

Integrative Environmental Physiology of aquatic organisms

Integrative Environmental **Physiology** of aquatic organisms

study the function of organisms

Integrative Environmental **Physiology** of aquatic organisms

study the function of organisms

how life works

Integrative Environmental **Physiology** of aquatic organisms

study the function of organisms

how life works

metabolism
homeostasis
reproduce

Explanations of physiological processes

- mechanistic - *How does it work?*
- evolutionary - *How did it evolve this way?*

Explanations of physiological processes

- mechanistic - *How does it work?*
- evolutionary - *How did it evolve this way?*

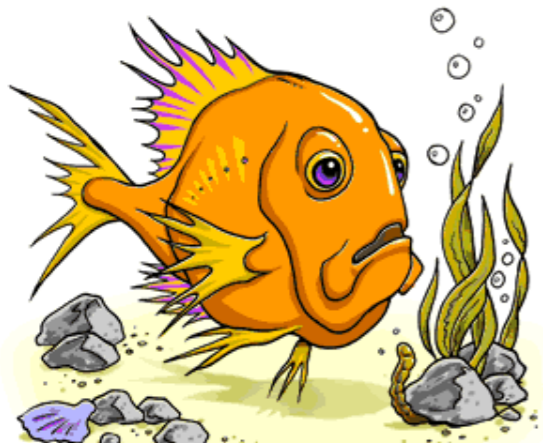
selective pressure

Explanations of physiological processes

metabolism

immune

reproduction



<http://www.starfish.govt.nz/science/facts/fact-fish-chars.htm>



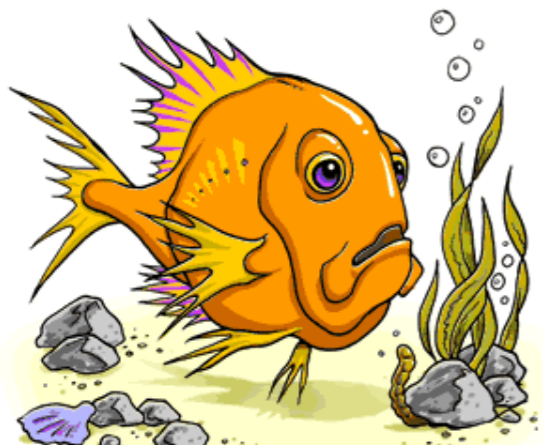
http://www.patagoniavolunteer.org/images/environment_volunteering_640.jpg



Explanations of physiological processes

Evolutionary Implications

Genotype



<http://www.starfish.govt.nz/science/facts/fact-fish-chars.htm>

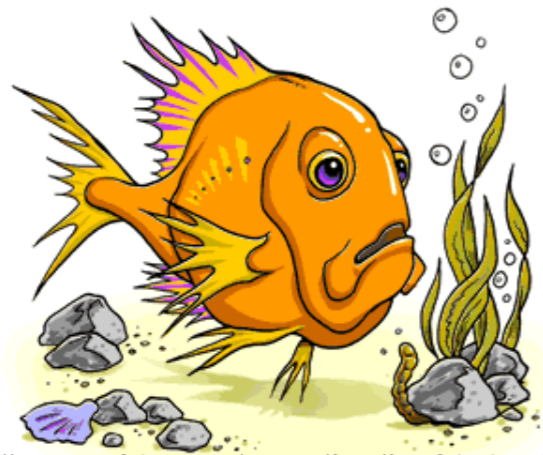


http://www.patagoniavolunteer.org/images/environment_volunteering_640.jpg

Phenotype

Natural Selection

Methods



<http://www.starfish.govt.nz/science/facts/fact-fish-chars.htm>



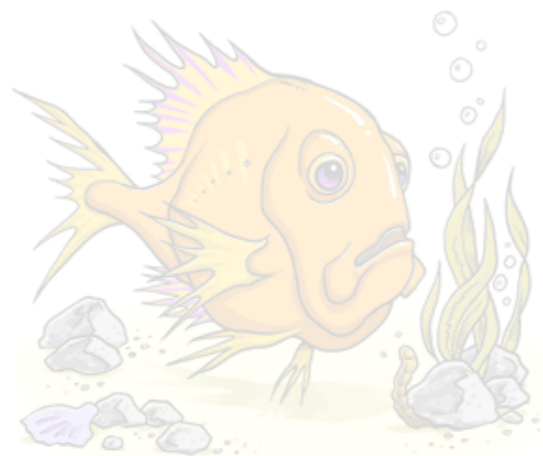
<http://www.starfish.govt.nz/science/facts/fact-fish-chars.htm>

Methods

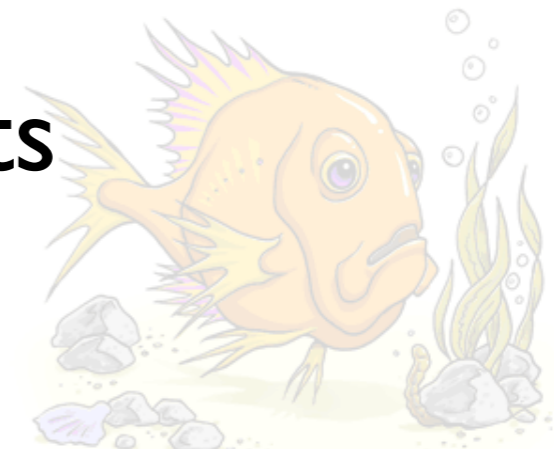
Ask question

Propose hypotheses

Design experiments



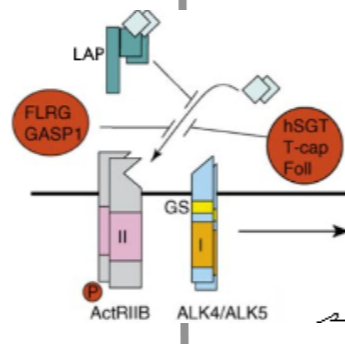
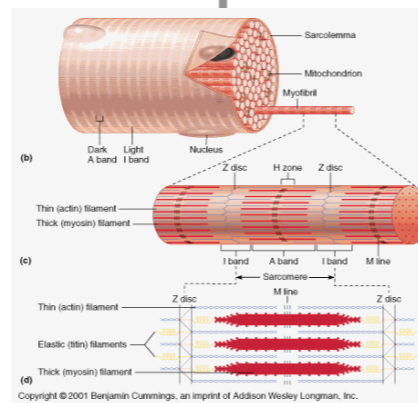
<http://www.starfish.govt.nz/science/facts/fact-fish-chars.htm>



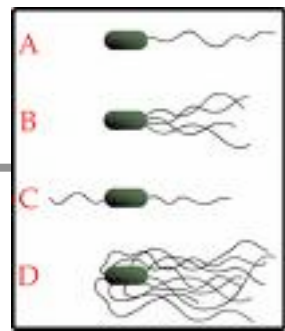
<http://www.starfish.govt.nz/science/facts/fact-fish-chars.htm>

Integrative Environmental Physiology of aquatic organisms

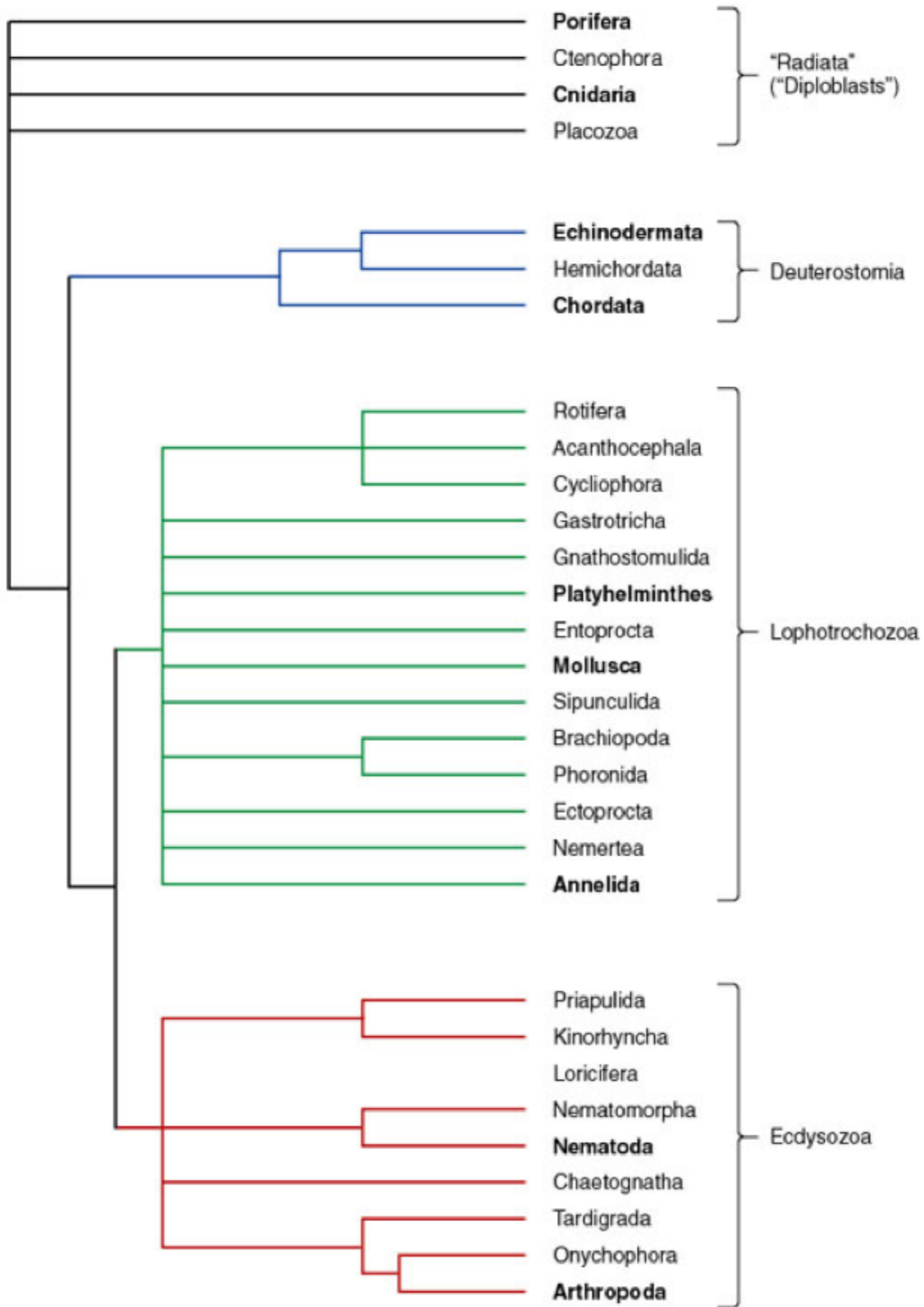
Integrative Environmental Physiology of aquatic organisms



Integrative (*Comparative*) Environmental Physiology of aquatic organisms



Why do we have to learn about salamanders?

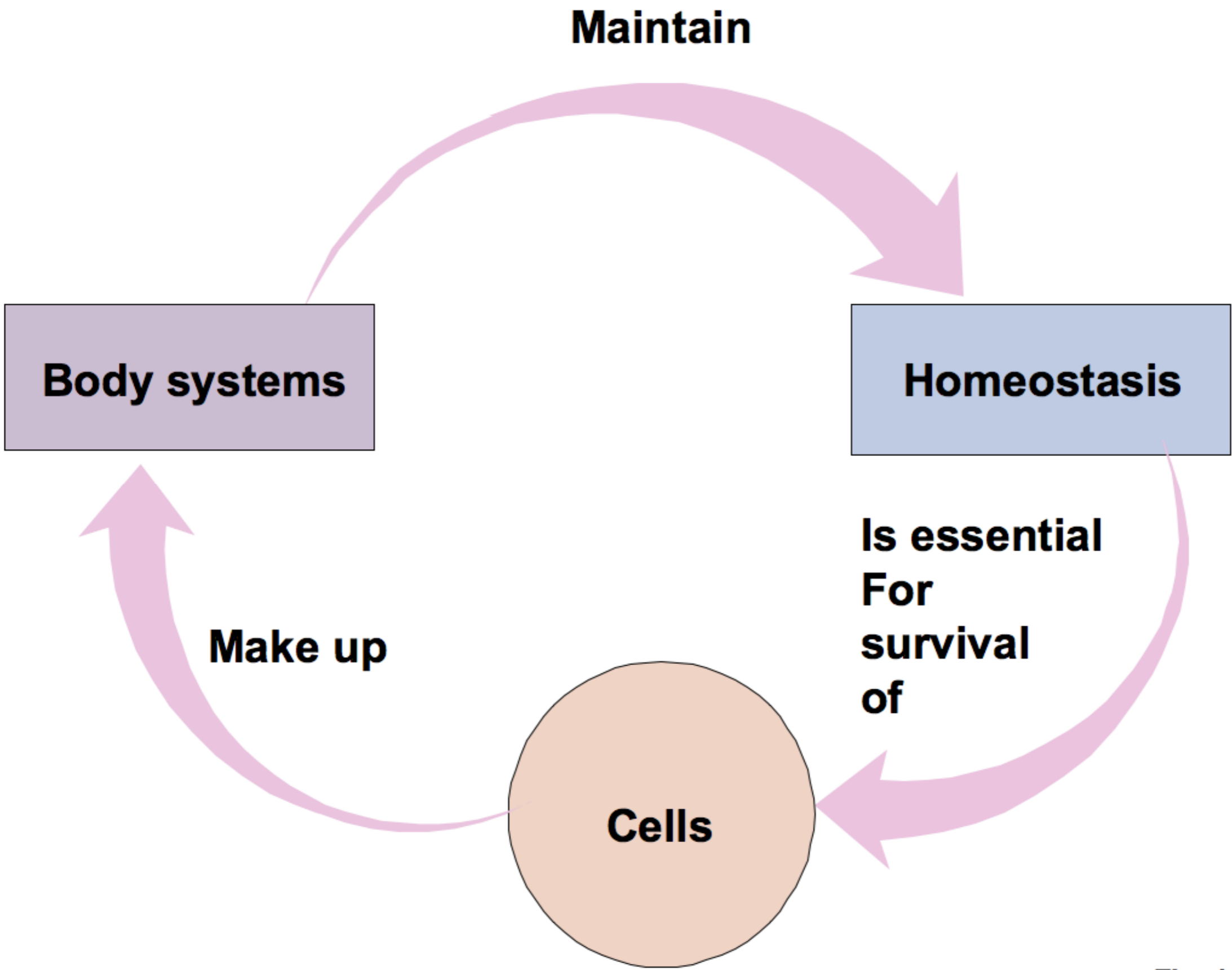


To examine in
evolutionary
sense
need to know....

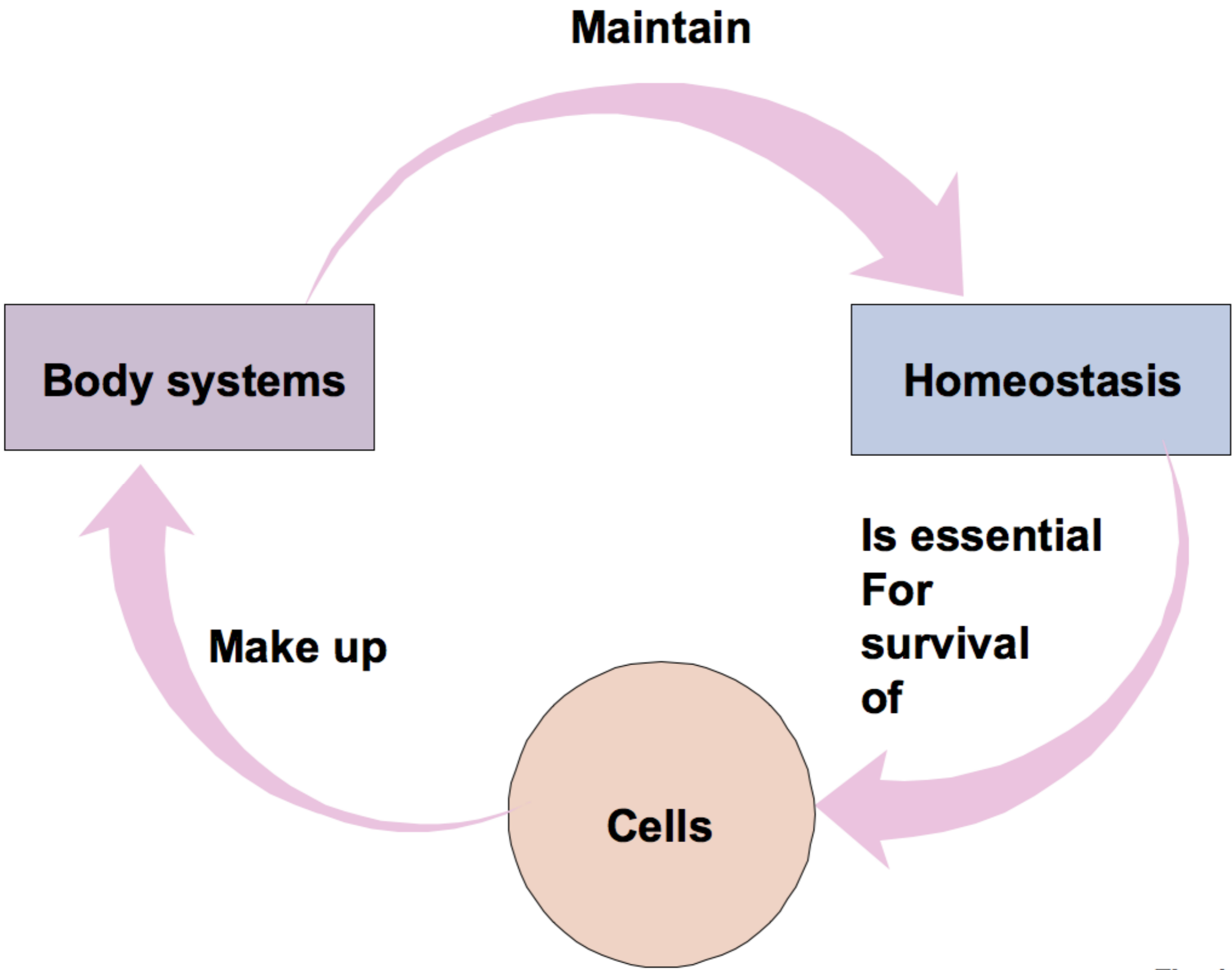
Organisms

Environment

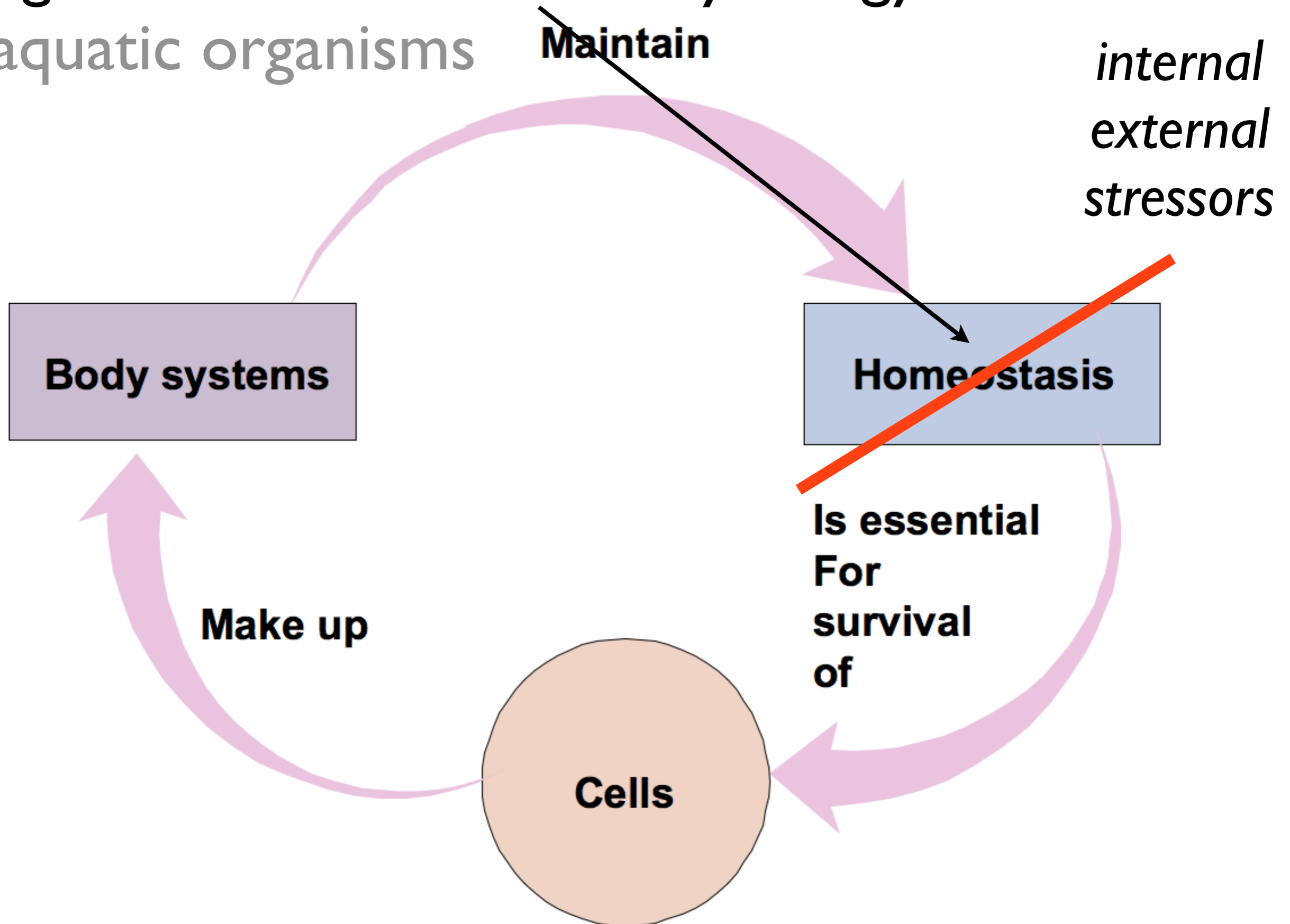
Homeostasis



Homeostasis



Integrative **Environmental** Physiology of aquatic organisms



Homeostasis

Factors of internal environment often regulated

Homeostasis

Factors of internal environment often regulated

- Concentration of energy rich molecules
- Concentration of O₂ and CO₂
- Concentration of waste products
- pH
- Concentration of water, salt, and other electrolytes
- Volume and pressure
- Temperature
- Social Parameters

Homeostasis

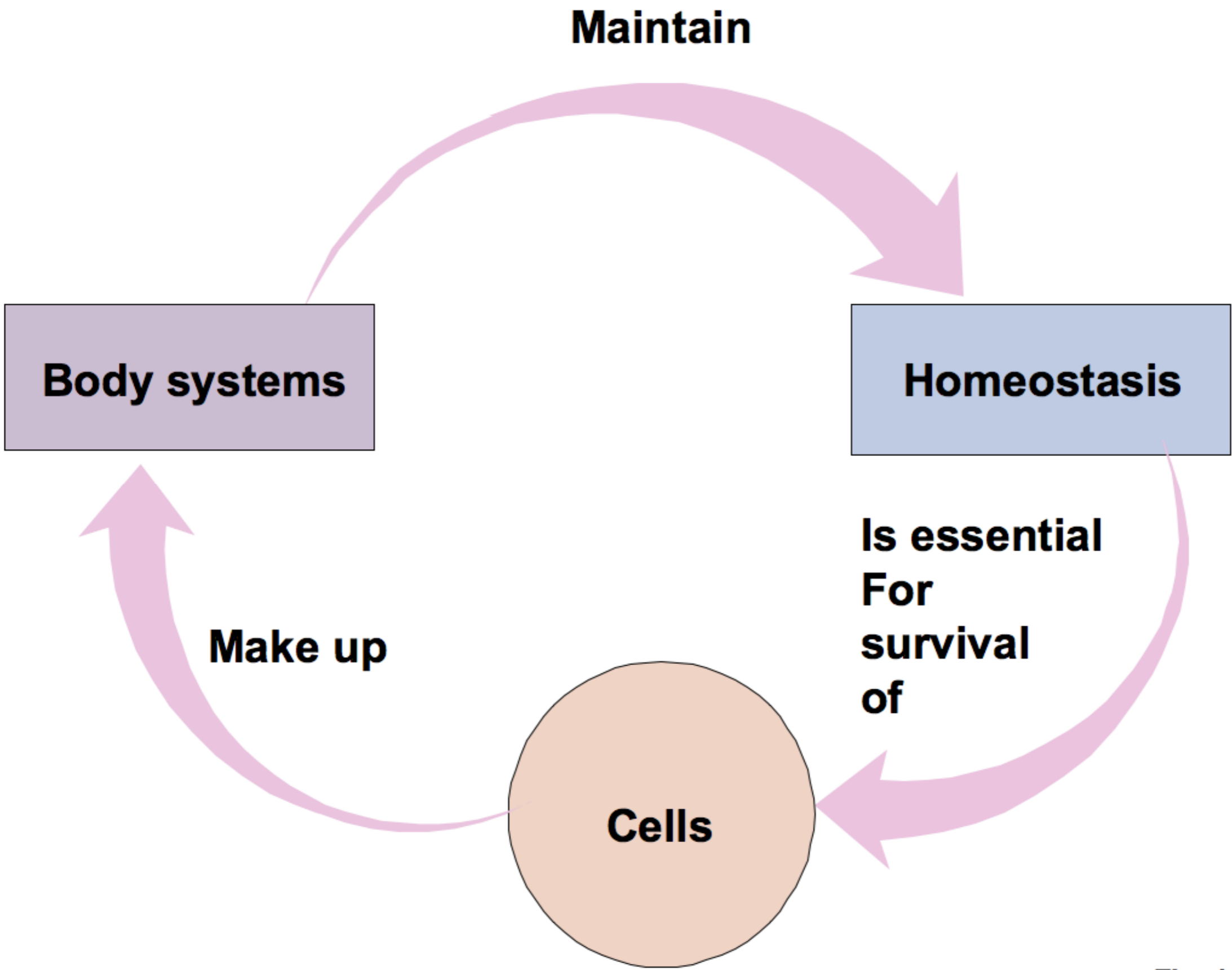
- Most intrinsic and extrinsic control systems generally operate on the principle of negative feedback
- Inadequacies in basic negative feedback systems can be improved with feedforward systems and acclimatization systems.
- Pathophysiological states ensue when one or more of organisms systems fail to function properly.

Homeostasis

- *Maintenance of a desired state in the face of disturbances*
- Can occur at cellular level
- Many processes occur at whole body level

- **Not everything in organisms is homeostatic**

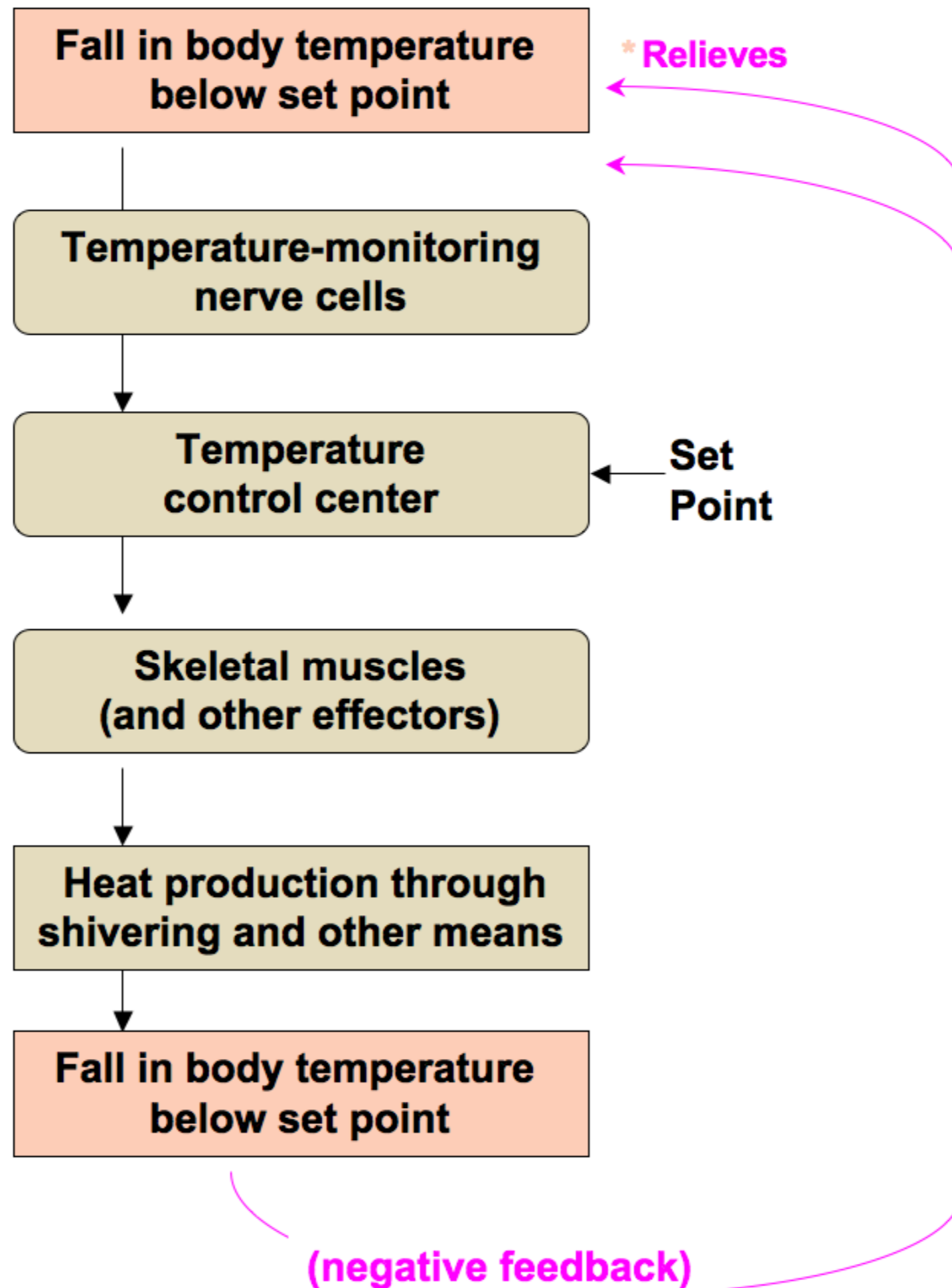
Homeostasis



Homeostasis

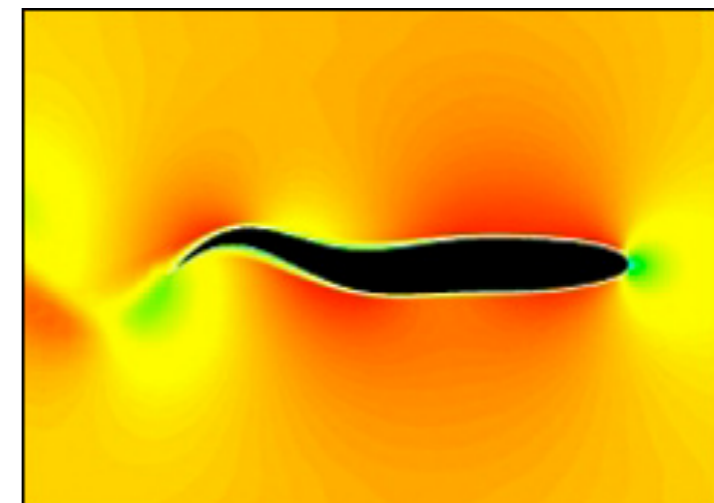
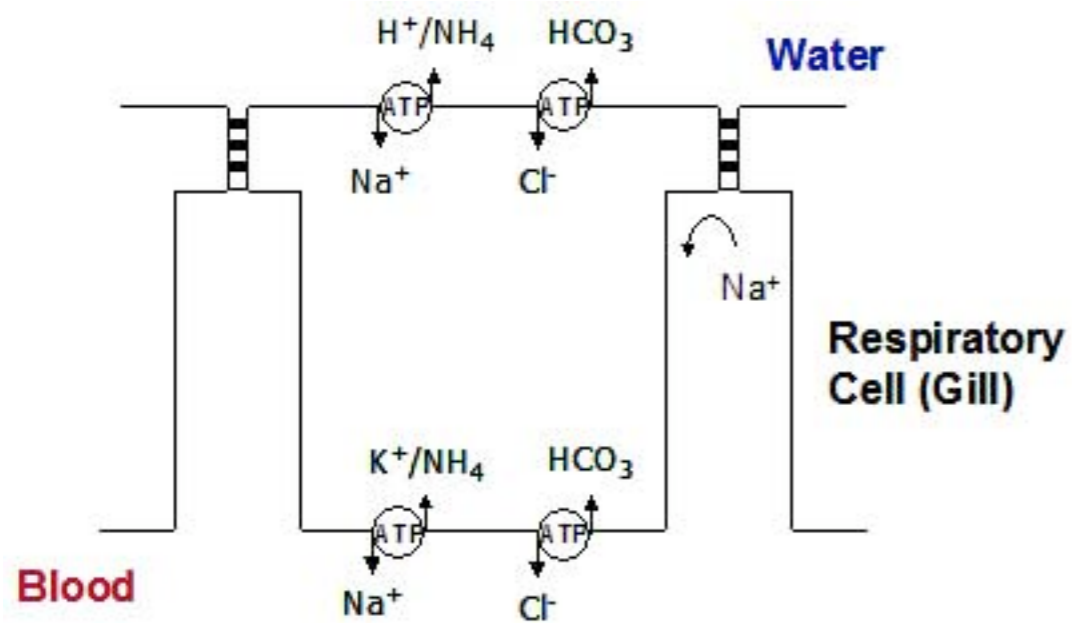
- Most intrinsic and extrinsic control systems generally operate on the principle of negative feedback
- Inadequacies in basic negative feedback systems can be improved with feedforward systems and acclimatization systems.
- Pathophysiological states ensue when one or more of organisms systems fail to function properly.

Maintenance



Effector Internal cells AND Behavior

Killifish and salinity



http://www.oxyedge-chum.com/oxygen_or_salt.htm

Improving negative feedback

why?

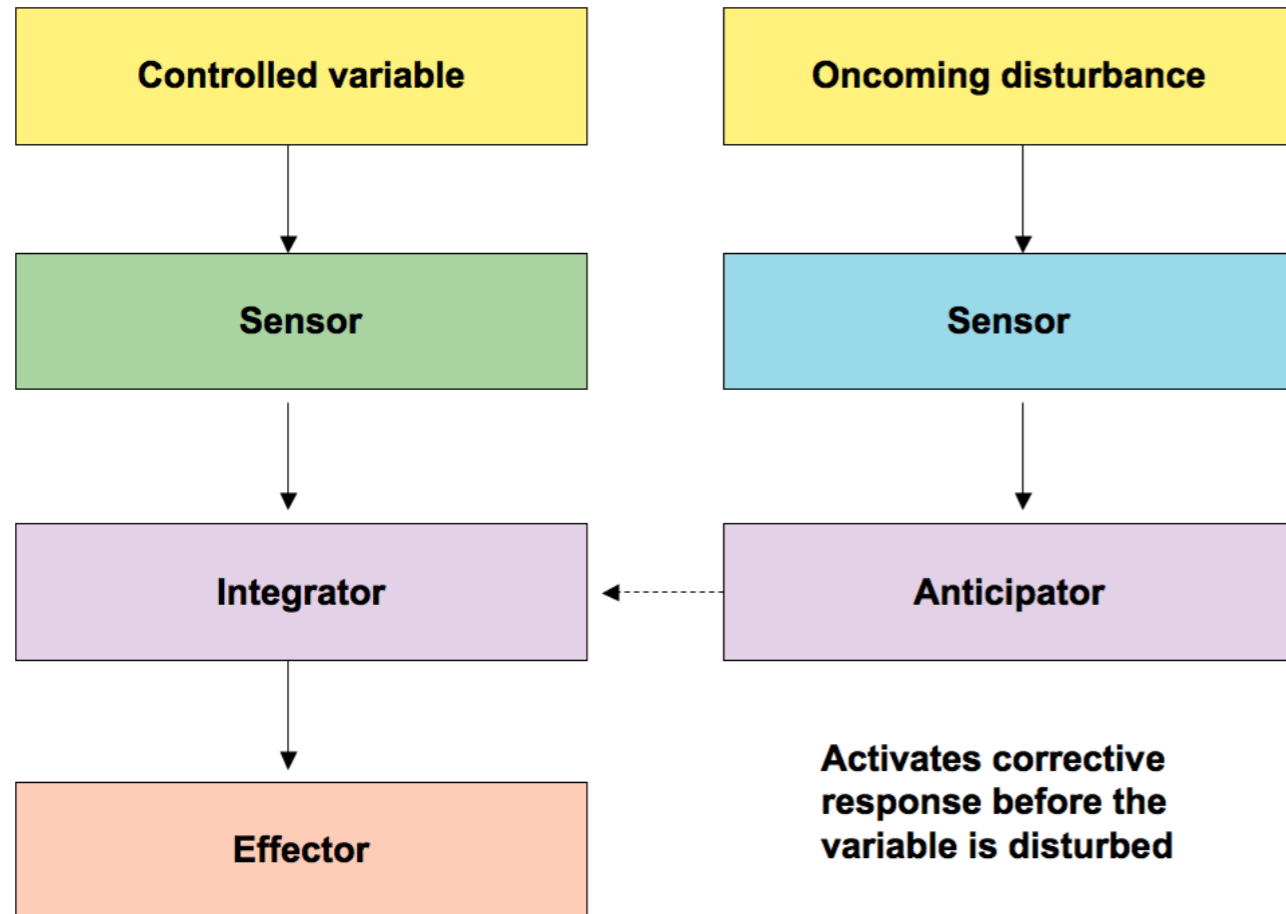
Improving negative feedback

Anticipation

Acclimatization

Improving negative feedback

Anticipation

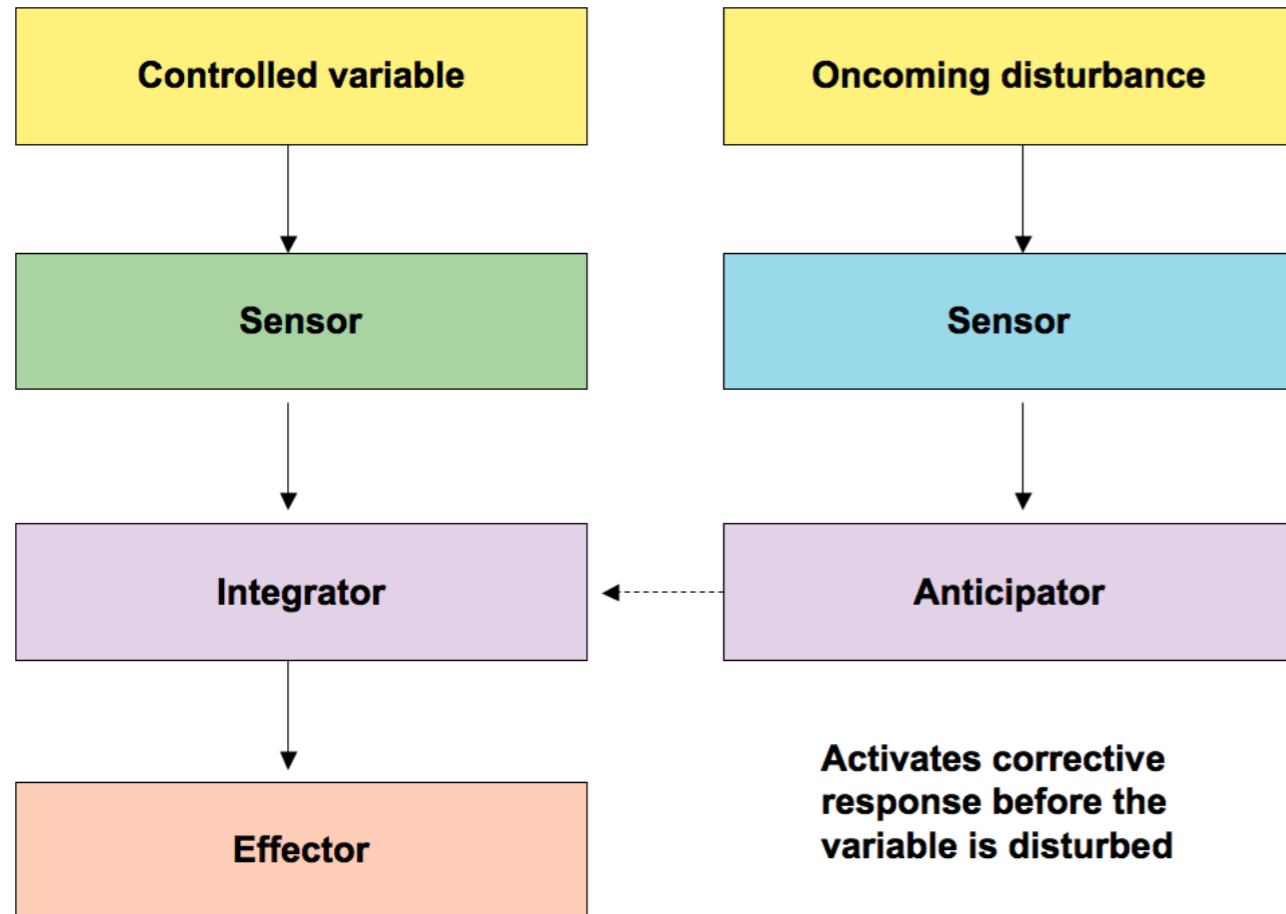


Acclimatization

temp
food

Improving negative feedback

Anticipation



Acclimatization



Uploaded on August 20, 2008
by [papalars](#)

Acclimatization

acclimation

adaptation

when things are not homeostatic

Dormancy



acclimatization taken to non-homeostatic state

negative feedback will not do.

when things are not homeostatic

Dormancy



© 2005 Brooks/Cole - Thomson

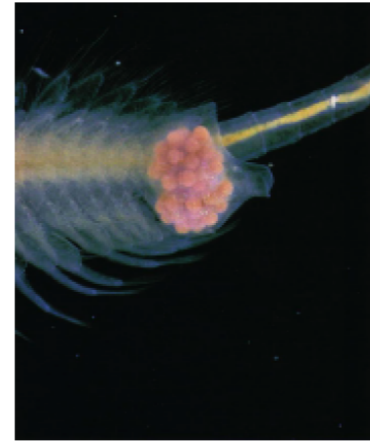
Brine Shrimp

Sex and the Single Brine Shrimp

Around the Mediterranean, female brine shrimp have been reproducing—without help from males—for millions of years
by Robert A. Browne

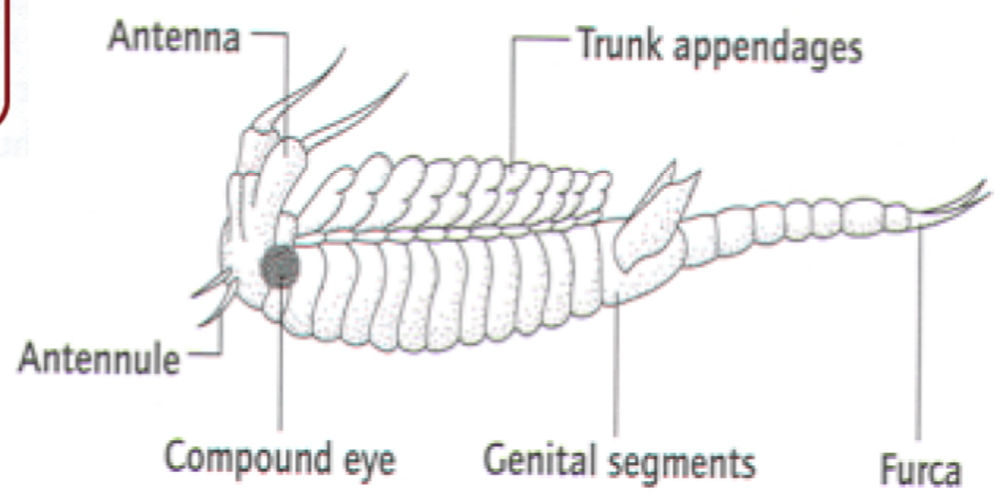
- Class Crustacea
 - Subclass Malacostraca
 - Order Isopoda—pillbugs, woodlice
 - Order Amphipoda—sand fleas
 - Order Euphausiacea—euphausiids (krill)
 - Order Stomatopoda—stomatopods
 - Order Decapoda—crabs, lobsters, shrimp, hermit crabs

- Subclass Branchiopoda—brine (fairy) shrimp, clam shrimp, water fleas
- Subclass Ostracoda—the ostracods
- Subclass Copepoda—the copepods
- Subclass Pentastomida
- Subclass Cirripedia—the barnacles



Anostraca

- Brine or Fairy Shrimps
- Lack carapace
- Brood chamber in body
- Harsh environments
- Extreme resting forms



Can withstand drying, freezing, fish - birds - mammals

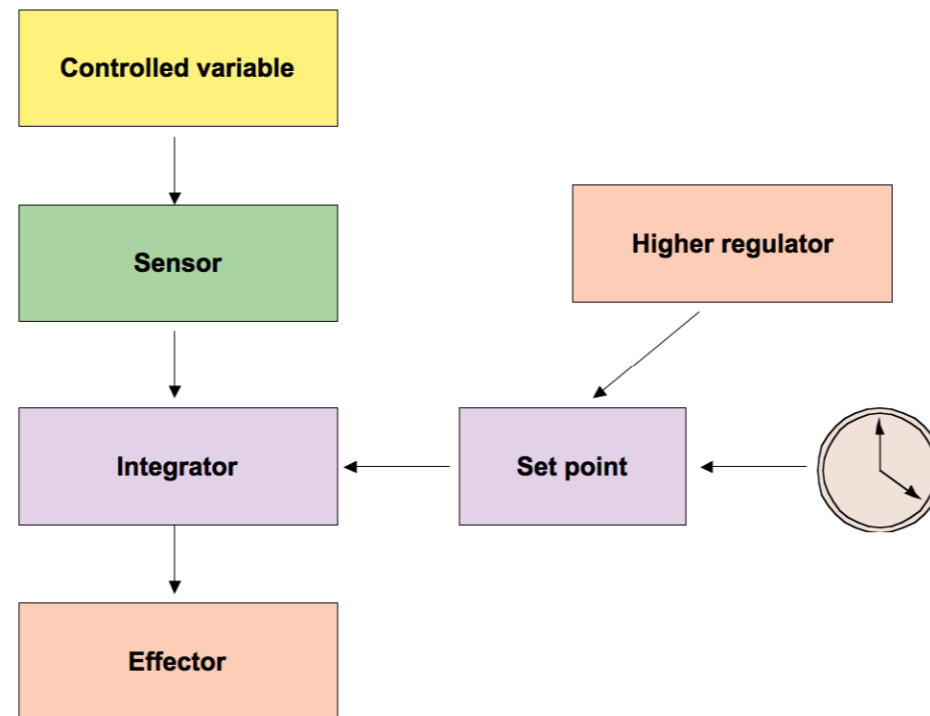
Regulated change

Dormancy



© 2005 Brooks/Cole - Thomson

Reset System



when things are not homeostatic

Regulated change

Dormancy



© 2005 Brooks/Cole - Thomson

Reset System

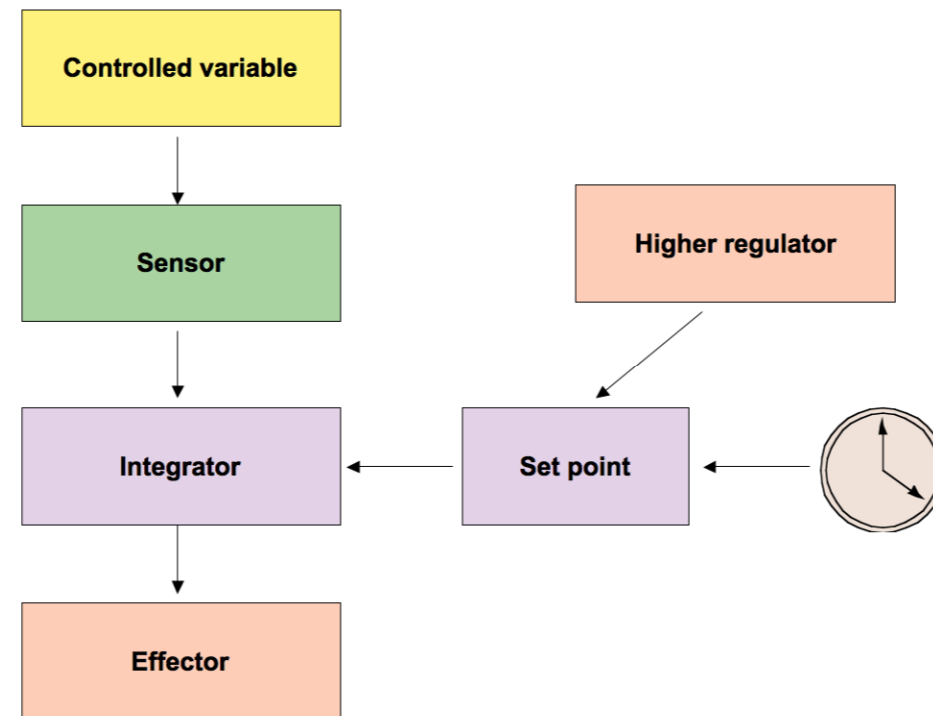


Image © M. McGrouther

when things are not homeostatic

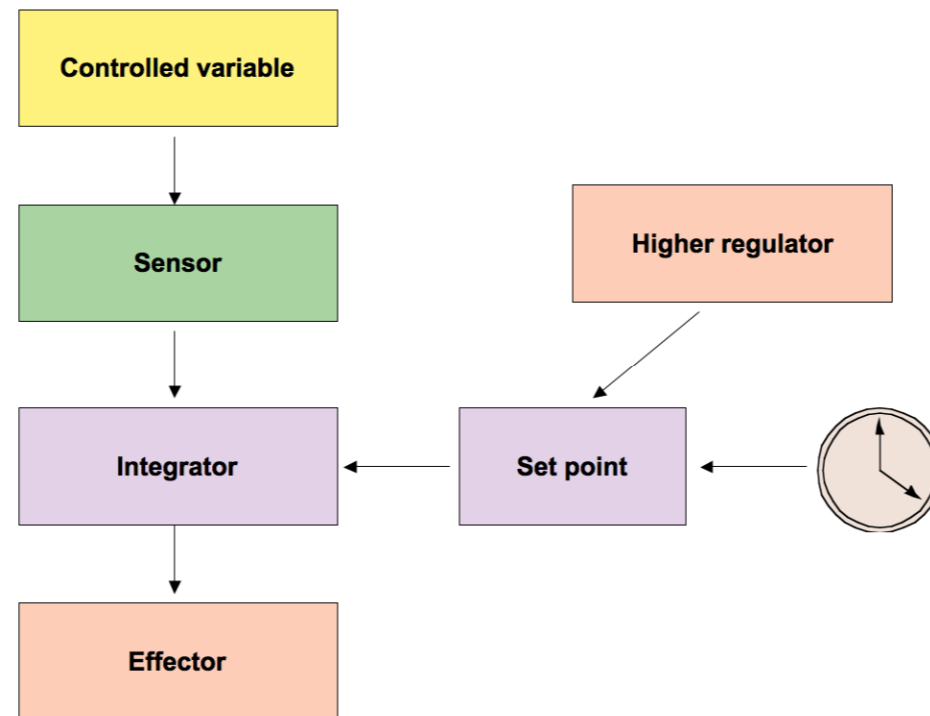
Regulated change

Dormancy

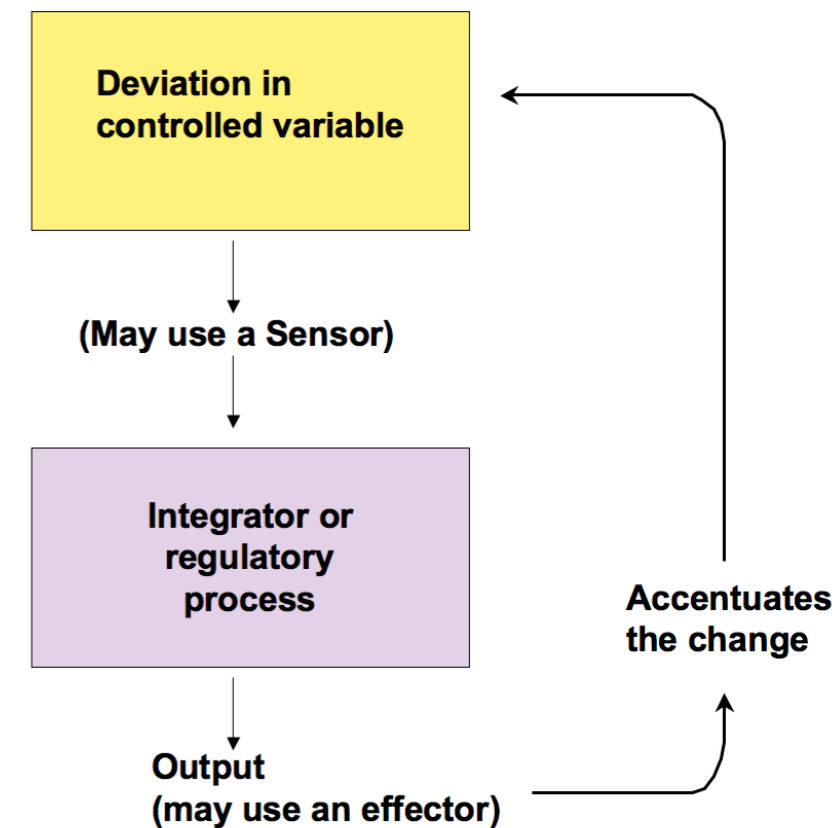


© 2005 Brooks/Cole - Thomson

Reset System



Positive Feedback



when things are not homeostatic

Examples of positive feedback

when things are not homeostatic

Regulated change

Dormancy

Reset System

Positive Feedback

1

2

3

when things are not homeostatic