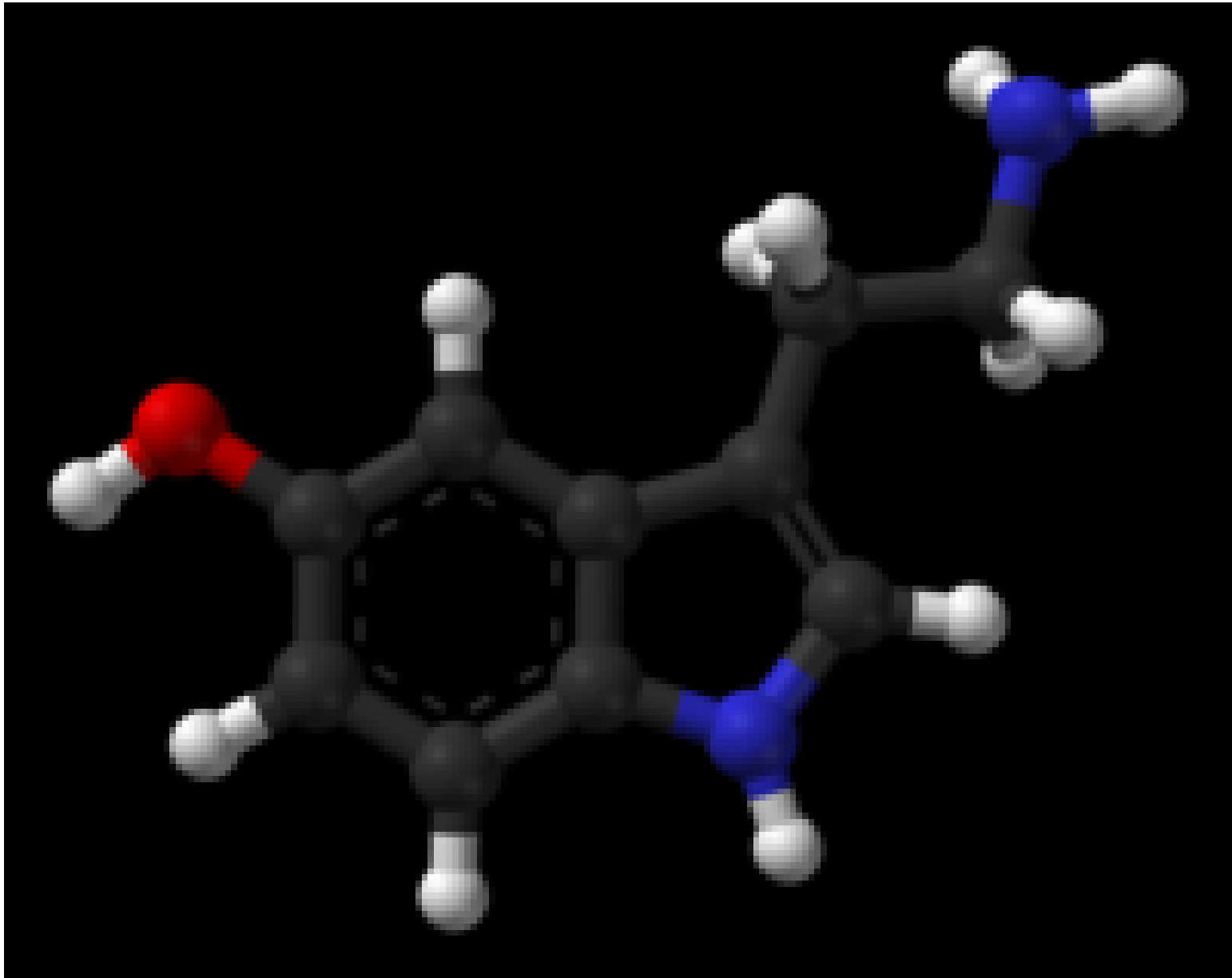
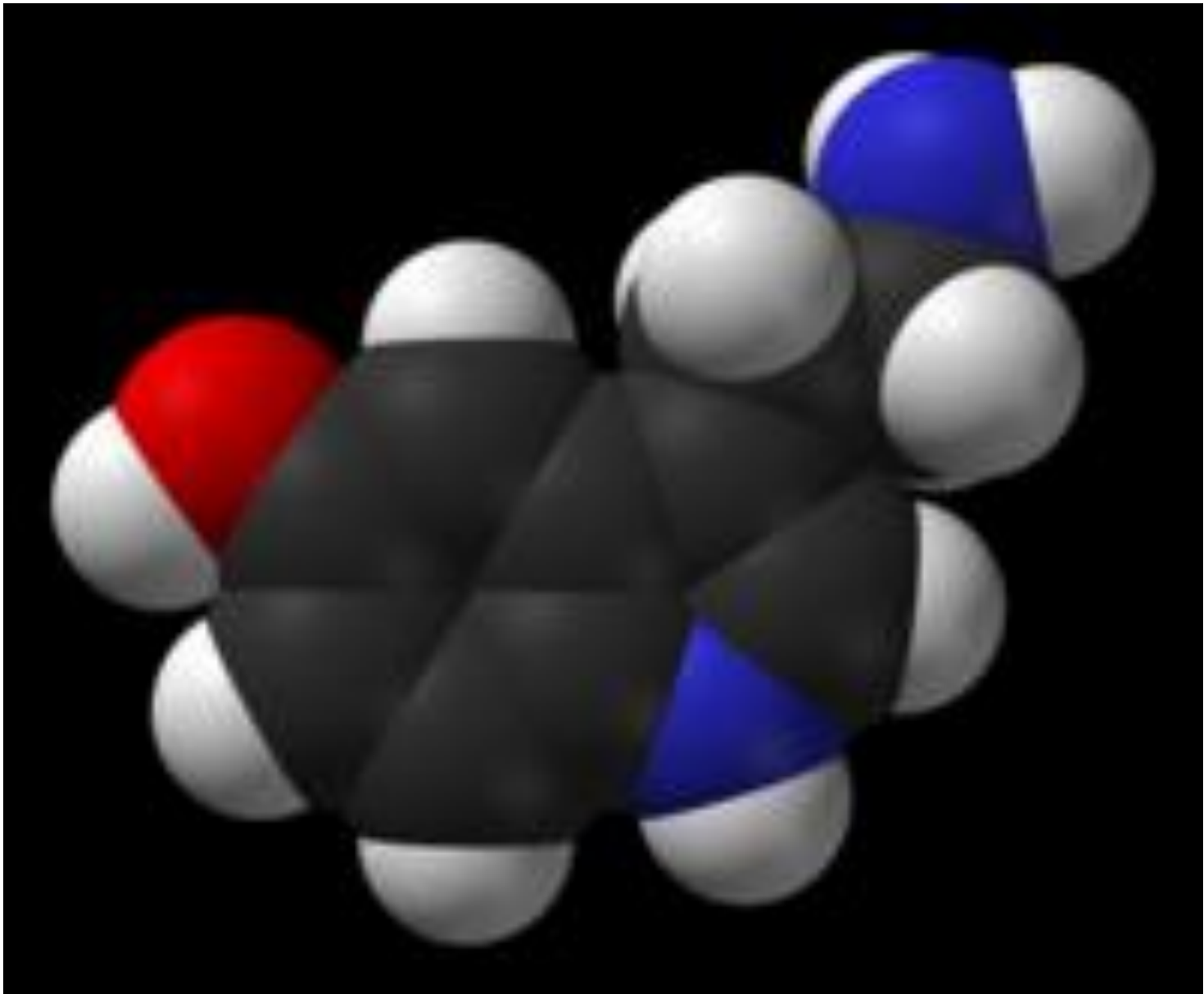


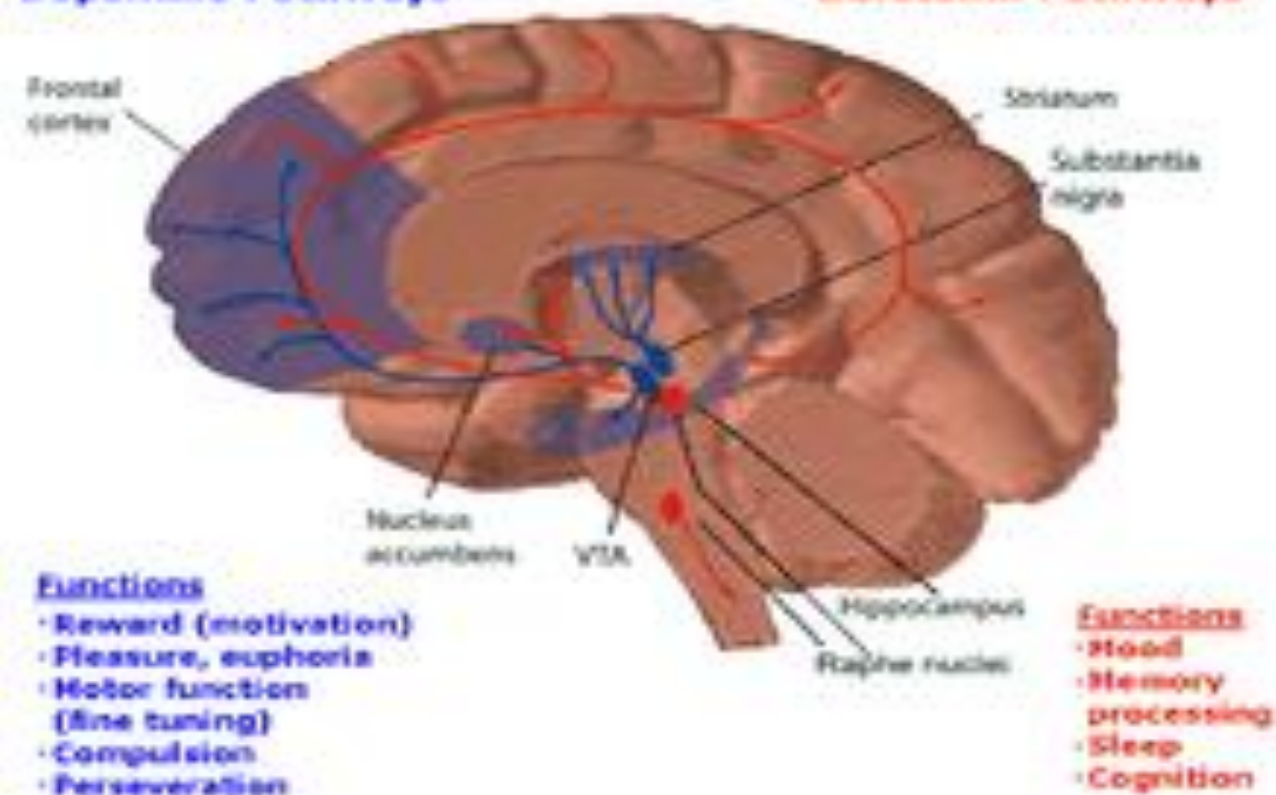
**Serotonin**  
**the happiness factor**





## Dopamine Pathways

## Serotonin Pathways



In the morning sunlight falls on the eye lid. sensors in the eye signal the brain that is about time to wake up . The brain responds by releasing serotonin . Serotonin helps rouse the body from sleep enter a state of alertness and maintain alertness throughout the day.

The reverse process happens at night . Sensors in the eye signal the brain that is dark and time to go to sleep . The brain responds by using serotonin to create melatonin which induce sleep this melatonin will be used to produce serotonin in the walking hours. So the cycle will repeat its self day after day.

Serotonin level changes with season which is low in winter because of low serotonin transporter protein . This explain why some people feel miserable during winter.

Brain serotonin system differ between men and women . Women are affected more with depression and chronic anxiety.

People with depression have significantly fewer serotonin receptors in their hippocampus.



Stress is a common cause of low serotonin level .  
The absence of serotonin has been associated  
with greater aggressive behavior.

Location of serotonin in the body:

1. in the brain as neurotransmitter.
2. digestive tract secreted from enterochromaffin cell.
3. Pineal body.
4. blood platelets.

How can we elevate serotonin in the body?

1. good regular exercise.
2. eating mixed food which contain precursors of serotonin like potatoes .grains, cheeses ,milk and meat.

In 1935, Italian Vittorio Erspamer showed an extract from enterochromaffin cells made intestines contract. Some believed it contained adrenaline, but two years later, Erspamer was able to show it was a previously unknown amine, which he named "enteramine. In 1948, Maurice M. Rapport, Arda Green, and Irvine Page of the Cleveland Clinic discovered a vasoconstrictor substance in blood serum, and since it was a serum agent affecting vascular tone, they named it serotonin.

In 1952, enteramine was shown to be the same substance as serotonin, and as the broad range of physiological roles was elucidated, the abbreviation 5-HT of the proper chemical name 5-hydroxytryptamine became the preferred name in the pharmacological field. Synonyms of serotonin include: 5-hydroxytryptamine, thrombotin, enteramin, substance DS, and 3-( $\beta$ -Aminoethyl)-5-hydroxyindole. In 1953, Betty Twarog and Page discovered serotonin in the central nervous system

## **Serotonin or 5-hydroxytryptamine (5-HT)**

is a monoamine neurotransmitter. Biochemically derived from tryptophan, serotonin is primarily found in the gastrointestinal (GI) tract, platelets, and in the central nervous system (CNS) of animals, including humans. It is popularly thought to be a contributor to feelings of well-being and happiness

Approximately 90% of the human body's total serotonin is located in the enterochromaffin cells in the alimentary canal (gut), where it is used to regulate intestinal movements. The remainder is synthesized in serotonergic neurons of the CNS, where it has various functions. These include the regulation of mood, appetite, and sleep. Serotonin also has some cognitive functions, including memory and learning. Modulation of serotonin at synapses is thought to be a major action of several classes of pharmacological antidepressants

Serotonin secreted from the enterochromaffin cells eventually finds its way out of tissues into the blood. There, it is actively taken up by blood platelets, which store it. When the platelets bind to a clot, they release serotonin, where it serves as a vasoconstrictor and helps to regulate hemostasis and blood clotting. Serotonin also is a growth factor for some types of cells, which may give it a role in wound healing.



Serotonin is mainly metabolized to 5-HIAA, chiefly by the liver. Metabolism involves first oxidation by monoamine oxidase to the corresponding aldehyde. This is followed by oxidation by aldehyde dehydrogenase to 5-HIAA, the indole acetic acid derivative. The latter is then excreted by the kidneys. One type of tumor, called carcinoid, sometimes secretes large amounts of serotonin into the blood, which causes various forms of the carcinoid syndrome of flushing, diarrhea, and heart problems. Because of serotonin's growth-promoting effect on cardiac myocytes,<sup>1</sup> persons with serotonin-secreting carcinoid may suffer a right heart (tricuspid) valve disease syndrome, caused by proliferation of myocytes onto the valve

In humans, serotonin levels are affected by diet. An increase in the ratio of tryptophan to phenylalanine and leucine will increase serotonin levels. Fruits with a high ratio include dates, papayas and bananas. Research also suggests eating a diet rich in carbohydrates and low in protein will increase serotonin by secreting insulin, which helps in amino acid competition.

The gut is surrounded by enterochromaffin cells, which release serotonin in response to food in the lumen. This makes the gut contract around the food. Platelets in the veins draining the gut collect excess serotonin.

If irritants are present in the food, the enterochromaffin cells release more serotonin to make the gut move faster, i.e., to cause diarrhea, so the gut is emptied of the noxious substance. If serotonin is released in the blood faster than the platelets can absorb it, the level of free serotonin in the blood is increased.

This activates 5HT3 receptors in the chemoreceptor trigger zone that stimulate vomiting. The enterochromaffin cells not only react to bad food, but they are also very sensitive to irradiation and cancer chemotherapy. Drugs that block 5HT3 are very effective in controlling the nausea and vomiting produced by cancer treatment, and are considered the gold standard for this purpose

Serotonin, in addition, evokes endothelial nitric oxide synthase activation and stimulates, through a 5-HT<sub>1B</sub> receptor-mediated mechanism, the phosphorylation of p44/p42 mitogen-activated protein kinase activation in bovine aortic endothelial cell cultures. In blood, serotonin is collected from plasma by platelets, which store it. It is thus active wherever platelets bind in damaged tissue, as a vasoconstrictor to stop bleeding, and also as a fibrocyte mitotic (growth factor), to aid healing

Since serotonin is an indicator of bleeding, a sudden large increase in peripheral levels causes pain. The reason wasps and deathstalker scorpions have serotonin in their venom may be to increase the pain of their stings on large animals, and also to cause lethal vasoconstriction in smaller prey.

The 5-HT receptors, the receptors for serotonin, are located on the cell membrane of nerve cells and other cell types in animals, and mediate the effects of serotonin as the endogenous ligand and of a broad range of pharmaceutical and hallucinogenic drugs. With the exception of the 5-HT<sub>3</sub> receptor, a ligand-gated ion channel, all other 5-HT receptors are G protein-coupled, seven transmembrane (or heptahelical) receptors that activate an intracellular second messenger cascade

1 Food sources that help with serotonin production - foods high in B-vitamins (brown rice, chicken, corn, eggs, green leafy vegetables, legumes, meat, nuts, peas, sunflower seeds, nutritional yeast),

stress depletes serotonin levels. Short term stress actually increases serotonin, but after time you get burn-out and it becomes increasingly difficult for the body to produce serotonin.