

## Hormones are one form of communication in our body

Together, the **endocrine** and **nervous** systems are responsible for most of the communication in our bodies

Our **endocrine organs** secrete **hormones** into our bloodstream

These hormones travel in our bloodstream and **bind to receptors on specific target tissues**

Because hormones only bind receptors on target tissues:

- Their effect is not felt immediately (usually minutes to hours)

- They have LARGE effects on the body at small concentrations (usually in the nM range!)

- Their effects can be long lasting (months in the case of pregnancy)

## Hormones are one form of communication in our body

Remember that hormones work to regulate function **within** our body

**Pheromones** are a special category of chemical messengers that mediate interactions **between** individuals

Pheromones are common in many groups of animals:

- species recognition

- territory marking

- navigation

- parent-offspring interactions

- reproduction (gender recognition, sex attractants, receptivity indication, etc.)

**Human pheromones** are probably unimportant: only one or two conclusively demonstrated (control timing of female reproductive cycles). **NO** proven sex attractants, social indicators, etc.

## Hormones are one form of communication in our body

Because there are so many types of hormones, they play a wide range of roles:

- Changes in plasma membrane **permeability** (electrical state)

- Synthesis of proteins** within the cell

- Activation** of enzymes

- Stimulation of **mitosis**

- Promotion of **secretory activity** by the cell (sometimes stimulates secretion of more hormones)

## Hormones are chemical substances

There are 100s of hormones produced by our bodies

All can be classified chemically as:

- amino acid based molecules**

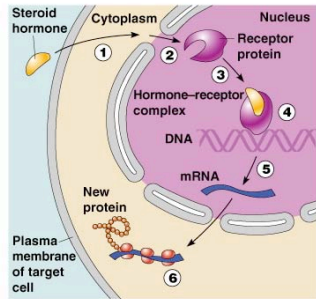
- steroids (derived from cholesterol)**

- prostaglandins** (another lipid-derived messenger molecule)

As we'll see in a minute, a hormone's composition greatly affects its mechanism of action

## The mechanism depends on the composition

**Steroid hormones** can freely pass through the cell membrane, so they have a different mechanism of action than **amino acid-based hormones**

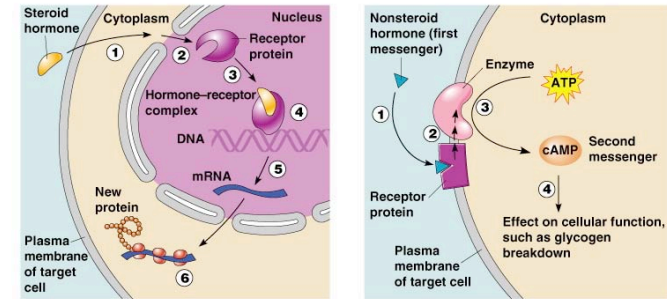


(a) Steroid hormone action

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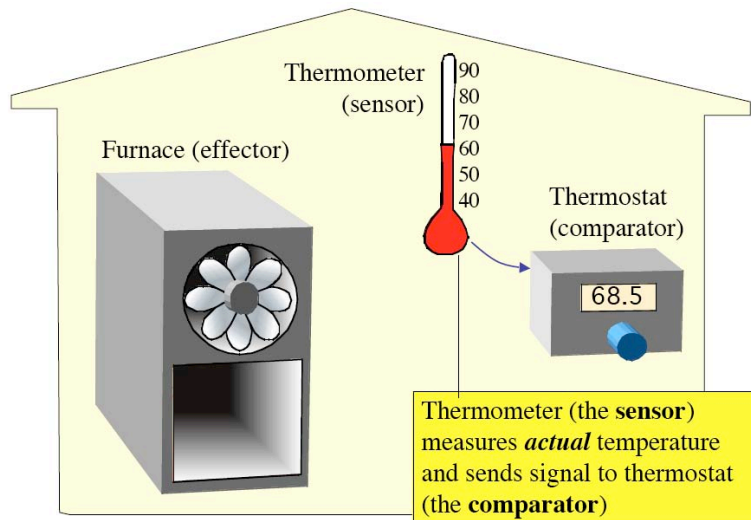


(a) Steroid hormone action

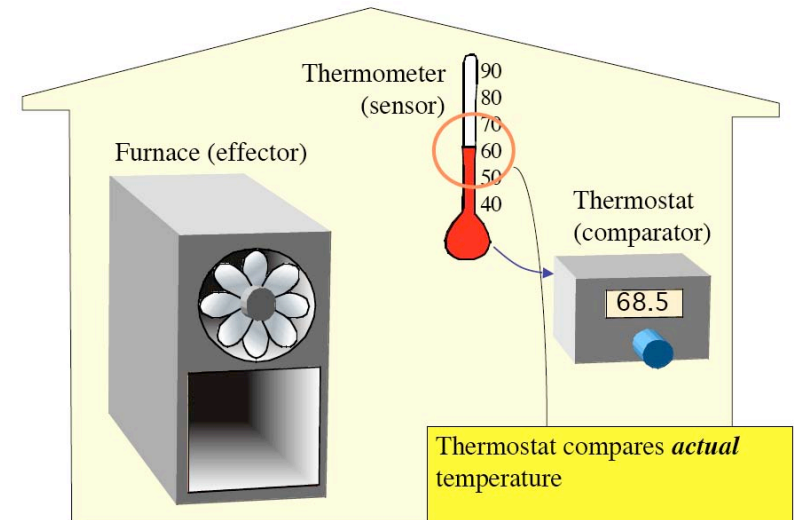
(b) Nonsteroid hormone action

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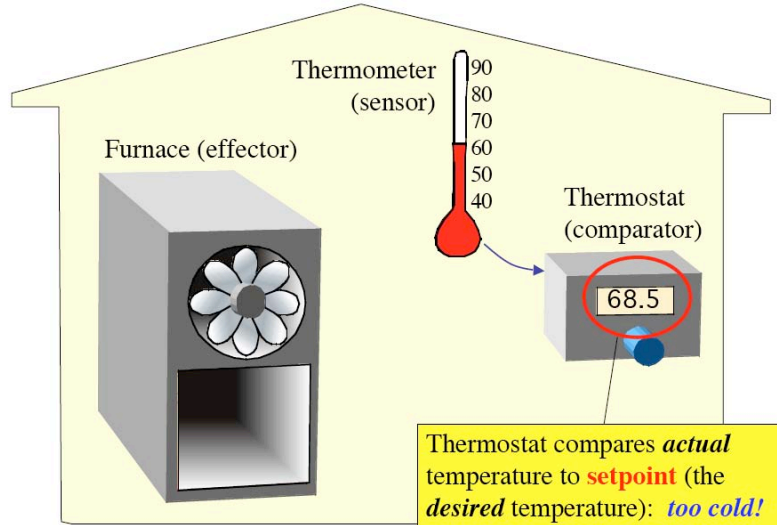
## Negative feedback example: home heating system



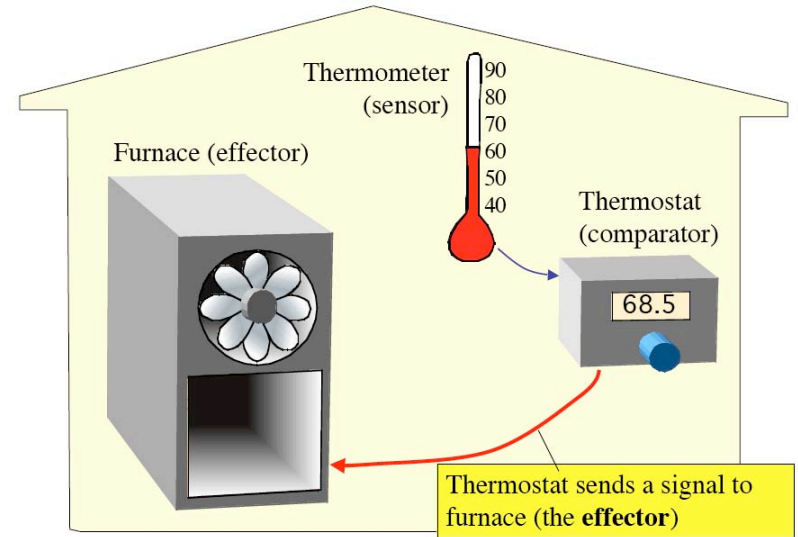
## Negative feedback example: home heating system



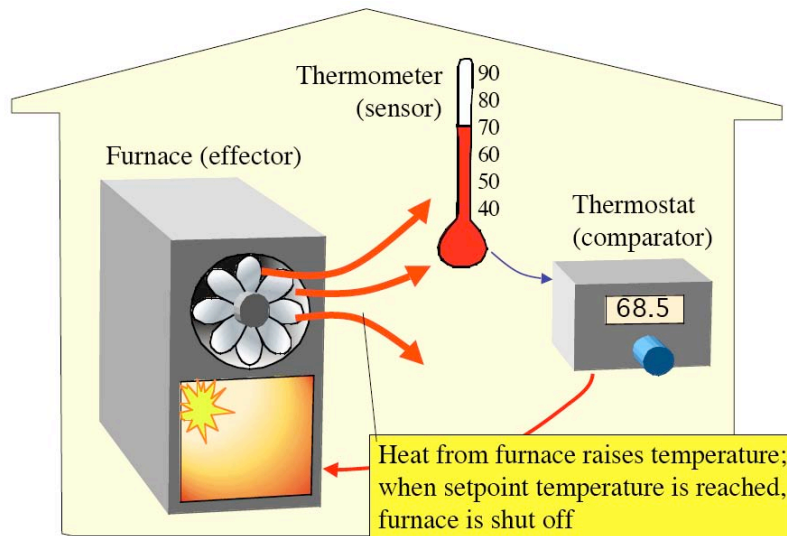
Negative feedback example: home heating system



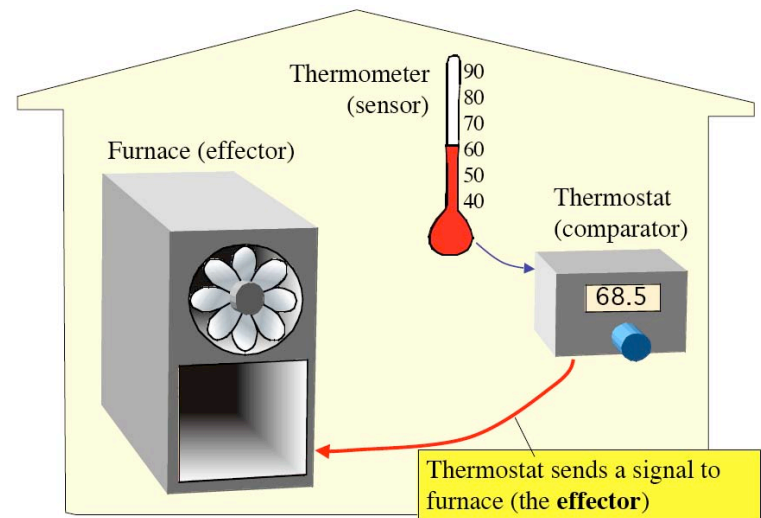
Negative feedback example: home heating system



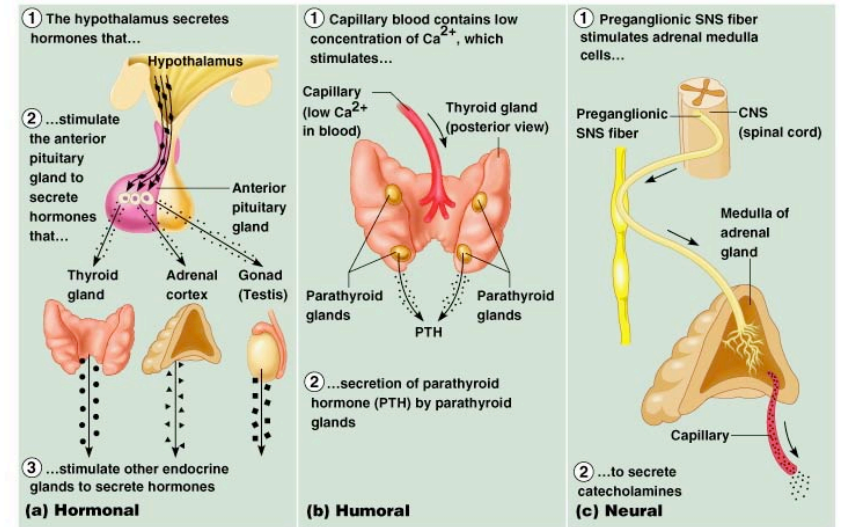
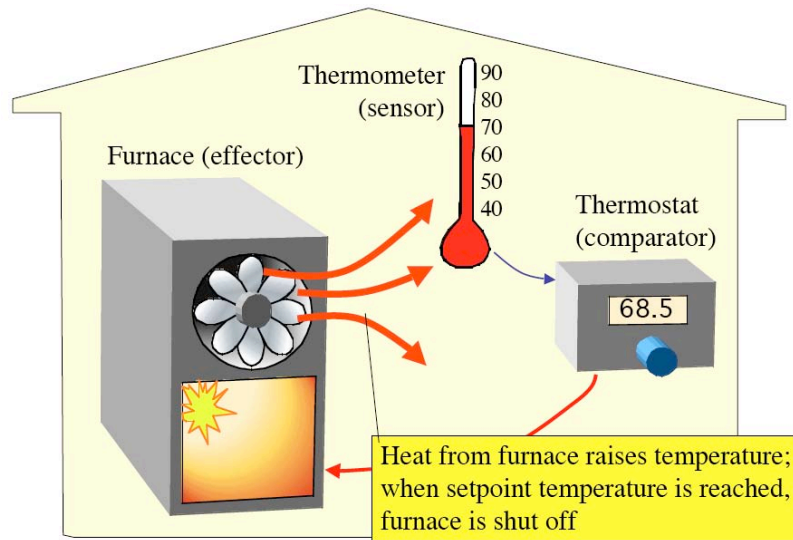
Negative feedback example: home heating system



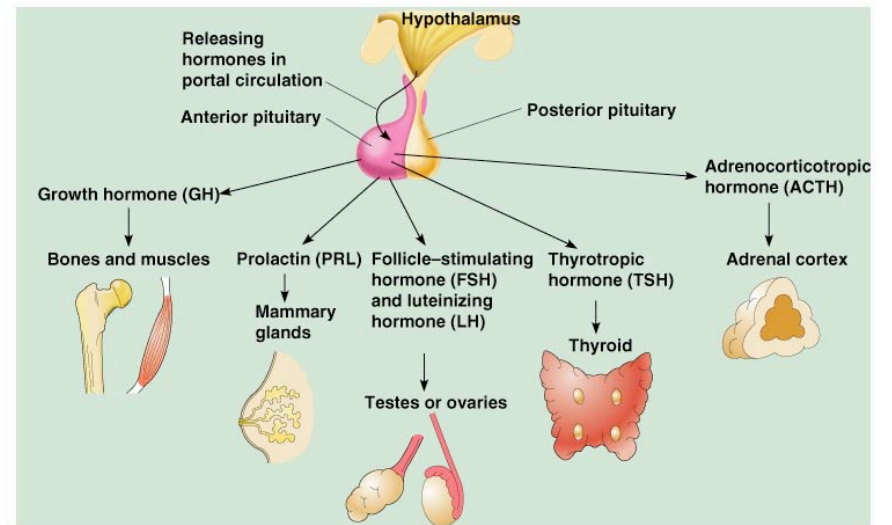
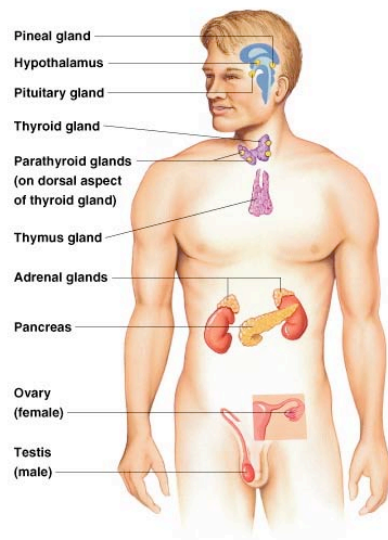
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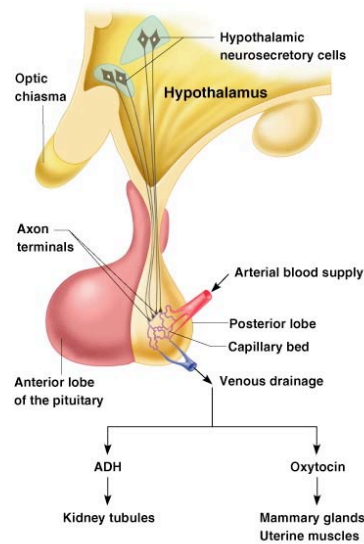
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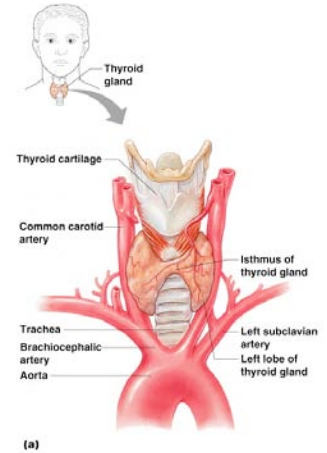
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## The thyroid gland regulates our metabolism

Thyroid hormone consists of two hormones,  $T_3$  and  $T_4$   
Controls the rate at which glucose is burned or oxidized

**Iodine** is essential for the formation of these hormones

**Calcitonin** lowers blood calcium levels



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## Parathyroid hormone counteracts calcitonin

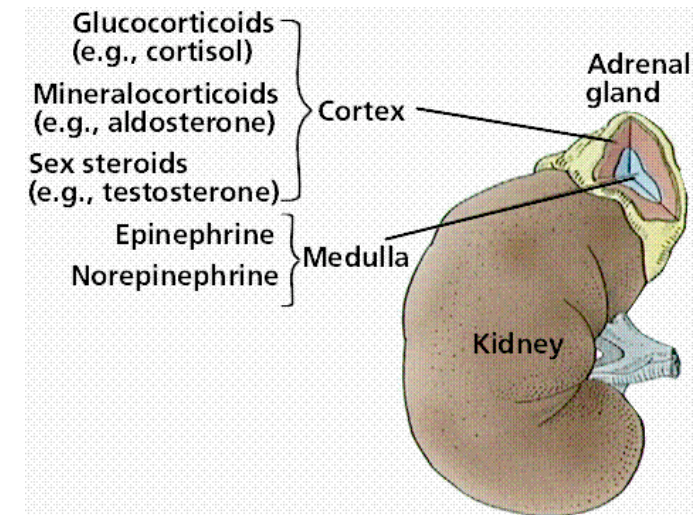
The parathyroid glands are located on the posterior surface of the thyroid gland

They secrete **parathyroid hormone**, which causes an **increase in blood calcium levels**

*Where does the calcium come from?*

*What type of cell "releases" it?*

Because PTH and Calcitonin counteract each other, we call them **antagonists**; lots of hormones act antagonistically.



## Adrenal cortex hormones

### *Mineralcorticoids* (mainly *aldosterone*)

Regulate water and electrolyte balance of the body by targeting *kidney tubules* for selective reabsorption of ions

Aldosterone regulates blood sodium levels (and thus blood pressure)

### Cortisone and cortisol

Work in the management of long-term stress by promoting glucose metabolism, release of prostaglandins, reducing swelling

### *Sex hormones*

Made in low amounts throughout life

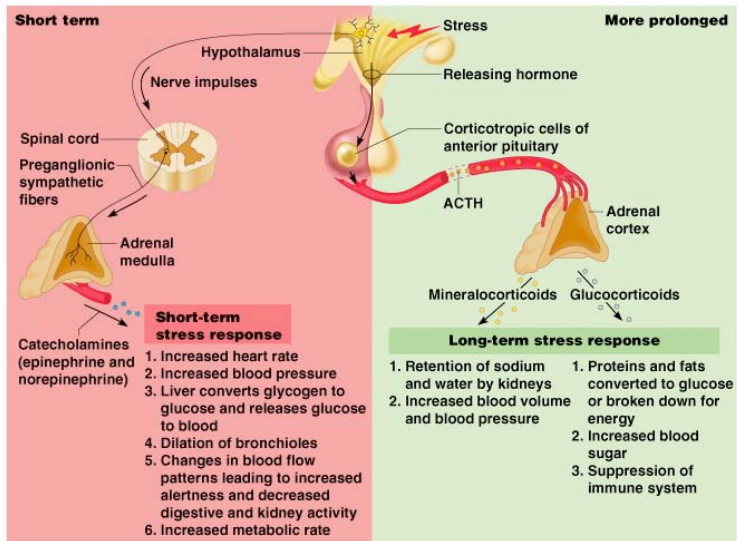
Mainly androgens are made

Some estrogens are also made here

## Adrenal medulla hormones

Stimulated by the sympathetic nervous system to secrete its hormones

*Catecholamines* (adrenaline or epinephrine) are released

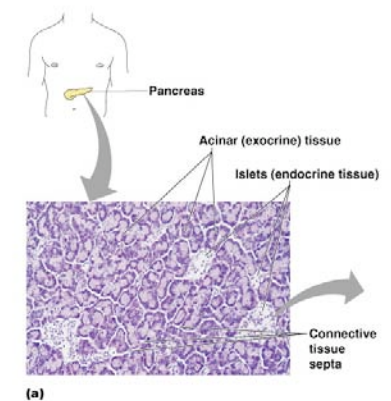


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## Pancreatic Islets

*Beta cells* secrete the hormone insulin, which signals cells to “take up” more circulatory glucose, reducing blood glucose levels

The hormone glucagon acts as an antagonist to insulin, causing glucose release from the liver during times of low blood sugar; it is secreted by alpha cells



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## Pineal gland

Pinecone shaped gland located in the brain's third ventricle  
Melatonin is secreted  
Melatonin levels are highest at night, and are lowest around noon  
Believed to regulate the sleep cycle as well as regulate the timing of sexual maturity

## Thymus gland

Located in the upper thorax, posterior to the sternum  
Secretes *thymosin* which helps the thymus act as an incubator for *T cells*, which help boost your immune response

## Ovarian hormones

Product estrogens and progesterone  
Estrogens are produced by *Graafian follicles* and promote the development of secondary sexual characteristics in females  
Estrogens also play a large role in the *menstrual cycle* and help the breasts to produce milk  
Progesterone quiets the muscles of the uterus during pregnancy to discourage abortion  
Progesterone is secreted by the *corpus luteum*

## Testicular hormones

Testosterone is the most important of the androgens secreted by the testes  
Causes development of male sex characteristics  
Necessary for continued production of sperm

## The placenta

Has many sustaining qualities for growing babies

Human chorionic gonadotropin (hCG) is produced early in pregnancy to signal the ovaries to continue producing estrogen and progesterone so the uterine lining is not sloughed off

Later, the placenta produces its own estrogen/progesterone

Human placental lactogen also functions to prepare the breasts for lactation