The human body works best under certain conditions:
- A temperature of 37°C
- A blood sugar of 0.1%
- A pH of 7.35

Since the environments we live in don’t always provide those conditions, our bodies have mechanisms in-place to help maintain the ideal conditions.
Dynamic Equilibrium

In order for homeostasis to work the body need some stress or stimulus to for the system to respond to. The body constantly monitors these stimuli and responds through homeostatic control systems to exert control over itself. In this way, the internal environment is constant even when the external environment is changing.

All homeostatic control systems have three functional components:

- **Receptors**
  - monitor internal conditions and send signals to the brain

- **Control Centres (Regulators)**
  - take in the message and relay the information to the appropriate regulator, usually the brain

- **Effectors**
  - muscles, organs, or other structures that receive signals from the brain or control center and help restore the normal balance
Homeostasis and Feedback loops

Some Example Responses:

Carbon Dioxide Levels
- Increase during exercise
- Chemical receptors in the brain are stimulated
- Nerve cells from the brain carry impulses to muscles that increase breathing rate

Oxygen Levels
- Low levels detected by arteries in the neck trigger signals to be sent to the brain
- The brain relays messages to the muscles that regulate breathing
In most homeostatic controls systems there is a **negative feedback** loop. The stimulus produces a response from the effectors that ultimately reduces the stimulus.

Squinting in bright sunlight

---

**Stimulus**

Sunlight

**Receptor**

Eye

**Regulator**

Brain

**Effectors**

Eyelid muscles and Pupil Contraction

Afferent (sensory) Nerves

Efferent (motor) Nerves

Light reduced
Homeostasis and Feedback loops

Can you think of any other negative feedback loops in your body???

- Flinching
- Shivering
- Sweating
- Touch hot object
- Eating/drinking
Properties of Feedback Systems

1) Homeostatic systems can only operate within certain limits. They have evolved to deal with the usual set of conditions encountered in the environment the organism is adapted for. Example: Extreme cold = hypothermia

2) All homeostatic systems require energy to work, but have evolved to be naturally energy saving: Less energy is required to work the receptor than is required for the effector to take corrective action.
3) All homeostatic systems operate on feedback loops. They respond to a stimulus with a series of small, repeated responses rather than large, potentially wasteful responses. There are two kinds of feedback loops:

1) **Negative feedback loops** - stimulus produces a response which reduces the original stimulus.
   **MOST SYSTEMS FALL UNDER THIS CATEGORY**

2) **Positive feedback loops** - stimulus produces a response which increases the stimulus.
   Example: mosquito bites, drug addictions
Other Positive Feedback Loops

Childbirth
• Contractions cause oxytocin to be released
• Oxytocin causes stronger contractions
• Each subsequent contraction causes the baby to be pushed out

Breastfeeding
• Baby suckling stimulates more milk to be produced until the baby stops

When the cervix has dilated to 10 cm, the mother has an uncontrollable urge to push
4) In a homeostatic system you can experience **overshoots**. These happen when the effectors do not accurately target the optimal level. **Positive overshoots** do not reduce the stimulus enough, while **negative overshoots** reduce the stimulus too much.

Example: light intensity

![Diagram of light intensity](http://www.youtube.com/watch?v=YxKFzVQ0_FM)