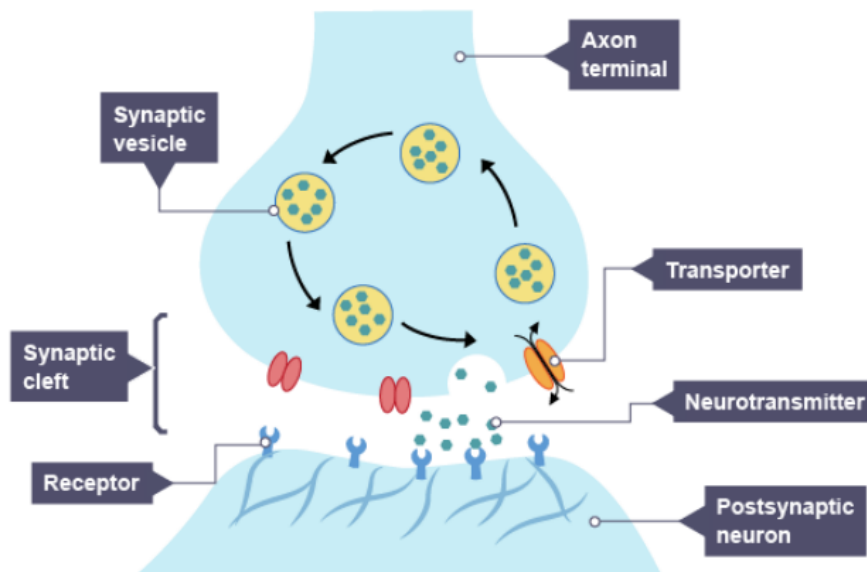


Nerve transmission

Neurotransmitters at synapses

Neurons connect with other neurons/ muscle fibres via releasing neurotransmitters to relay impulses across the synaptic cleft



Stages of nerve impulse

1. Nerve impulse arrives at the pre-synaptic neuron.
2. Vesicles containing the chemical neurotransmitters are activated.
3. The vesicles move and release the neurotransmitters into the cleft.
4. Neurotransmitters diffuse across the cleft and bind to specific receptors on the post-synaptic neuron.
5. Nerve impulse is passed through the post synaptic neuron if threshold is met.

Threshold

The minimum number of neurotransmitter molecules attaching to receptors on the postsynaptic membrane for impulse to be transmitted.

Weak stimulus

If a weak stimulus cannot meet threshold with insufficient neurotransmitters released into the synapse, the synapse will filter out the weak stimulus.

Summation

Effect of a number of weak stimuli firing simultaneously from a number of different pre-synaptic neurons, cumulatively reaching threshold.

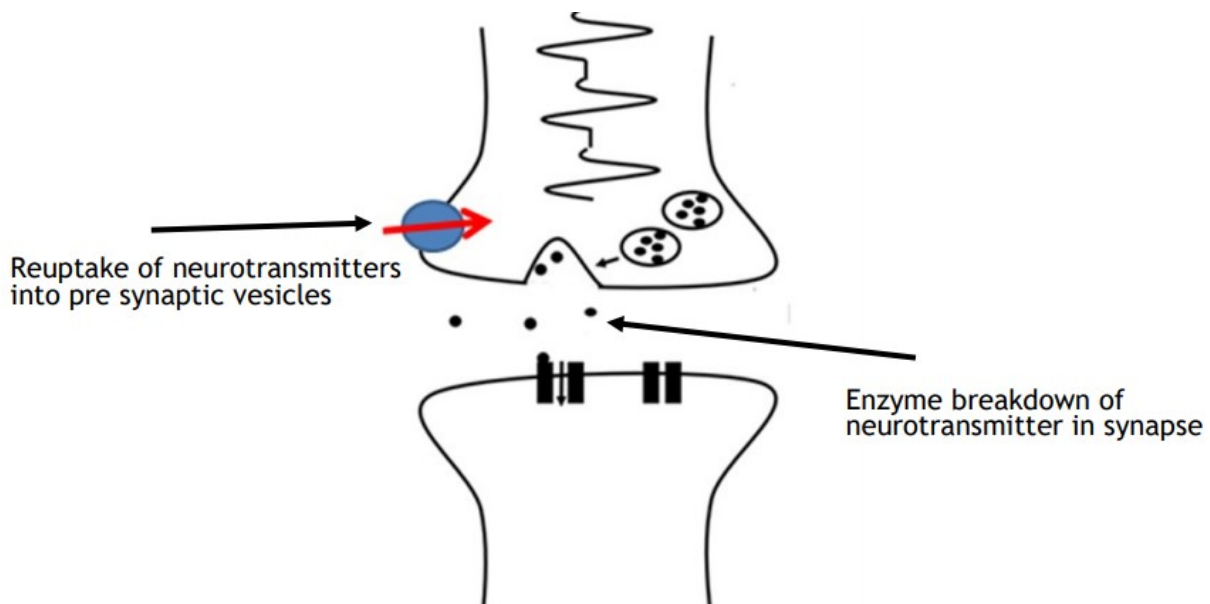
Example: Converging pathway

Nerve transmission

Removal of Neurotransmitters

The neurotransmitters need to be removed so that there is not continuous stimulation of the post-synaptic neuron after impulse has been transmitted.

1. Breakdown of the neurotransmitters by enzymes.
2. Reuptake of neurotransmitters by transporters into vesicles in the pre-synaptic neuron.



Excitatory and inhibitory signals

Signals generated at synapses can be

1. Excitatory (increase or cause activity)
2. Inhibitory (slow down or stop activity)

The type of signal generated depends on the type of receptor present on the post synaptic neuron.

Some neurotransmitters can have an excitatory effect at one neuron and an inhibitory effect at another.

e.g. acetylcholine will have an excitatory effect at skeletal muscles but an inhibitory effect at cardiac muscle.

Neurotransmitters

Endorphins

Neurotransmitters that **reduce the intensity of pain**

Activities that produce endorphins

1. Sex
2. Eating food
3. Prolonged exercise

Severe injury and **stress** can also produce endorphins

Dopamine

Neurotransmitters induces feelings of **pleasure**.

Reinforces satisfying behaviour by activating the reward pathway in the brain.

Reward Pathway

Involves neurons which produce/respond to **dopamine**.

Activated when an individual engages in a behaviour that is perceived beneficial to them.

Example 1— Eating

When a person eats they are satisfying a fundamental need.

This stimulates the release of dopamine which activates the reward pathway ensuring eating behaviour continued.

Example 2—Taking illegal drugs

When a person takes an illegal drug they are inducing feelings of pleasure.

This stimulates the release of dopamine which activates the reward pathway ensuring drug taking behaviour continues.

Neurotransmitter Related Drugs

1. Agonists

Chemicals that bind to and stimulate specific receptors by mimicking the action of a neurotransmitter at a synapse.

2. Antagonists

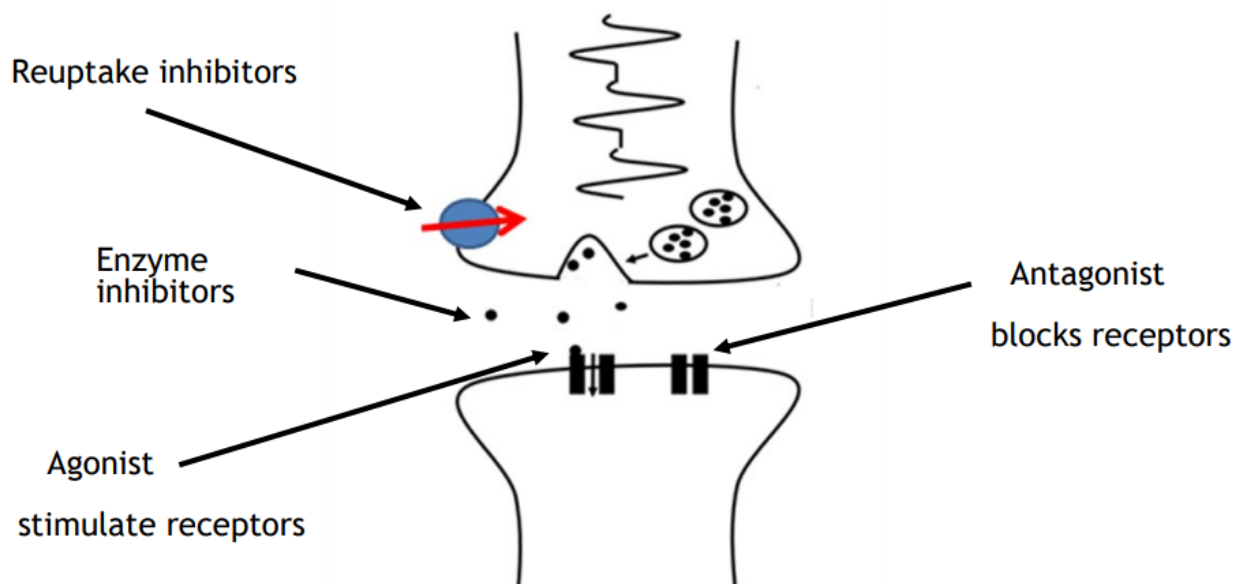
Chemicals that bind to specific receptors blocking the action of a neurotransmitter at a synapse.

3. Enzymes Inhibitors

Prevent degradation of neurotransmitters at synapse.
Neurotransmitter level at synapse remains high.

4. Reuptake inhibitors

Prevent re uptake of neurotransmitters which are normally recycled into pre synaptic vesicles.
Neurotransmitter level at synapse remains high.



Recreational Drugs

Mode of Action of Recreational Drugs

Recreational drugs can also act as **agonists/antagonists** & disturb the **normal neurotransmission** at synapses affecting:

1. **Mood**
2. **cognition** (ability to process information)
3. **perception** (interpreting what is around you)
4. **behaviour.**

Reward Pathway

Many recreational drugs affect neurotransmission in the **reward pathway of the brain.**

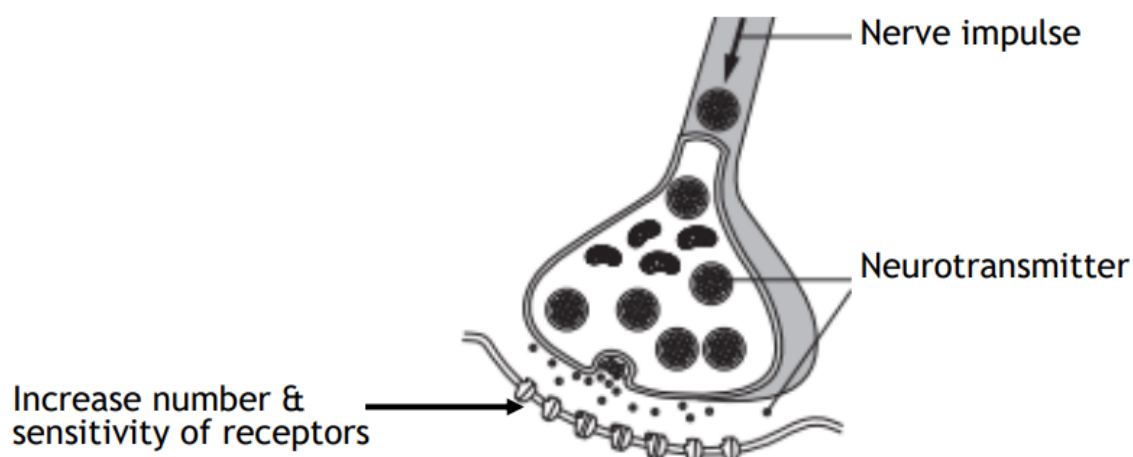
This explains why many recreational drugs give feelings of **pleasure**.

Drug addiction

Repeated use of **antagonist drugs** which **block** specific receptors.

The nervous system **increases both the number and sensitivity** of receptors.

This **sensitisation** leads to **addiction** where the individual **craves** more of the drug



Recreational Drugs

Drug tolerance

Repeated use of **agonist drugs** which stimulates specific receptors

The nervous system **decreases both the number and sensitivity** of receptors.

This **desensitisation** leads to **drug tolerance** where the individual must take **more** of the drug to get an effect

