

The Chemistry of Stress (A-Review)



CHEMISTRY

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ABSTRACT

Stress is the sum total of all non-specific biological phenomena elicited by adverse external influences (Dorland's Medical Dictionary). It leads to negative health consequences. Although life itself is dependent upon certain forms of stress, but when stress is not handled with proper care it leads to serious problems. Some physical symptoms of stress include ulcers, high blood pressure, arthritis, heart problems, skin conditions (i.e. acne) also Symptoms pertaining to mental/emotional health include irritation, lack of focus, anxiety, and depression.

Study of chemistry of Stress reveals that during stress the brain is overloaded with powerful hormones that are intended only for short-term duty in emergency situations. Their cumulative effect damages and kills brain cells. In order to cope with Stress Ayurvedic, allopathic medicines are available or one can change life style.

International survey of worries has shown that at least in 40% of cases we worry about things which never happen at all, in 30% about things which have already happened, 12% are needless health worries and 10% are miscellaneous avoidable worries. Barely 8% of worries are genuine and rest avoidable, but worrying alone cannot do anything just one has to act so in a way worries are useless.

Two powerful body systems cope with stress. The nervous system controls the rapid body changes, while the endocrine system regulates the longer-term patterns of stress response by releasing hormones into the blood. The adrenal activates the sympathetic nervous system, reducing the normalizing effects of body function. This increases the metabolic rate, heart rate, circulation and blood pressure. In addition, effectiveness of the digestive system is diminished and disturbances in sleep patterns become common.

The Chemistry of Stress

Understanding the chemistry of stress begins with an appreciation of molecules in our bodies called neurotransmitters; these are produced throughout our bodies, most notably in the brain and along the gastrointestinal tract.

Body fights the stress in many ways primarily by involving both the nervous and endocrine system. First of all the Hypothalamus, the stress centre in the brain responds to alarming events by altering the autonomic nervous system and by activating the pituitary glands which in turn signals an excess release of stress hormone like cortisone and adrenaline (by a pair of walnut sized glands atop the kidneys) which puts a body in state of alertness ('fight or flight') to act appropriately and less intensely to the stress-provoking events.

The 'fight or flight' symptoms are familiar: rapid heart rate, muscle contraction, cold hands and feet, racing thoughts. As uncomfortable as these symptoms may sound, in the right situation they are useful

The stress hormone, adrenaline also stimulates the release of fatty acids and glucose into the blood stream with view to providing fuel to the "silently fatigued" muscles but this increase the risk of strokes and heart diseases among the stressed

Fortunately, the brain has some built-in safety systems. Too much Cortisol in the blood signals the brain and adrenal glands to decrease or stop Cortisol production. Under continuous stress, however, this feedback system breaks down. The hypothalamus keeps reading the stress as a threat, furiously sending messages to the pituitary gland, which screams out to the adrenal glands to keep pumping out Cortisol, which at this point be-

gins to be neurotoxic — poison to the brain.

On a typical day in the brain, trillions of messages are sent and received. The messages that are happy, upbeat messages are carried by the brain's "HAPPY MESSENGERS" (Endorphin System). Other messages are somber and quieting. They are carried by the brain's "SAD MESSENGERS". Most nerve centers receive input from both types of messengers. As long as this input is balanced, everything runs along on an even keel.

There are three Happy Messengers: SEROTONIN, NORADRENALIN, and DOPAMINE. These are the brain chemicals that begin to malfunction when stress levels become more than a person can handle.

Serotonin: One of the neurotransmitters, serotonin, seems to have been installed in us to lessen our physical response to stress.

Brain contains only 5 to 10mg of serotonin (neurotransmitter) 2% of the total serotonin of body, it controls mood, regulates temperature, arouses sexual desire and appetite, this affects almost all of the approximately 40 million cells.

And remaining 98 percent of the serotonin found in the body is located in blood platelets, mast cells and the digestive tract.

Only those neurotransmitters synthesized in the brain can affect the brain because serotonin formed in the body cannot cross the blood-brain barrier.

While both forms of serotonin are produced from the amino acid tryptophan, Consuming purified tryptophan increases brain serotonin whereas eating foods containing tryptophan do not (Wurtman, Hefti and Melamed, 1980) This is because the transport system which brings tryptophan across the blood-brain barrier is also selective for the other amino acids contained in protein sources (Young, 2007)

High plasma levels of other large neutral amino acids compete for transport and prevent the elevated plasma tryptophan from increasing serotonin synthesis.

Whole grains help speedily supply the amino acid Tryptophen to the brain and that increases the level of Serotonin which acts as sedative for the frayed nerves. Richly pigmented fruits and vegetables like cherries, black grapes, plums, tomatoes, carrots and flavonoids fight free radicals produced excessively by the body under stress. In addition to animals, serotonin is found in fungi and plants (Kang and colleagues, 2009)

Since Serotonin is usually the first happy messenger to fail under stress, the first sign of over stress will usually be inability to have a restful sleep.

Serotonin, is also the “mainspring” of the Body Clock. If stress causes Serotonin to fail, the Body Clock will stop working. You will not be able to obtain a restful sleep, no matter how hard you try

Noradrenalin: Giving Us Energy; People with Noradrenalin failure become progressively more and more lethargic. They do not seem to have any energy to do anything. Running your brain with low Noradrenalin is akin to running your car with a failing battery. Sooner or later, it just won't start.

Dopamine: Pleasure and Pain

Our third Happy Messenger, Dopamine, seems to be concentrated in areas of the brain immediately adjacent to where the major Endorphin releasing mechanisms lie. When Dopamine function declines, Endorphin function also declines. Hence, when too much stress causes failure of Dopamine function, it also causes loss of body's natural “pain killer”.

Dopamine also runs body's “Pleasure Center”. This is the area of your brain that allows to enjoy life. When stress interferes with Dopamine function, the Pleasure Center becomes inoperative. Normally pleasurable activities no longer give any pleasure. With severe Dopamine/Endorphin malfunction, life becomes painful and devoid of any pleasure.

When too much stress is placed on the brain, the Happy Messengers begin to fall behind on their deliveries. As the stress continues, the happy messages begin to fail. Important nerve centers then receive mostly SAD MESSAGES, and the whole brain becomes distressed. The person enters a state of brain chemical imbalance known as -- OVERSTRESS.

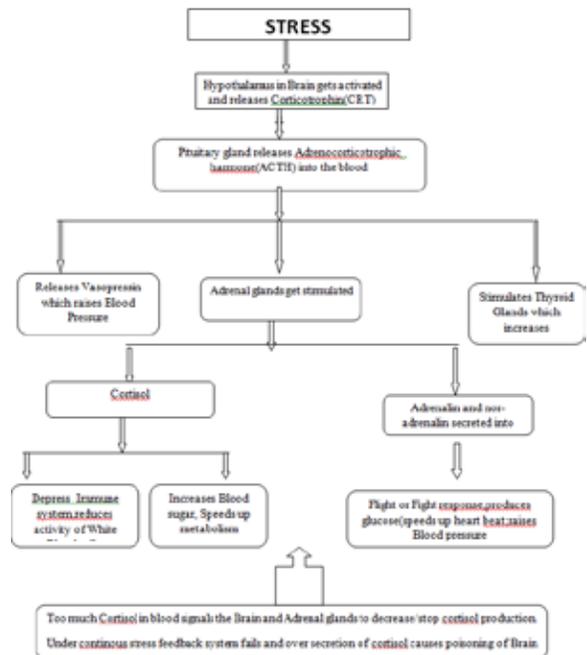
With over stress people complain of being tired, unable to fall asleep or to obtain a restful night's sleep. They have plagues of aches and pains, lack of energy, lack of enjoyment of life. They feel depressed, anxious, or just unable to cope with life.

A large body of evidence supports the idea that exercise, including exercise to fatigue, is associated with an increase in plasma tryptophan and a decrease in the plasma level of the branched chain amino acids (BCAAs) leucine, isoleucine and valine(Blomstrand ,2001)(Davis, Alderson and Welsh ,2000)

The study by Perreau-Linck and colleagues (2007) is the first to report that self-induced changes in mood can influence serotonin synthesis. This raises the possibility that the interaction between serotonin synthesis and mood may be 2-way, with serotonin influencing mood and mood influencing serotonin.

Also getting Enough Rest, daily meditation can relieve stress (Kjaer, Bertelsen and Piccini ,2002)

Also without medicines Stress can be managed by Regular Exercise (Salmon , 2001)



Conclusions: stress creates an environment in humans which is disastrous for health, stress depresses immune system, increases blood sugar, increases heart rate, increases blood pressure and reduces the capacity of brain to work. Every person has different level of withstanding stress. As stress reduces the overall efficiency of the body it may be tackled immediately or one can avoid stress by leaving the environment which is causing stress. The change of environment provides different types of inputs to brain and stress is relieved.

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