

Homeostasis

Regulator & Conformer

When things work...

Honda Accord 'Cog' commercial

http://www.youtube.com/watch?v=_ve4M4UsJQo



Homeostasis



- Regulation of internal environment through the constant physiological adjustments of the body in response to external environment changes
- also known as dynamic equilibrium
- Requires expenditure of energy

Example of homeostasis

- Brainstorm 3 physical effects observed in your body when you exercise.



Homeostasis of exercising

- Sweat
- Increased heart rate and breathing rate
- Muscle ache

What are these factors trying to counteract?



Homeostasis of exercising: counteraction

- Sweat: increase in body temperature
- Increased heart rate and breathing rate: increased oxygen demand
- Muscle ache: increased cellular respiration (but anaerobic because oxygen isn't enough)

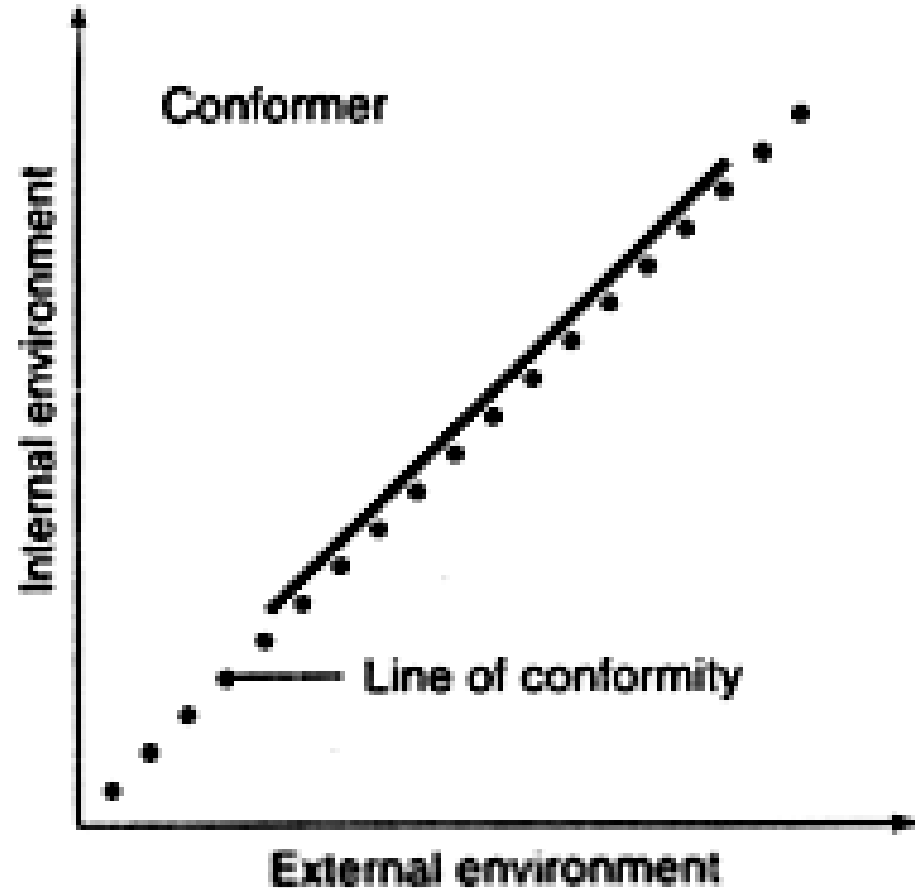
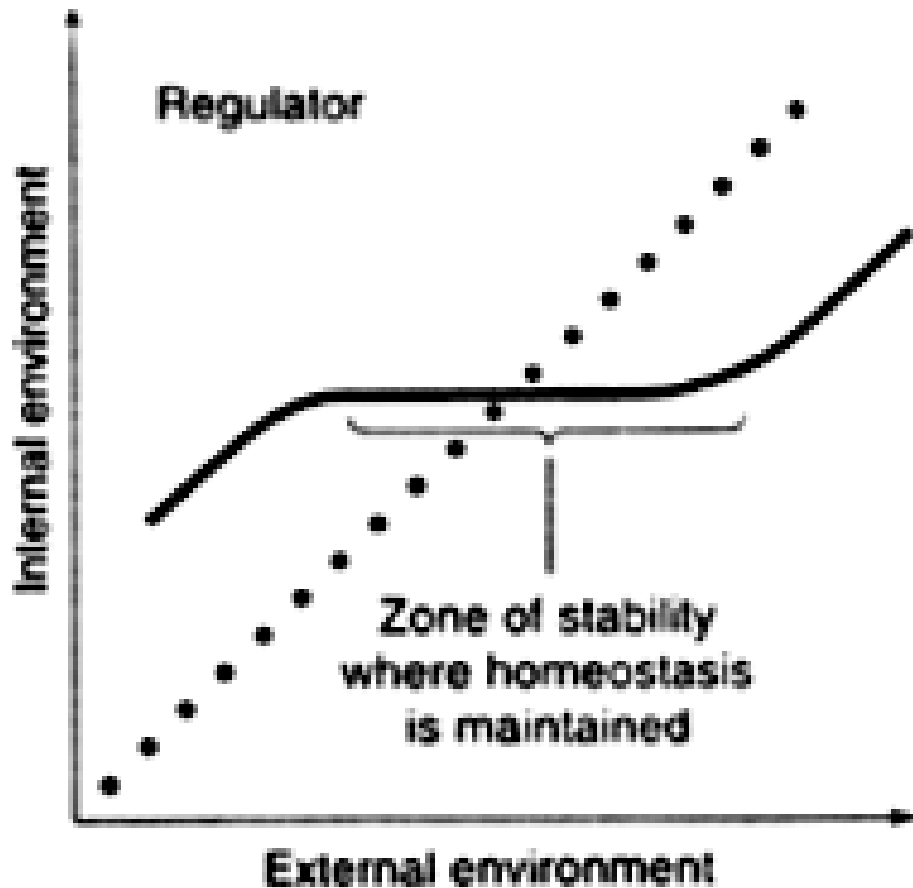


Homeostasis of exercising

- Body temperature increases
 - evaporation of sweat to cool off
- Oxygen levels being used up
 - heart and breathing rate increases to increase blood flow
- Increased cellular metabolism
 - pancreas signals breaking down of biomolecules



Regulation and Conformity



Regulator

- Organisms that moderate internal changes in the face of external fluctuations
- Examples:
 - Glycoregulator: humans
 - Oxyregulator: humans, minnows

Fathead minnows survived over the winter in an ice-covered lake with seasonally **low oxygen** concentrations by **increasing the use of anaerobic pathways** for the production of energy. (Klinger et al. 1982)

Conformer

- Organisms that allow conditions within their body to vary with external changes
- Tend to live in stable environments
- Examples:
 - Glycoconformer: bacteria
 - Oxyconformer: Trout
 - Osmoconformer: marine invertebrates



Spider Crab (*Libinia emarginata*).
Will lose or gain water to conform to external environment even when this internal adjustment causes death.

Continuum



- The same organism can be both a regulator and conformer of different variables
- Example: Pacific salmon
 - osmoregulator (fresh water and salt water)
 - thermoconformer

Continuum

- The same organism can be both a regulator and conformer of the same variable depending on their stage in life
- Example: Minnow
 - Oxyconformer: larvae stage
 - Oxyregulator: when mature



Continuum

- The same organism can be both a regulator and conformer of the same variable depending on the environmental condition



Lizard (*Anolis cristatellus*)

- Thermoconformer: when in the forest its not worth the risk of traveling long distances to find a sunny patch)
- Thermoregulator: when in open habitats it has a behavioural adaptation to warm up by basking in the sun

Summary of organism examples

Variable	Regulator	Conformer
Sugar levels (glyco)		
Oxygen use (oxy)		
Temperature (thermo)		
Salinity (osmo)		

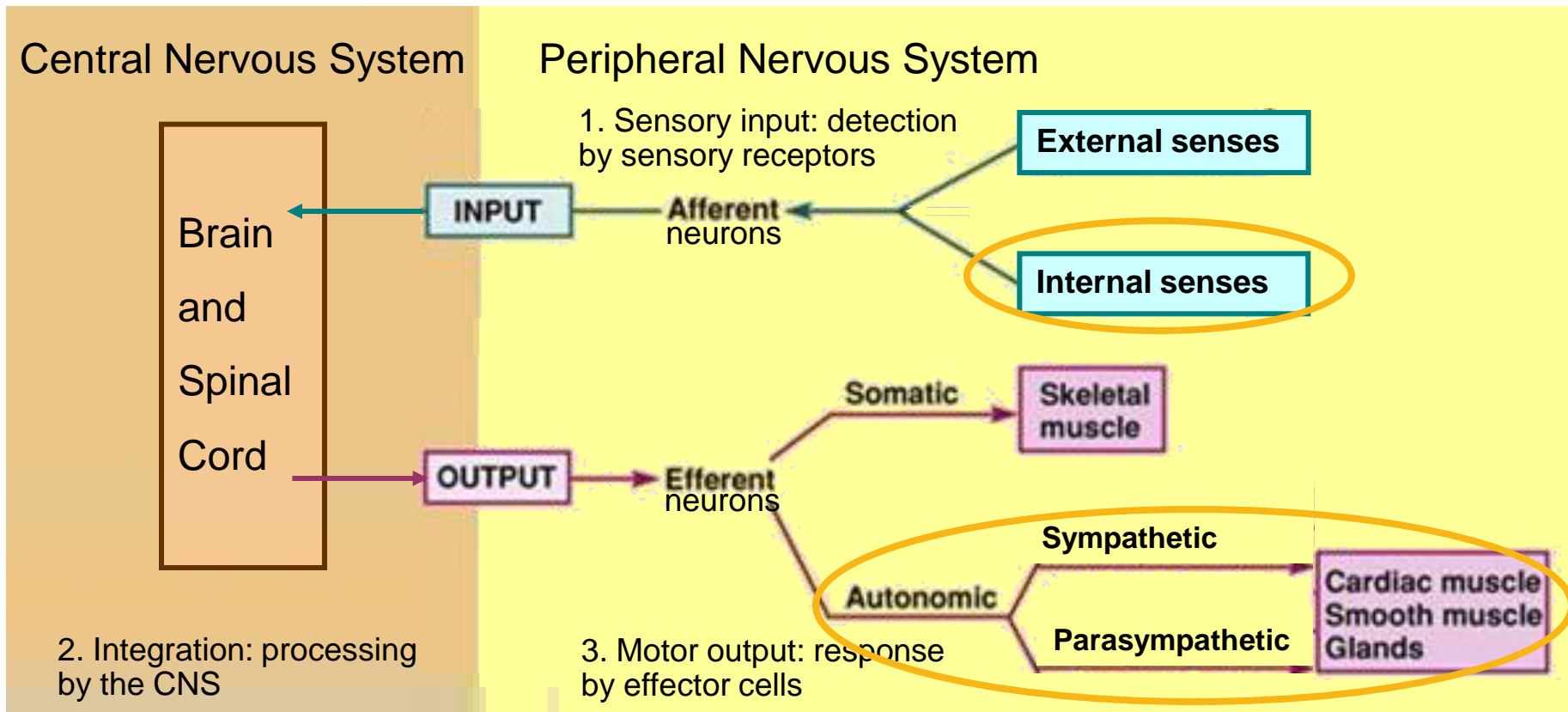
Summary of organism examples

Variable	Regulator	Conformer
Sugar levels (glyco)	■ Humans	■ Bacteria
Oxygen use (oxy)	■ Humans ■ Minnow (mature)	■ Trout ■ Minnows (larvae)
Temperature (thermo)	■ Endotherms ■ Lizards in open	■ Pacific salmon ■ Lizards in forest
Salinity (osmo)	■ Pacific salmon	■ Marine invertebrates

Nervous vs Endocrine System

- Nervous system: coordinates **rapid** responses to stimuli via action potentials (**electrical** signal)
- Endocrine system: coordinates **long-term** responses using **chemical** signals (hormones)

Integration of nervous and endocrine



Dual roles of some hormones

- Some chemicals are both hormones in the endocrine system and signals in the nervous system
- Example: epinephrine
 - “flight or fight” hormone produced by adrenal medulla (endocrine gland)
 - Neurotransmitter that conveys message between neurons

Hormones

- Chemical signals carried by blood and cause specific changes in target cells
- Function:
 - regulate energy use, metabolism and growth
 - maintain homeostasis

Effector (Target) Cell

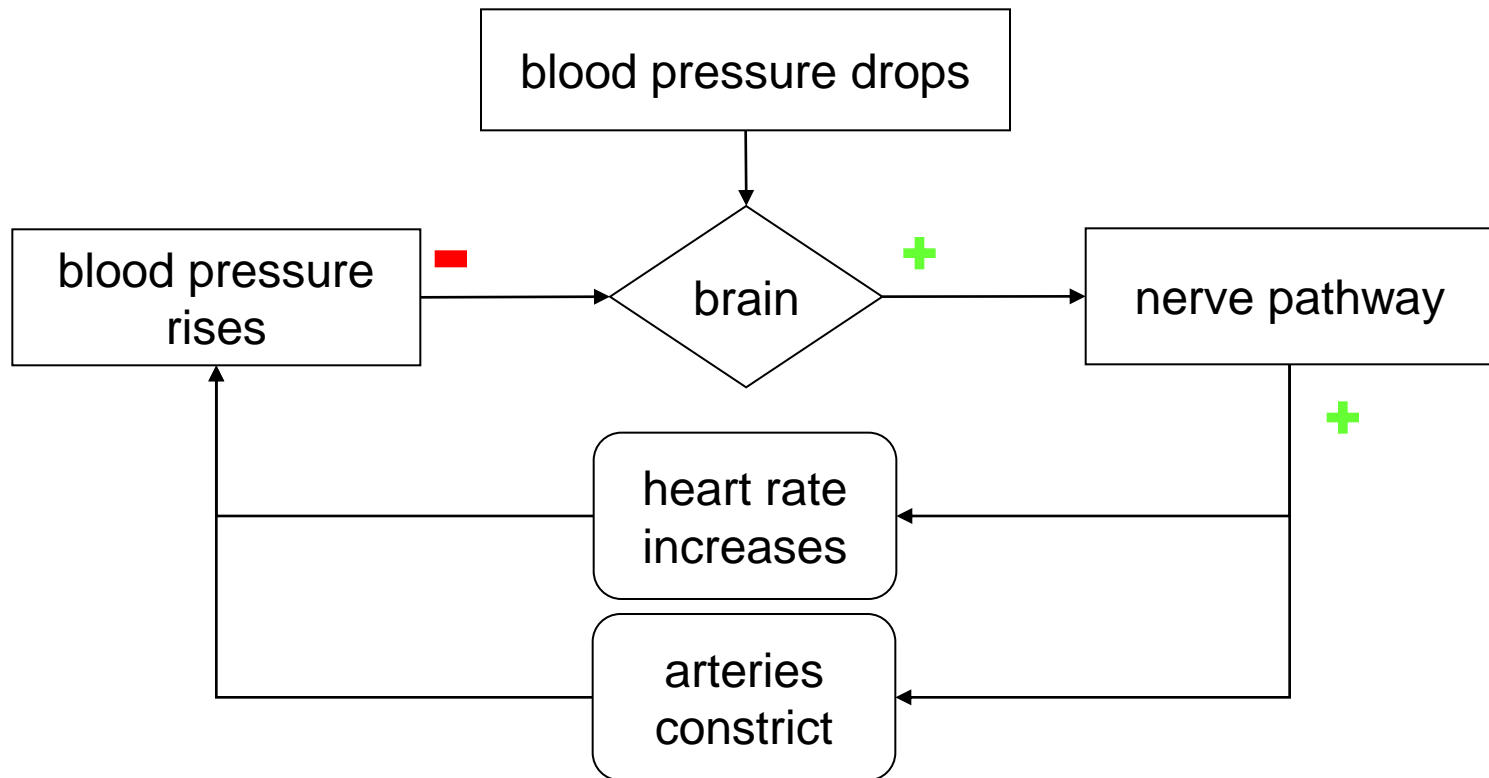
- Cells that respond to a regulatory signal
- E.g. have specific receptors for hormones
- Performs the body's response to the hormonal signals

Regulation by Feedback Systems



- Negative and positive feedback

Example of Negative Feedback System



Example of Positive Feedback System

