

The Serotonin Connection

 www.hypoglycemia.asn.au/2011/the-serotonin-connection/

By Jurriaan Plesman, BA(Psych), Post Grad Dip Clin Nutr

I will attempt to describe briefly **The Serotonin Connection** as a sequence of psychological and biochemical events in the development of emotional disorders. Most of the statements below can be verified by [scientific studies](#), but some are still controversial, especially the relationship between insulin resistance and absorption of amino acids. Much research needs to be done in this area. The events appear to follow a predetermined sequence as follows;

- 1) An extended period of physical or psychological **stress**, will produce stress hormones such as cortisol and adrenaline, that can interfere with the synthesis of the brain neurotransmitter, Serotonin.
- 2) A **neurotransmitter** is any one of numerous chemicals that occupy the gap (synapse) between two or more nerve cells (neurons) and thereby allows the triggering of a tiny electrical currents in adjacent cells. Each neurotransmitter fits into a unique receptor – like a key fitting into a lock – thus allowing messages to be carried along nerve pathways. **See Figure 1**

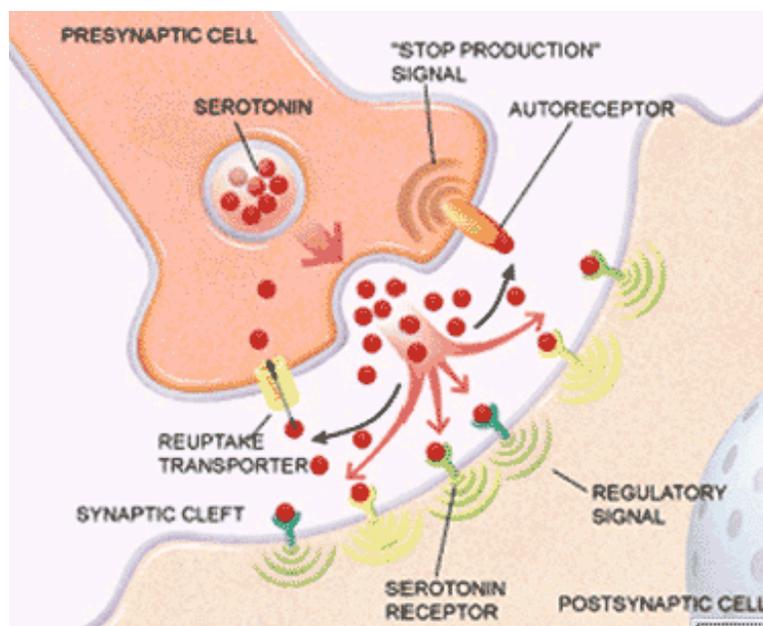


Figure 1

- 3) **Serotonin** is a neurotransmitter that conveys the positive sensations of satiety, satisfaction and relaxation. It regulates appetite and when converted to melatonin helps us to sleep.
- 4) A deficiency of Serotonin in the brain can cause **endogenous depression**, upsets the **appetite** mechanism and may lead to **obesity** or other eating disorders such as **anorexia** and **bulimia nervosa** and may be responsible for **insomnia**. Doctors usually prescribe **Selective Serotonin Reuptake Inhibitors (SSRIs)** which have the effects of increasing the amount Serotonin and thereby medically treat the above conditions. Unfortunately, SSRIs may have side effects in some patients, and generally do not address the underlying biochemical causes of depression.
- 5) Serotonin is produced from an *essential* amino acid (protein unit), called **tryptophan**, obtained from food and then converted to Serotonin under the influence of vitamin B6 (Pyridoxine) and magnesium. "Essential" amino acids

are sources of protein, that the body cannot produce and **must** obtain from food!

6) If there is a deficiency of vitamin B3 (niacin), the body will use dietary tryptophan to synthesize niacin. It takes 60 mg of tryptophan to produce 1 mg of niacin. Hence, niacin deficiency may also be responsible for depression.

7) The absorption of tryptophan competes with the absorption of other amino acids in the digestive process.

8) The absorption of tryptophan can be accelerated by consuming refined carbohydrates, such as sugar.

9) Sugar consumption stimulates the body to produce insulin, a hormone which transports glucose, fatty acids and amino acids (except tryptophan) into body cells. Thus insulin speeds up the absorption of amino acids other than tryptophan.

10) This leaves tryptophan available for absorption and conversion to Serotonin (via 5-hydroxytryptophan, 5-HTP) in the presence of vitamin B6 and magnesium, **and presto we feel happy**.

11) A person low in Serotonin will be inclined to consume greater amounts of sugar in an attempt to increase Serotonin production and this may lead to **sugar addiction**.

12) Sugar addiction can lead to insulin resistance. High levels of insulin cause receptors for insulin to shut down by means of 'down-regulation'.

13) **Insulin resistance** starts first as mild insulin resistance leading to **hypoglycemia** (low blood sugar level also called 'hyperinsulinism'), then **reactive hypoglycemia**, more severe insulin resistance which causes unstable concentrations of blood glucose, and finally more **complete insulin resistance**, causing diabetes over time. Thus there is a range of insulin resistance from low to severe which causes erratic and unpredictable sugar levels in the blood and to the brain. This explains some of the variable 'psychological' and physical symptoms of hypoglycemia.

14) High levels of insulin – **hyperinsulinism** – blocks the utilization of fat cells (adipocytes) as a source of energy, thus causing obesity. It also causes to dump magnesium into the urine, upsetting the delicate balance of intracellular magnesium and calcium ions that regulate blood pressure, thereby contributing to hypertension.

15) The brain requires an inordinate amount of biological energy (about 70-80% at any time), mainly derived from carbohydrates, to synthesize the feel-good neurotransmitters, such as serotonin. In the absence of energy the brain is energy starved, cannot synthesize neurotransmitters and will trigger the release of stress hormones.

16) In **hypoglycemia** wild fluctuations in blood sugar levels causes the body to produce excess **adrenaline**, which functions to convert glycogen (stored sugar) into glucose in an attempt to stabilize the supply of glucose to the brain. The brain normally has no other source of energy than glucose and needs a stable supply.

17) Treatment of hypoglycemia is achieved by adopting a **hypoglycemic diet** accompanied with vitamin and mineral supplements (Vitamin C, Zinc, Chromium picolinate, Thiamine (B1) and other B-complex vitamins, see "[The Hypoglycemic Diet](#)"). This helps to stabilize the blood sugar, insulin and stress hormone levels, even out mood swings, rebalance the appetite mechanism, equalize energy intake and expenditure; and halt if not reverse obesity.

18) The overproduction of adrenaline, known as the fight/flight hormone, can cause **nervousness, panic attacks, anxiety, phobias, extreme mood swings and bouts of aggression** and many other symptoms of hypoglycemia, described in the article "What is Hypoglycemia?" An immediate natural remedy (but not a cure) is [Glycerine](#), that bypasses a faulty insulin production and directly enters glycolysis and may restore proper energy levels to the brain.

19) **Depressant drugs**, such as alcohol, tranquilizers, benzodiazepines, sleeping pills may temporarily counteract the effects of adrenaline, these are however very addictive and this helps to explain how hypoglycemia may lead to alcohol or drug addiction. **Most drug addicts have been found to be hypoglycemic!**

20) It is suggested that insulin resistance may also interfere with the absorption of other essential amino acids such as **phenylalanine and tyrosine**, which are forerunners of important brain neurotransmitters, such as **dopamine and norepinephrine**.

21) **Norepinephrine** (closely associated with dopamine) is believed to be a neurotransmitter that blocks out any irrelevant information from the brain and helps a person (usually young children) to concentrate on the task at hand. An error in norepinephrine synthesis has been associated with **Attention Deficit and Hyperactivity Disorder (ADHD)**, because the person is bombarded with irrelevant information and cannot concentrate. Thus ADHD is considered another consequence of insulin resistance and hypoglycemia.

22) Hypoglycemia and/or insulin resistance is believed to result in a dysfunction of dopamine metabolism. **Dopamine** conveys the sensation of pleasure and many addictive drugs such as heroin and cocaine increase the amount of dopamine, by blocking (inhibiting) the reabsorption (reuptake) of dopamine by brain cells. This causes increased levels of dopamine which is felt by the addict as a **high** and as a feeling of great pleasure.

23) The presence of excess dopamine in the brain causes the **down-regulation** of dopamine receptors as a defence against superfluous dopamine. Receptors for dopamine are reduced and the person becomes dependent on the heroin, cocaine or any other addictive drug to artificially obtain 'normal' levels of dopamine. Treatment aims at rebuilding natural dopamine receptors through abstinence from drugs and with nutritional aids, such as omega-3 essential fatty acids (fish oil) which is thought to help restore brain cell membranes.

24) **Treatment** aims at reversing the **Serotonin Connection** by correcting the chemical imbalance of the various neurotransmitters. It is essential that the patient adopt the **hypoglycemic diet** together with nutrient supplements, vitamins and minerals, omega-3 fatty acids, neurotransmitter precursors, exercises and so on as explained in the article **Treatment of Drug Addiction**. This is generally a medical treatment intended to restore a person's health.

25) Considering exposure to emotional **STRESS** as being a possible factor of the Serotonin Connection, it is important that the person undergoes a course of psychotherapy to help him deal with stress situations more effectively by learning new social skills. But it is important to realize that psychotherapy can only be effective **AFTER** treatment of the biochemical factors. Talk therapy can not "cure" a physiological abnormality. Such a course is available free of charge at the web Hypoglycemic site at: [Psychotherapy Course](#).

Further readings:

["What is Hypoglycemia?"](#)

["The Hypoglycemic Diet"](#)

["Depression – a Nutritional Disorder"](#)

["Depression – a Disease of Energy Production"](#)

["Post Traumatic Stress Disorder \(PTSD\) and Hypoglycemia"](#)

["Hypochondria and Hypoglycemia"](#)

["Hit or Miss Supplements for Depression"](#)

["Beating Anxiety and Panic Attacks"](#)