

## Lecture 1.2

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### Homeostasis

- the maintenance of a relatively constant internal environment. This is essential for the survival of cells and thus the individual. The systems that need to be maintained depend a lot on the particular environment that one is in e.g. equilibrium becomes very important on the edge of a cliff.

First there must be a sensor that detects change, this is conveyed to the integrating centre by the *afferent pathway*, the *integrating centre* translates the signal whilst comparing it to the set point then sends it out the *efferent pathway*. Next, the *target or effector* elicits a response which returns us to the set point through *negative feedback* (returning the body to the set point i.e. in the opposite direction to what the sensor is sensing).

### Signalling:

- *Nerves* = very fast, short lasting, and specific signals conveyed through nerves. Nerves are ideal for short, and fast acting messages.
- *Endocrine: hormones* = slower, hormones are released into the blood which enables them to act on any cell of the body that has the receptors. Their effects are also longer lasting and their duration can be varied. A lot of endocrine systems are both sensors and integrating centers.
- *Positive feedback* = reinforces a stimulus and escalates a response. It is rare in the body but very necessary for things such as action potentials, birth etc.

### Diffusion:

A spontaneous and passive process that involves the net movement of molecules from a high concentration to a low concentration until both sides of the membrane have equal concentrations.

*Cell membrane* - a layer of molecules that separates the cell from its environment to create distinct compartments. Energy is needed to maintain this distinction. Anything that is lipophilic can cross the membrane (small, uncharged particles) whilst lipophobic (charged and large) particles can not e.g. ions, proteins.

*Osmolarity* - the total concentration of solutes both penetrating and non-penetrating per litre of solution. It's measured in milliosmoles, and usually the body is 300mOsm.

*Osmolality* is the same concept except it involves measuring moles of solute by weight.

Tonicity - the total concentration of non-penetrating solutes. Tonicity is always in reference to the ECF non-penetrating solute concentration. It tells us what will happen to a cell when it is put in the solution.

**Fick's law:**

*Rate of diffusion:*

(surface area X concentration gradient X membrane permeability)

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membrane thickness

Osmotic equilibrium - the body is in osmotic equilibrium because the membranes are readily permeable to water. This doesn't mean particles are equally distributed e.g. more Na<sup>+</sup> outside, we are actually in a state of chemical *disequilibrium*.