

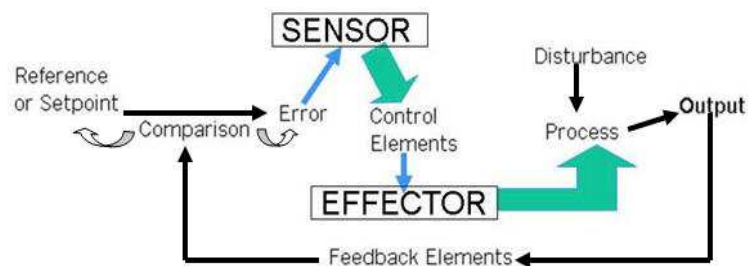
# THE HOMEOSTASIS MODEL: A Flow Diagram *featuring the BODY TEMPERATURE REGULATION story*

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Based on material presented at the HAPS, 2000

## THE PARTS OF THE HOMEOSTASIS MODEL



**Control Systems General Model**  
Adapted from presentation at HAPS, 2000

## REFERENCE OR SETPOINT <sup>Comparison</sup> →

- Is a starting point.
- Is often called the “normal” value.
- May be an arithmetic average.
- May be the middle value (midpoint) of a range of values.
- May be the most frequently occurring value.

Normal Body Temperature of 98.6° F.

## ERRORS OCCUR!

- Errors are *Normal changes*, usually gradual.
- *Normal variation* around the set point within a range of values is an error.

Normal thermogenic mechanisms like exercise and digestion (diet-induced thermogenesis) can raise body temperature slightly.

Deviation in values away from  
the set point triggers a  
**COMPARISON**

REFERENCE OR SETPOINT  $\xrightarrow{\text{Comparison}}$  ERROR  $\longrightarrow$

Body temperature increases to 99° F.  
which is above the set point of 98° F.

**CONTROL ELEMENTS  
ACTIVATED BY SENSORS**  $\longrightarrow$

- Sensors pick up the change.
  - They are a type of receptor.
  - They activate a control element to stimulate a process.

Central thermoreceptors sense the  
increase in core body temperature.

## CONTROL ELEMENTS ACTIVATED BY SENSORS

- The Nervous System is a control element.
- The Endocrine System is another control element.

The Nervous System—specifically the *hypothalamic thermoregulatory center*-- is activated by the increase in core body temperature.

## CONTROL ELEMENTS ACTIVATED BY SENSORS

- The Nervous System is a control element.

The *hypothalamic thermoregulatory center* activates the descending reticulospinal tract. This tract synapses with preganglionic sympathetic neurons of the autonomic nervous system .

Preganglionic neurons synapse with cholinergic postganglionic neurons in the sympathetic chain.

CONTROL ELEMENTS USE EFFECTORS  
TO TRIGGER A PROCESS THAT  
PRODUCES AN OUTPUT.

- The Control Element stimulates the effector to trigger a process.

Cholinergic postganglionic sympathetic neurons synapse with sweat glands and blood vessels in the skin.

CONTROL ELEMENTS USE EFFECTORS  
TO TRIGGER A PROCESS THAT  
PRODUCES AN OUTPUT.

- The *Process* is a series of steps that produces a correction—an *Output*.

Sweat glands produce sweat. Sweat moves through the duct and pore of the sweat gland to the surface of the body.

Cholinergic sympathetic stimulation causes vasodilation of peripheral blood vessels. Vasodilation causes blood to move to the surface of the body and heat exchange with the environment occurs.

**CONTROL ELEMENTS USE EFFECTORS TO TRIGGER A PROCESS THAT PRODUCES AN OUTPUT.**

- The *Output* is produced by the effector(s) and is the immediate result of the process.

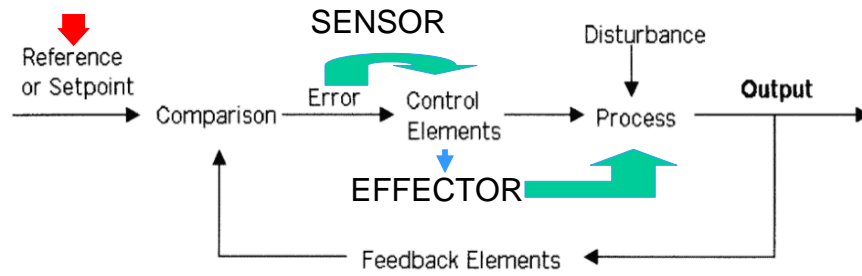
The body cools down.

**FEEDBACK ELEMENTS ARE THE RESULT OF THE OUTPUT—THEY RETURN THE BODY TO NORMAL**

- The Output should correct the error.
- Compare the result of the *Output* to the *Set point*.

The new 98.6° F. body temperature is compared to set point!

AN ANIMATED VERSION OF THE MODEL WITH A PATHOLOGICAL DISTURBANCE LOOKS LIKE THIS



**FEVER IS A DISTURBANCE.**

Chemicals called **PYROGENS** are secreted during the immune response. They act on the hypothalamic thermoregulatory center and set point increases.