

CHAPTER 3:

Coordination and response

TODAY:-

- Homeostasis?
- Homeostatic Control Process
- Regulation of Water Content
- Regulation of Body Temperature



What is Homeostasis?

Maintenance of a stable internal environment in the body of an organism

Temperature, water, pH and blood pressure are in a balanced and stable condition

Provide optimum conditions so that all living processes in the body function well

Importance of Homeostasis

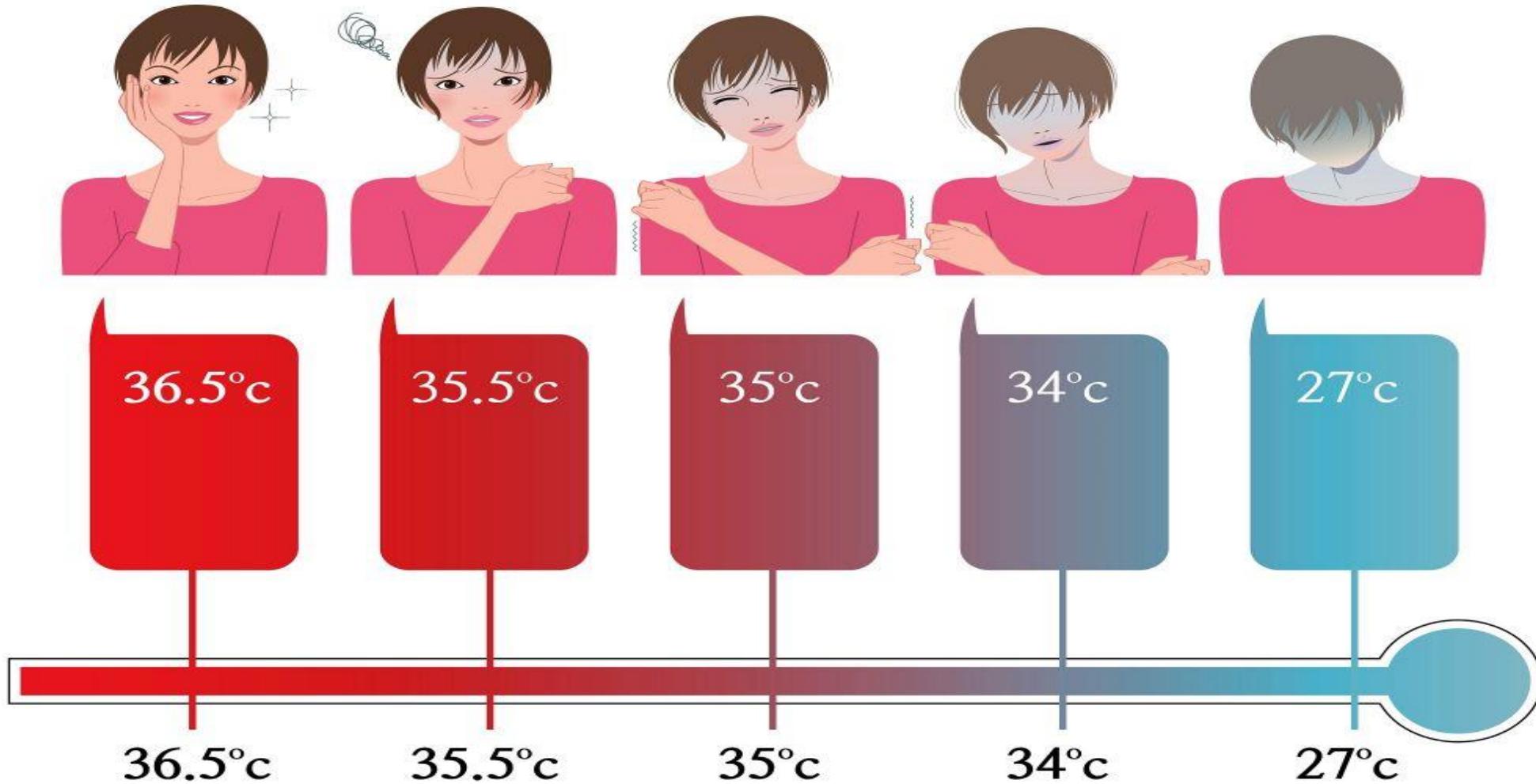
To provide a stable environment in the body for the cells to function optimally

To enable enzymes to function at their optimum rate

Allow living processes in body → work well



Hypothermia



Temperature too high → cells in organism may die

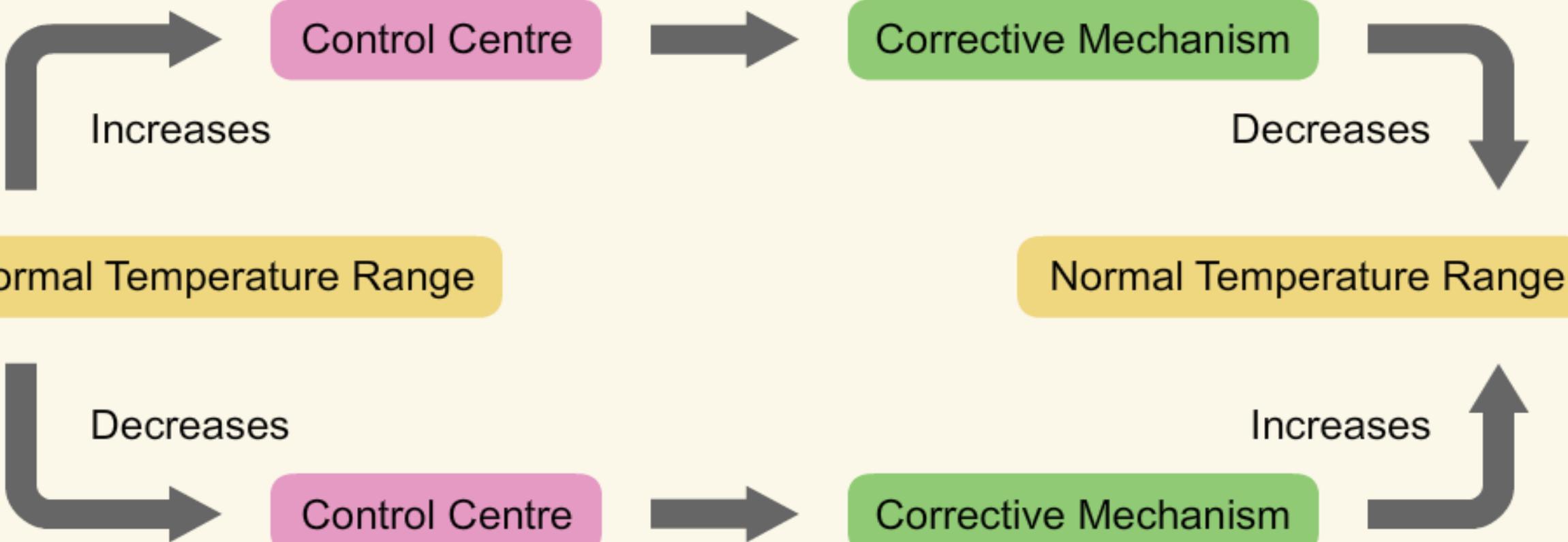


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Homeostatic Control Process



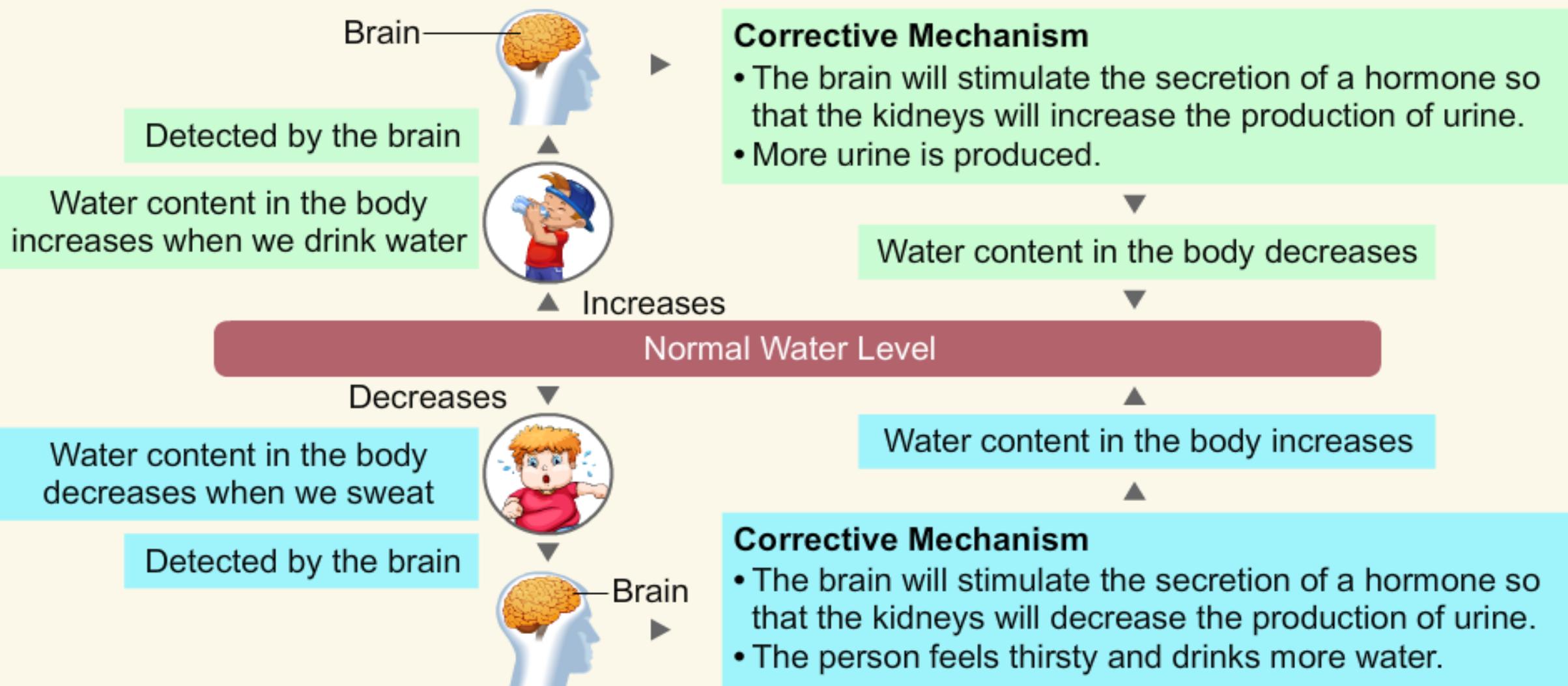
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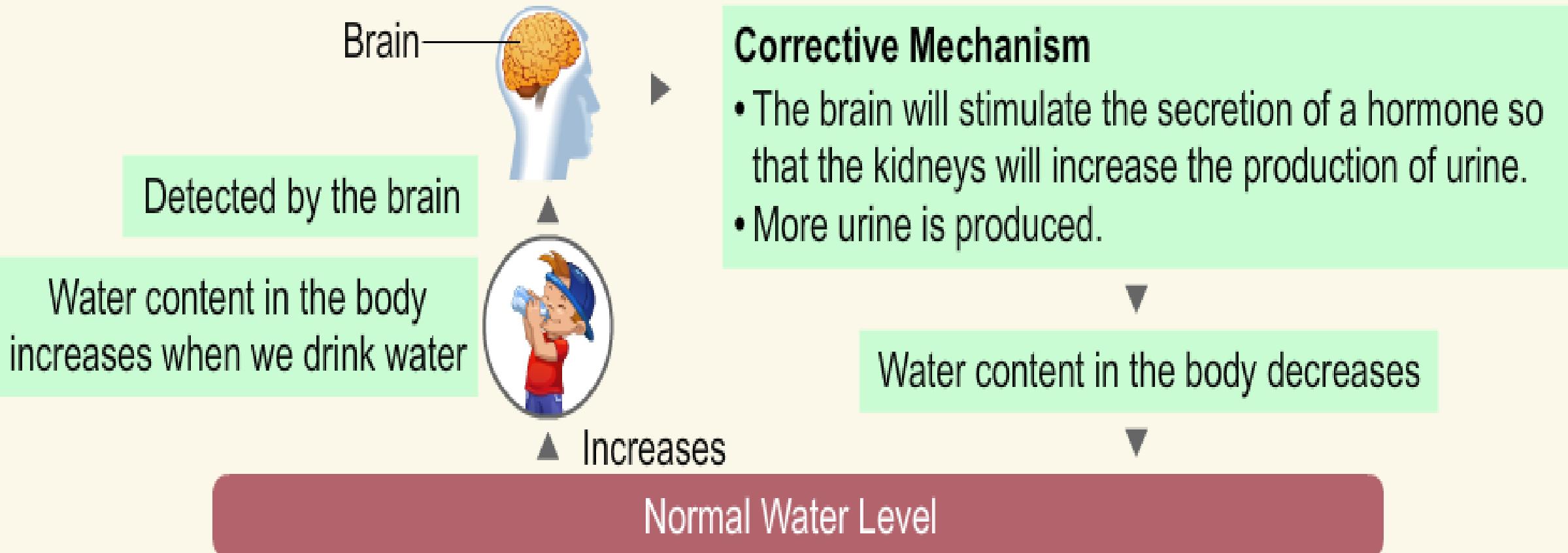
Regulation of Water Content

Systems involved: **Nervous system, Excretory system and Endocrine system**

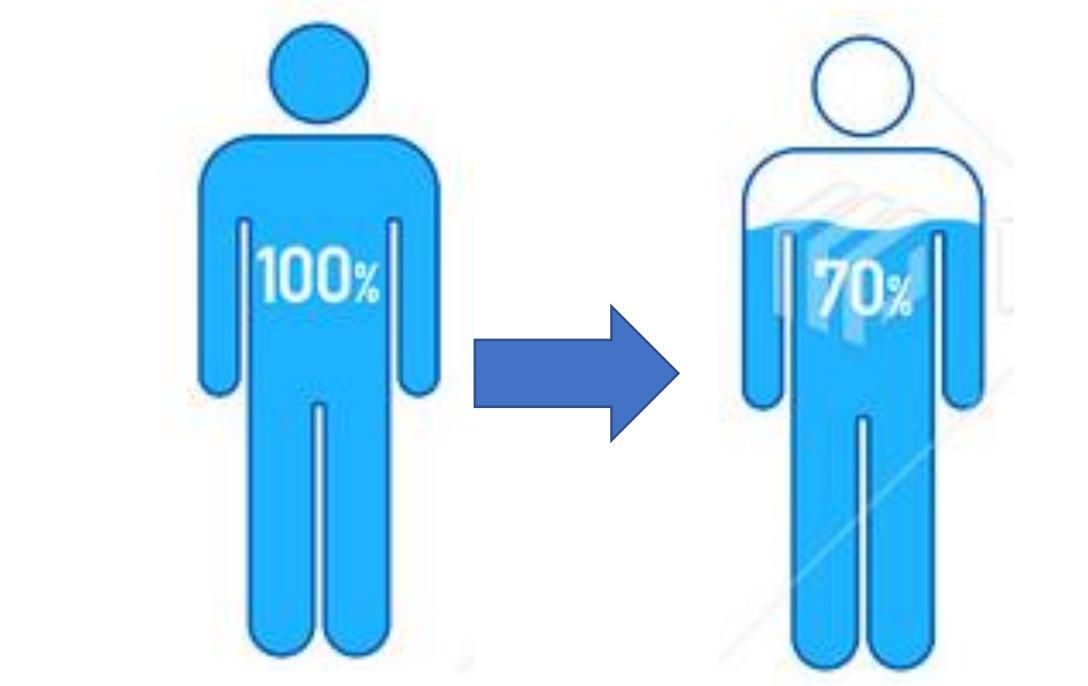
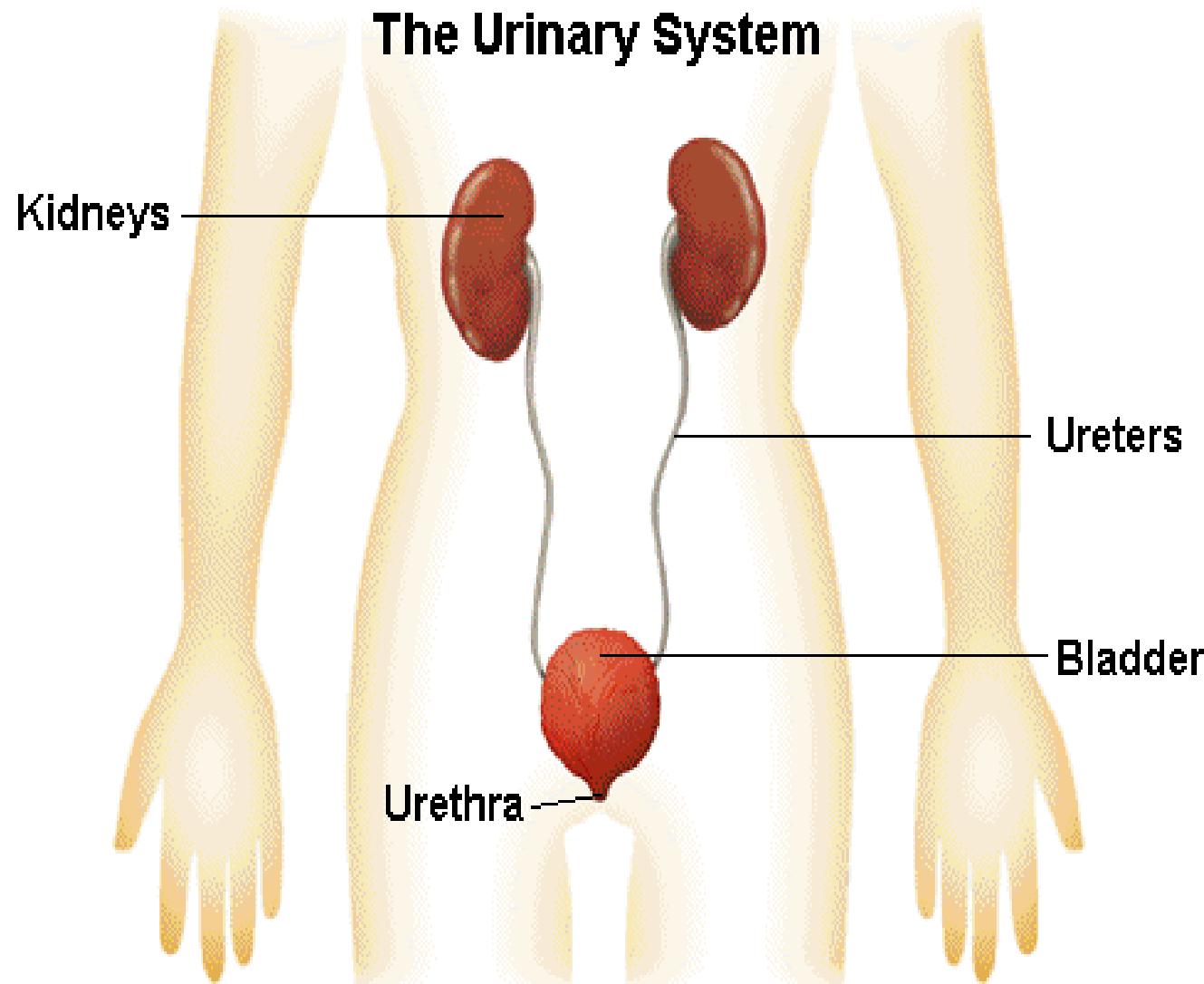


Regulation of Water Content

Systems involved: **Nervous system, Excretory system and Endocrine system**



The Urinary System



Regulation of Water Content

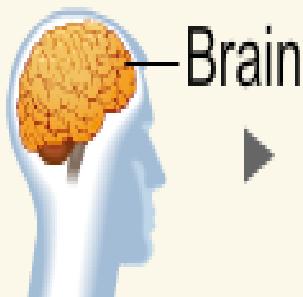
Systems involved: **Nervous system**, **Excretory system** and **Endocrine system**

Decreases

Water content in the body decreases when we sweat



Detected by the brain



Normal Water Level

Water content in the body increases

Corrective Mechanism

- The brain will stimulate the secretion of a hormone so that the kidneys will decrease the production of urine.
- The person feels thirsty and drinks more water.

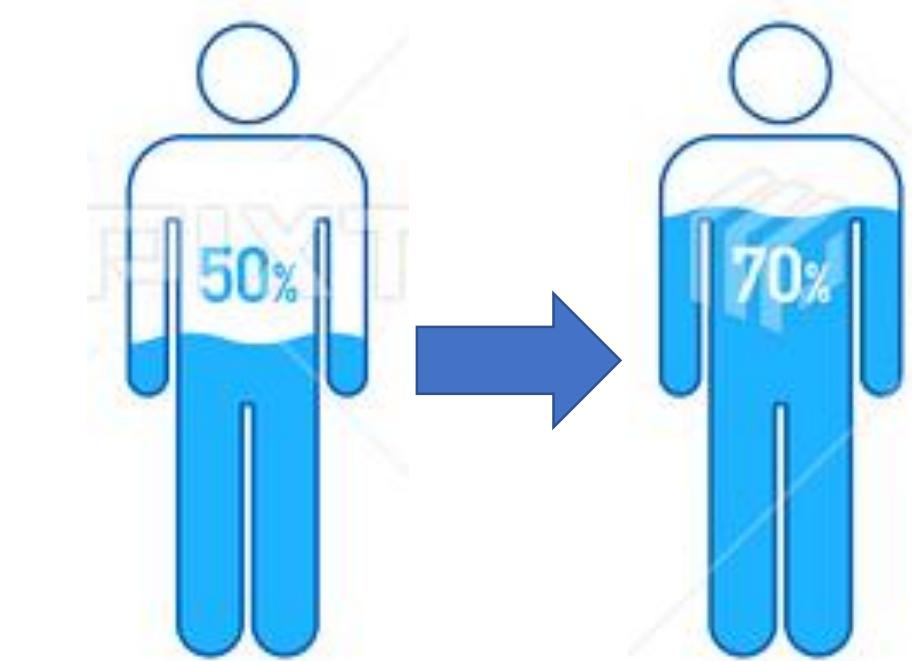
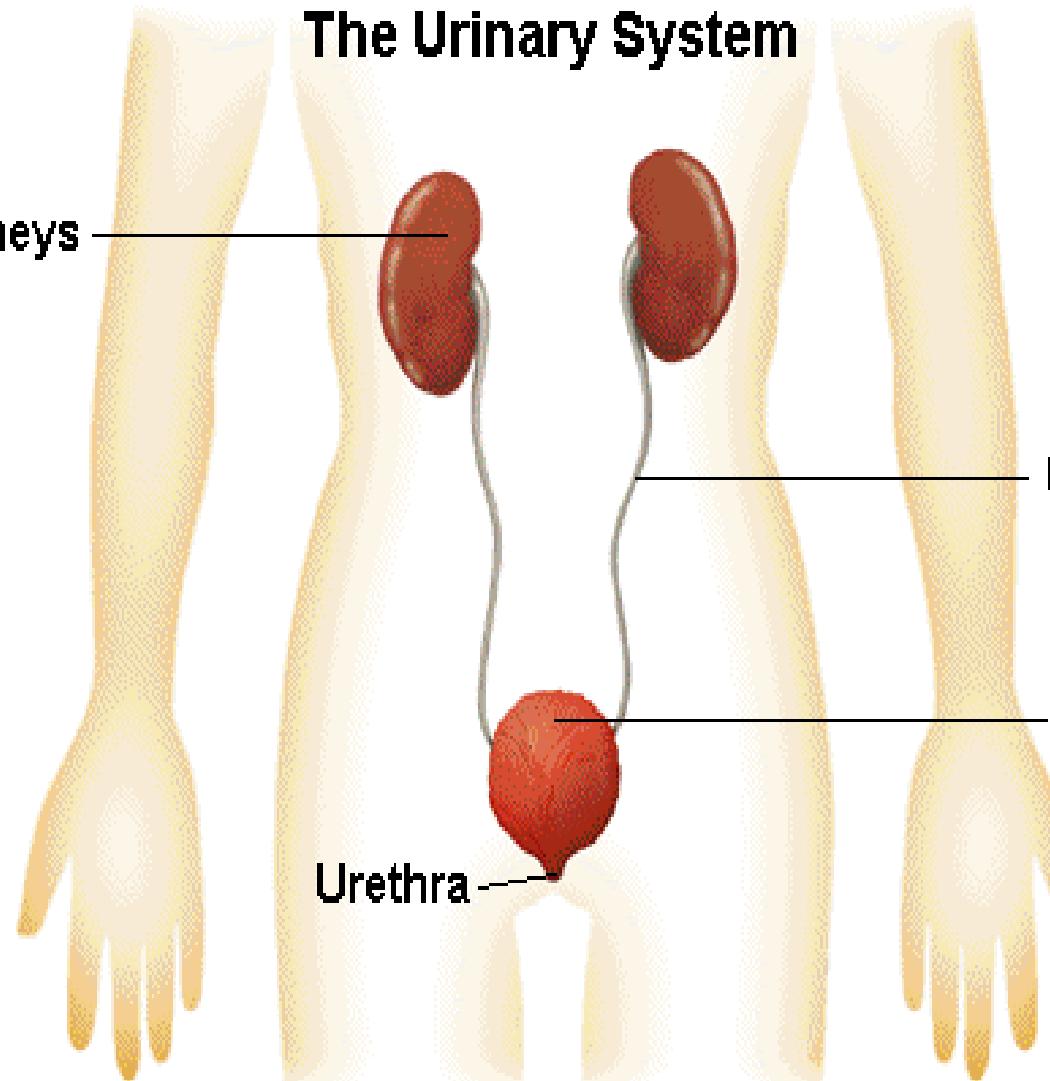
The Urinary System

Kidneys

Ureters

Bladder

Urethra



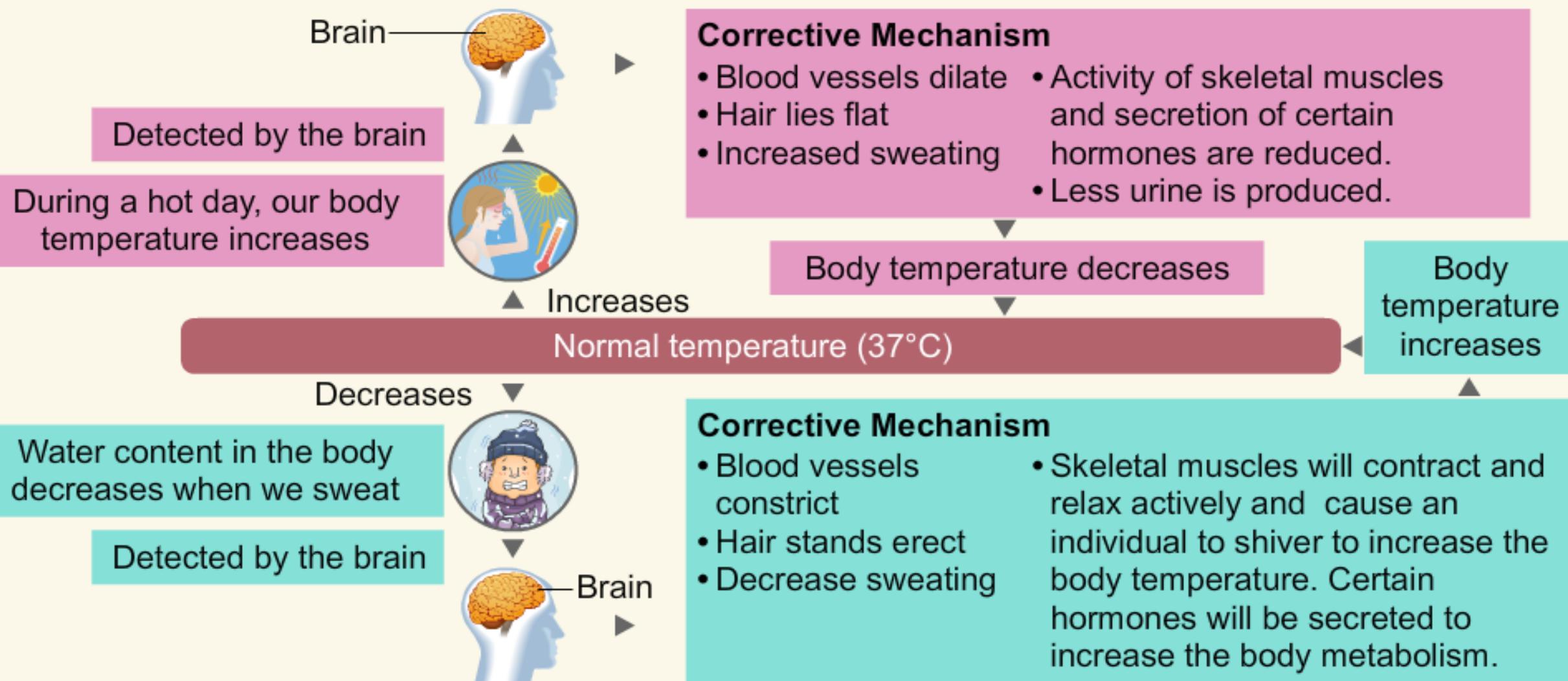
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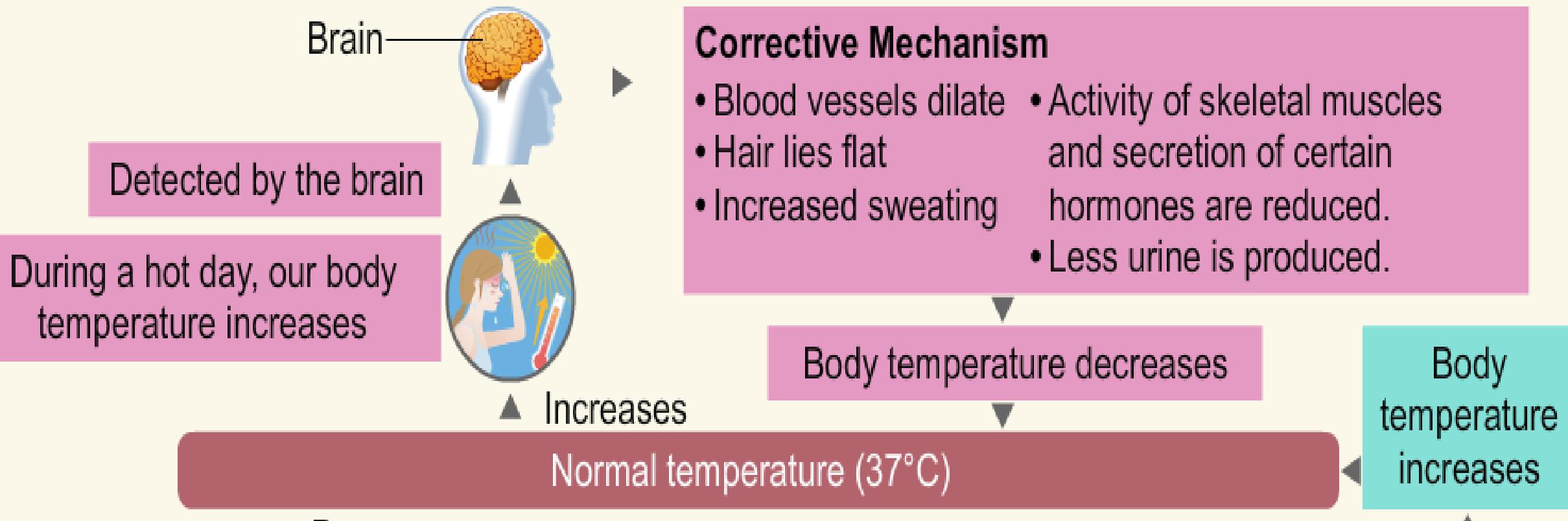
Regulation of Body Temperature

Systems involved: Nervous system, Excretory system, Muscular system, Circulatory system and Endocrine system



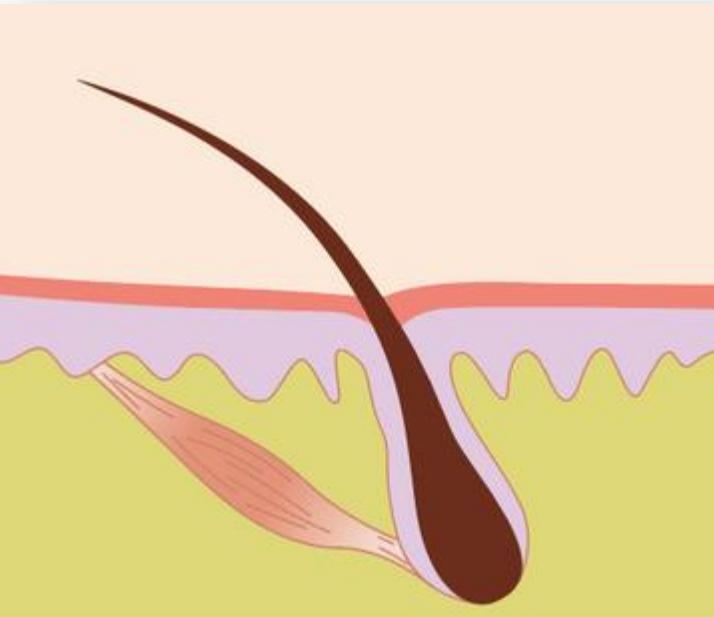
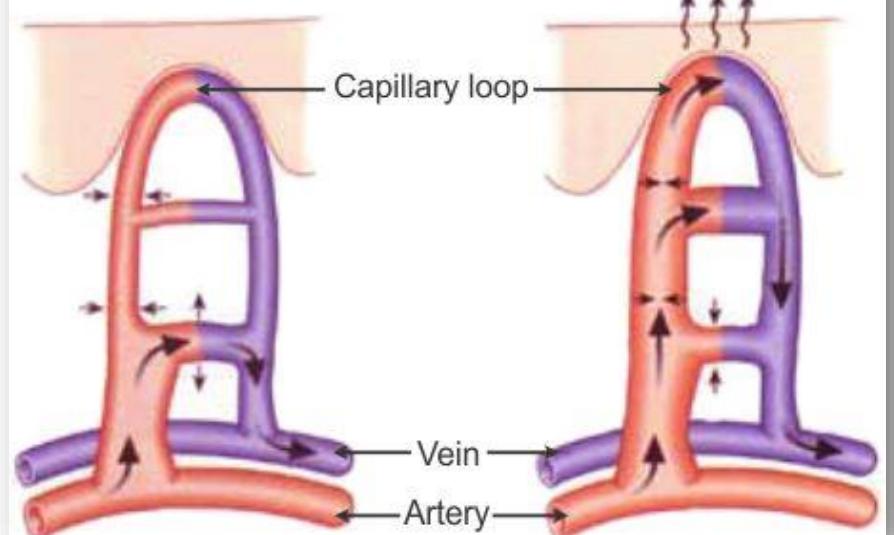
Regulation of Body Temperature

Systems involved: Nervous system, Excretory system, Muscular system, Circulatory system and Endocrine system



Heat kept in and retained by the body

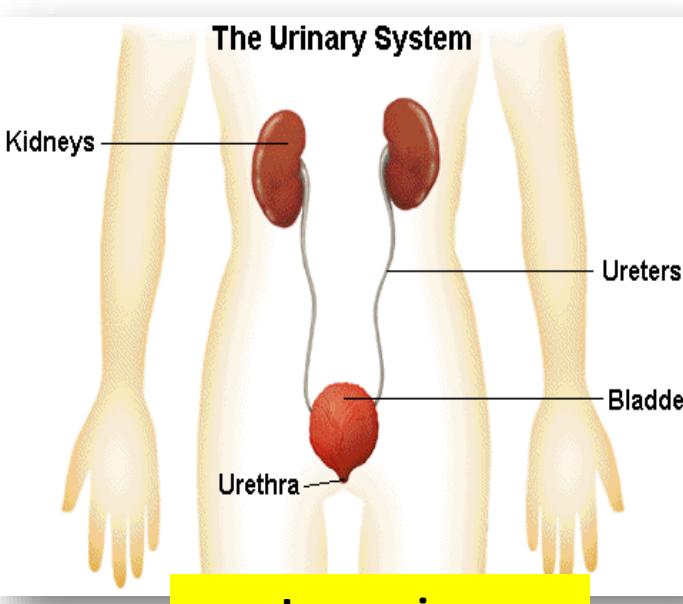
Heat loss by convection and radiation



blood vessel dilate



Hair lie flat



Increase sweating



Reddish skin

Less urine

Regulation of Body Temperature

Systems involved: Nervous system, Excretory system, Muscular system, Circulatory system and Endocrine system

Normal temperature (37°C)

Water content in the body decreases when we sweat

Detected by the brain

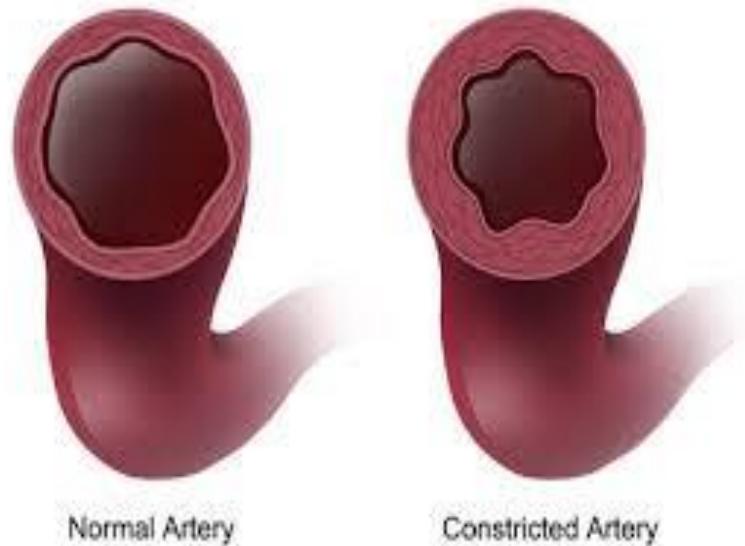


Decreases

Corrective Mechanism

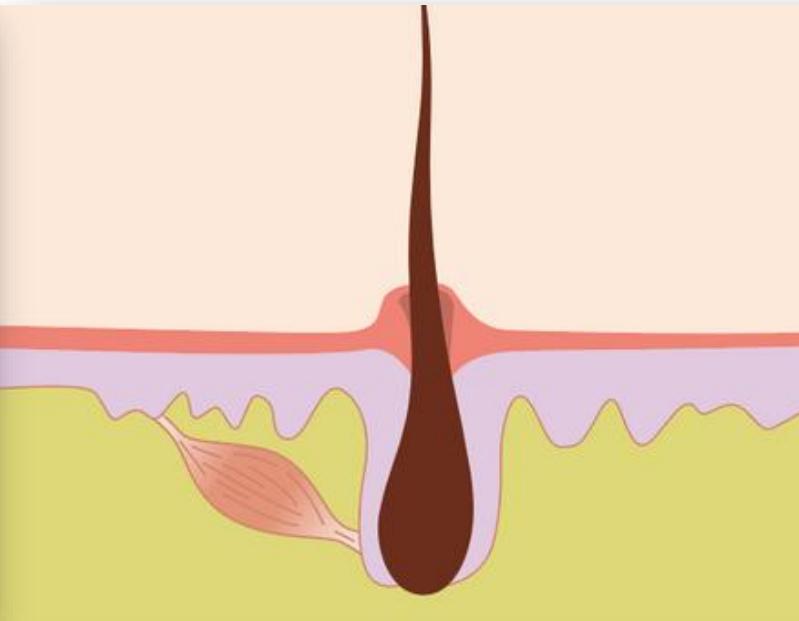
- Blood vessels constrict
- Hair stands erect
- Decrease sweating
- Skeletal muscles will contract and relax actively and cause an individual to shiver to increase the body temperature. Certain hormones will be secreted to increase the body metabolism.

Body temperature increases



Normal Artery

Constricted Artery



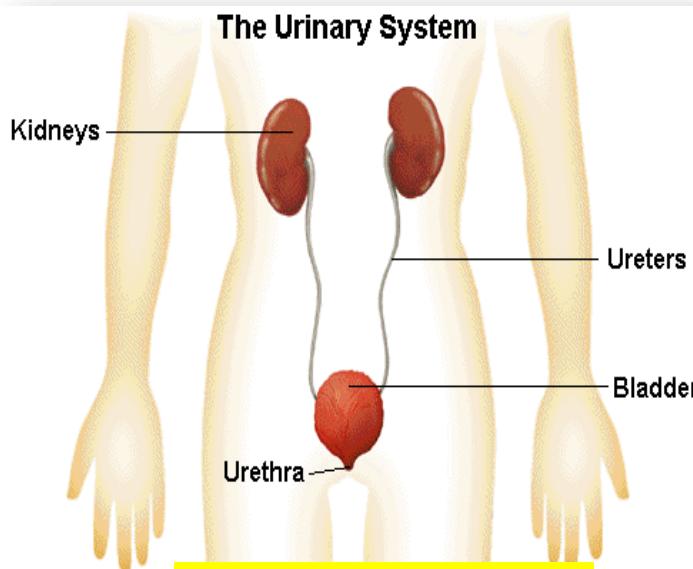
blood vessel constrict



Pale skin



Decrease sweating



More urine



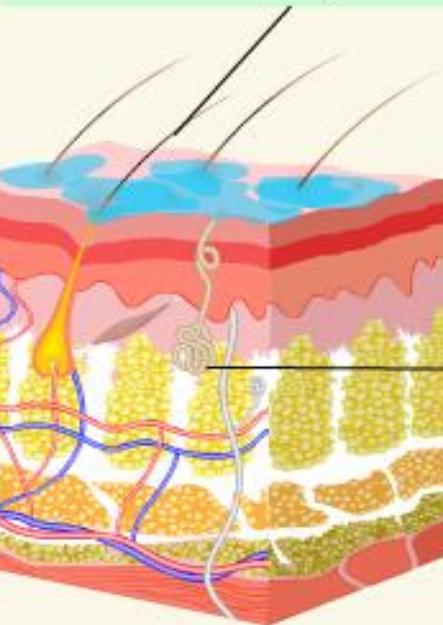
Shivering

Function of the Skin in Regulating Body Temperature



In a Warm Environment

- Blood vessels dilate to allow more blood flow close to the skin to increase heat loss.



- Hair lies flat
- Very little air is trapped
- Heat is easily lost

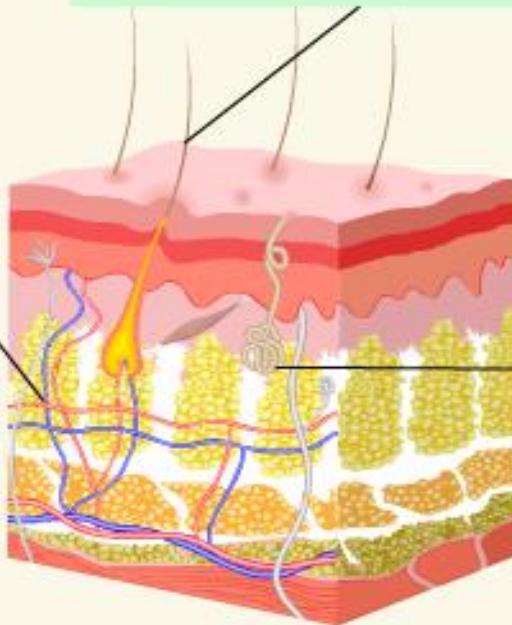
- Sweat glands produce more sweat to cool the skin when sweat is evaporated.

Function of the Skin in Regulating Body Temperature



In a Cold Environment

- Blood vessels constrict to reduce blood flow to the skin to reduce heat loss.



- Hair becomes erect and traps a thick layer of air that acts as a heat insulator.

- Less sweat is produced and heat is conserved.

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Summative Practice

3

1. How do plants control homeostasis?
2. How do our bodies respond to changes in temperature when we enter a very cold room?
3. What is the role of blood vessels in increasing heat loss?
4. What is the advantage of having a constant body temperature?
5. During exercise, our body loses a lot of water. Why do people who exercise need to drink water before feeling thirsty? 
6. Why does our face look red after doing an active exercise but pale when feeling cold? 

Summative Practice

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Summative Practice

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1. How do plants control homeostasis?
2. How do our bodies respond to changes in temperature when we enter a very cold room?

- **Blood vessels constrict** (to reduce heat released to surroundings)
- **Hair stands erect** (to trap heat from being lost to the surroundings)
- **Less sweating** (to reduce heat loss through evaporation)
- **Skeletal muscles contract and relax actively** (causing our body to shiver and increase the body temperature)
- **certain hormones are secreted** (to increase the body's metabolism)

Summative Practice

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Summative Practice

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Blood vessels dilate to enable more blood to flow near the surface of the skin to release more heat to the surroundings.

Summative Practice

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**Enables enzymes to function
optimally at 37°C to regulate all
chemical reactions in living cells.**

Summative Practice

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to **replace the water lost** through evaporation during sweating.

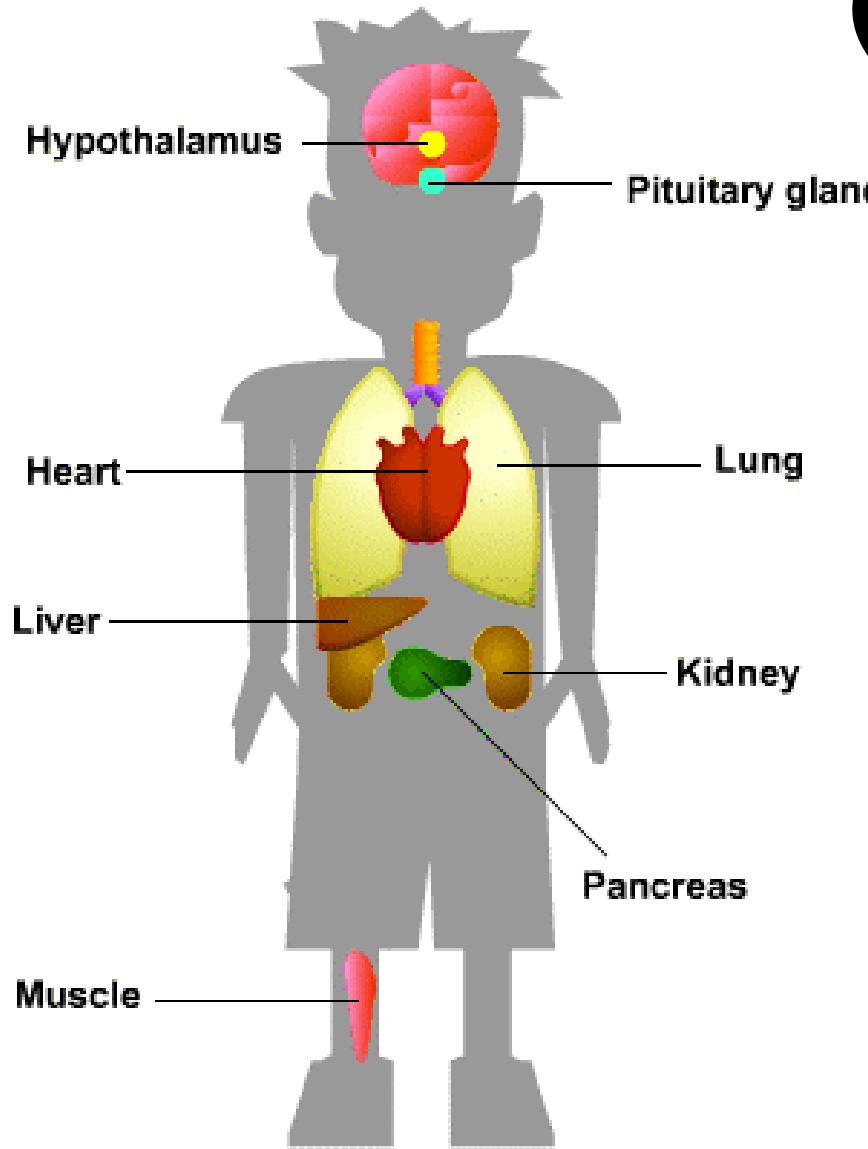
6. Why does our face look red after doing an active exercise but pale when feeling cold?



6. Why does our face look red after doing an active exercise but pale when feeling cold?



- After doing an active **exercise**, our body **temperature will increase**.
- **Blood vessels dilate** to enable more blood flow to the skin **to release heat**. Thus, **we blush**.
- On the other hand, our body **temperature decreases when we feel cold**.
- **Blood vessels constrict** to enable more blood flow away from the skin **to reduce heat loss**. Thus, our **face will become pale**.



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and

response

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- Homeostasis in Plants
- Transpiration
- Importance of Homeostasis to Humans
and Living Things



HOMEOSTASIS IN ANIMALS



They **have no sweat gland**, except in their sole. **How they maintain homeostasis?**



I hang out my tongue
to reduce my body
temperature

I lick my fur to
reduce my body
temperature



Homeostasis in Animals



Our fur stands erect
when it is cold to trap
heat



How do lizards maintain homeostasis when the surrounding temperature changes?

In a Cold Environment

- Lizards become less active
- Muscles function more slowly
- Metabolism rate decreases
- Body temperature decreases



In a Warm Environment

- The heart beats faster
- Movements become faster
- Metabolism rate increases
- Body temperature increases

How do snails and bees maintain homeostasis when the surrounding temperature increases?

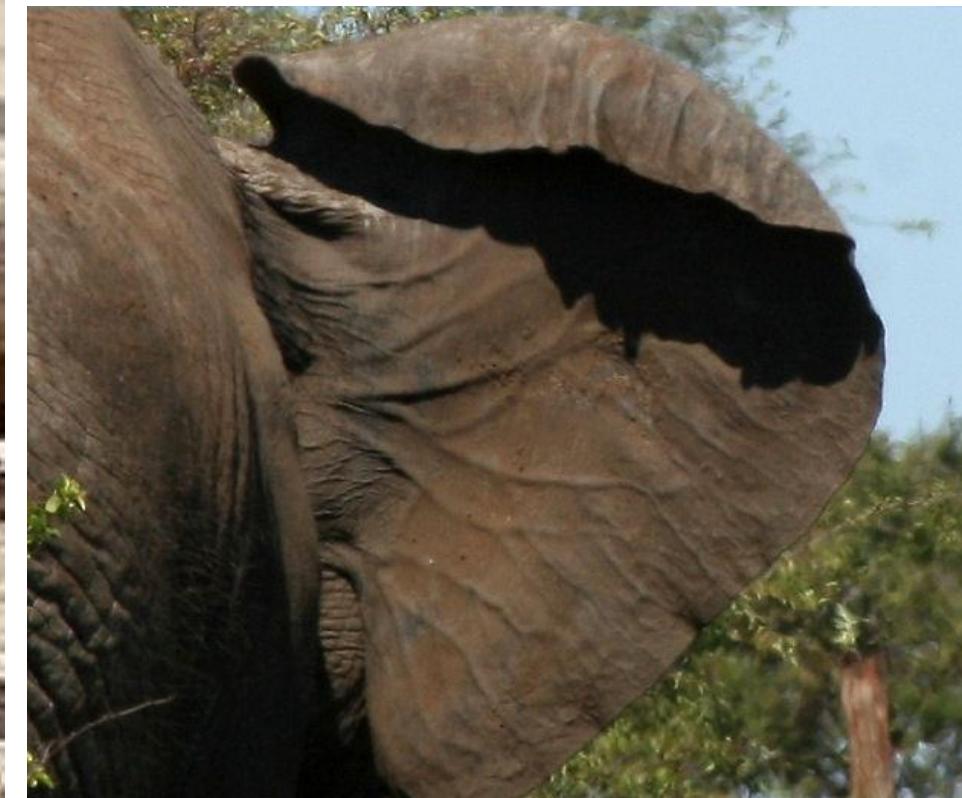


- Snails lose a lot of water through evaporation from the skin surface.
- Snails produce slime and move to humid places to reduce water loss by evaporation.



- Bees have a waxy skin layer to prevent excess loss of water by evaporation.
- Bees close their spiracles between two breathing movements to reduce loss of water.

**Elephant
flapping ears
on hot days**



**Crocodile
open mouth
during hot days**





Hippopotamus and buffalo
Soaking in water / mud on hot days

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HOMEOSTASIS IN PLANTS



Afternoon
(Banana leaves roll up to
avoid excessive water loss)



evening



Mid summer
(Tomato leaves curl to avoid excessive water loss)

TODAY:-

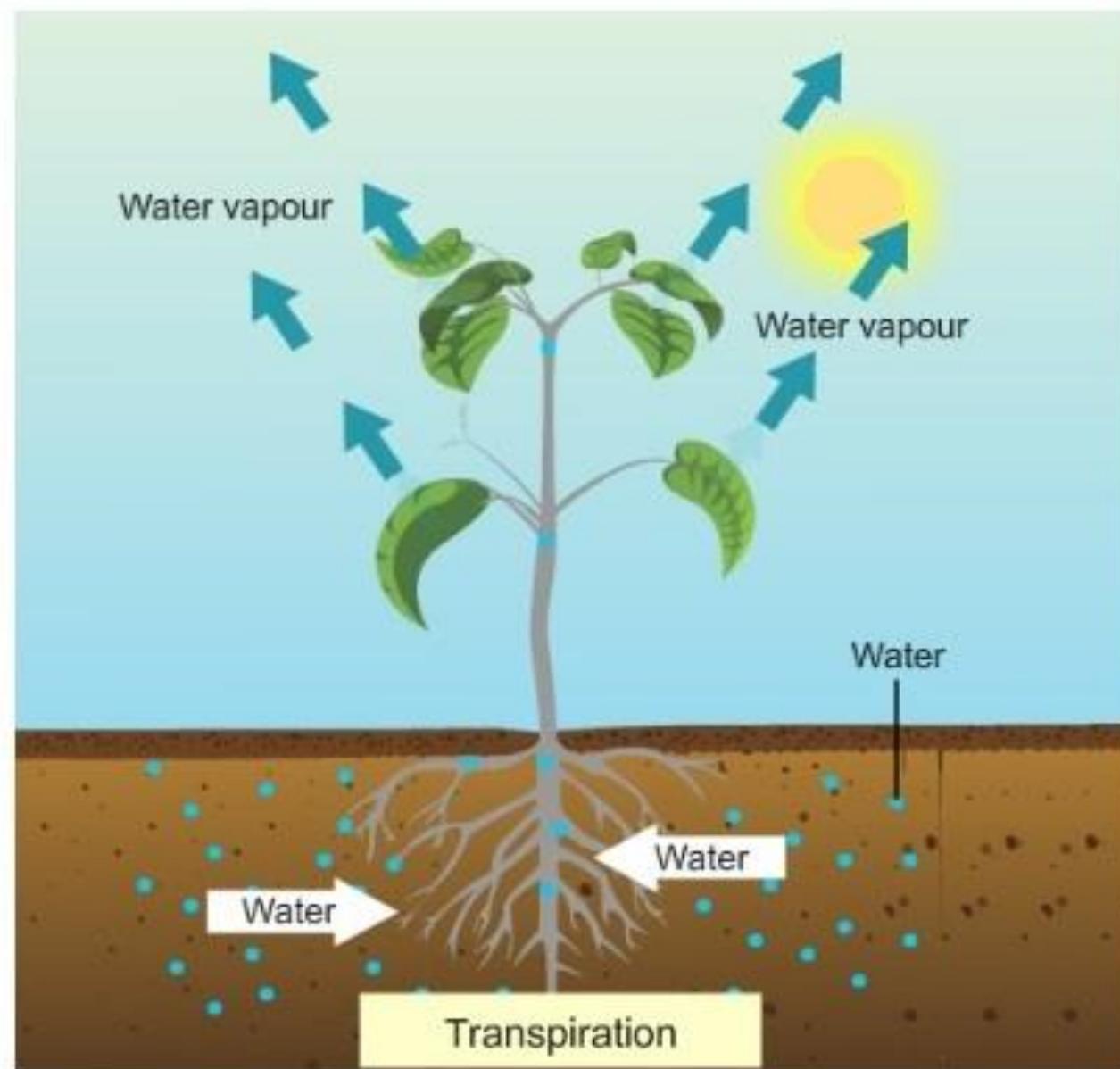
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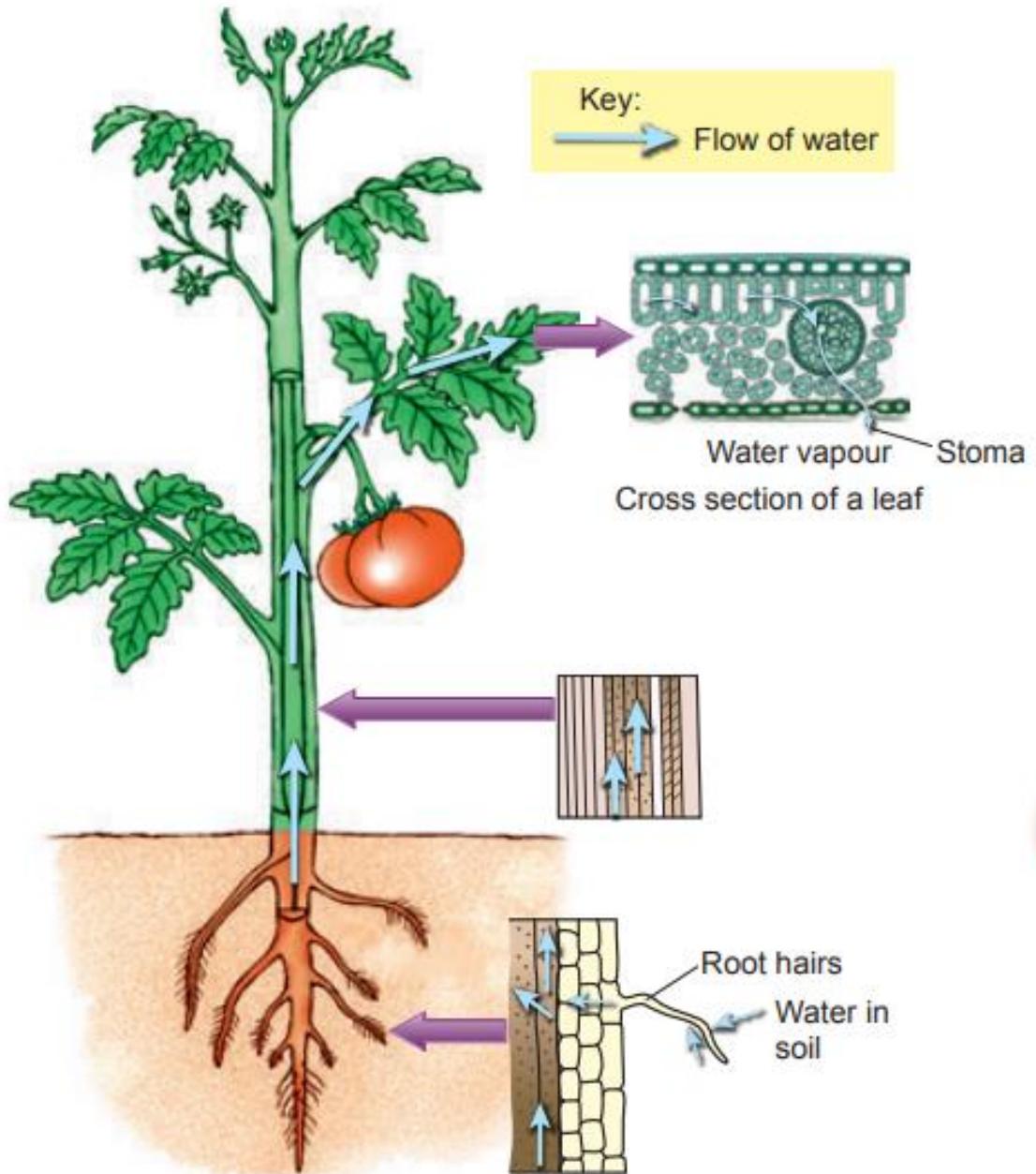


Homeostasis in Plants

Transpiration

- Plants release water through **transpiration** as part of their need to maintain **homeostasis**.
- **Transpiration** is the loss of water from the leaves in the form of water vapour to the surroundings through the stomata.





Science Exploration

Almost 90% of water absorbed by the roots of plants is lost through transpiration.

2

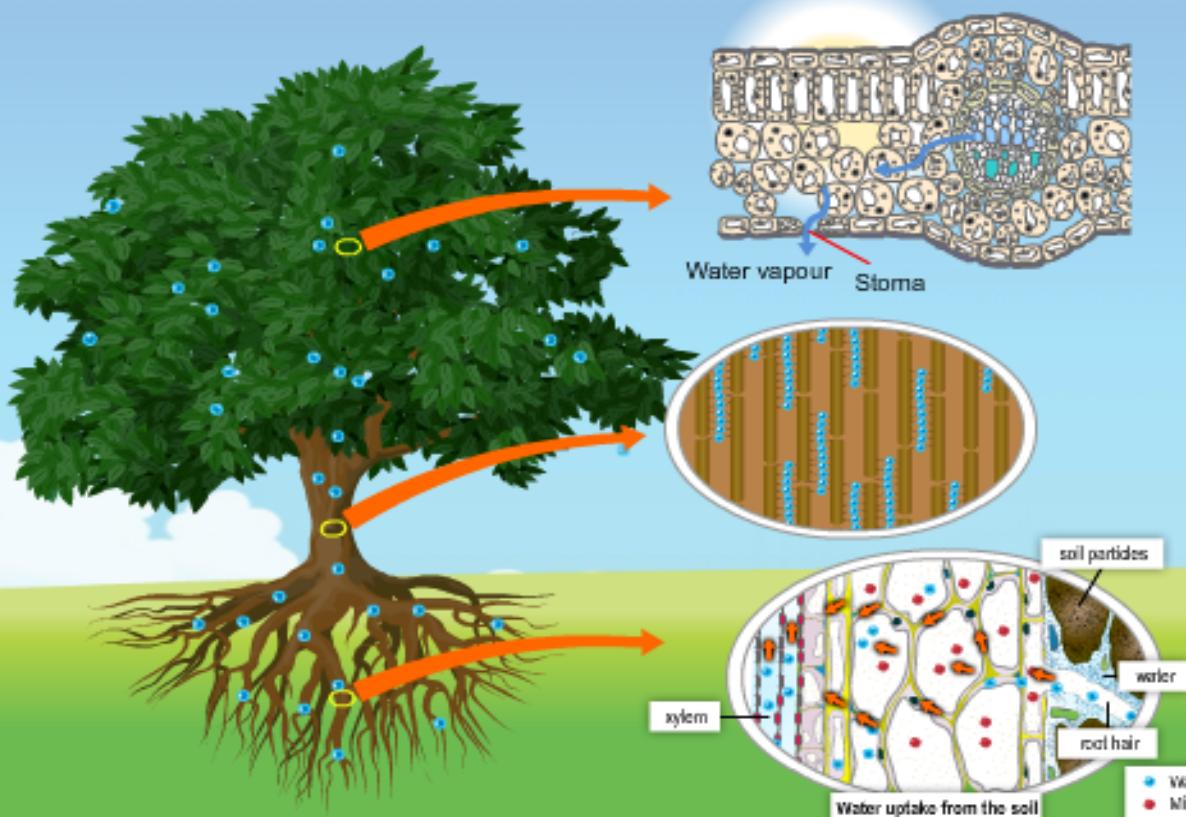
Transpiration on leaves produces force that draws water from the stems of plants.

1

Roots of plants absorb water and minerals from soil.

Figure 3.5 Transpiration helps in water transportation from roots to leaves

Importance of Transpiration



1

Roots absorb water and minerals from the soil.

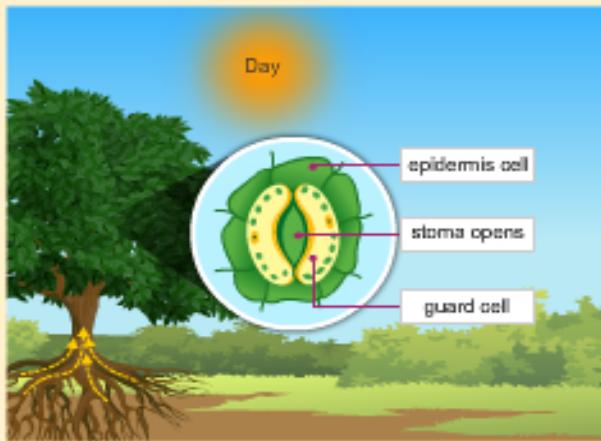
2

Transpiration produces a force to pull the water up from the soil to the leaves.

- Helps plants to absorb and transport water and minerals from the soil to all parts of the plant.
- Gives a cooling effect to the leaves and stems on a hot day.

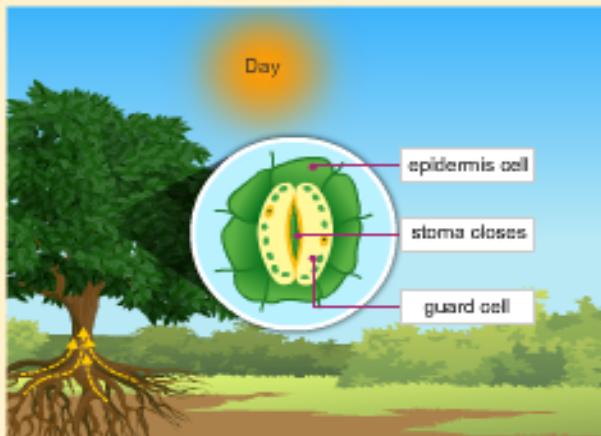
The Opening and Closing of Stoma

During the day



- Guard cells control the opening and closing of stoma. During the day, the stoma opens to enable the exchange of gases such as carbon dioxide and oxygen.
- At the same time, water vapour evaporates from the leaves through transpiration.

During a hot day



- When the temperature is too high, the stoma closes to reduce water loss from the leaves through transpiration.
- This is to prevent plants from withering or dying.

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IMPORTANCE OF HOMEOSTASIS TO HUMANS AND LIVING THINGS

- Provide optimum conditions
- Maintained in a balanced and stable condition
- Without homeostasis:



TODAY:-

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Homeostasis in Animals *Homeostasis dalam haiwan*

1. Homeostasis also occurs in animals. Animals like cats and dogs do not have sweat glands except on **their sole**.

Homeostasis belaku pada haiwan. Haiwan seperti kucing dan anjing tidak mempunyai kelenjar peluh kecuali pada _____.

2. How do they maintain homeostasis during changes in surrounding temperature?

Bagaimanakah haiwan - haiwan itu dapat mengekalkan homeostasis terhadap perubahan suhu persekitaran?



3. How do reptiles such as lizards maintain homeostasis towards changes in surrounding temperature?

Bagaimakah haiwan reptilia seperti cicak mengekalkan homeostasis terhadap perubahan suhu persekitaran?

Cold Surrounding

Persekutaran yang sejuk:

- **Body activities become slower**
- **Muscles function more slowly**
- **Movements become slower**
- **Metabolism rate decreases**
- **Body temperature decreases**



Hot Surrounding

Persekutaran yang panas:

- **The heart beats faster**
- **Movements become faster**
- **Metabolism rate increases**
- **Body temperature increases**

How about snail and bee to maintain their homeostasis?

Bagaimakah siput babi dengan lebah mengekalkan homeostasis?



Snail/ *Siput babi*

During cold,

- Loses a lot of water through evaporation on skin surface.

During hot,

- Produces fluid
- looks for humid places to reduce water loss.



Bee/ lebah

During cold,

- Has waxy skin layer
- loss of water vapour occurs through its spiracles

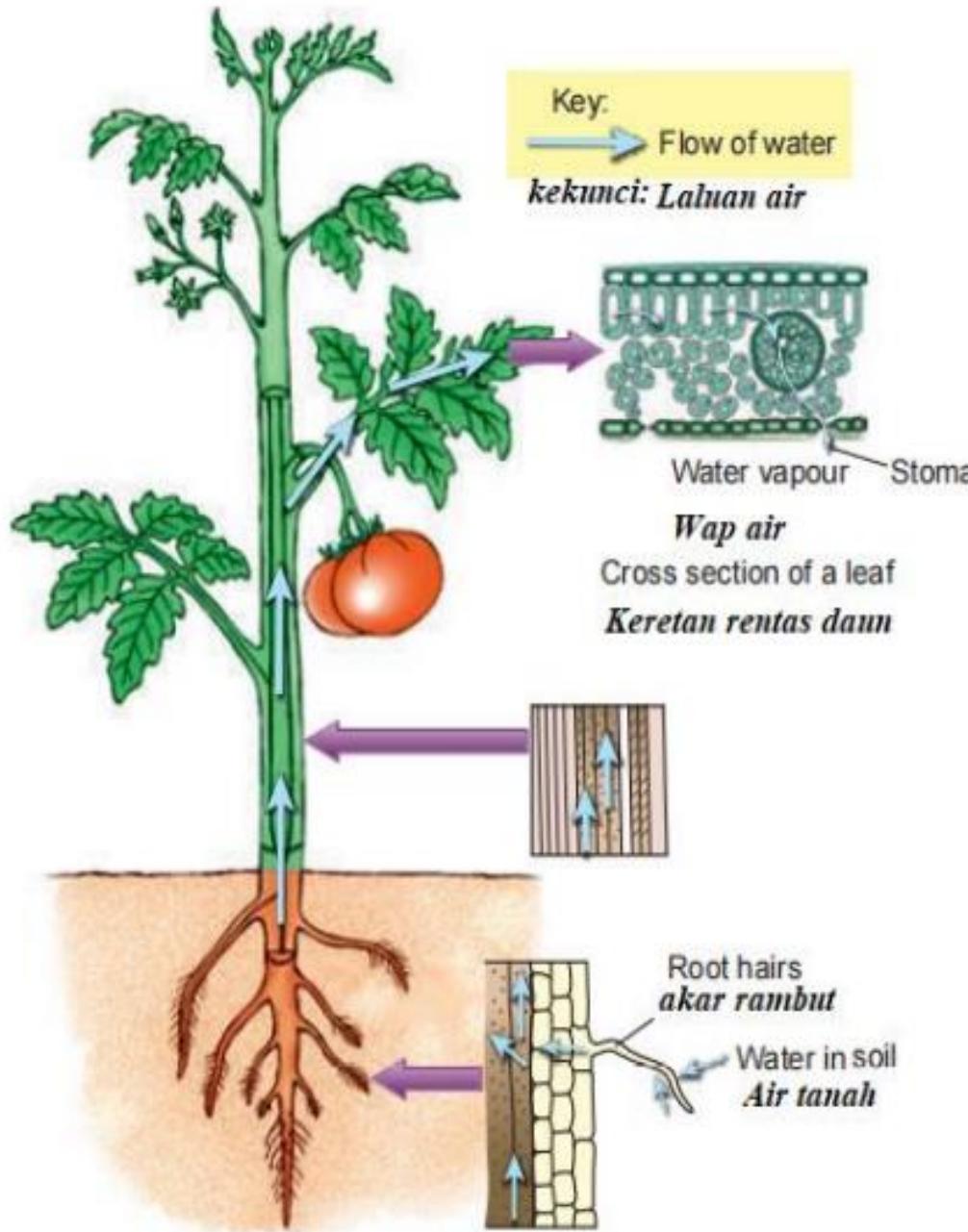
During hot,

- Closes spiracles between two breathing movements to reduce water loss.
-

Homeostasis in Plants

Homeostasis dalam tumbuhan.

1. Water from plants are lost through a process known as **transpiration**. During transpiration, plants **lose** water from leaves in the form of water vapour to the surrounding through the **stoma**. This involves the transport system in plants.
Air daripada tumbuhan hilang melalui proses yang dikenali sebagai _____ . Semasa transpirasi, air _____ daripada daun dalam bentuk wap air ke persekitaran melalui _____. Hal ini melibatkan sistem pengangkutan dalam tumbuhan.
2. Transpiration helps plants to **absorb** and carry **water** and **minerals** from the soil to all parts of the plant. **Evaporation** of water from the leaves **cools** the plant during hot days.
Transpirasi membantu tumbuhan _____ dan mengangkat air dan mineral dari tanah ke seluruh bahagian tumbuhan. _____ air daripada daun _____ tumbuhan pada hari panas.



Transpiration on leaves produces **force** that **draws** water from the stems of plants.
Transpirasi pada daun menghasilkan yang air dari bahagian batang tumbuhan

Roots of plants absorb **water** and **minerals** from soil.
Bahagian akar tumbuhan air dan dari tanah.

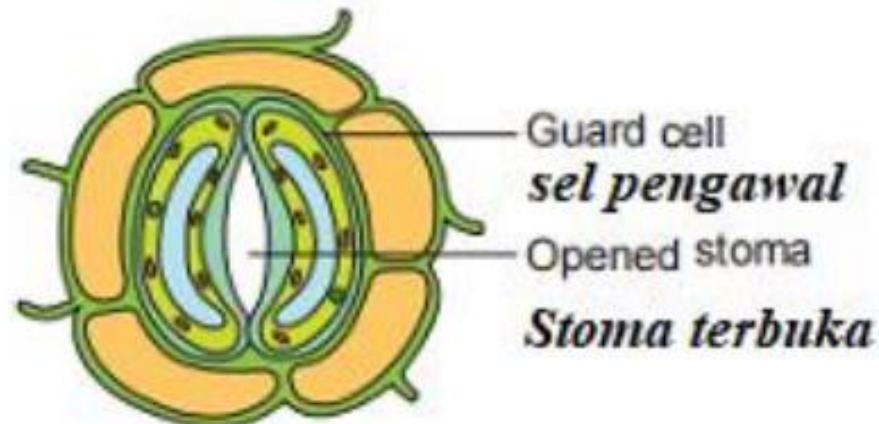
3. Stoma

Guard cells control the opening and closing of stoma. During the day, stoma opens to enable exchange of gas. At the same time, water will be lost from the leaves and this will increase the rate of water intake by the roots.

Sel-sel pengawal mengawal _____ dan _____ stoma. Pada waktu siang, stoma _____ untuk _____ gas. Pada masa sama, _____ akan _____ daripada daun dan hal ini akan meningkatkan air oleh akar.

During the day

Pada waktu siang

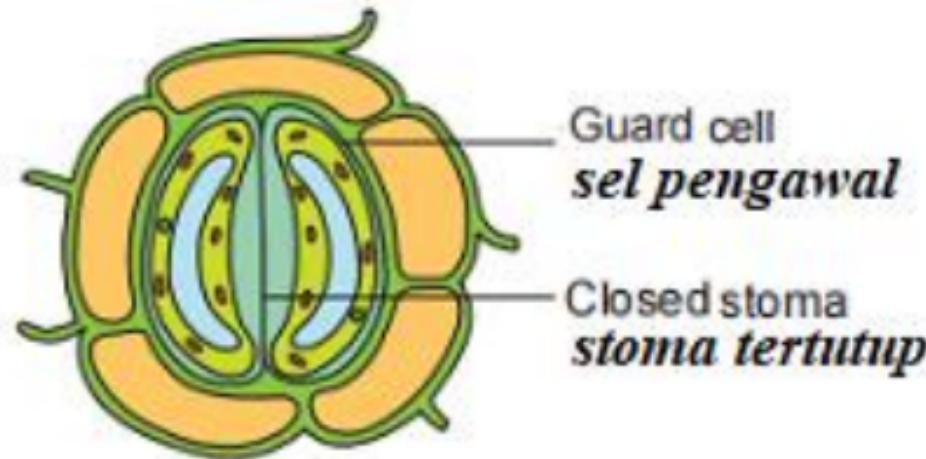


During the day, stoma opens to enable more water to be evaporated from the leaves through transpiration.

Pada waktu siang, stoma _____ supaya lebih air _____ daripada daun melalui transpirasi.

When the temperature is too high.

Pada suhu yang terlalu tinggi.



When the temperature is too high, **stoma closes** to reduce water **evaporated** from the leaves through transpiration.

Pada suhu yang terlalu tinggi, stoma akan untuk mengurangkan air yang dari pada daun melalui transpirasi.

Diagram 13: The opening and closing of stoma

Rajah 13: Pembukaan dan penutupan stoma

3. The bar chart shows the daily amount of water lost by various organs.

Carta bar berikut menunjukkan jumlah air yang hilang daripada pelbagai organ setiap hari.

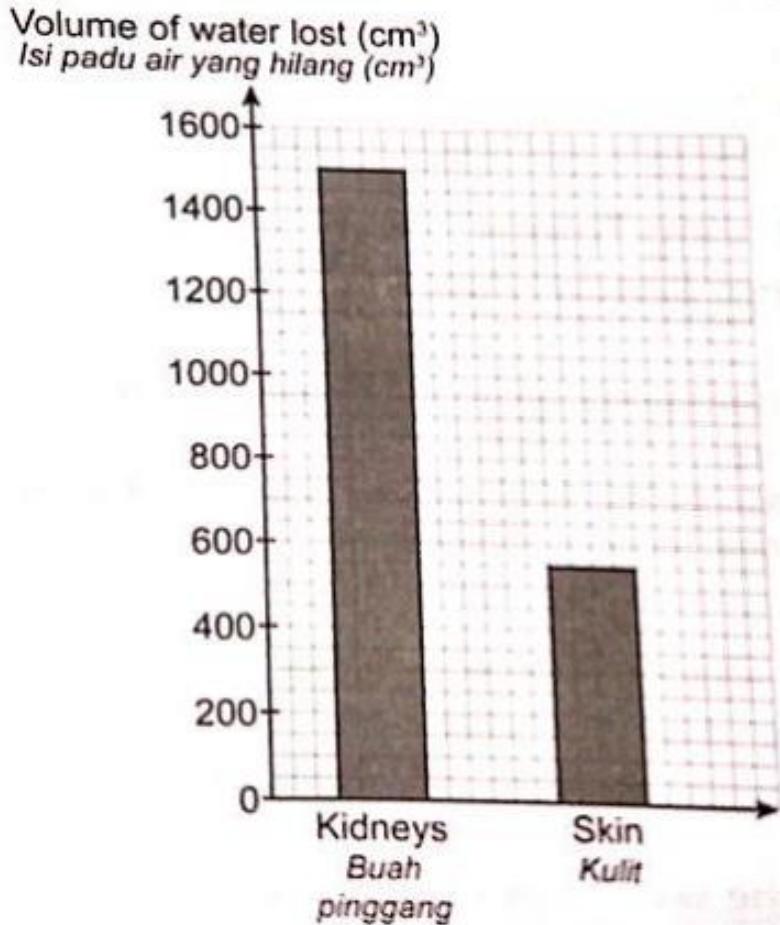


Diagram 14/ Rajah 14

(a) What is the total volume of water lost by various organs per day?

Apakah jumlah air yang hilang daripada pelbagai organ setiap hari?

3. The bar chart shows the daily amount of water lost by various organs.

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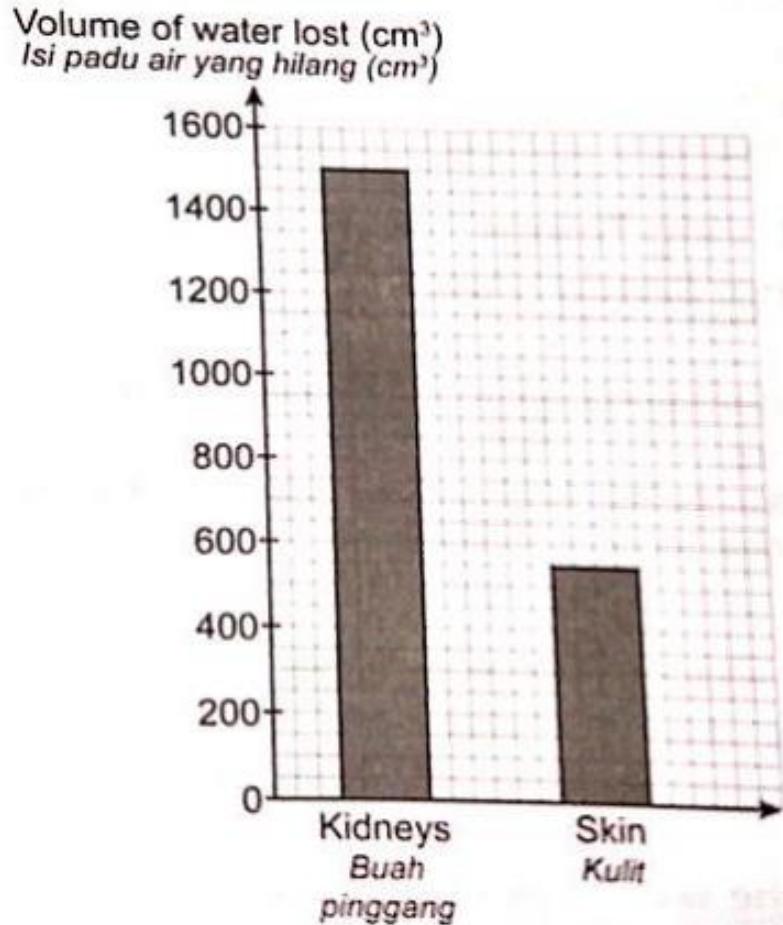


Diagram 14/ Rajah 14

(a) What is the total volume of water lost by various organs per day?

Apakah jumlah air yang hilang daripada pelbagai organ setiap hari?

2050 cm³

(b) What fraction of the total water loss is lost through the skin compared to total water lost?

Apakah pecahan air yang hilang melalui kulit berbanding jumlah air yang hilang? Tunjukkan pengiraan anda.

(c) Explain why a person who does vigorous exercise each day would lose more water?

Terangkan mengapa seseorang yang kerap bersenam setiap hari akan kehilangan lebih banyak air.

(b) What fraction of the total water loss is lost through the skin compared to total water lost?

Apakah pecahan air yang hilang melalui kulit berbanding jumlah air yang hilang? Tunjukkan pengiraan anda.

$$\textcolor{red}{550/2050 = 1/4}$$

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1/4

(c) Explain why a person who does vigorous exercise each day would lose more water?

Terangkan mengapa seseorang yang kerap bersenam setiap hari akan kehilangan lebih banyak air.

- **The body temperature of that person will increase**
- **He will sweat a lot to cool his body**
- **Therefore, more water lost from his body**

(d) During summer, the volume of water lost by the skin increases and the volume of water lost by kidneys decreases. Explain why.

Semasa musim panas, isipadu air yang hilang daripada kulit meningkat dan isipadu air yang hilang daripada ginjal berkurang. Terangkan mengapa.

(d) During summer, the volume of water lost by the skin increases and the volume of water lost by kidneys decreases. Explain why.

Semasa musim panas, isipadu air yang hilang daripada kulit meningkat dan isipadu air yang hilang daripada ginjal berkurang. Terangkan mengapa.

- **Body temperature will increase during summer**
- **Sweat released to cool the body, will cause more water lost**
- **To balance the water content in the body, water lost by kidneys will decrease**