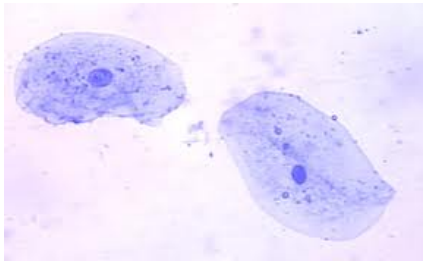
Biology 12

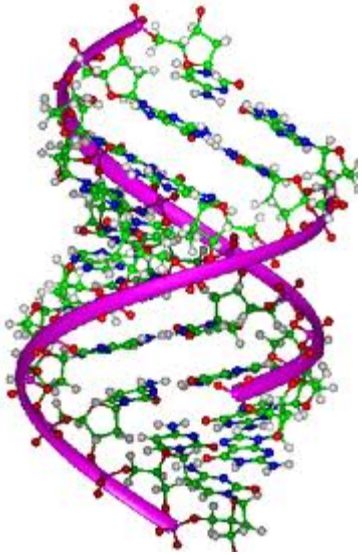
An Introduction

Biology is the STUDY OF LIFE

All living things:



1. Are made up of cells
2. Grow and maintain structure by taking in chemicals and energy from their environment
3. Respond to the external environment
4. Reproduce and pass on their organization (genetic information) to their offspring
5. At the species level, evolve/change and adapt to the environment



Biologists use the Scientific Method

- We:
  - ask questions
  - observe the world
  - formulate hypotheses
  - test them in controlled experiments
  - revise
  - make conclusions

- Hypothesis
  - This is a tentative explanation of what you've observed (e.g. "AIDS is caused by a retrovirus"). used to decide the type of experiment needed to test hypotheses**.** ***A hypothesis can be wrong!***

  - A hypothesis can be used to propose a logical experiment. *For example: "If green light is the best light for growing tomato plants, then tomatoes grown under green light will be heavier than tomatoes grown under red or blue light.*

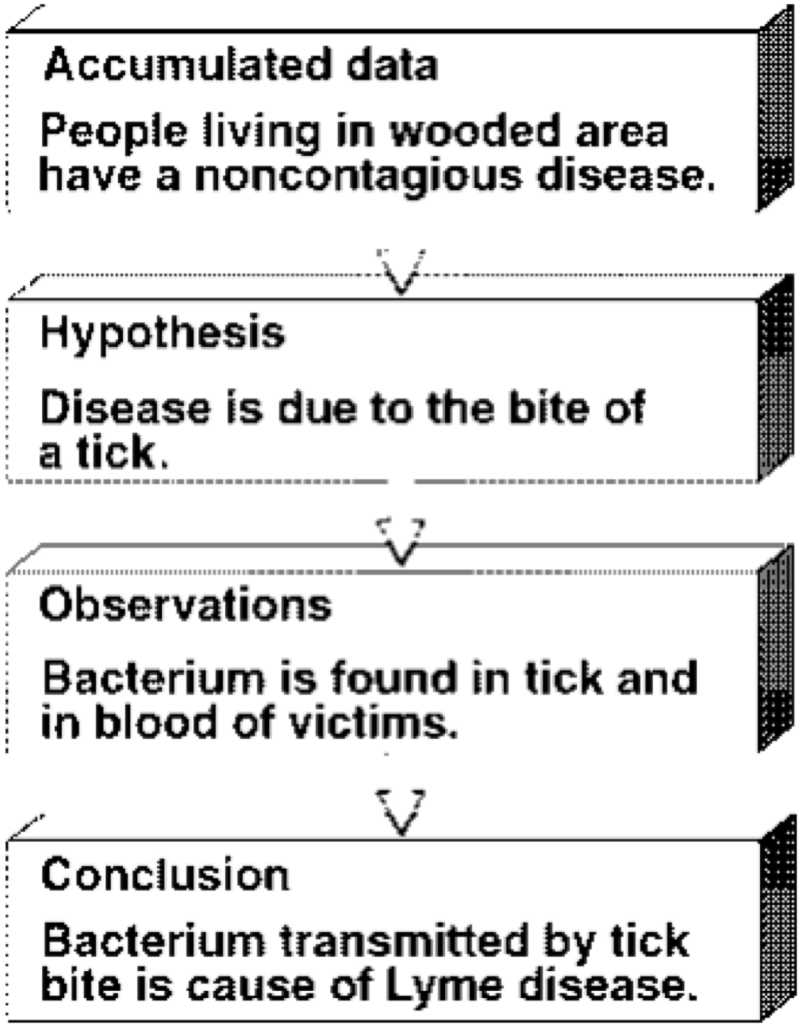
  - **THEORY** - widely accepted, successful, tested hypothesis accepted around the world. By the time a hypotheses becomes a theory, scientists have the utmost confidence in it. (e.g. Theory of General Relativity).

- Experimental "**CONTROL**": a control is a sample that undergoes all the same steps in the experiment except the one being tested.

  - necessary in order to eliminate other effects that might influence the outcome of the experiment

  - necessary so that scientists may establish a ***cause*** and ***effect*** relationship. (want to eliminate, for example, the "placebo effect"). Important for testing new medicines, for example.

Scientific Method Animation

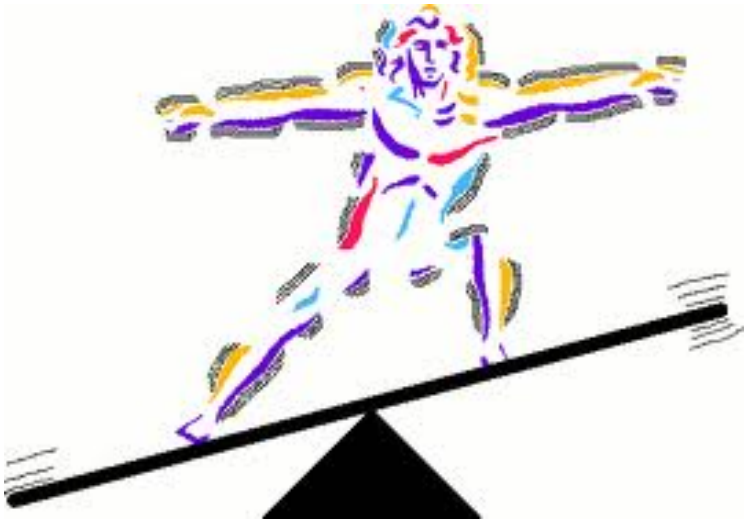


Homeostasis Animation

Homeostasis

(The most important word in Biology 12!)

- all the things living organisms do that cause it to maintain a relatively constant, stable internal environment regardless of the external environment.



- There are countless examples in the human body:

- Eg. If we are cold we shiver to make heat

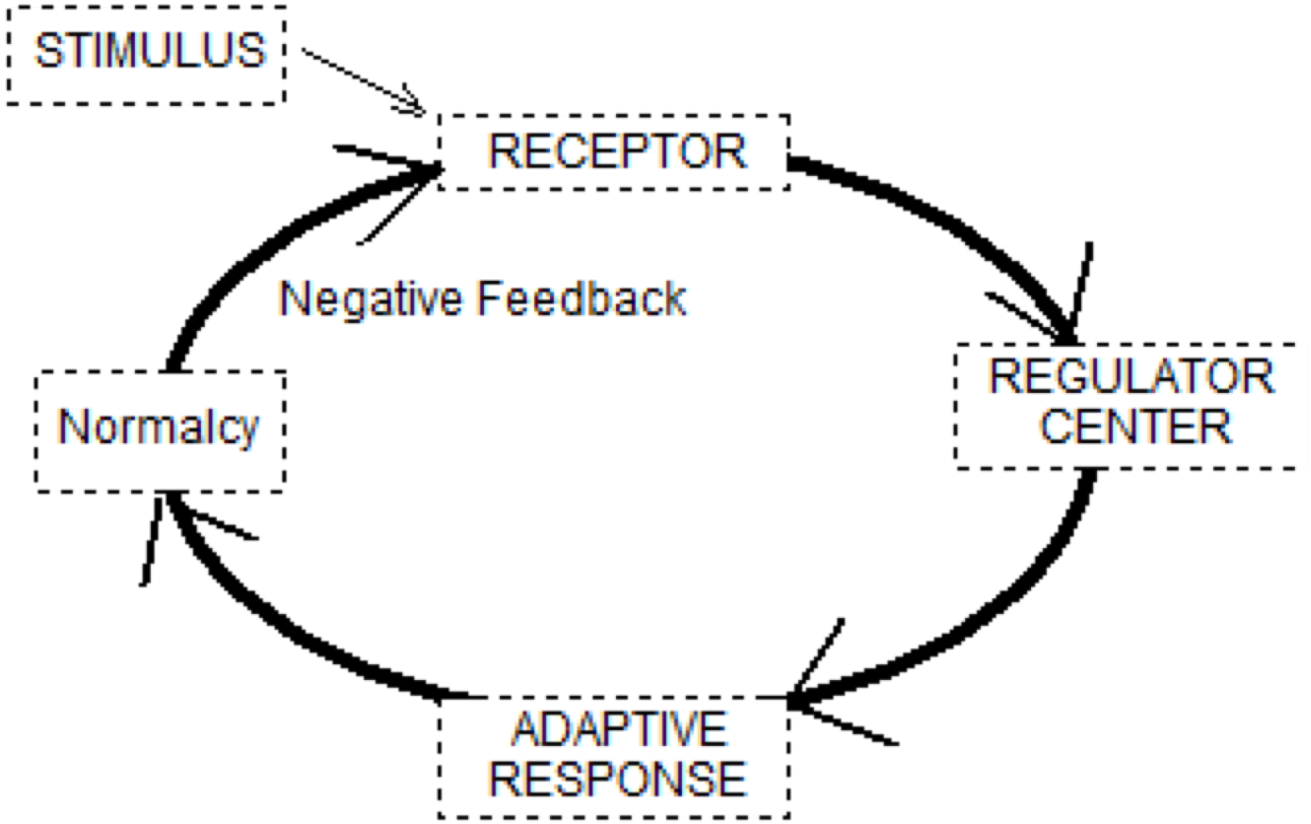
Homeostasis

blood pH =7.4	body temp. = 37° C
blood pressure = 120/80	blood [glucose] = 0.1%

Our bodies work hard to keep these conditions stable in our body

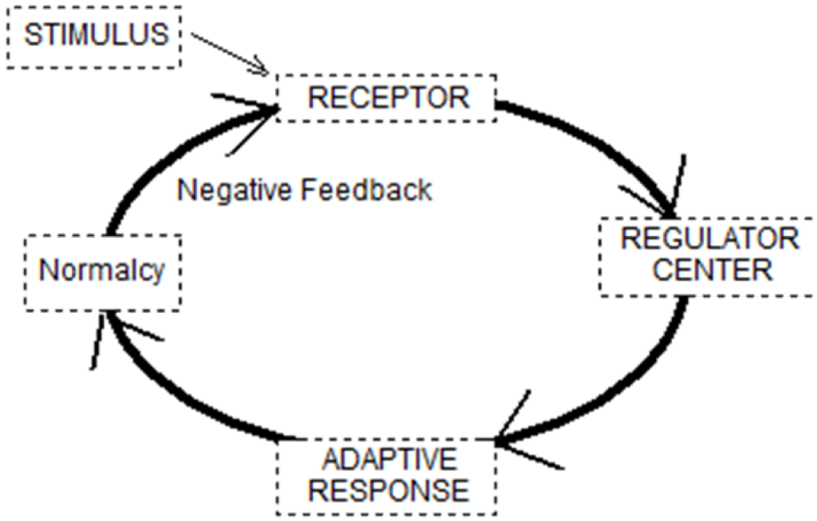
Homeostasis – How does it work?

- How is homeostasis controlled?
  - It relies on a feedback mechanism



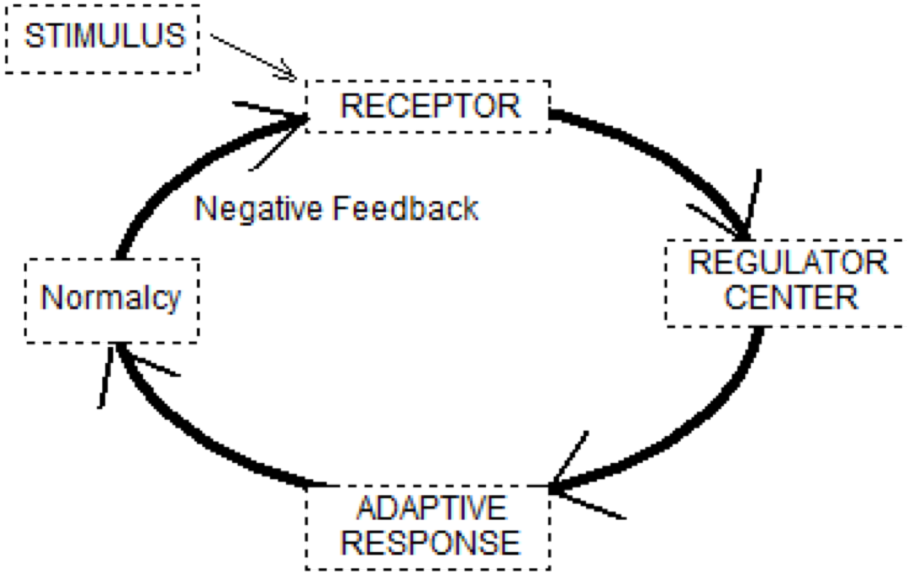
- Brain **<u>control centers</u>** (e.g. in the **hypothalamus**) monitor and control body conditions (e.g. pH, temperature, blood pressure glucose levels)

- **<u>Sensors</u>** all over body **detect unacceptable** levels and signal the appropriate brain center (e.g. temperature sensors in skin stimulate brain if skin gets colder than 37° C).



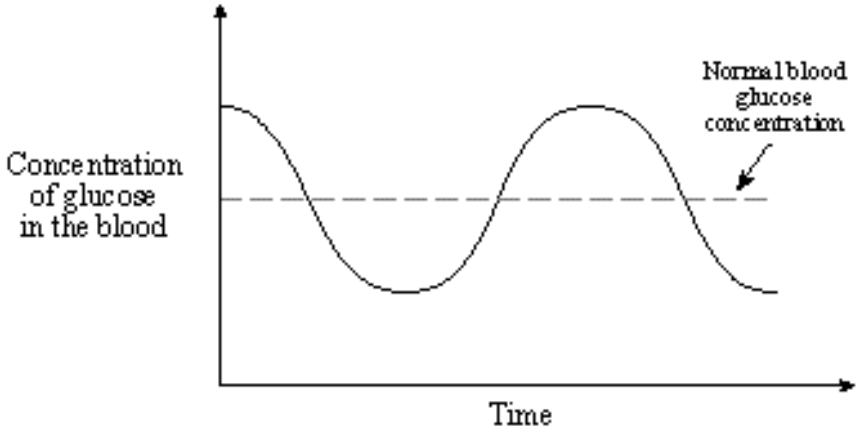
- **control center directs body** to behave in such a way that **normal state is regained** (e.g. shivering). This is called an adaptive response.

- Once normal state is regained, the **sensor stops signaling the brain center** (this the "*negative feedback part*"), so adaptive response stops.



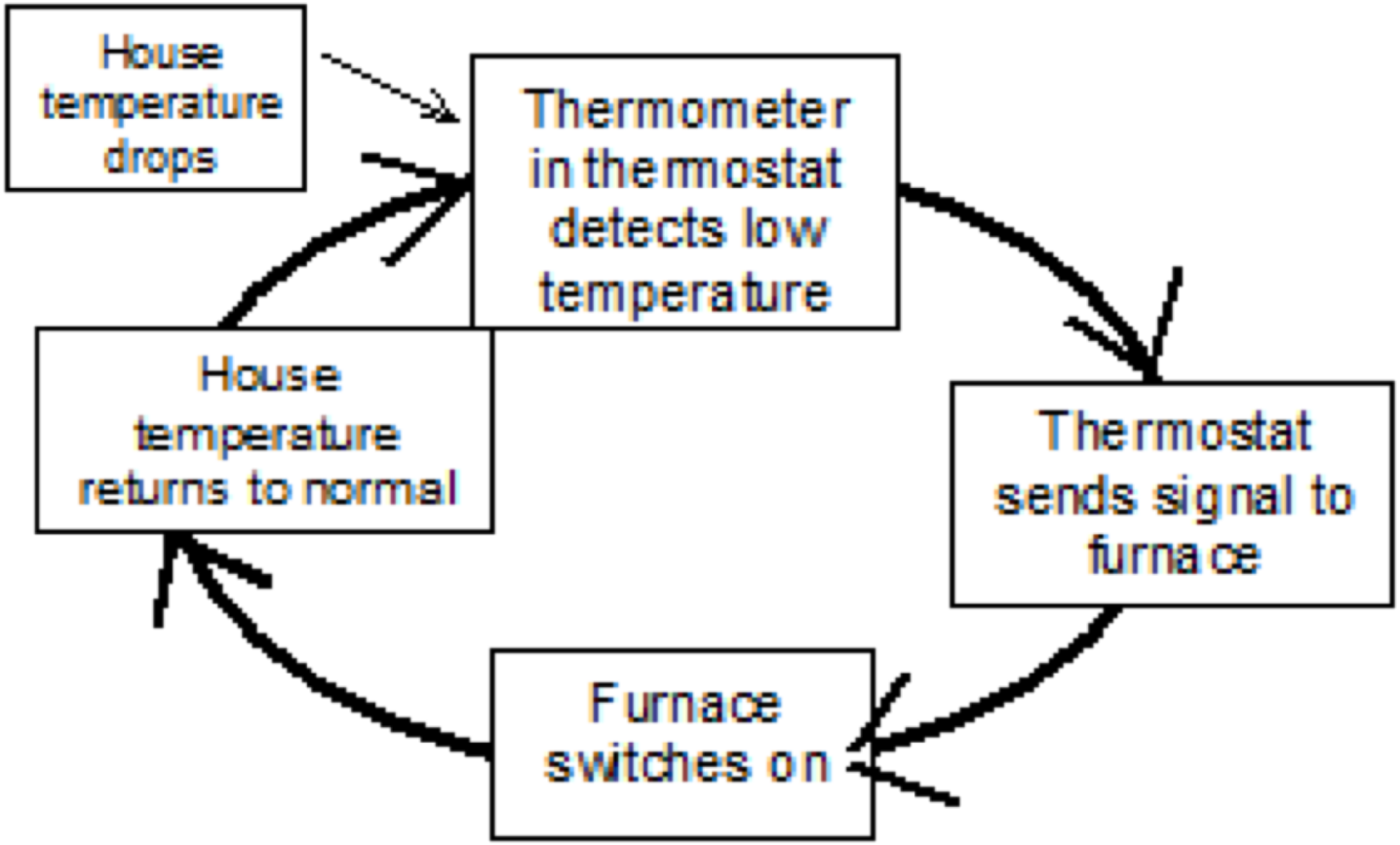
This results in a **FLUCTUATION** between two levels

- e.g. the concentration of glucose in your blood is almost never exactly 0.1%.
  - It's usually a little bit above or a little bit below.

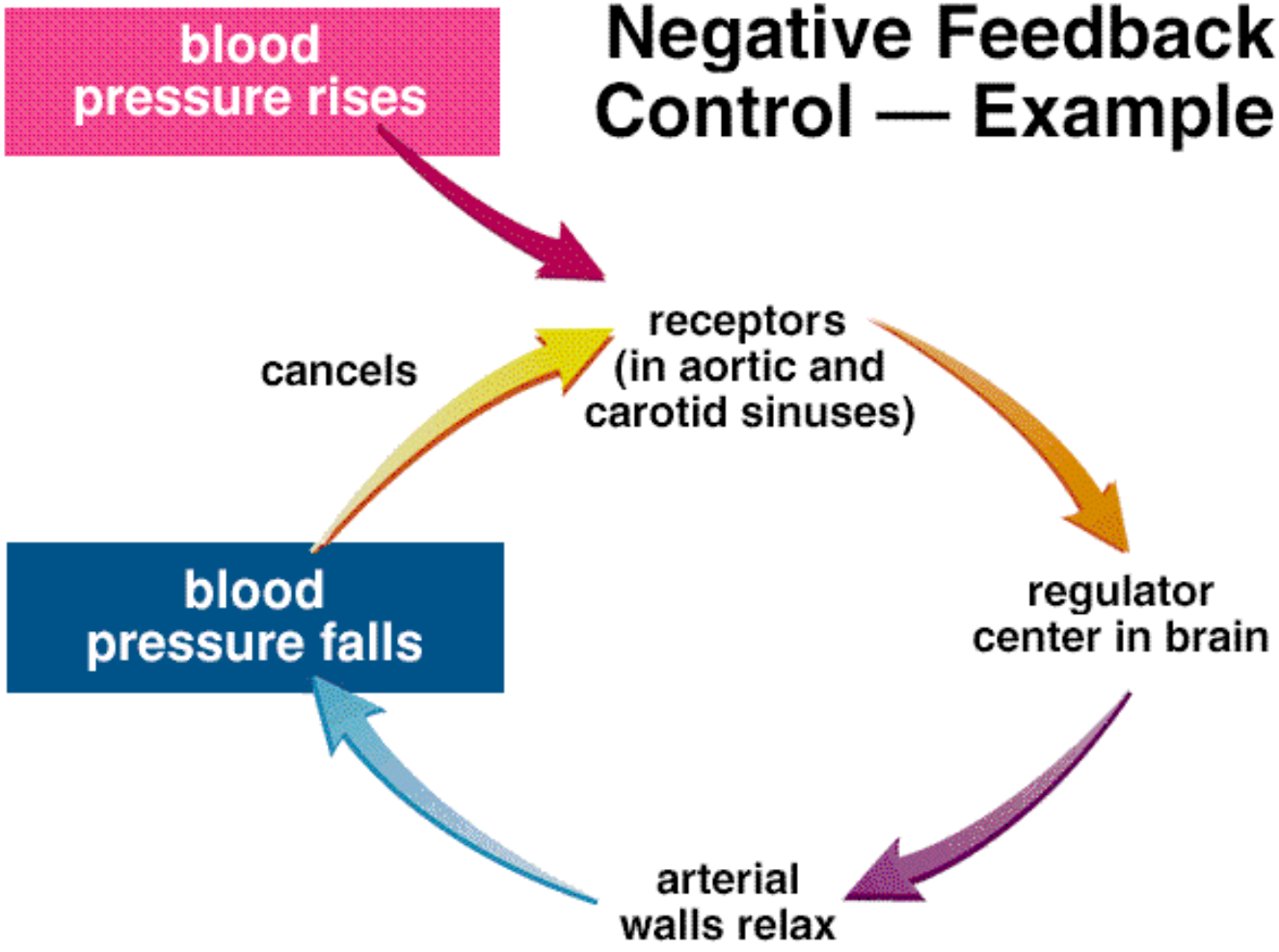


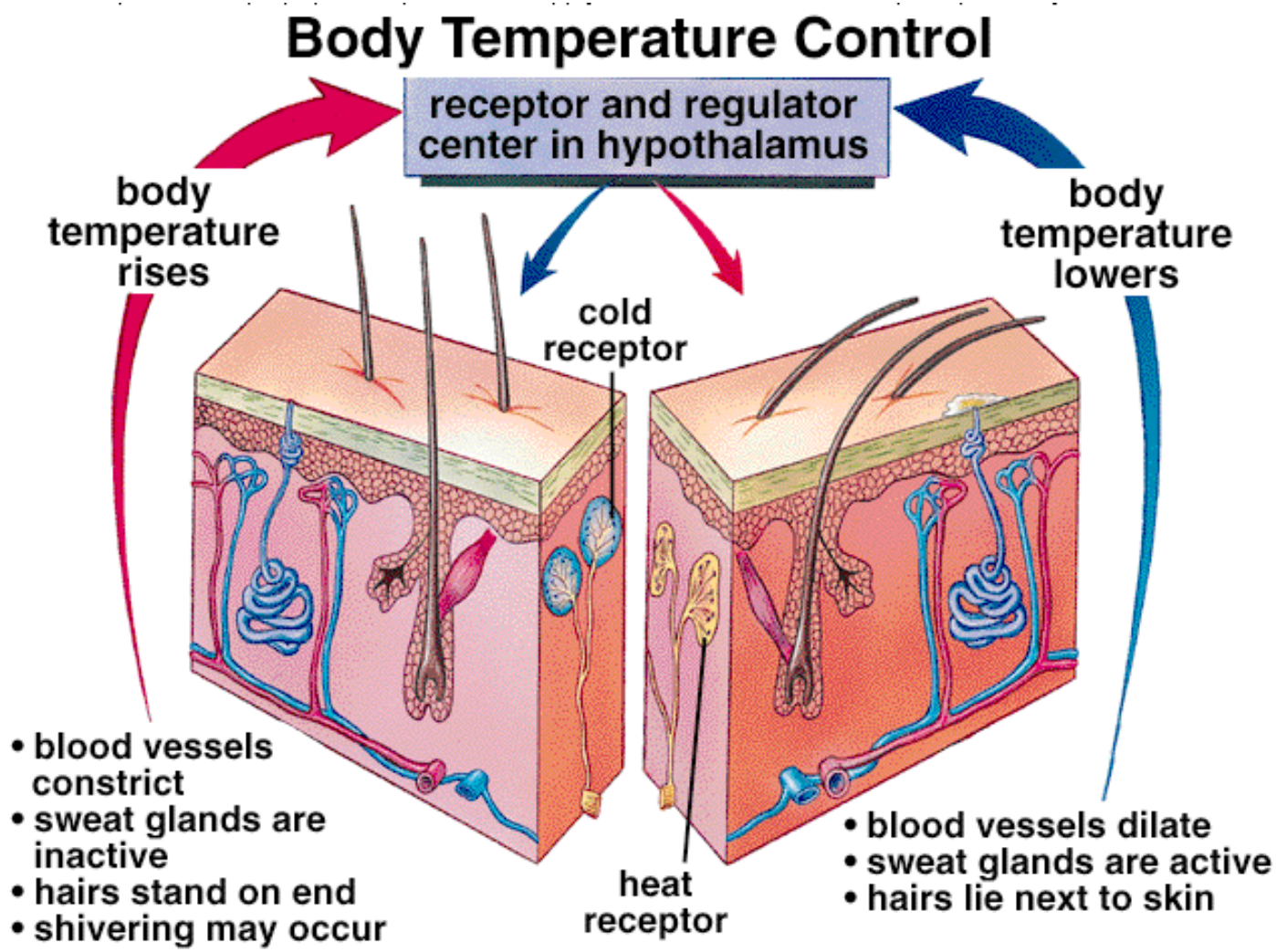
- Over the course of a day, though, it would average out to be exactly 0.1%.

Let's look at a classic example of negative feedback: temperature control in your house



Let's look at a few examples from our bodies



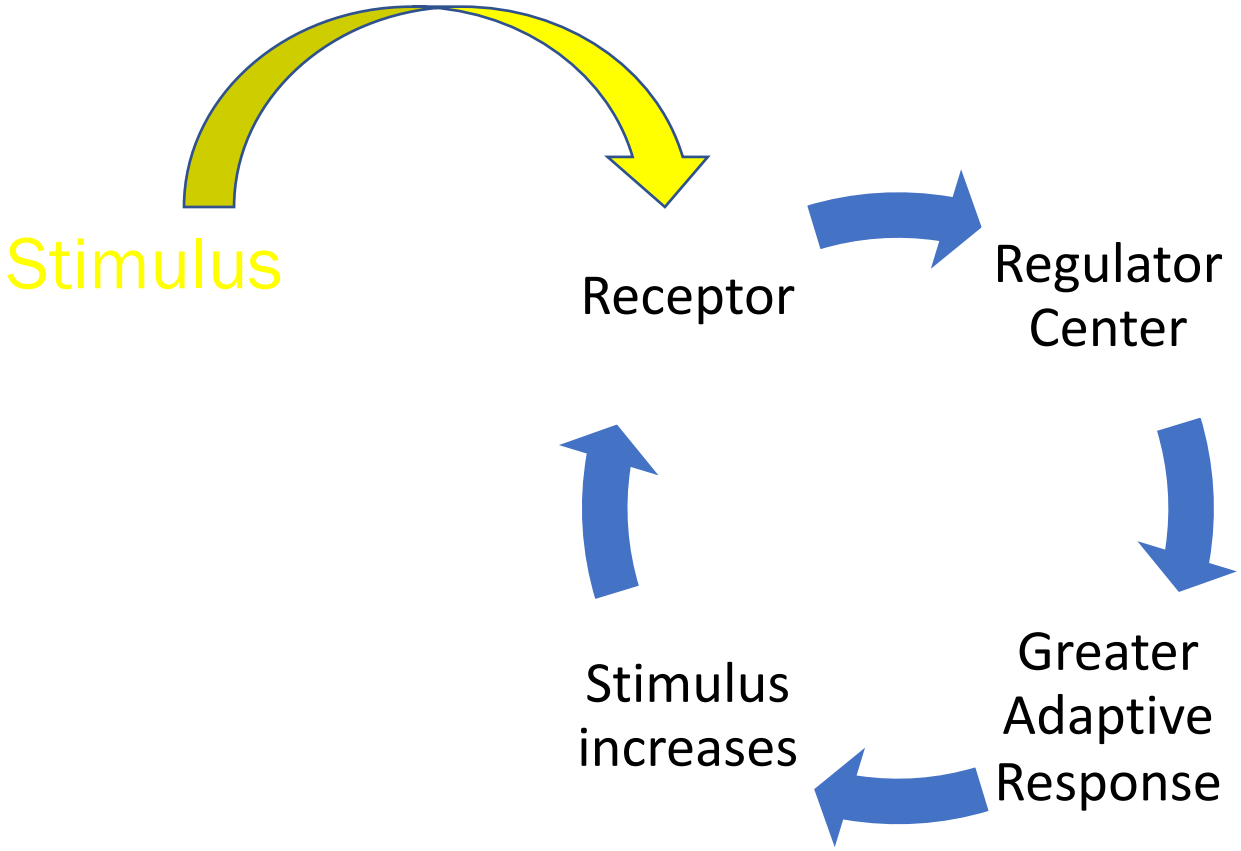


So it is negative feedback that keeps things constant in your body. There are thousands of these negative feedback cycles known. So what then is *positive feedback?* Snickers Ads

Positive Feedback

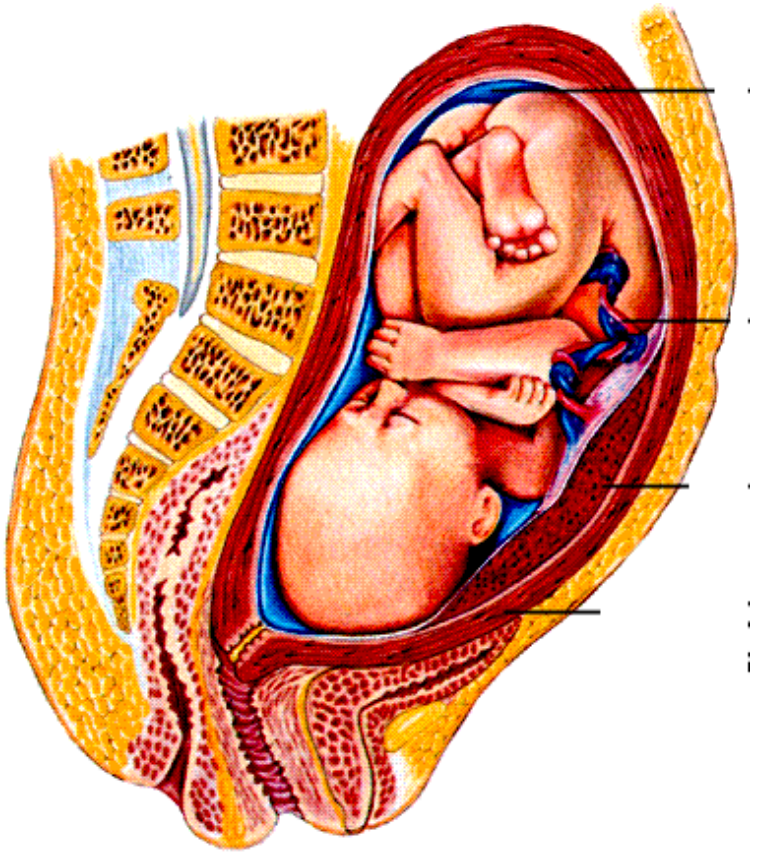
- **POSITIVE FEEDBACK** has a number of things in common with negative feedback, such also as requiring receptors and regulatory centers. However, in positive feedback, the stimulus **does not bring about an adaptive response that cancels the stimulus**. Instead, it causes the stimulus to be **increased**. This in turn causes a greater adaptive response, which in turn causes a greater stimulus, and so on. Obviously, this can't go on forever. A positive feedback cycle usually ends up in something being ejected from the body. Because of its nature, positive feedback has a much more limited range of usefulness than negative feedback

Positive Feedback

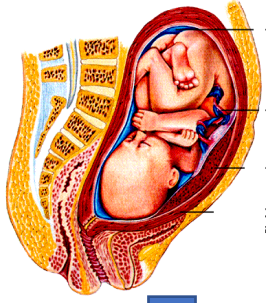


An Example from our body

Indeed, in Biology 12, there is only ONE specific example of positive feedback that you must know, and that is the positive feedback loop that occurs during **LABOUR** (childbirth) involving the hormone **OXYTOCIN**. Oxytocin is ***made in the* hypothalamus** and **stored in the posterior pituitary**. It causes the uterus to contract.



Just before birth, the growing baby's head exerts pressure against the cervix. This pressure triggers sensory nerves in the cervix to send a nerve signal to the posterior pituitary to release oxytocin. The oxytocin is released into the blood. When it gets to the uterus, it causes **stronger** uterine contractions, which causes greater stimulation of the sensory nerves, which causes more oxytocin to be released, which causes stronger uterine contractions, and so on. The cycle ends when the baby is pushed out of the uterus, stopping the stimulation of sensory nerves to the pituitary.



Baby pushing on cervix

Nerve signals to posterior pituitary

Oxytocin into blood

Stronger Uterine Contractions

Greater Stimulation of Sensory nerves