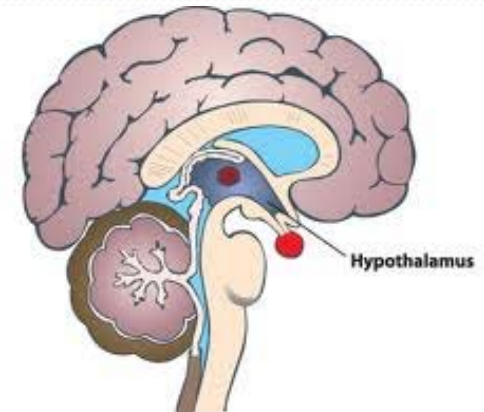


Thermoregulation

Control of an organism's temperature within a functional range

Human Thermostat

- Control Center = Hypothalamus
- Range 36°C - 38°C
- Usually $\sim 37^{\circ}\text{C}$ / 98.6°F
- Diurnal variation – varies throughout day
 - Max: 10am-6pm
 - Min: 11pm – 3am

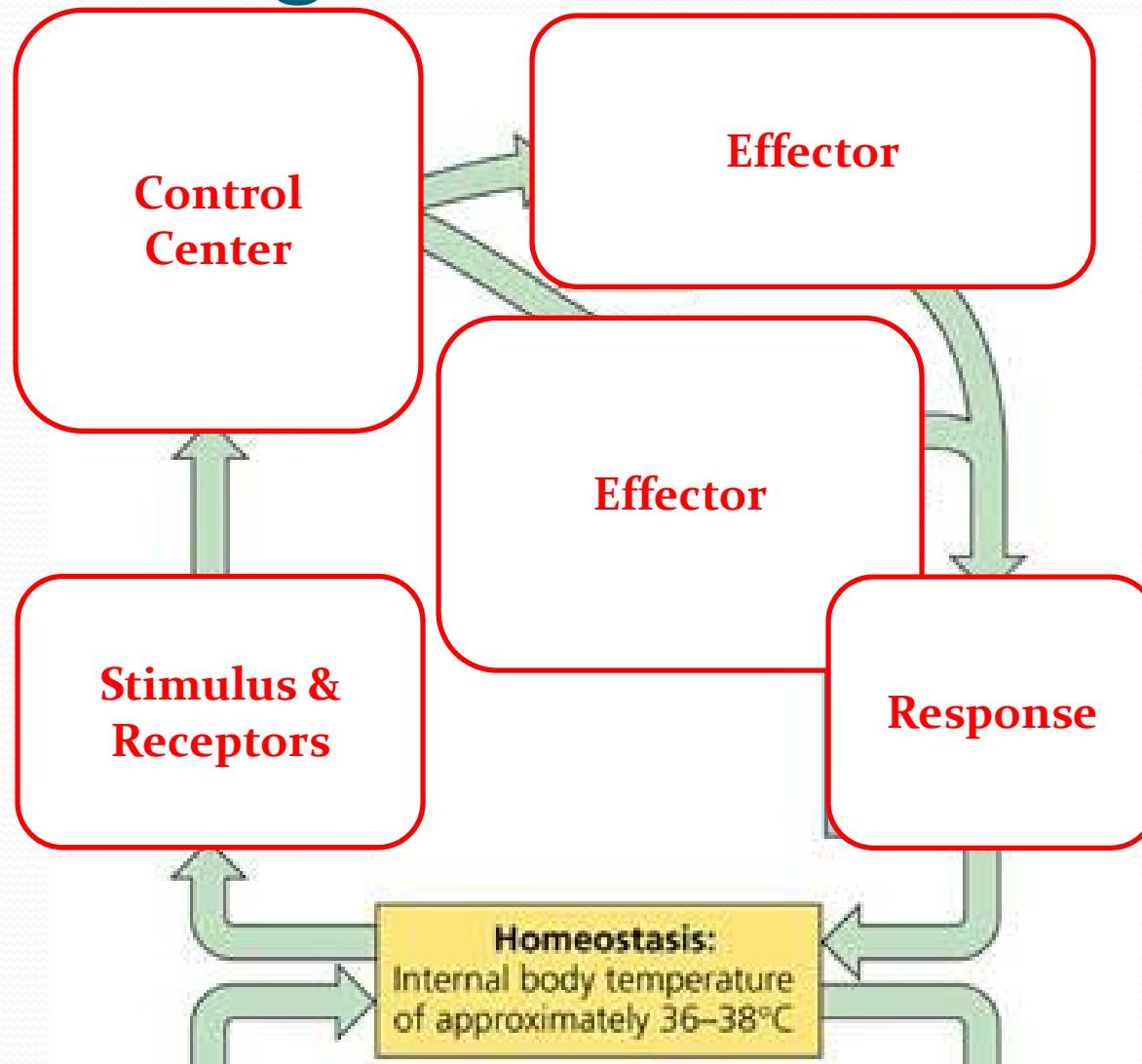


Circadian Rhythm (Body-Temperature Cycle)



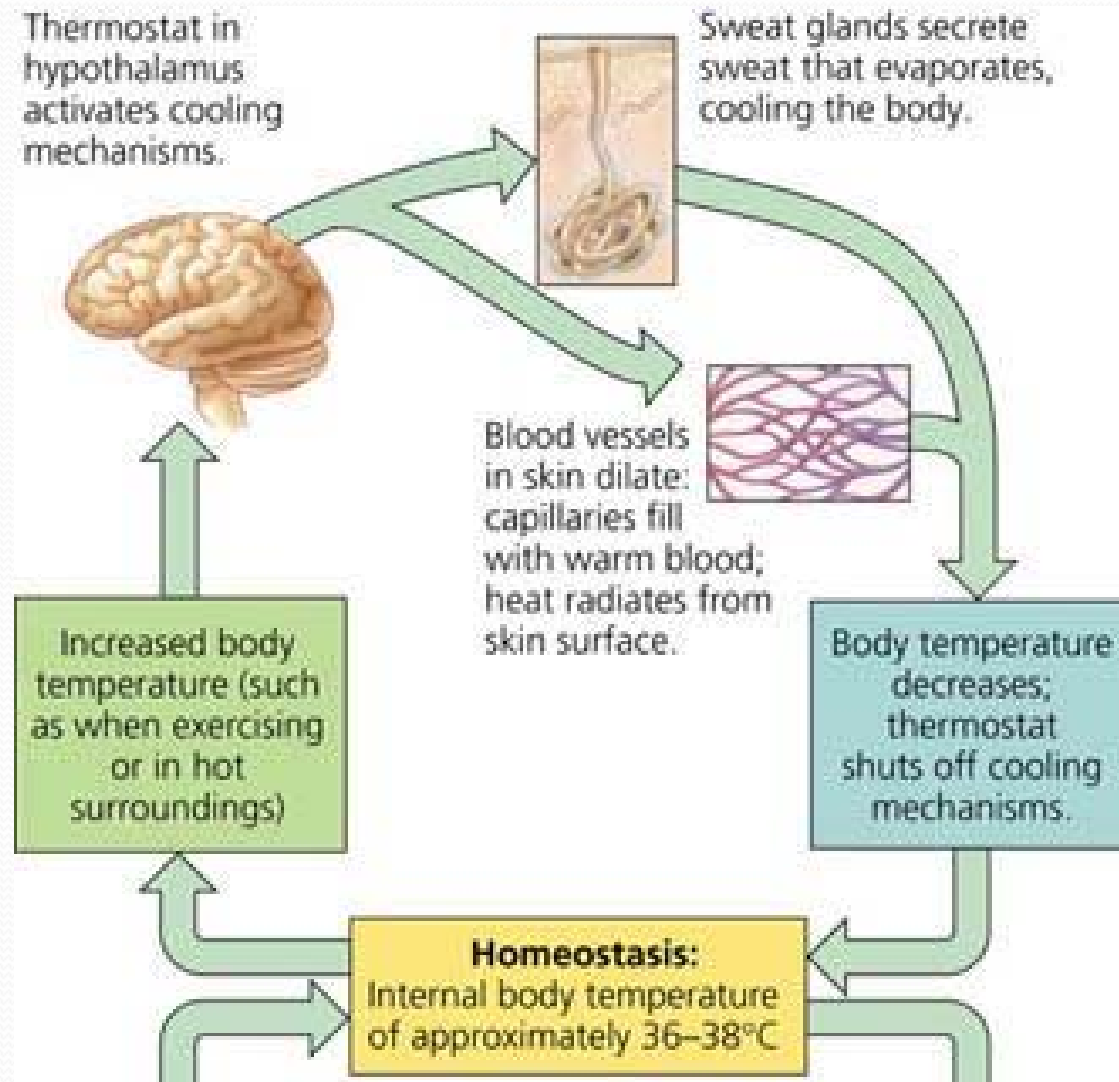
Control: Negative Feedback Loops

Increase Temp



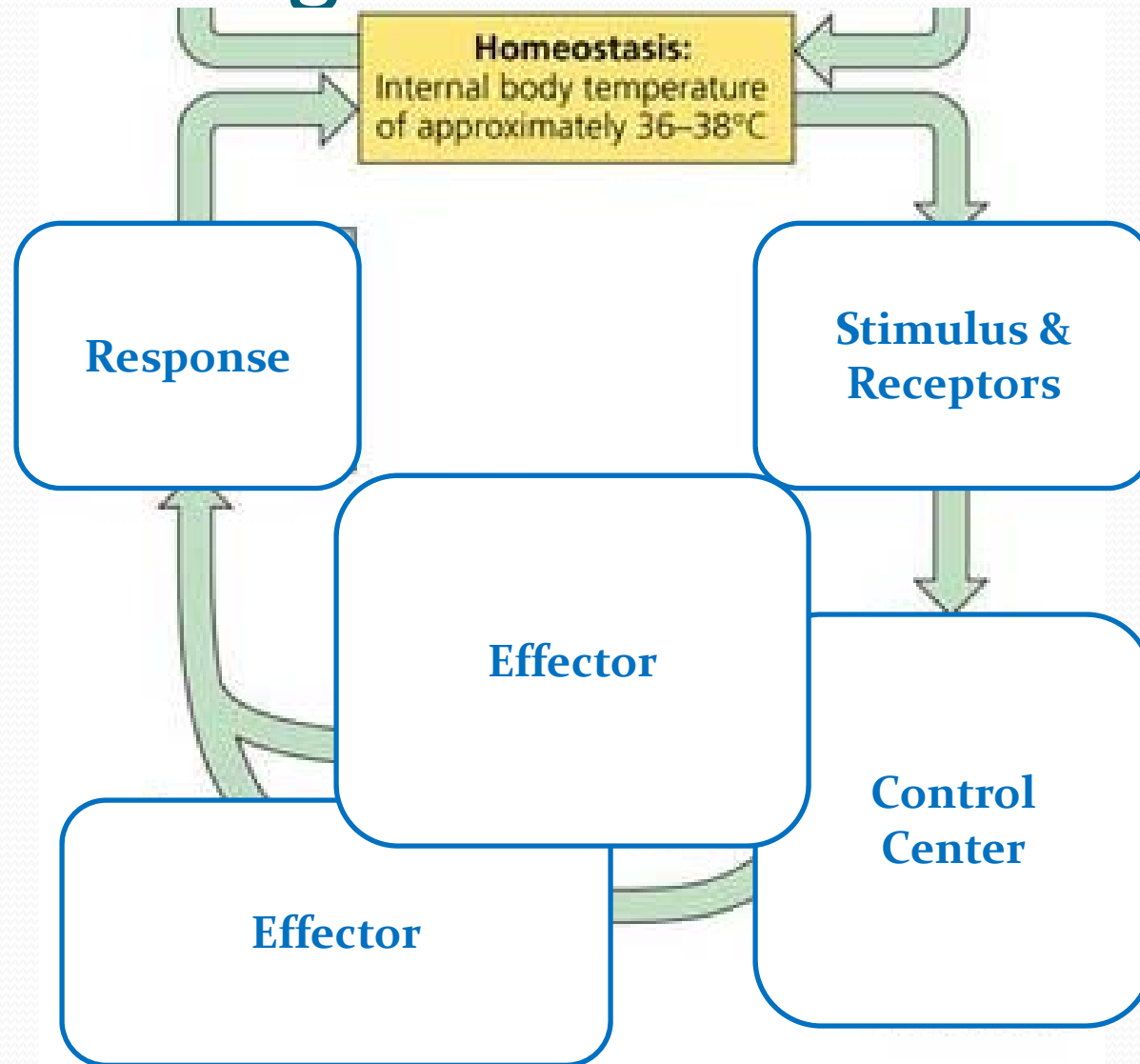
Control: Negative Feedback Loops

Increase Temp



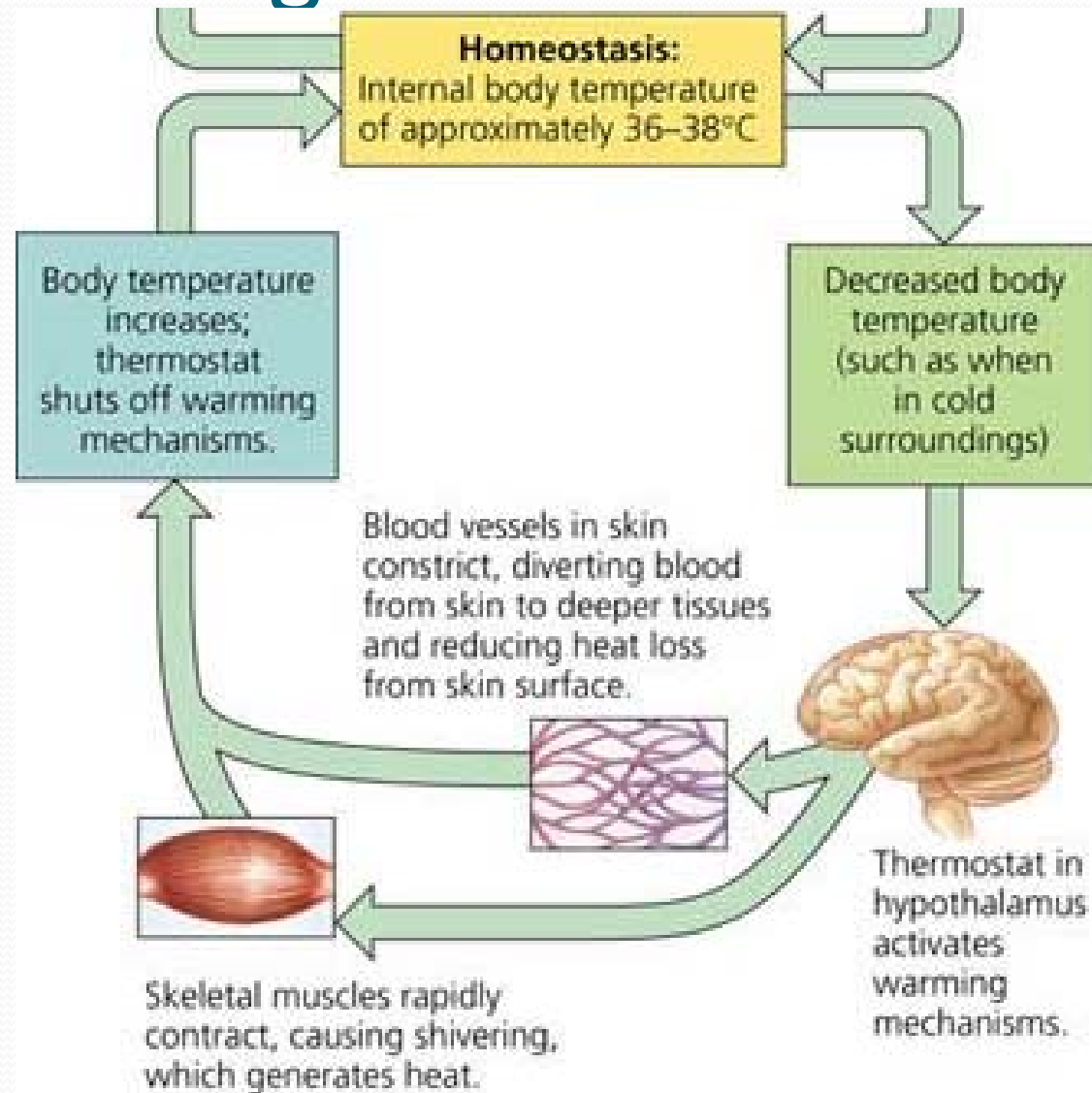
Control: Negative Feedback Loops

Decrease Temp





Control: Negative Feedback Loops

Decrease Temp

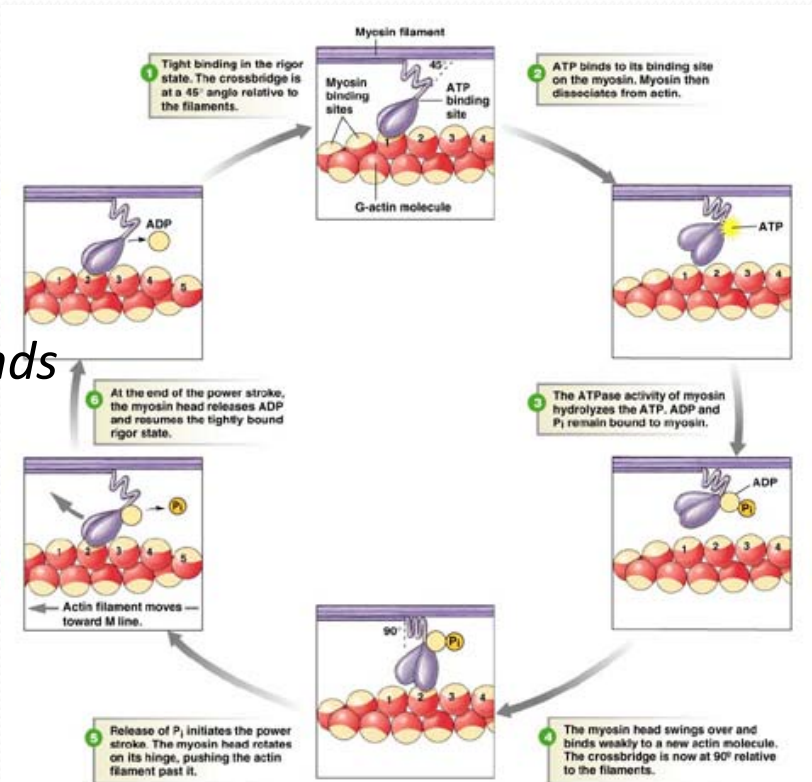


Summary of Regulatory Activity

Effector/ Regulator	Over Heating 	Over Cooling 
Blood Vessels	<ul style="list-style-type: none"> - Dilate - ↑ heat loss 	<ul style="list-style-type: none"> - Constrict - ↓ heat loss
Glands	<ul style="list-style-type: none"> - Initiate sweating - ↑ heat loss 	<ul style="list-style-type: none"> - N/A
Skeletal Muscles	<ul style="list-style-type: none"> - N/A 	<ul style="list-style-type: none"> - Rapid Contractions - ↑ heat release to body

Lack of Control

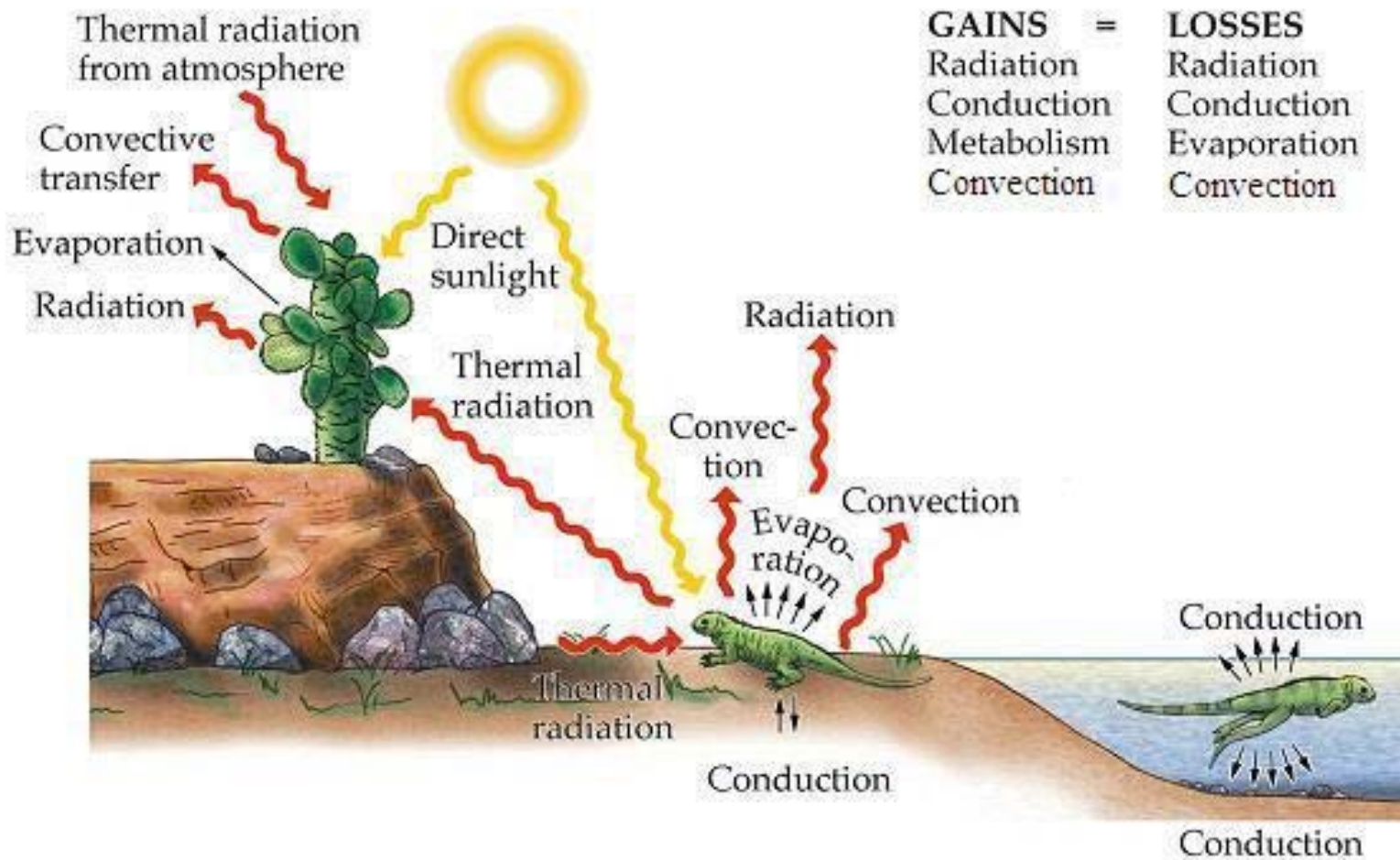
- If too **HIGH**:
 - Shortness of breath
 - Upper limit $\sim 45^{\circ}\text{C} / 113^{\circ}\text{F}$
 - Rigor at $50^{\circ}\text{C} / 122^{\circ}\text{F}$
 - *can't hydrolyze ATP to release bonds*
- If too **LOW**:
 - No set value
 - Lose consciousness, brain conserving energy
 - 15°C self-anesthetized



Heat Gain & Loss

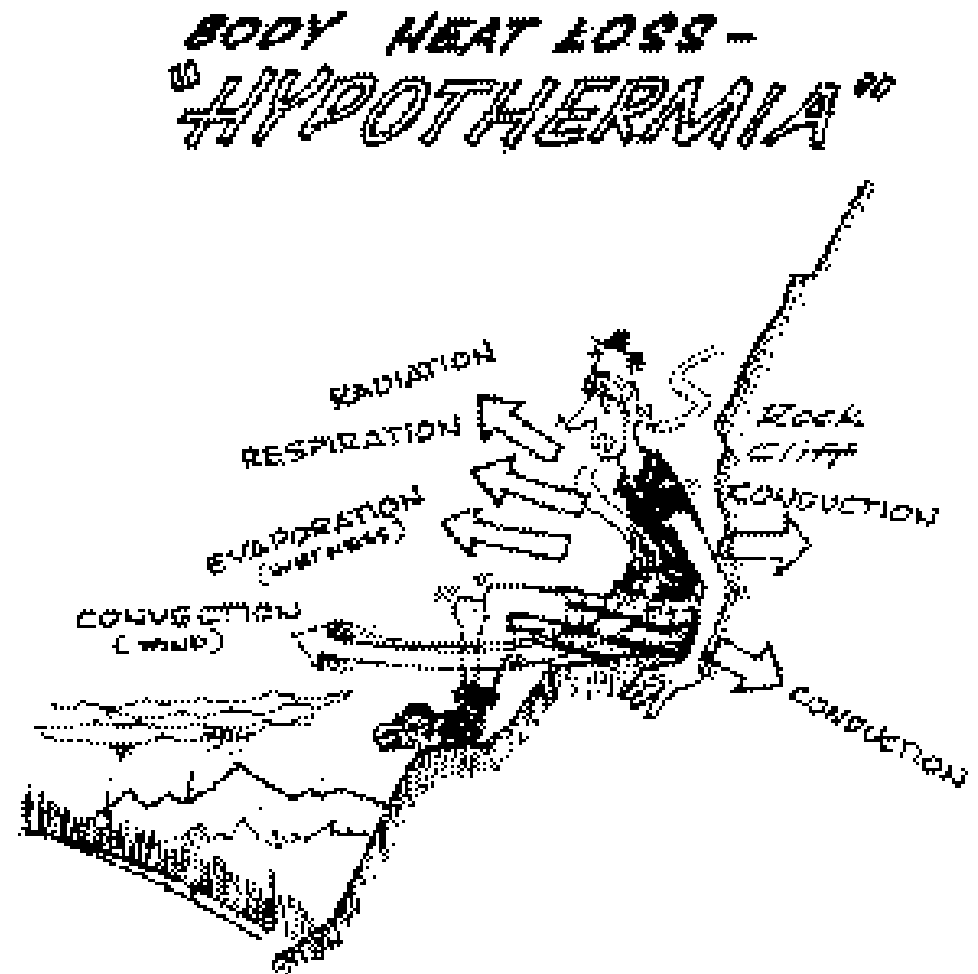


Heat Gain & Loss



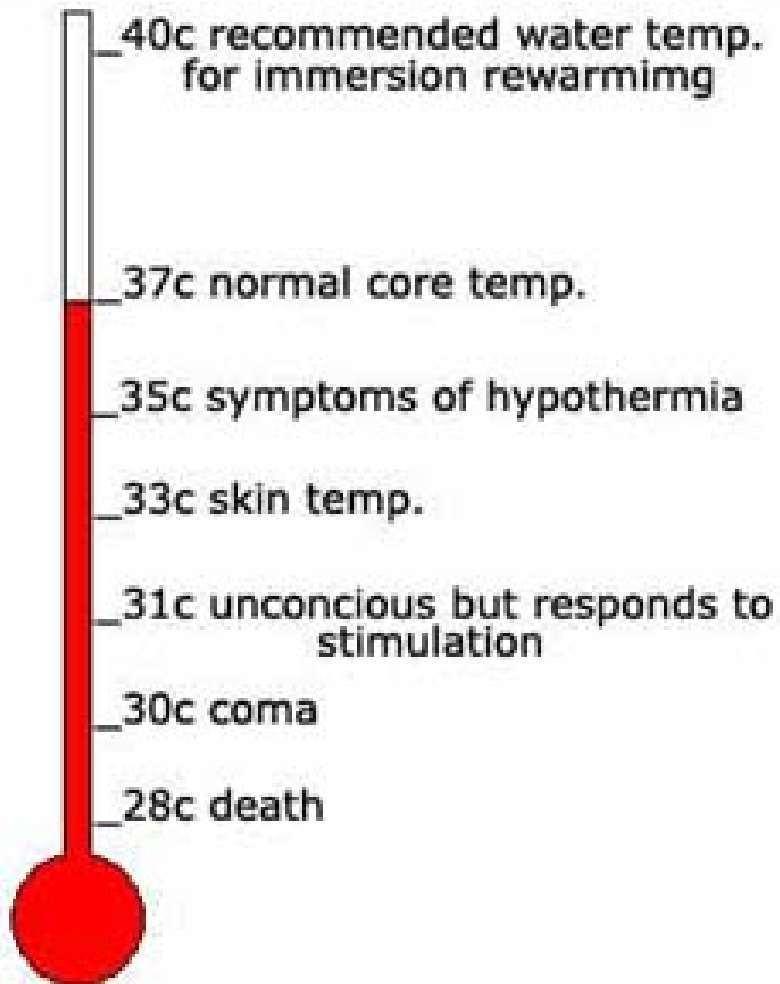
Natural Heat

- Relative heat loss:
 - Feces & urine 3%
 - Respiration 20%
 - Skin 77%
- Natural generation:
 - **Muscles**
 - **Chemical changes**



**WIND AND WETNESS
TAKE AWAY BODY HEAT FASTER
THAN IT CAN BE PRODUCED.**

Case Study



When the body temperature
is decreased by **1 degree**

36% of immune function
declines!

12% of basic metabolism
declines!

50% of enzyme activities
decline!