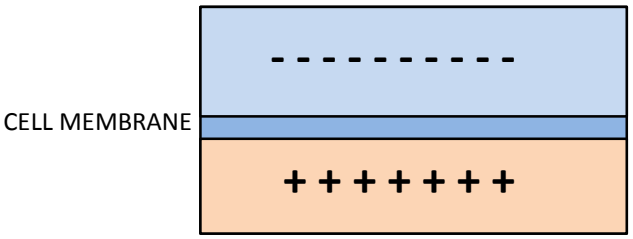
Potentials in Neurones; RESTING POTENTIAL

When a nervous system receptor is in its *resting state* there's a difference in charge between the inside and the outside of the cell ; the inside is –ve; outside is +ve - there is a *potential difference* across the membrane.

- This is known as the *resting potential* and is approximately -70mV. This potential is maintained via the use of ion channels and pumps.



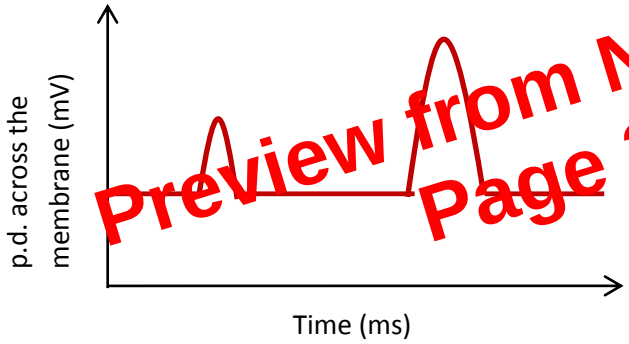
INTRACELLULAR – RELATIVE **NEGATIVE** CHARGE

EXTRACELLULAR – RELATIVE **POSITIVE** CHARGE

Potential in Neurones; GENERATOR POTENTIAL

When a stimulus is detected, the cell membrane is excited and becomes more permeable, allowing the flow of ions in and out of the cell – altering the potential difference. The change in p.d. due to a stimulus is known as the *generator potential*.

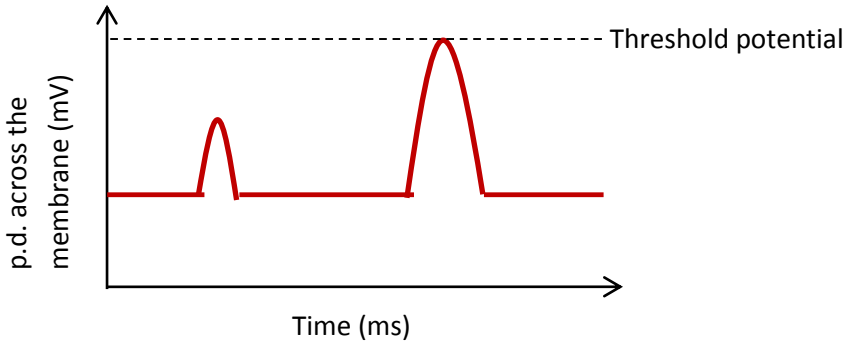
- The bigger the stimulus, the greater the change in p.d. – the potential must reach the threshold potential to produce an action potential.



Potential in Neurones; ACTION POTENTIAL

If the generator potential is large enough, it will trigger an action potential/nerve impulse along a neurone.

- This only occurs if the *threshold potential* is reached; -55mV



Disruption of synaptic transmission

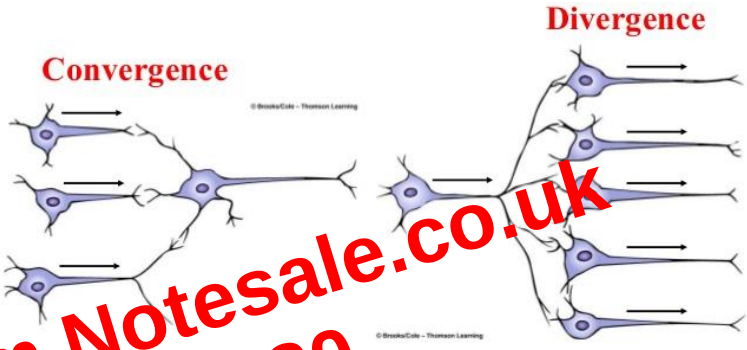
Because synapses rely on chemical communication, they can be affected by various chemicals e.g. drugs, toxins or poisons.

- **Mimics –** some chemicals are similar in shape to neurotransmitters, so they mimic their action at receptors (these are known as agonistic drugs).
- **Blockers –** some chemical will block receptors so that they cannot be activated by neurotransmitters.
- **Inhibitors (enzyme) –** some chemicals inhibit the enzyme that breaks down the neurotransmitter; the neurotransmitters remain in the synaptic cleft and receptors for longer.
- **Inhibitors (neurotransmitter) –** some chemicals inhibit the release of the neurotransmitter from the presynaptic knob, this can be achieved for example by blocking the Ca^{2+} ion channels.

Roles of synapses

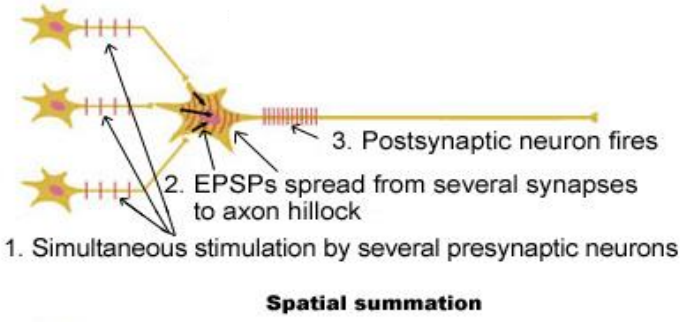
Divergence & convergence

- One neuron to many neurons; divergence, allows information to be dispersed to many different parts of the body.
- Many neurons to one neuron; convergence, allows information to be amplified.



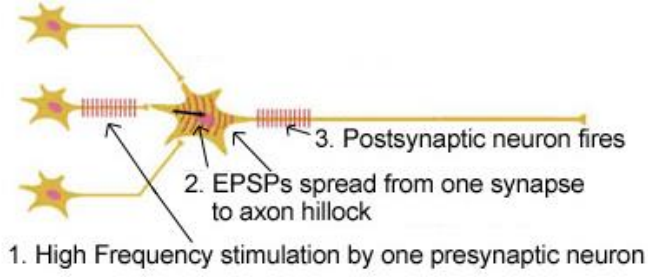
Summation

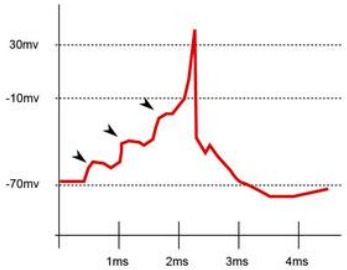
- *Spatial Summation* – where two or more presynaptic neurones release their neurotransmitters at the same time. The small amount of neurotransmitter from each can altogether produce a depolarisation great enough to cause an impulse in the postsynaptic neurone.



Spatial summation

- *Temporal Summation* – where two or more excitatory postsynaptic potentials (EPSPs) arrive in quick succession from the same neuron; releasing more neurotransmitter into the synaptic cleft





Temporal summation

Homeostasis Basics

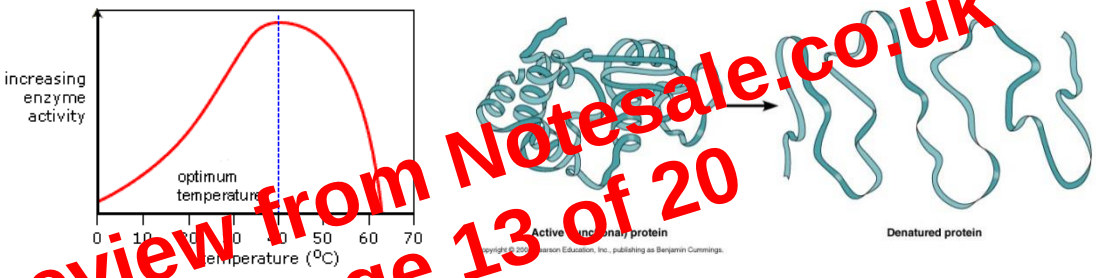
Homeostasis

Changes in the external environment can affect your internal environment – homeostasis is the maintenance of a constant internal environment. It is controlled by systems that maintain the correct internal conditions to promote enzyme activity and avoid cellular damage.

- **Temperature** – the rate of metabolic reactions increases as temperature increases; more heat means more kinetic energy, therefore increasing the speed of which molecules move at. Thus, there is a higher chance that substrate molecules will collide with enzymes, with the correct level of energy (activation energy), so the reaction is more likely to occur

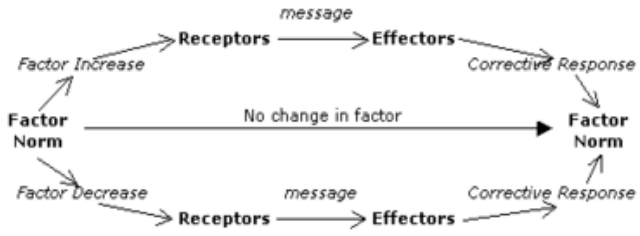
  However, at high temperatures (≥40ºC) the reaction will stop. This is due to the fact that the rise in temperature causes the bonds in an enzyme to vibrate more, at some point these bonds will break; changing the shape of the active site and denaturing the enzyme – causing the inability to act as a catalyst.

  At low temperatures, enzyme activity is reduced due to the decrease in kinetic energy. The optimal temperature is around 37.5ºC (body temperature). pH and other factors will also affect enzyme activity.



Negative feedback

Homeostatic systems involve receptors, a communication system and effectors. Receptors detect when a level is too high or too low, and the information's communicated via the nervous/hormonal system to effectors. Effectors will work to counteract the change – bringing the level back to normal. The mechanism that counteracts a change in internal environment and restoring the level to normal is known as *negative feedback.*



((Positive feedback))

Some changes trigger a positive feedback mechanism, which amplifies the change. The mechanism that amplifies a change away from normal levels is called *positive feedback.*

Positive feedback is NOT involved in homeostasis as it does not keep the internal environment constant. E.g. formation of a blood clot, more and more platelets will gather.