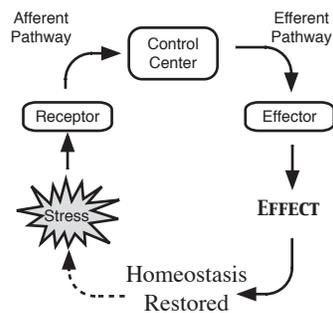


Feedback Systems

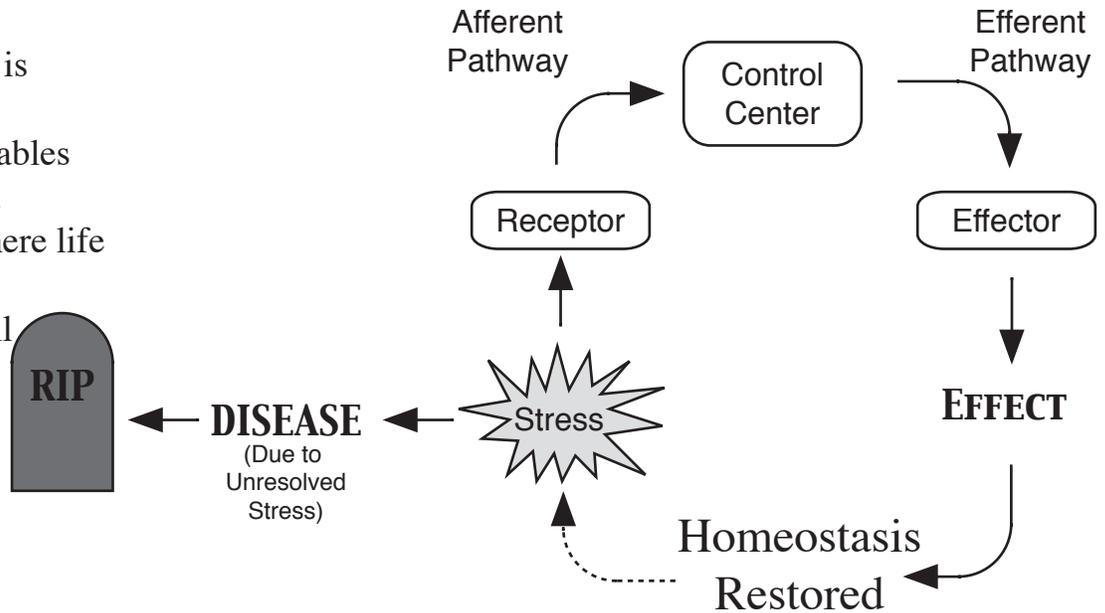
An Introduction to
Negative and Positive Feedback Systems
with emphasis on
Homeostasis and Stress



By Noel Ways

Control Paradigm (Negative Feedback System)

Homeostasis refers to the processes whereby the body is able to control physiological variables within precise and optimal ranges where life may be sustained. Such variables will include body temperature, blood pressure, ion and mineral concentrations, etc. Each variable will be monitored by a control center by comparing it to a genetically predetermined set point. Should the variable have deviated above or below the set point, a state of "stress" will have occurred, and the system will effect some change to rectify the "stress", and negate the initial stimulus.

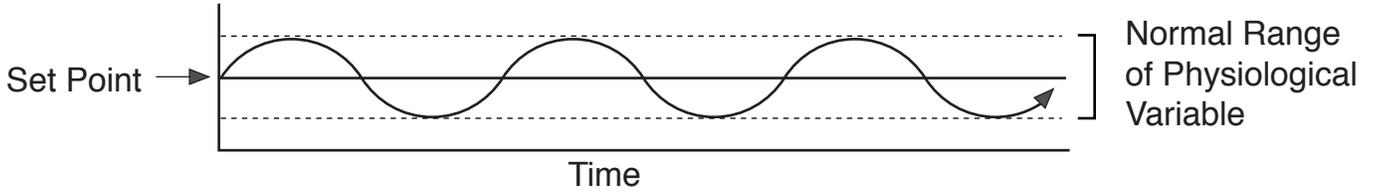


A Disruption of
Homeostasis will Activate the
System.

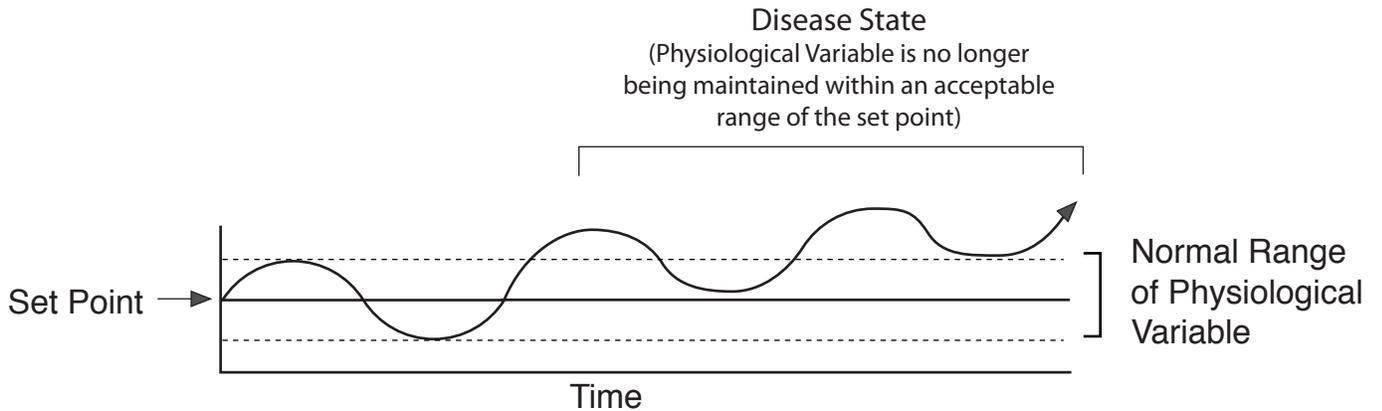
System Inactivated
Once Homeostasis
is Restored

Such a system is called a negative feedback mechanism. And it operates by collecting information via receptors and transmitting this information to a control center by an afferent pathway. Should the control center "determine" that state of stress exists, then an efferent pathway will be utilized to communicate to a particular effector to operate to bring the variable back to the set point, thereby restoring homeostasis. Once the effector does its job, the stress is eliminated and homeostasis is restored. Here a negative feedback mechanism negated the initial stimulus that set the system in motion.

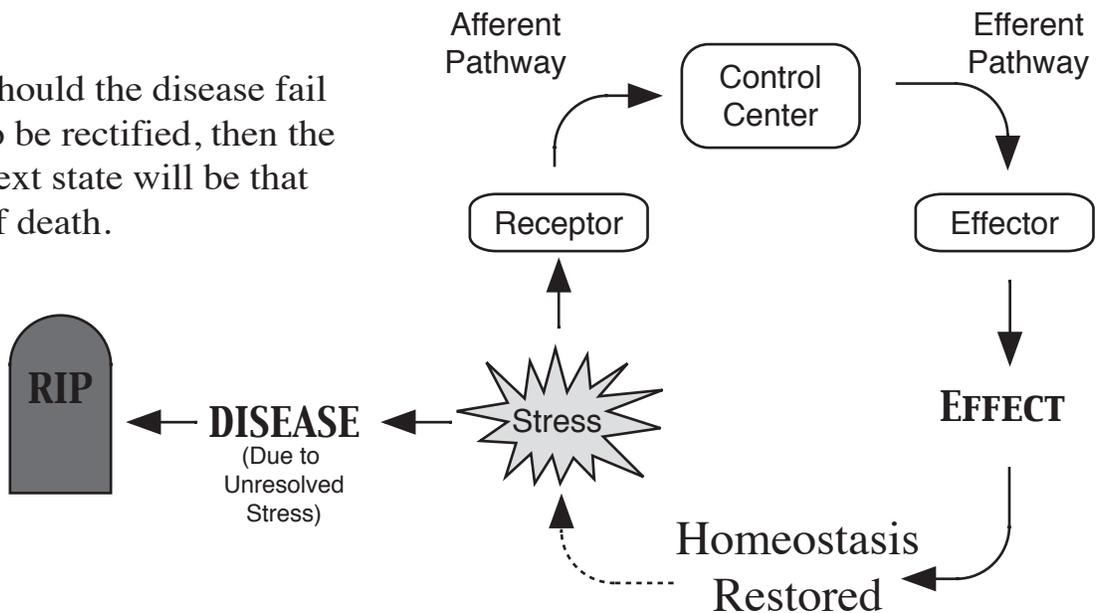
In the diagram below, note that a particular physiological variable will oscillate within an acceptable range above and below the set point. Each time the variable deviates above or below the set point, the appropriate negative feedback system will bring the variable back to the set point.



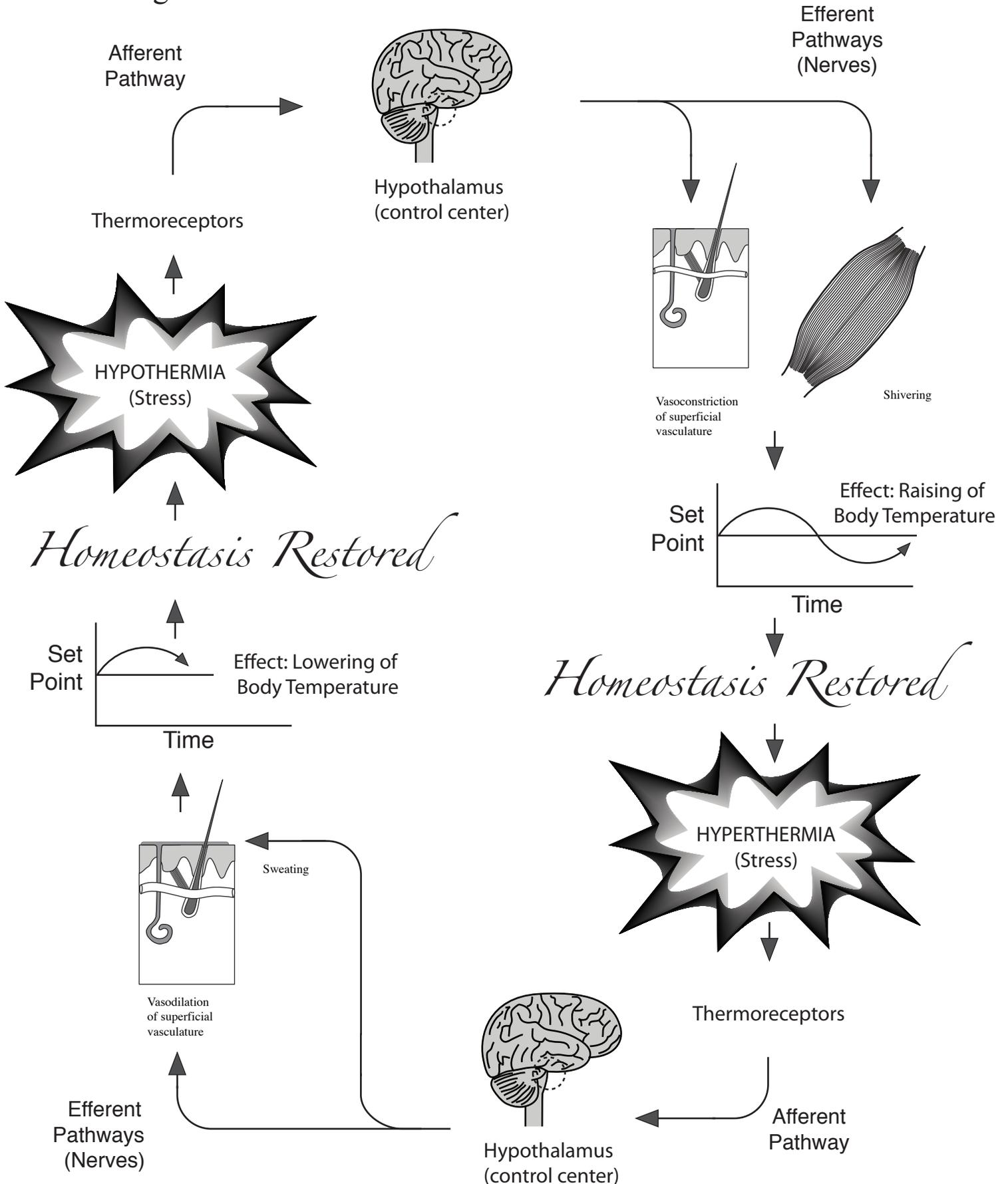
Should a particular negative feedback mechanism fail to maintain its particular physiological variable around its set point, then the body will remain in a state of ongoing stress. Such a state is called "disease". Should the disease fail to be rectified, then the next state will be that of death.



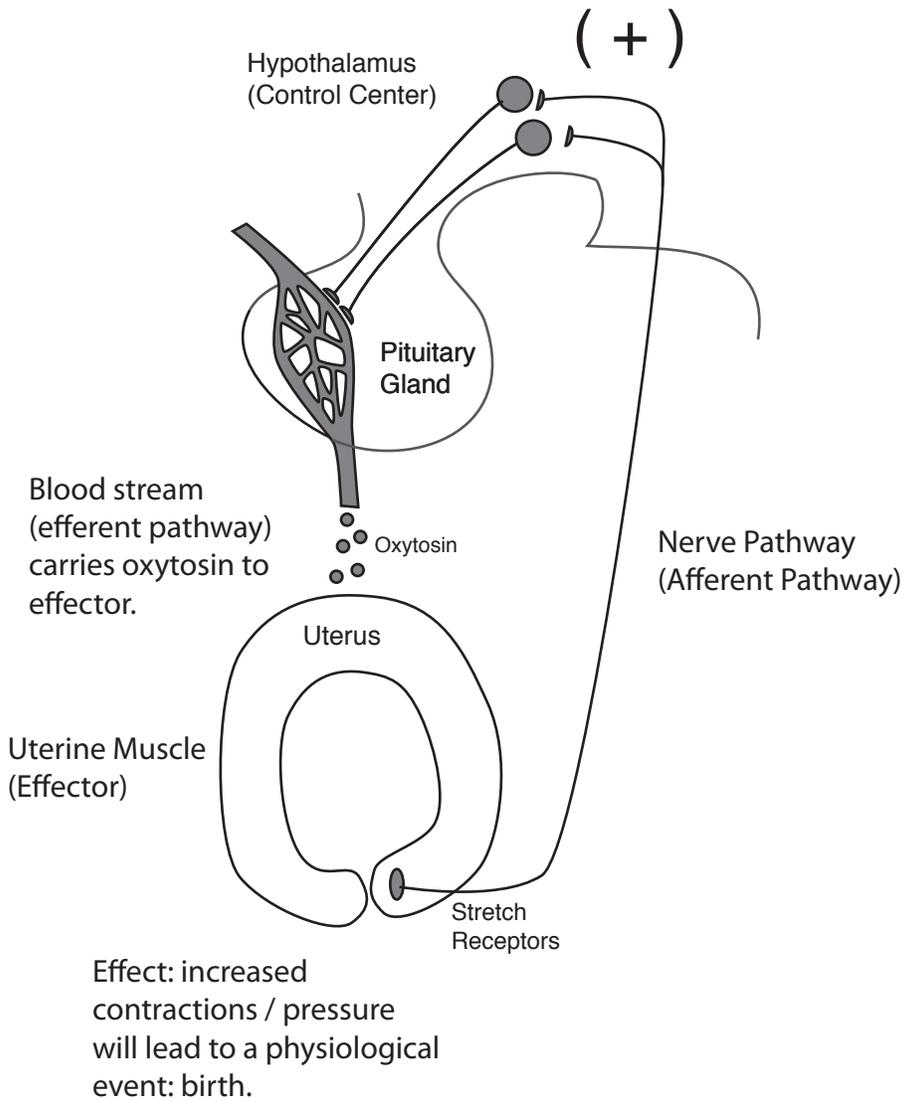
Should the disease fail to be rectified, then the next state will be that of death.



Example of a Negative Feedback System: Thermoregulation



Example of a Positive Feedback System: Childbirth



Childbirth: an example of a positive feedback mechanism. Whereas a negative feedback mechanism will serve to reduce or negate the original stimuli, a positive feedback mechanism will enhance and reinforce the original stimuli. The result will be a building process that culminates in a physiological event in time. It is only after the event occurs that the system ceases. In the case of childbirth, the initial stretching of the cervix causes local stretch receptors to send nerve impulses (afferent pathway) to the hypothalamus (control center), which will cause the pituitary gland to secrete oxytocin into the blood stream (efferent pathway). The oxytocin causes the uterus to contract resulting in further stimulation of the stretch receptors. These receptors will further signal the hypothalamus to yet again have the pituitary gland secrete more oxytocin. The cycle continues with ever increasing contractions as more and more oxytocin is secreted. Eventually, the pressure reaches such force that the baby is expelled (a "threshold" has been reached), and the system ceases.

