CHEMICAL STRUCTURES OF NEUROTRANSMITTERS

**Adrenaline**  
**C₉H₁₃NO₃**  
The right or flight neurotransmitter  
Adrenaline, also known as epinephrine, is a hormone produced in high stress or exciting situations. It stimulates increased heart rate, contracts blood vessels, and dilates veins, to increase blood flow to the muscles to oxygenate the lungs. This leads to a physiological, or heightened awareness. Epinephrine, which are used to treat allergic reactions, work by injecting adrenaline.

**Norepinephrine**  
**C₈H₁₁NO₃**  
The concentration neurotransmitter  
Norepinephrine, also known as noradrenaline, is a neurotransmitter that affects attention and responding options in the brain. Alongside adrenaline, it is also involved in the fight or flight response. Its effect on the body is to contract blood vessels to increase blood flow. Patients diagnosed with ADHD will often be prescribed drugs designed to help increase levels of norepinephrine in the brain.

**Dopamine**  
**C₈H₁₁NO₂**  
The pleasure neurotransmitter  
Dopamine is associated with feelings of pleasure & satisfaction. It is also associated with addiction, movement, and motivation. The feelings of satisfaction caused by dopamine can become desired and to satisfy this the person will repeat behaviours that lead to release of dopamine. These behaviours can be natural, as with eating and sex, or unnatural, as with drug addiction.

**Serotonin**  
**C₁₀H₁₂NO₂**  
The mood neurotransmitter  
Serotonin is thought to be a contributor to feelings of well-being and happiness. It regulates the sleep cycle along with melatonin, and also regulates emotional movements. Low levels of serotonin have been linked to depression, anxiety, and some mental disorders. Antidepressants work by increasing serotonin levels. Exercise and light levels can also both have positive effects on the levels of serotonin.

**γ-Aminobutyric Acid (GABA)**  
**C₄H₉NO₂**  
The calming neurotransmitter  
γ-Aminobutyric acid (GABA) is the major inhibitory neurotransmitter in the brain, its role is to calm firing nerves in the central nervous system. Increased levels improve mental focus and relaxation, while low levels can cause anxiety, and have been linked with epilepsy. GABA also contributes to sleep. Drugs to treat epilepsy often act by increasing levels of GABA in the brain.

**Acetylcholine**  
**C₇H₁₆NO₂⁺**  
The learning neurotransmitter  
Acetylcholine, often shortened to ACh, is the principle neurotransmitter involved in thought, learning and memory. In the body, it is involved in activating muscle action. Damage to the acetylcholine producing areas of the brain has been linked with the memory deficits associated with Alzheimer’s disease. It is involved with attention, and enhancement of sensory perception upon waking.

**Glutamate**  
**C₅H₉NO₂**  
The memory neurotransmitter  
Glutamate is the most common neurotransmitter in the brain, and is involved in cognitive functions, such as learning and memory. It also regulates brain development and function of nerve contacts. Glutamate is acting basic to neurons in larger quantities, and if too much glutamate is present it can kill neurons. Seizure or strokes can lead to the creation of a harmful excess, killing brain cells.

**Endorphins**  
20+ types in the human body  
Endorphins are a range of compounds, the biologically active section of which is shown above, formed from long chains of multiple amino acids. They are released in the brain during exercise, excitement, pain, and sexual activity, and produce a feeling of well-being or even euphoria. At least 20 types have been identified in the human brain, and foods such as chocolate & spicy foods, can also stimulate the release of endorphins.