress are at increased risk for atherosclerosis."[21]

French researchers also reported that sustained anxiety was associated with increased blood vessel thickness in carotid arteries for both men and women. In this four-year study of more than 700 people, 59 to 71 years old, the stressed men also showed an accelerated development of atherosclerosis.[22]

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Sustained Stress Impairs Learning-Study

IExtreme or sustained stress can damage the brain's hippocampus, making it difficult to learn new things. Animal research at the University of South Florida found that stressed rats continuously explored their surroundings, as if they had no ability to retain memory.

They behaved as if they had sustained damage to their hippocampus, says psychology professor Dr. David Diamond, a behavioral neuroscientist at the Tampa Veterans Affairs Hospital.[23]

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Stress Weakens the Blood-Brain Barrier-Study

Stress can dramatically increase the ability of chemicals to pass through the blood-brain barrier , the complex system of blood vessels that protects the brain from toxins circulating in the bloodstream.

During the Gulf War, to protect themselves from chemical and biological weapons, Israeli soldiers took a drug called pyridostigmine. Nearly one-quarter of them complained of headaches, nausea, and dizziness – symptoms which occur only if the drug reaches the brain. Pyridostigmine molecules generally can't get into the brain, so why had the side-effects increased during combat?

An Israeli biochemist and physician wondered whether the stress of war might somehow have increased the permeability of the blood-brain barrier. The two researchers took a group of mice and stressed some by dunking them in water. They then injected the rodents with a dye and measured its intensity in the autopsied brains. They found that the dye had passed much more readily into the brains of the stressed animals.

The fact that stress can dramatically increase the ability of chemicals to pass through the blood-brain barrier has enormous implications, since many drugs are developed under the assumption that they will not enter the brain.[24]

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Rapid Stress Response at Unconscious Level-Study

Monitoring single neurons in the right prefrontal cortex, University of Iowa researchers found that these cells responded remarkably rapidly to unpleasant images, which included pictures of mutilations and scenes of war. Happy or neutral pictures did not cause the same rapid response from the neurons.

"The changes in firing pattern of neurons responding to the aversive visual stimuli happened within about 0.12 seconds, which is very fast and probably prior to the patient consciously 'seeing' the image," said principal investigator Ralph Adolphs, Ph.D., assistant professor of neurology. The findings are consistent with the idea that the brain evolved systems that can respond extremely rapidly to potentially dangerous or threatening kinds of stimuli.[25]

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