

HOMEOSTASIS

U1:L1

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- ▶ Our body is always working to maintain its internal physiological environment in a stable state, or a constant internal balance.



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- ▶ An example of this is constant body temperature.



A Cold Walk

- ▶ Before leaving the house you put on your winter outerwear – boots, mitts, hat, scarf and parka. The increased amount of clothing traps body heat and you begin to sweat as your body tries to cool down. As you leave the house and enter the cold winter air your exposed cheeks feel cold. Near the end of the walk you notice your toes and fingers beginning to feel numb. You're late so you run the rest of the way to school.
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A Cold Walk

- ▶ When you arrive you're glad to find the sun has warmed up your fingers and toes, however, as you walk through the hallway to your locker you find yourself beginning to sweat again. You remove your winter outer wear at your locker and head to class. A few minutes later you find yourself becoming cold and you begin to shiver as your body tries to warm up.
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- ▶ Your body is always trying to work to maintain a temperature of 37°C .
 - ▶ If your body is much colder or warmer than this temperature...

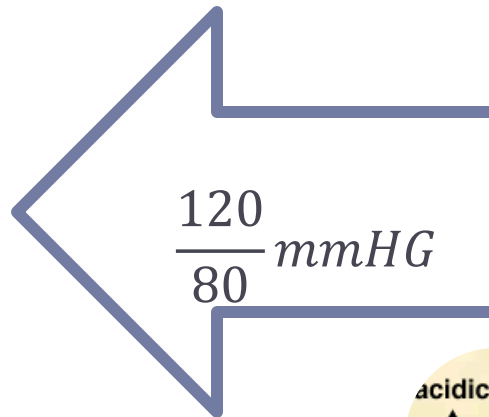
**DANGER
ZONE!**

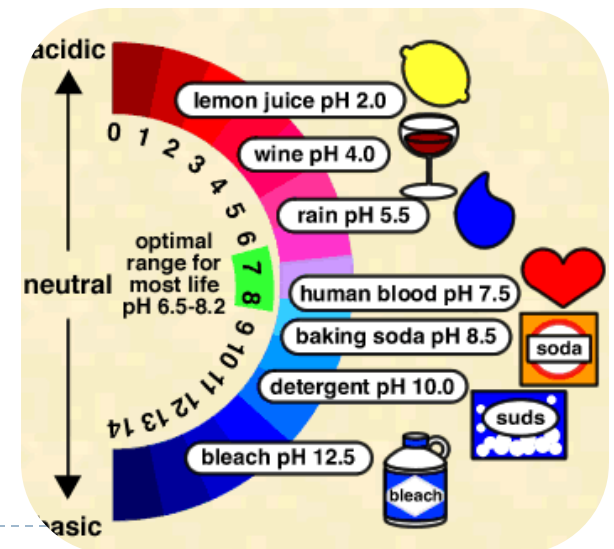


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- ▶ **HOMEOSTASIS** is the ability of the body to maintain its internal environment within acceptable ranges despite the changing external environment.
 - ▶ *Homeostasis is your body trying to stay the same all the time!*



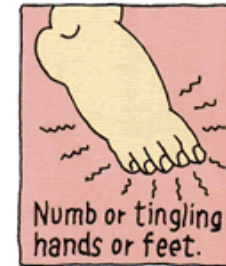
- ▶ In addition to a body temperature of about 37°C , your body also wants to maintain:
- ▶ Blood pressure of about $\frac{160}{106}\text{Kpa}$
- ▶ Blood pH near 7.4
- ▶ Blood glucose concentrations at about 100mg/mL ..


$$\frac{120}{80} \text{ mmHG}$$



DIABETES

KNOW THE SYMPTOMS



- ▶ While these “normals” do vary, if any of these normals are too “off” there is a serious **DANGER ZONE** (possibly fatal).

If you have any of these symptoms, see your doctor. For more information about diabetes call Eli Lilly and Company at 1-800-545-5979 or Boehringer Mannheim Corporation at 1-800-858-8072.

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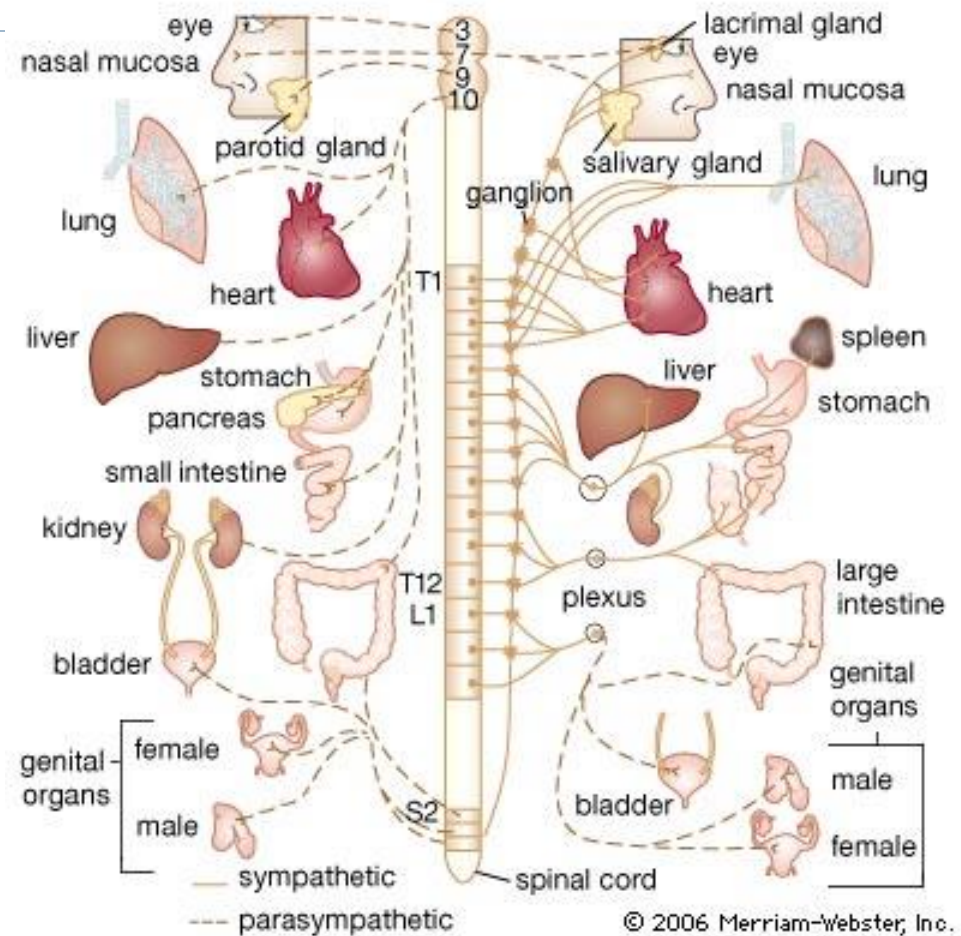
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In order to function properly, homeostatic mechanisms must allow the body to:

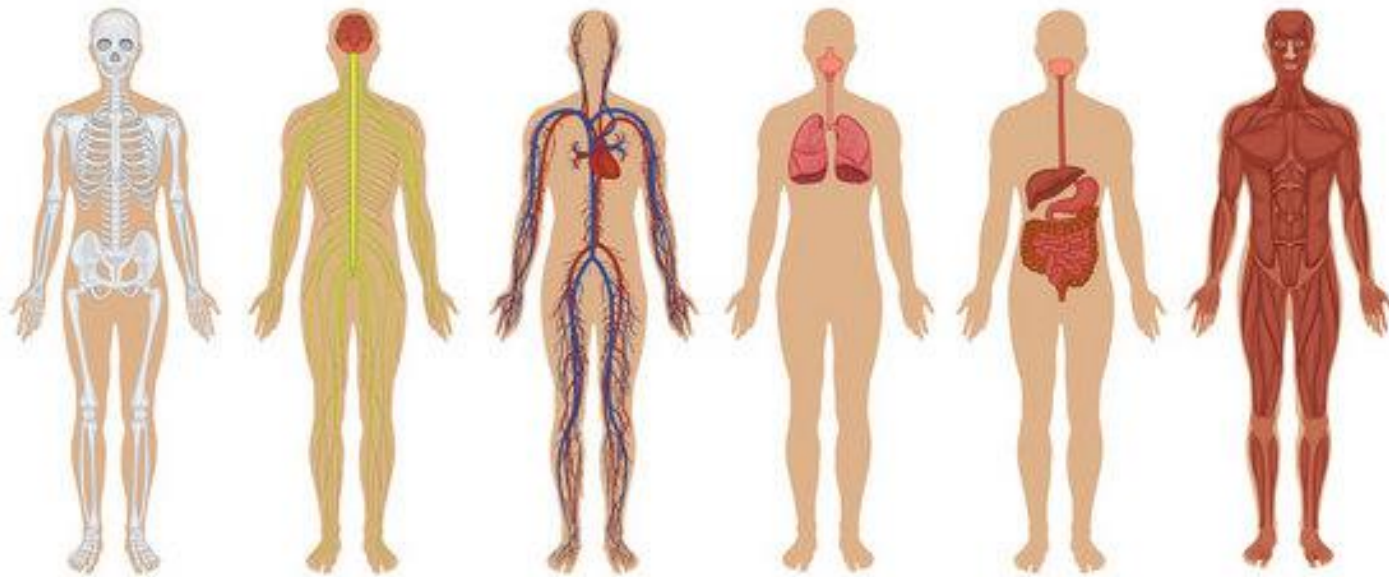
- ▶ regulate respiratory gases
 - ▶ maintain water and salt balance
 - ▶ regulate energy and nutrient supply
 - ▶ maintain constant body temperature
 - ▶ protect against pathogens
 - ▶ make repairs when injured
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- ▶ Homeostasis depends on the action and interaction of many different body systems working together to keep balance.



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- ▶ Because the external environment is constantly changing and homeostatic reactions respond to the change and bring the body back to a given set point, it is often referred to as a **dynamic equilibrium**.



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- ▶ A dynamic equilibrium is a **condition that remains stable within fluctuating limits.**
 - ▶ Many homeostatic reactions begin with the body's **sensing of changes in the external environment.**



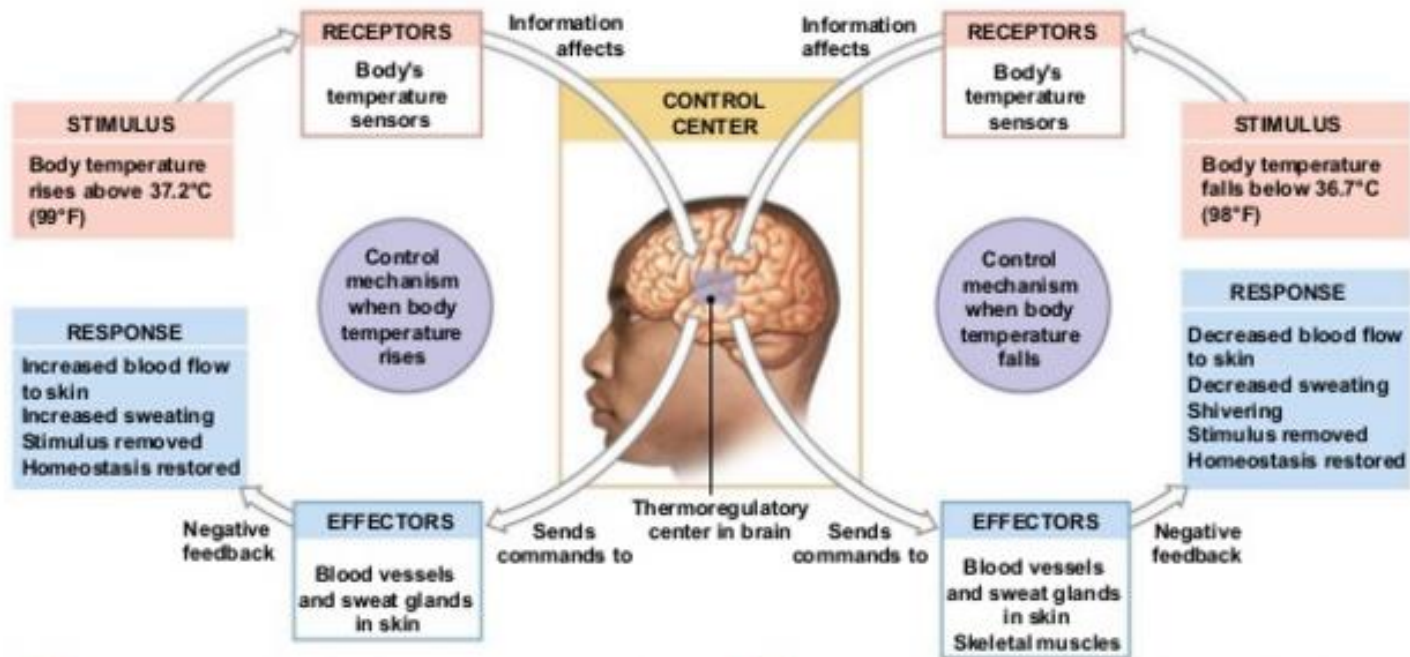
NEGATIVE FEEDBACK MECHANISMS

- ▶ Negative feedback systems are an important mechanism used to maintain homeostasis, or dynamic equilibrium.
- ▶ A negative feedback mechanism in your body makes adjustments to bring things back to within an acceptable range.



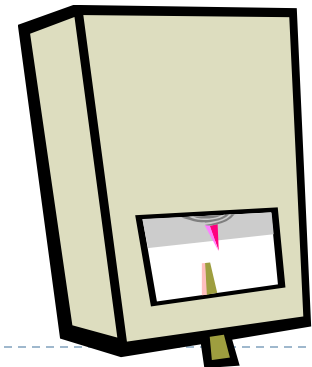
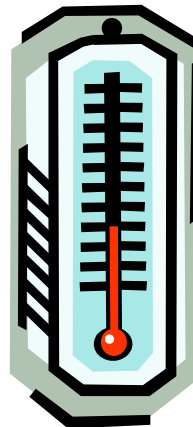
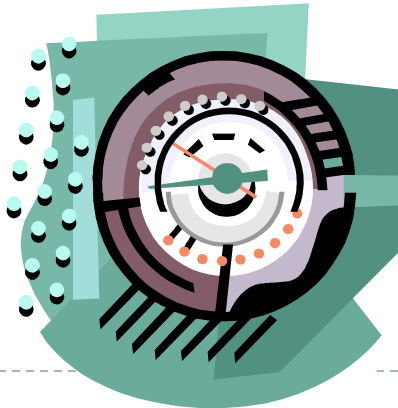
NEGATIVE FEEDBACK MECHANISMS

- ▶ Feedback mechanisms have three main components: **a sensor, a coordinating centre and an effector.**
- ▶ The **sensor** is responsible for detecting variation in the set point and will send messages to the **coordinating centre** that will then send a message to a specific **effector** to rectify any variation from a set point.

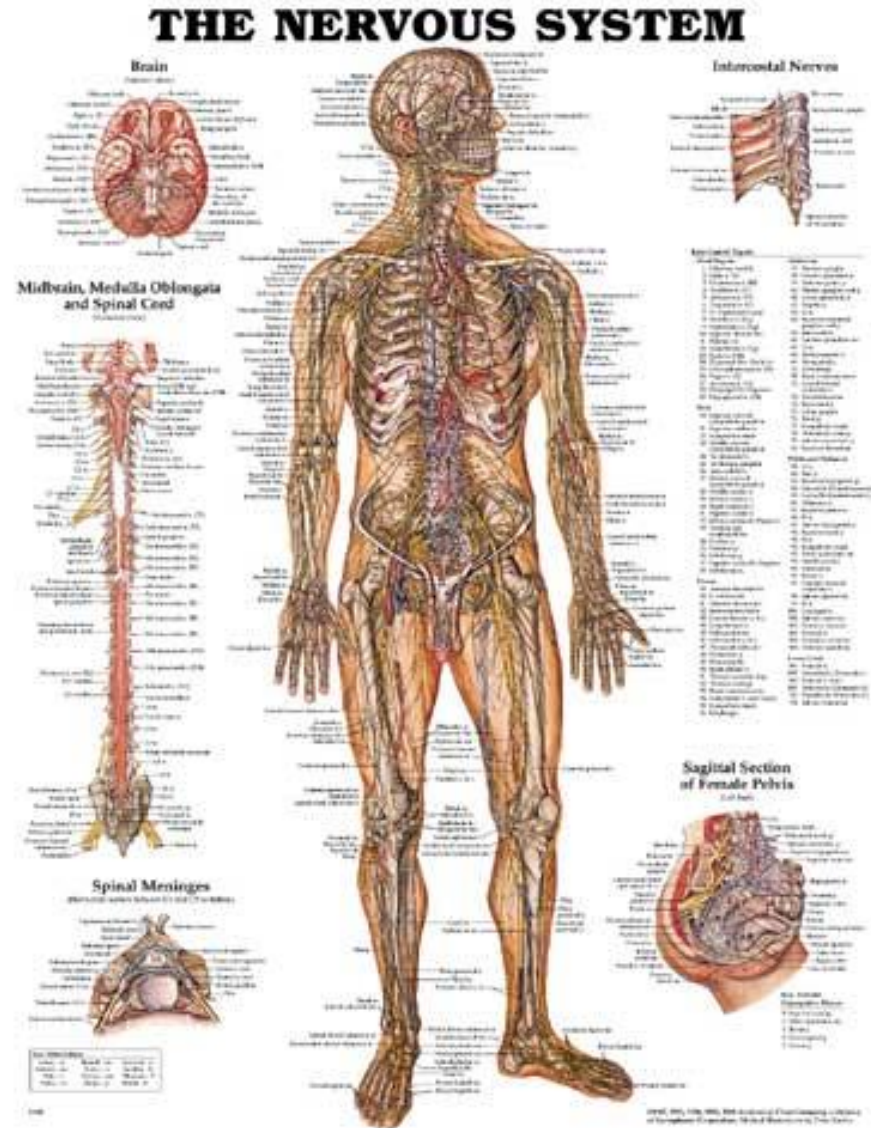


NEGATIVE FEEDBACK MECHANISMS

- ▶ Temperature set to 20⁰ C (NORMAL CONDITION)
- ▶ Internal house temperature drops to 17⁰ C (CHANGE)
- ▶ Thermostat detects drop in temperature (SENSOR)
- ▶ Thermostat turns on furnace (COORDINATING CENTRE)
- ▶ Furnace starts and begins to warm house (EFFECTOR)
- ▶ Temperature returns to 20⁰ C (NORMAL CONDITION)



- ▶ The coordination and regulation of homeostasis through negative feedback mechanism in the body is most often achieved by a combination of **nervous and hormonal mechanisms.**



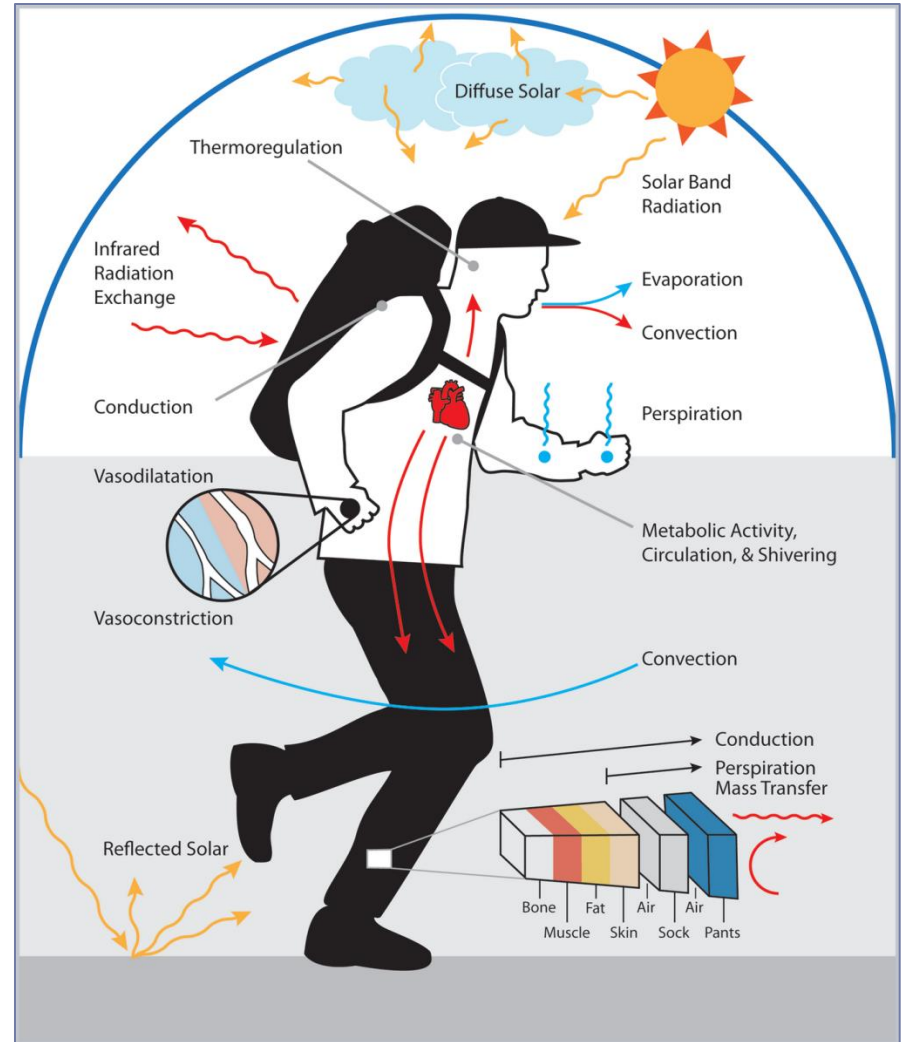
HOMEOSTATIC SYSTEMS

- ▶ Three important homeostatic systems in the human body that depend upon negative feedback mechanisms to maintain equilibrium are:
 - ▶ **1) thermoregulation** (the maintenance of body temperature)
 - ▶ **2) osmoregulation** (water balance) and
 - ▶ **3) waste management**

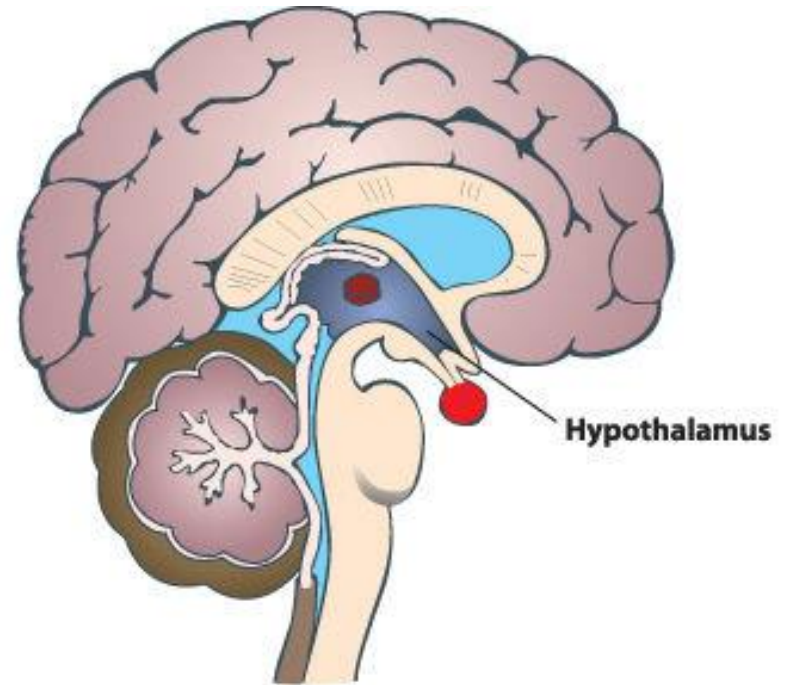


THERMOREGULATION

- ▶ Thermoregulation is the ability to maintain a constant body temperature.
- ▶ Humans are able to maintain a constant body temperature despite changes in the external environmental temperature.



- ▶ The **hypothalamus**, a part of the human brain, is the coordinating centre for body's temperature regulation.
- ▶ When there is a change in the external temperature the hypothalamus will release hormones that target specific effectors such as sweat glands.



OSMOREGULATION

- ▶ Osmoregulation is the ability to maintain a constant water balance.
- ▶ For the body to maintain water balance, humans must consume fluids daily.
- ▶ A drop in fluid intake by as little as 1 % of your body mass will cause thirst, a decrease of 5 % will result in extreme pain and collapse, while a decrease of 10 % often results in death.



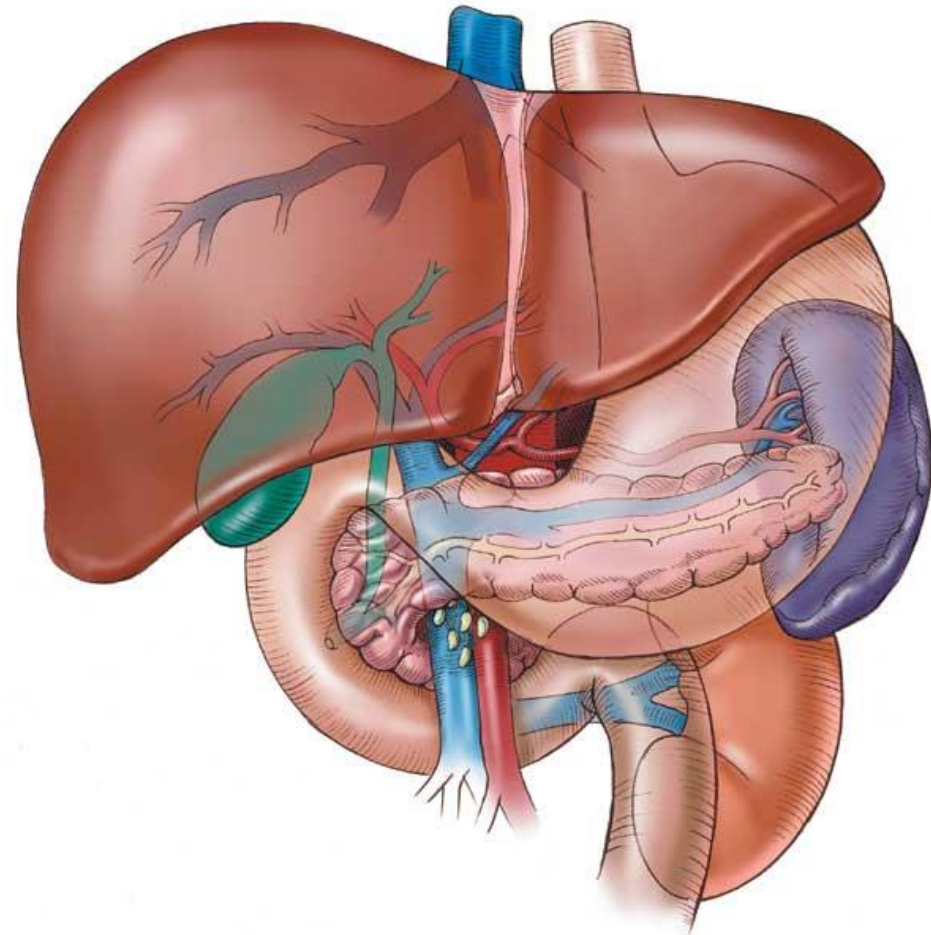
OSMOREGULATION

- ▶ The hypothalamus is the coordinating centre for water balance and can detect changes in the fluid concentrations of the blood.
- ▶ When the fluid concentration of the blood decreases (dehydration) then the hypothalamus will trigger the release of a hormone to increase water absorption.



WASTE MANAGEMENT

- ▶ Waste management, or the ability of the body to rid itself of harmful wastes, is essential for the maintenance of homeostasis.
- ▶ One example of a harmful waste product is the ammonia produced during the breakdown of proteins.
- ▶ Ammonia is extremely toxic to the body. The liver is most important organ involved in the elimination of ammonia.



► Organs, such as the **kidneys, lungs, skin** and **stomach** are involved in the elimination of waste products.

