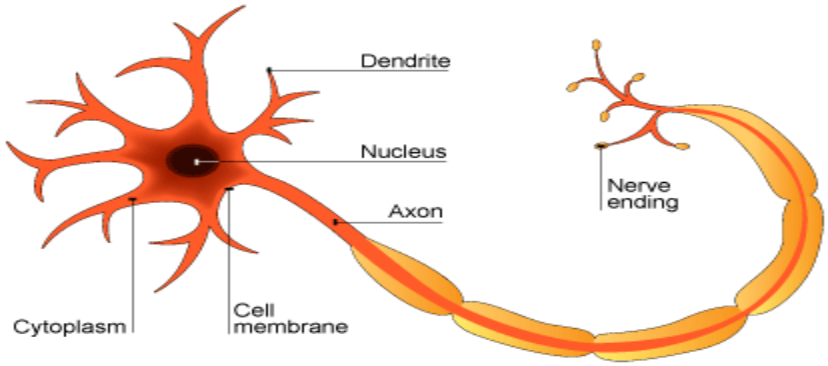
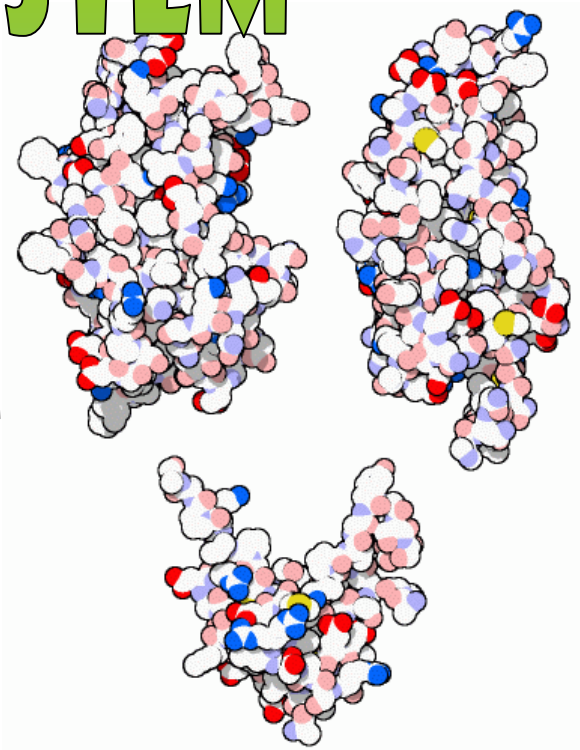
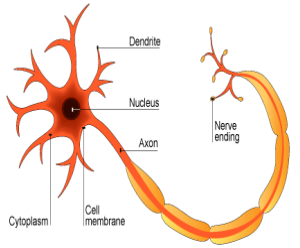


THE NERVOUS SYSTEM AND HORMONES

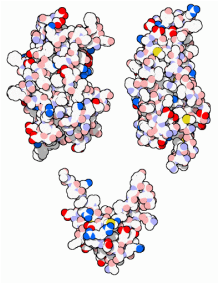


There are **two** systems in the body that transmit information. These are

- The **Nervous System** and
- The **Hormonal System**



These help us **to respond to changes in our environment.**



- Hormones **act more slowly** than the nervous system and **over a longer period of time**.

- Hormones are **chemicals**, whereas the nervous system uses **electrical signals** to transmit information

http://lgfl.skoool.co.uk/keystage4.aspx?id=315

9 The Nervous System

http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/human

The Nervous System

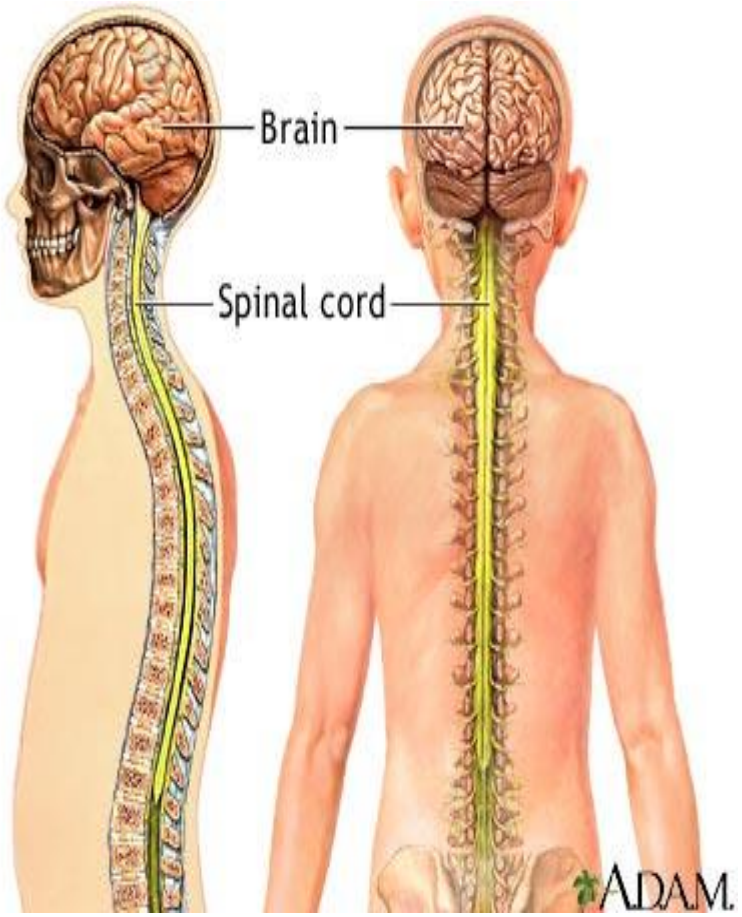
How do you detect smell?

The Nervous System

The **brain** and the **spinal cord** make up the

central nervous system

(CNS).

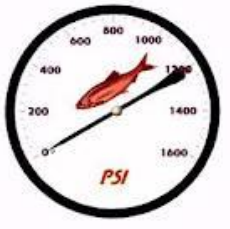


A STIMULUS

Anything that we respond to is called a **stimulus**.

Examples of these are

h<u>ea</u> t, c<u>ol</u> d, pr<u>essur</u> e and p<u>ai</u> n.



RECEPTORS

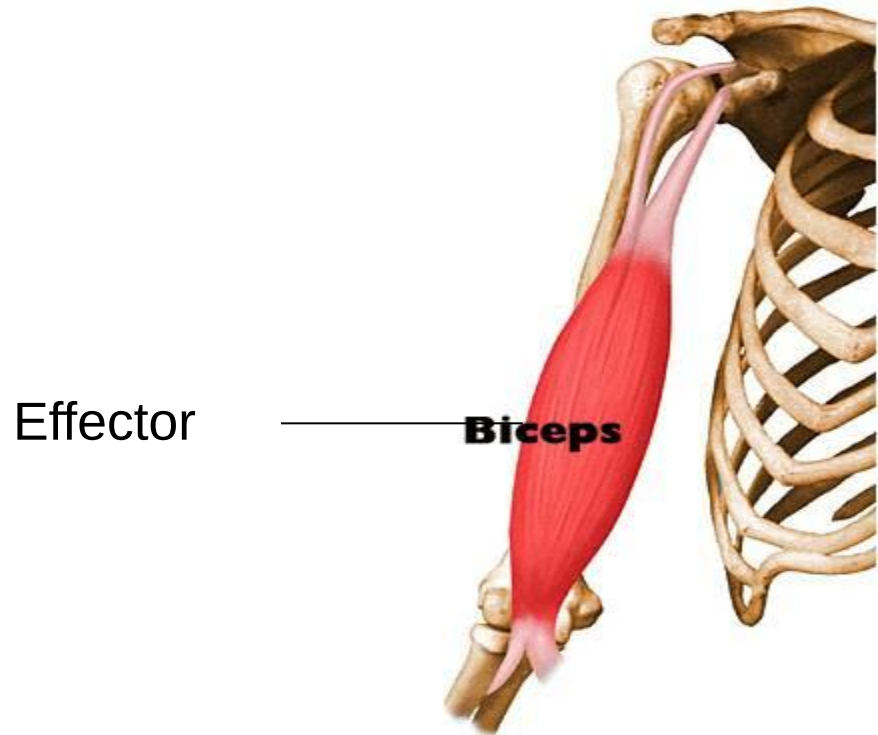
The **parts of the body which detect stimuli** are called **receptors**.

In our fingers we have receptors sensitive to touch, pressure and temperature. The tongue contains receptors for taste.

EFFECTORS

The part of the body which responds to a stimulus is called an **effector** *eg* **muscle**

If a receptor is stimulated it may cause an effector to produce a **response**.

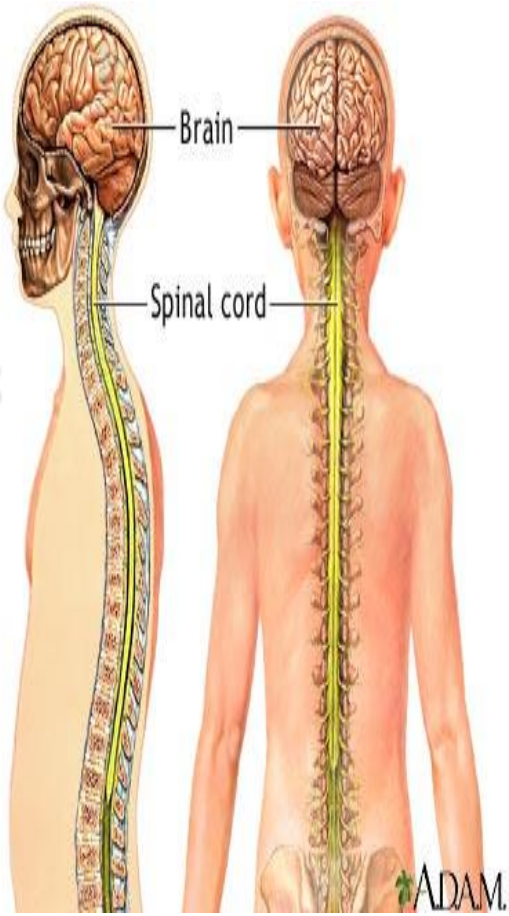


COORDINATORS

The brain and spinal cord are **coordinators**.

They make up the **central nervous system (CNS)**.

The brain and spinal cord coordinate responses between **receptors and effectors**.

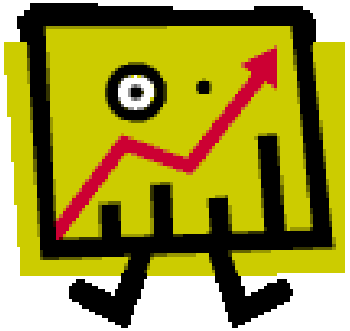


Mr Bloom's Questions

Name:
A stimulus
A receptor
An effector
A coordinator

Summary Flowchart

Stimulus ⇨ Receptor ⇨ Brain ⇨ Effector ⇨ Response



Question

- Think of an example of a response you made today and put it in flowchart form.

- Include stimulus; response; brain and effector.

Example

- *Stimulus:* Jane texts John
- *Receptor:* John's eye reads text
- *Brain:* John thinks what to do
- *Effector:* John types a reply
- *Response:* John texts Jane

Nerve cells are called **neurones.**

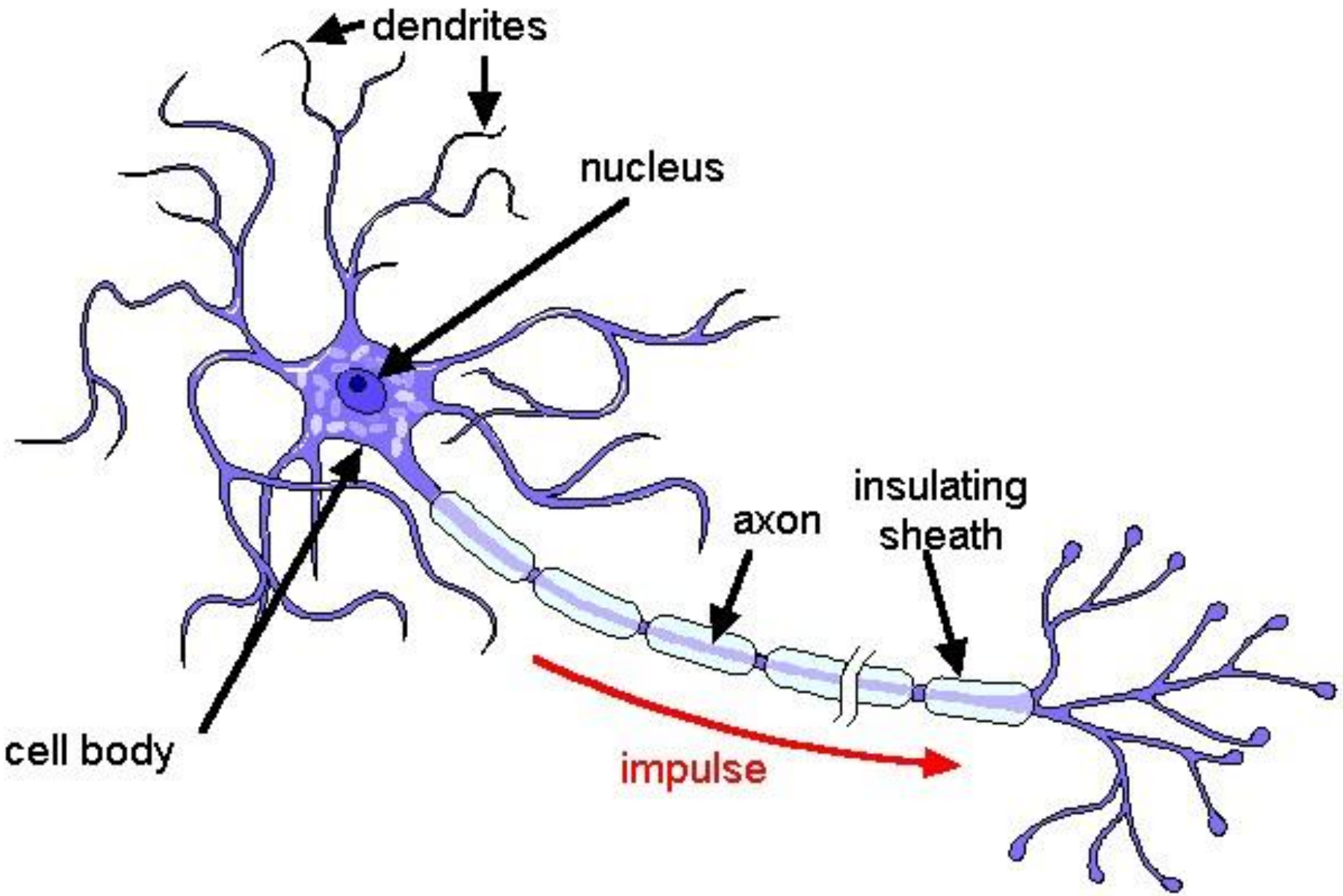
They link receptors (e.g. eye, ear …)

and effectors (muscles)

to the coordinator (brain).


how are these cells adapted to carry impulses?

Motor neurone



NEURONES - ADAPTATIONS

- **Neurones** are specially adapted to carry nerve impulses. These adaptations are:
- They have **branched ends (dendrites)** that allow them to transmit impulses over a greater area or to make more connections with other neurons.
- They are **long**.
- They are **coated with an insulating sheath** that helps speed up the transmission of an impulse.

TYPES OF NEURONES

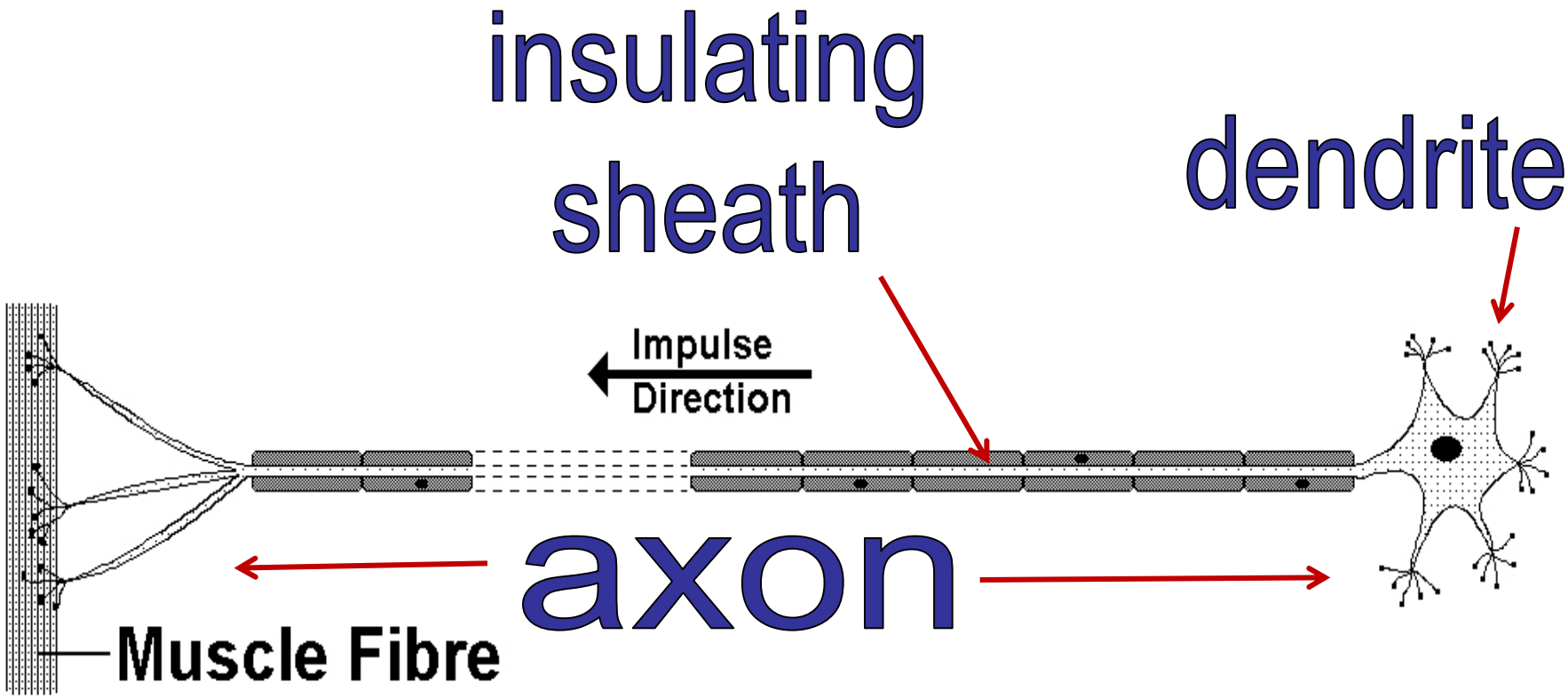
- There are 3 types of neurons:
- a **sensory** neuron
- an **association** neuron (sometimes called *relay* neuron)
- a **motor** neuron

Sensory neurones receive impulses from the receptors and send them to the CNS

Motor neurones send impulses from the CNS to the effectors telling them what to do.

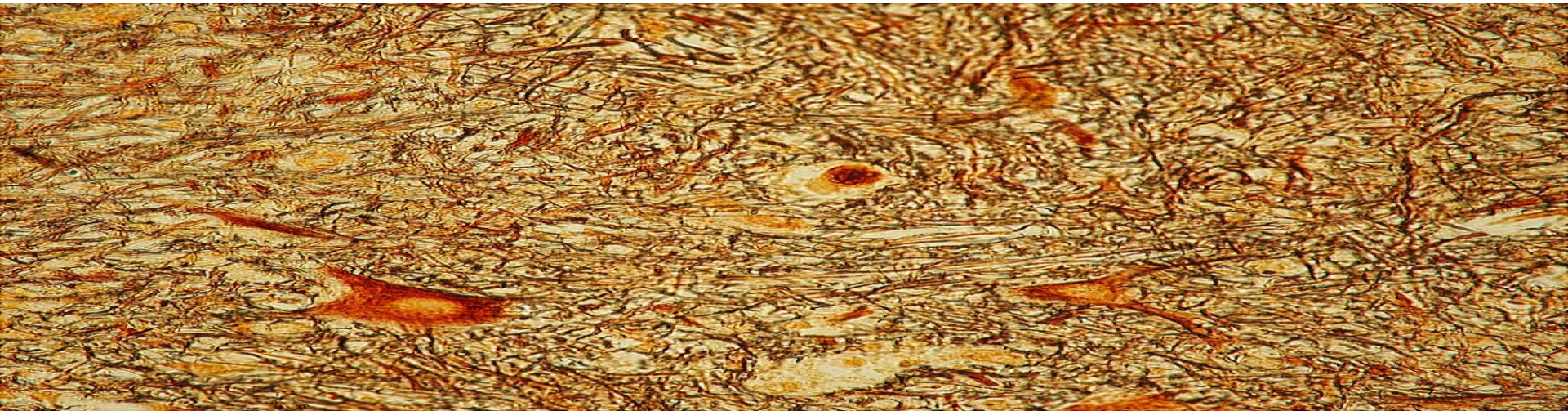
An association neurone connects the sensory neurone to the motor neurone in the CNS.

NEURONE	RECIEVES IMPULSE FROM	SENDS IMPULSE TO
SENSORY		
ASSOCIATION		
MOTOR		


insulating sheath
dendrites
Impulse Direction
axon
Muscle Fibre

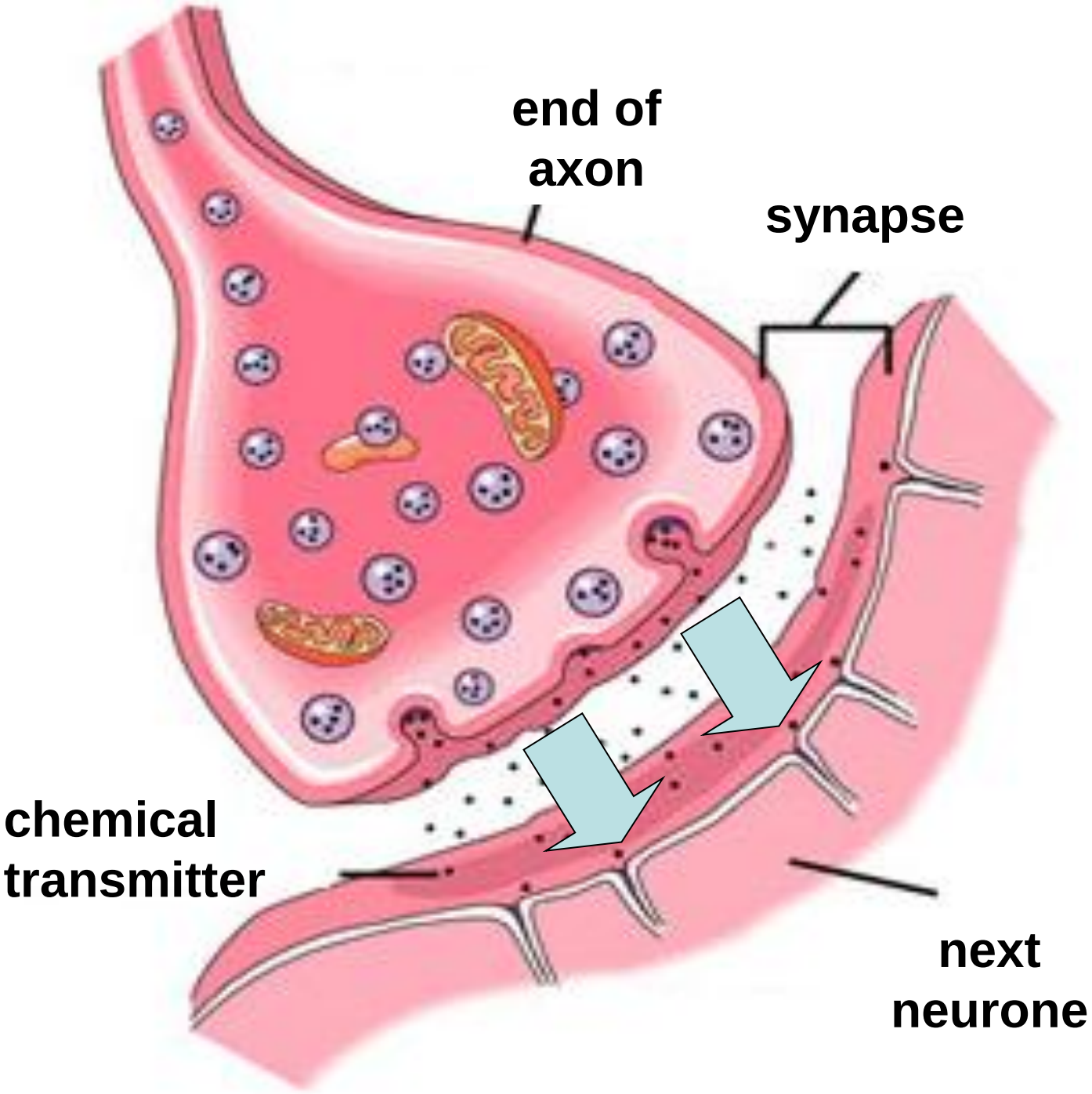
THE SYNAPSE

These are **small gaps between neurones**. Electrical impulses '**jump**' across these gaps, **using chemicals**.. Synapses allow **many connections to be made**. Synapses can be affected by drugs or alcohol, which **slow down synapses or even stop them.**



For an impulse to pass across a synapse the end of the neurone produces a **chemical transmitter.**

- This **diffuses** across the synapse to the next neurone.
- If the concentration is high enough an **impulse** will be triggered in the next neurone.


end of axon
synapse
chemical transmitter
next neurone

The Nervous System-Summary

Nerves are made up of a large number of nerve cells called N_____

Three types of N_____. These are the S_____ M_____ and A_____ N_____
S_____ N_____ receive information from the R_____. M_____ neurones carry the information to the E_____.
The A_____ N_____ are found in the spinal cord and link the S_____ and the M _____ N_____.

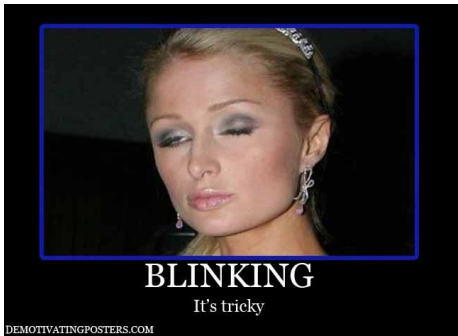
The Nervous System-Summary

E_____ are usually M_____or G_____.
R_____ are cells that detect stimuli and correspond to the 5 S_____
The R_____ are found in the E_r
S_____
E_e
T_____
N_____

The Syn_____ helps transfer an impulse from one N_____ to another by conducting an electrical impulse.

VOLUNTARY AND REFLEX ACTIONS

- Actions the we have to think about (conscious control) are called **voluntary actions** e.g putting your hand up to answer a question.
- Actions that we do NOT have to think about are called **reflex actions** e.g blinking. These actions are **rapid**.



VOLUNTARY OR REFLEX?

HEARTBEAT

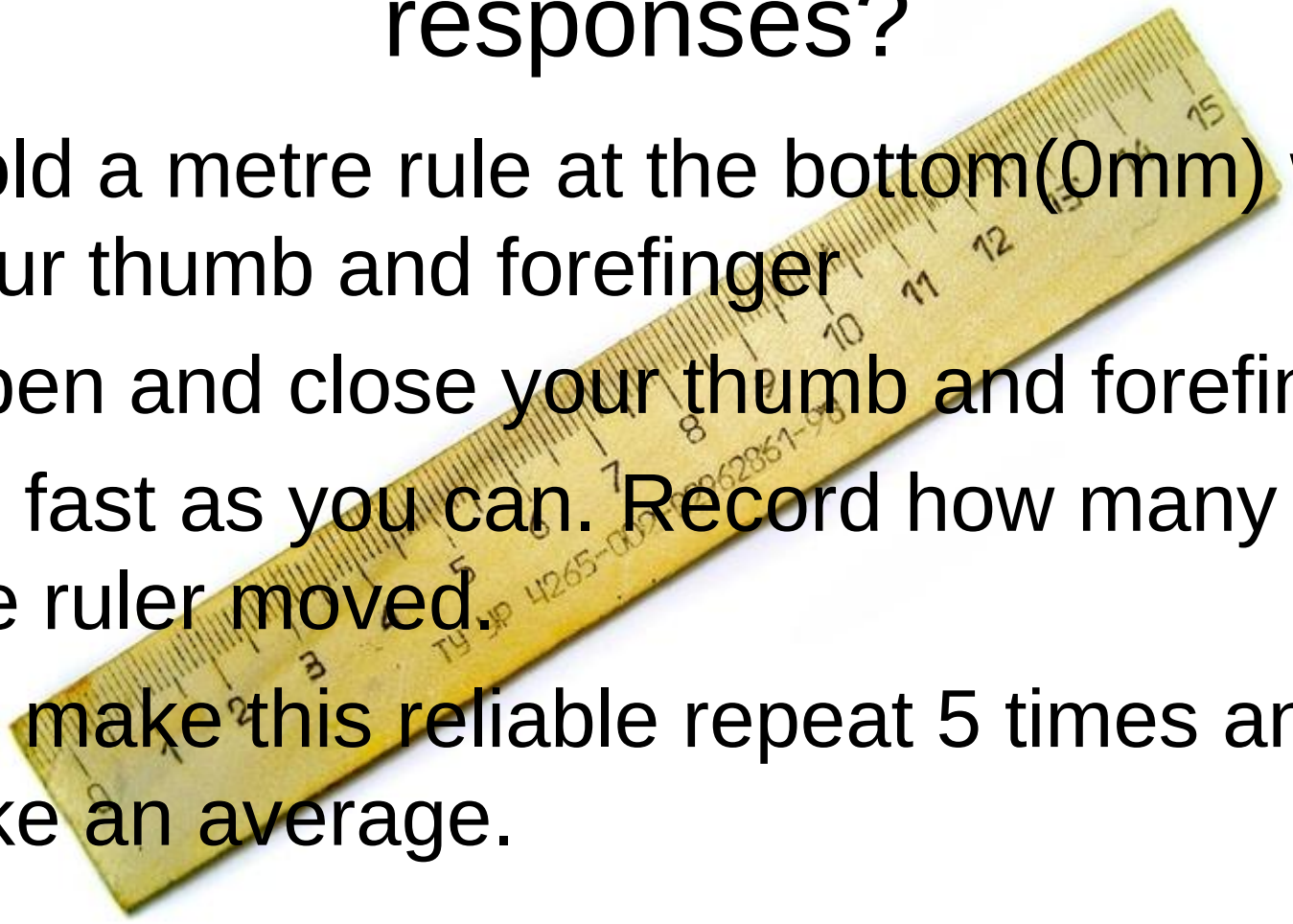
SNEEZING

READING

PERISTALSIS

SCRATCHING AN ITCH

Who has the fastest voluntary responses?



- Hold a metre rule at the bottom(0mm) with your thumb and forefinger
- Open and close your thumb and forefinger
- As fast as you can. Record how many mm the ruler moved.
- To make this reliable repeat 5 times and take an average.

http://www.bbc.co.uk/science/humanbody/sleep/sheep

A REFLEX ACTION

This is a rapid response to a stimuli, often used to protect us against danger. All reflex actions have two things in common

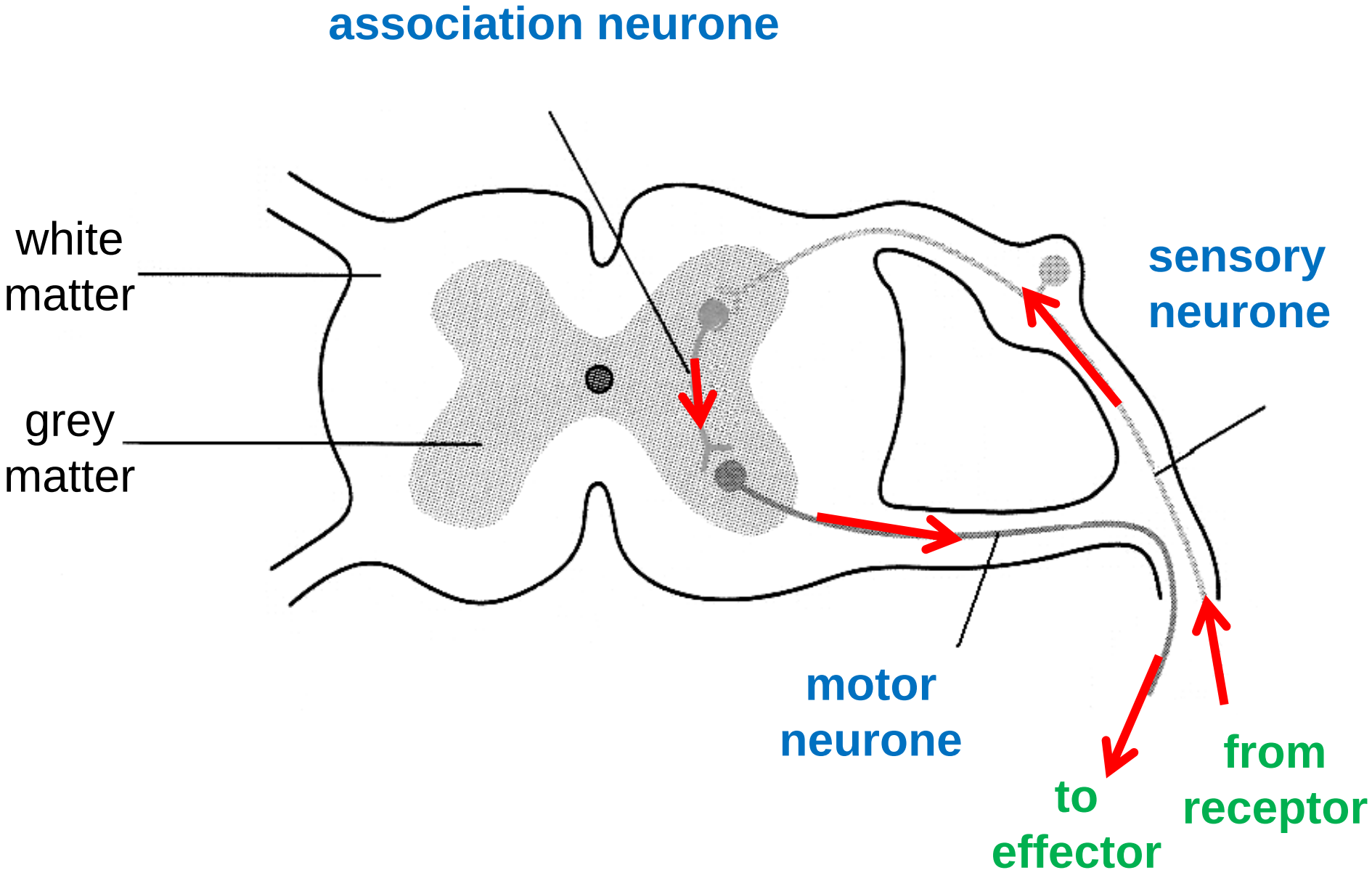
Occur very rapidly because **there are only 3 neurones involved and there are only 2 synapses** (these are the places where the impulses travel slowly).

They do not involve **conscious control (thinking time)**

e.g. touching a hot plate or a sharp object-your hand will move away rapidly.

THE REFLEX ARC

Reflex arc is the series of neurones and synapses by which an impulse passes from a receptor to an effector in a reflex action.


association neurone
white matter
grey matter
sensory neurone
motor neurone
to effector
from receptor

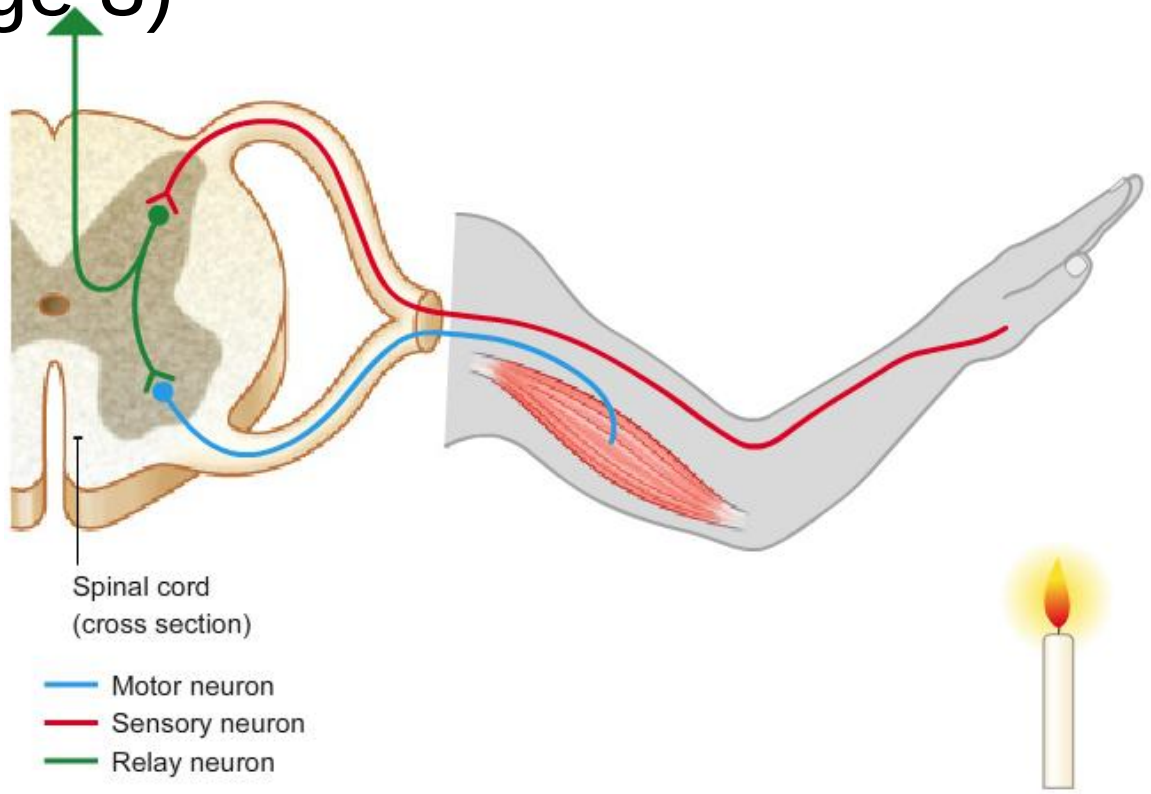
Reflex Arc: Touching Sharp Object

A sharp object (**STIMULUS**) is detected by a **receptor** in the finger.
It passes an **electrical impulse** along the axon of a **sensory neuron** to the **spinal cord**.
In the spinal cord the **impulse** is passed to the **association neuron**.
It passes the impulse to **motor neurons** that join to the **effector** (muscle in arm). The **muscle contracts** and your hand pulls away (**RESPONSE**).

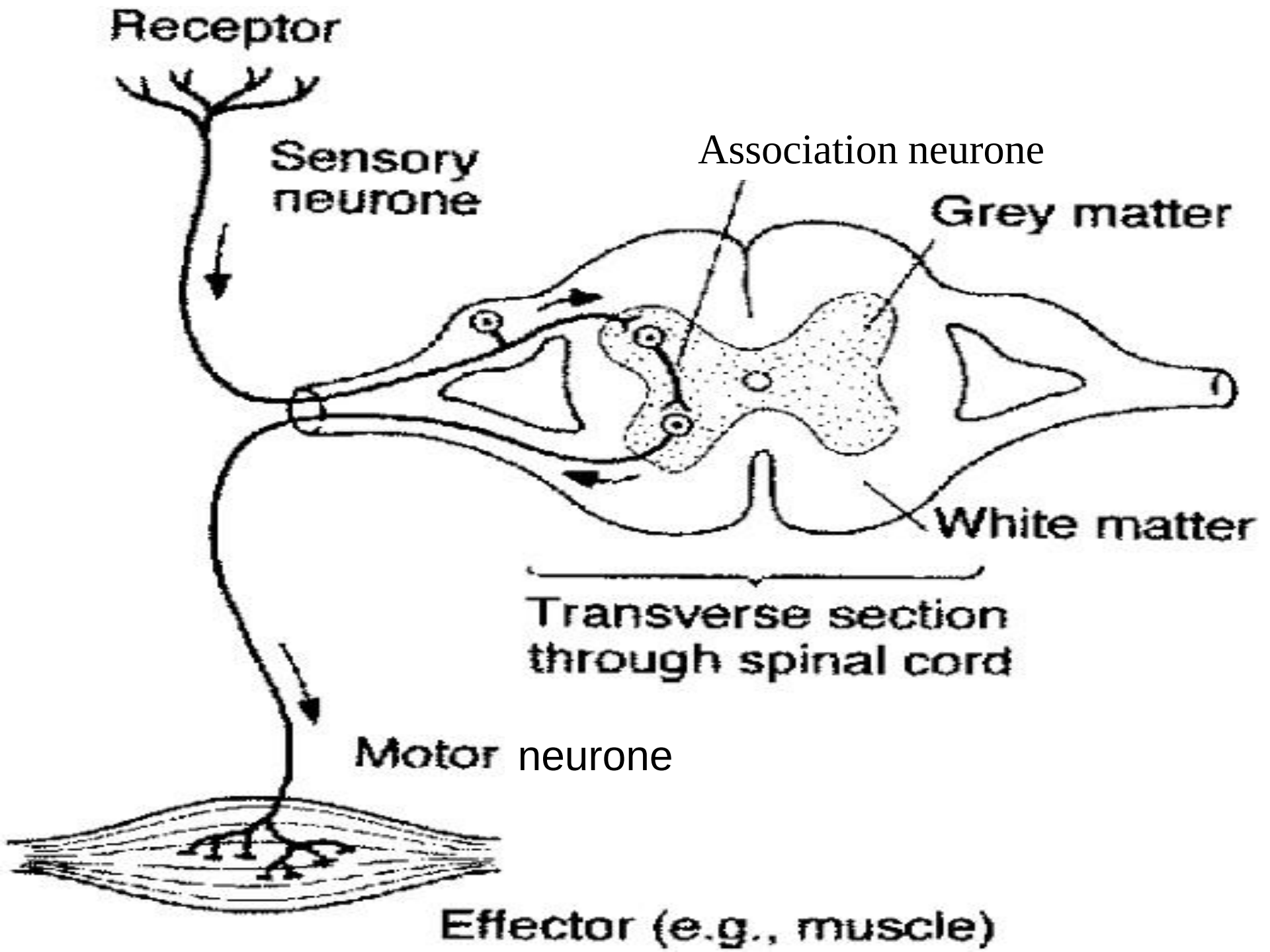
In reflex arcs involving pain a separate **spinal neurone** connects to the association neurons and carries the impulse to the brain, to give the **sensation of pain**.

REFLEX ARC: ANIMATIONS

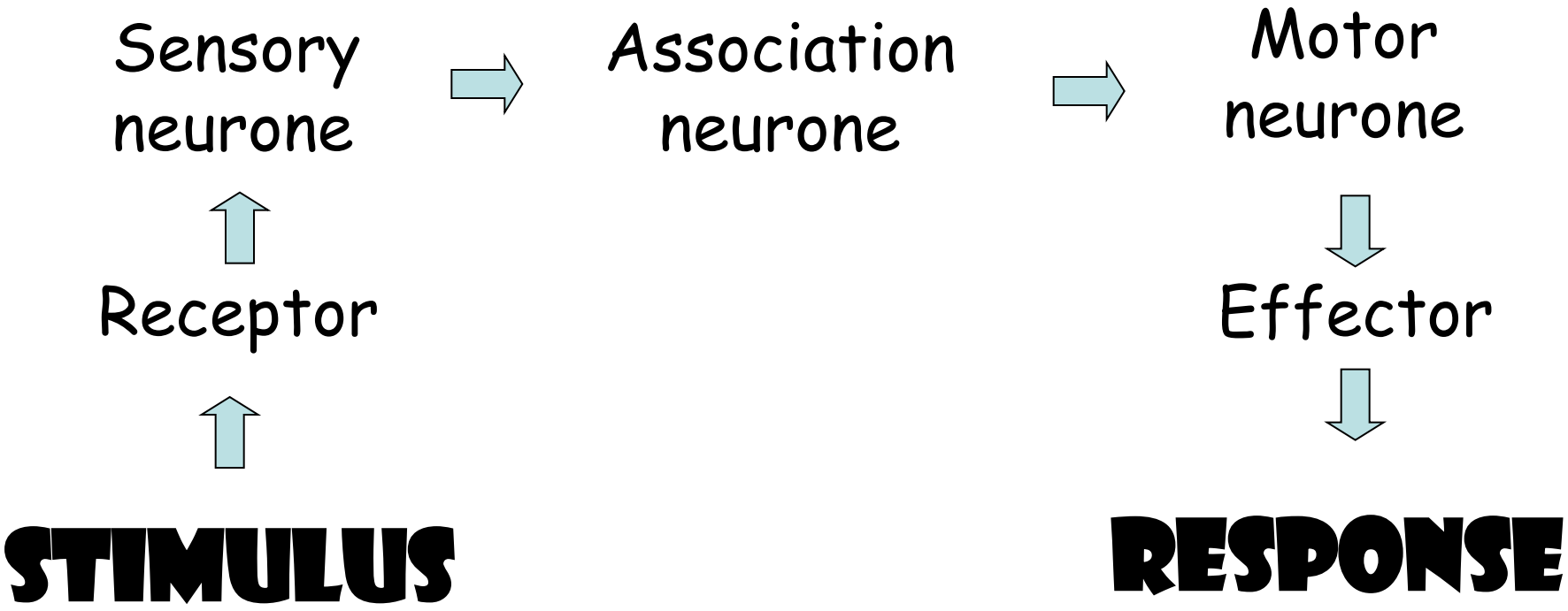
- Reflex arc (page 3)



- http://www.sumanasinc.com/webcontent/animations/content/reflexarcs2.html


Receptor
Sensory neurone
Association neurone
Grey matter
White matter
Transverse section through spinal cord
Motor neurone
Effector (e.g., muscle)

Flowchart of reflex arc

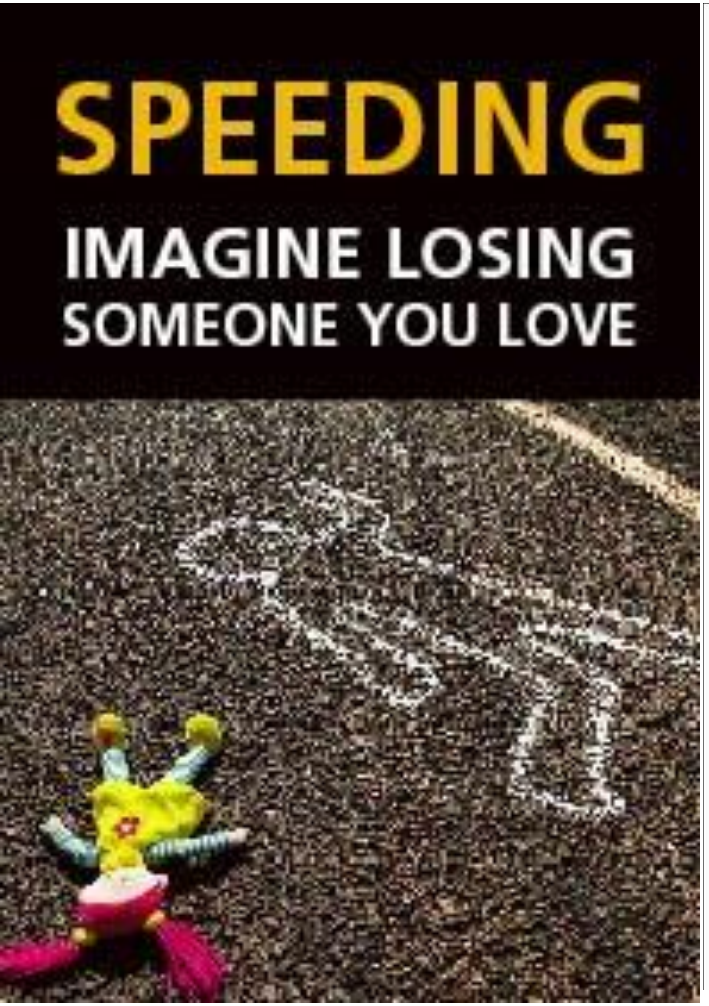


Create a Poster on the nervous system and the reflex

Learning Intentions

- To agree success criteria on what factors make a successful poster
- To review our notes on the Nervous System and the Reflex Arc
- To select the most important information on the Nervous System and the Reflex Arc
- To present the most important information in poster form
- To Review your work and decide on two things you really like about your work and one thing that could be improved.

Examples of Posters



ASSOCIATION FOR QUALITY EDUCATION LIMITED

NO MOBILE PHONES, iPODS, MP3/4 PLAYERS.

NO PRODUCTS WITH AN ELECTRONIC COMMUNICATION/STORAGE DEVICE OR DIGITAL FACILITY.

You **must not** bring any of these items into an assessment room; if you do so, you may lose your marks on this paper.

In particular, you **must not** have in your possession a mobile phone, whether switched on or not.

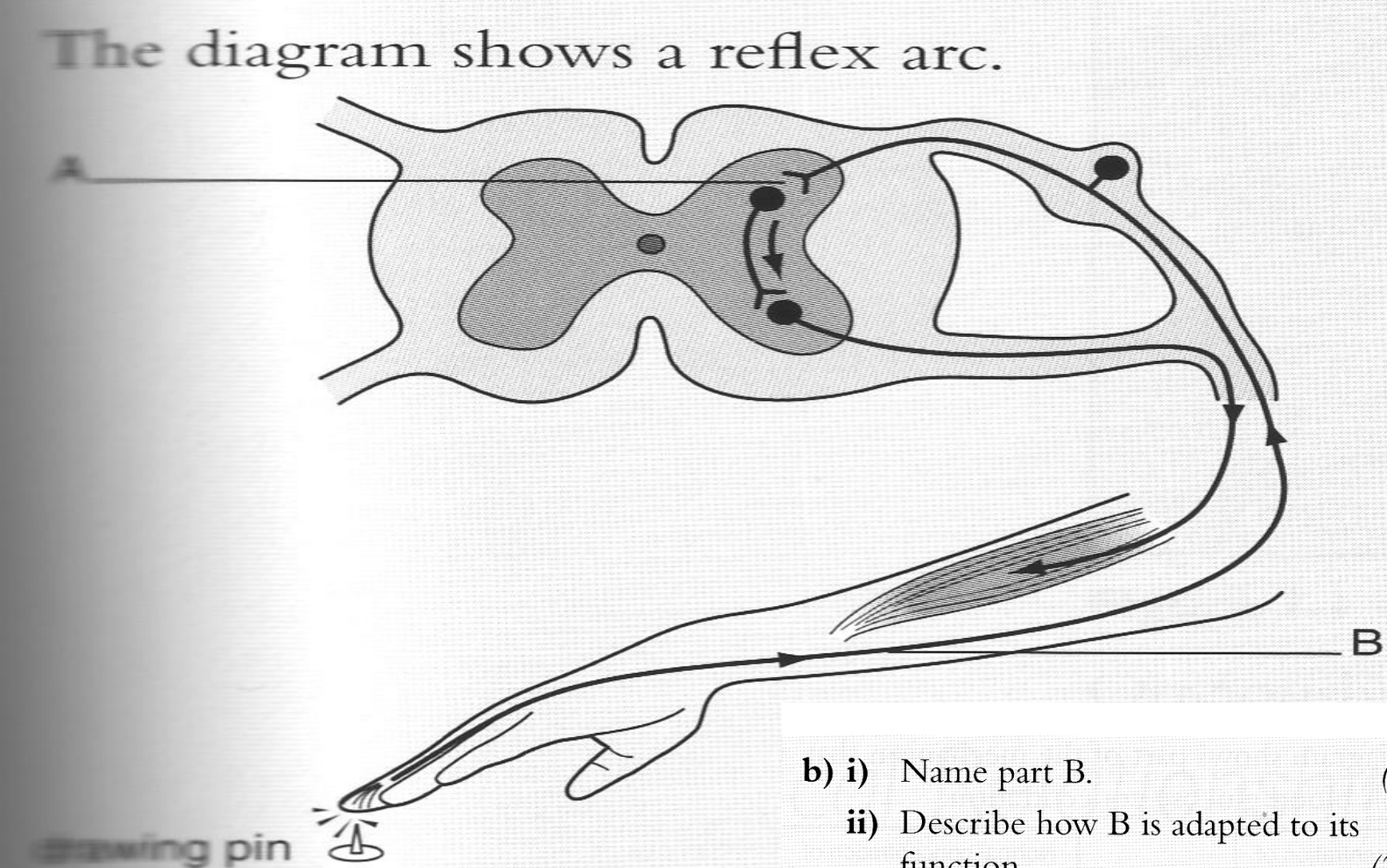
success criteria

Read through your notes and pick out the most important points

create your poster

Have a look at your poster and write on your card two things that you like about it and one thing that you think you could improve.

The diagram shows a reflex arc.



b) i) Name part B. *(1 mark)*

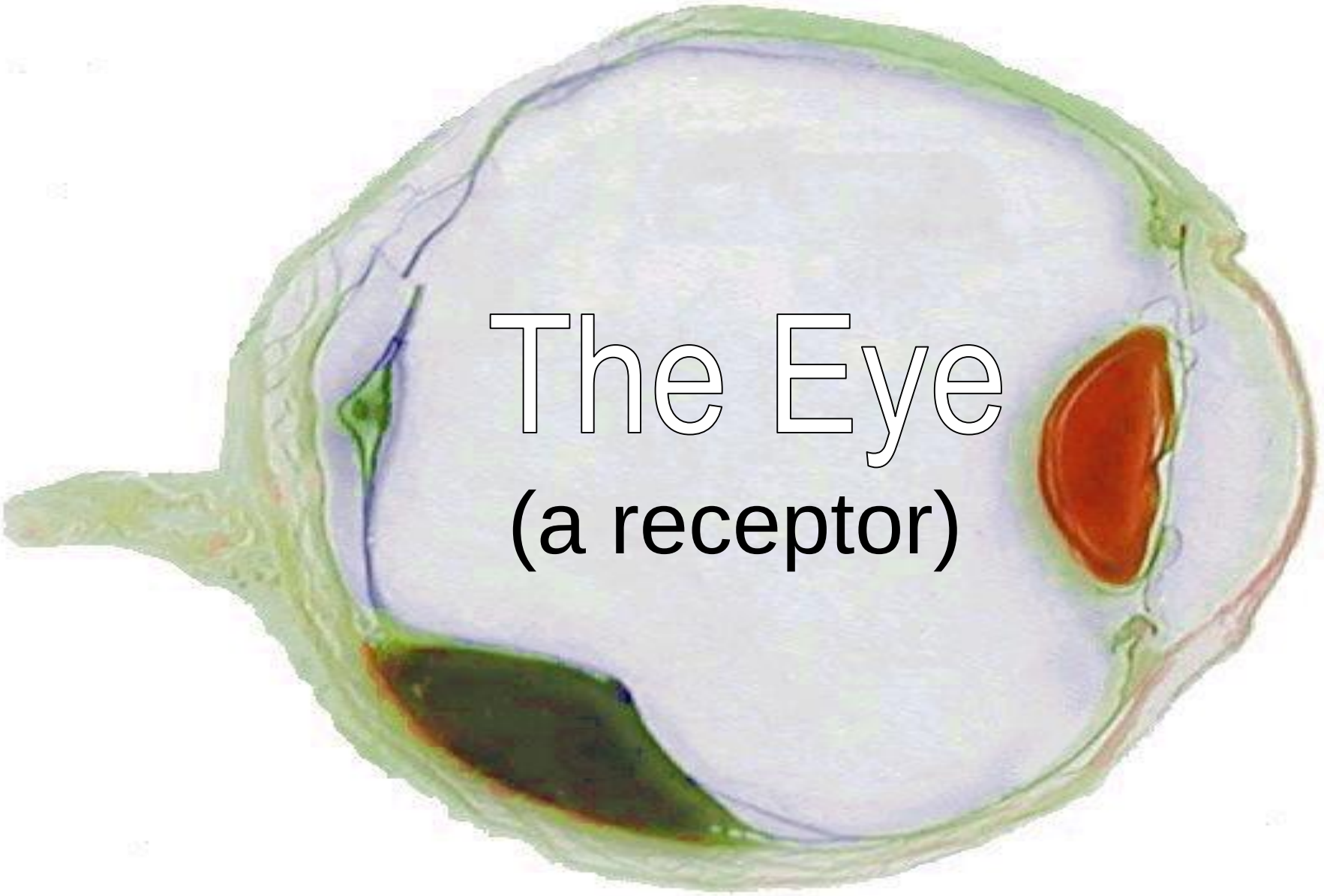
ii) Describe how B is adapted to its function. *(2 marks)*

c) A is a synapse. How does the nerve impulse pass across this synapse? *(2 marks)*

d) Explain why the response to the drawing pin through the reflex arc would be faster than that to a light being switched on.

http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/human
(Select ‘The Nervous System).

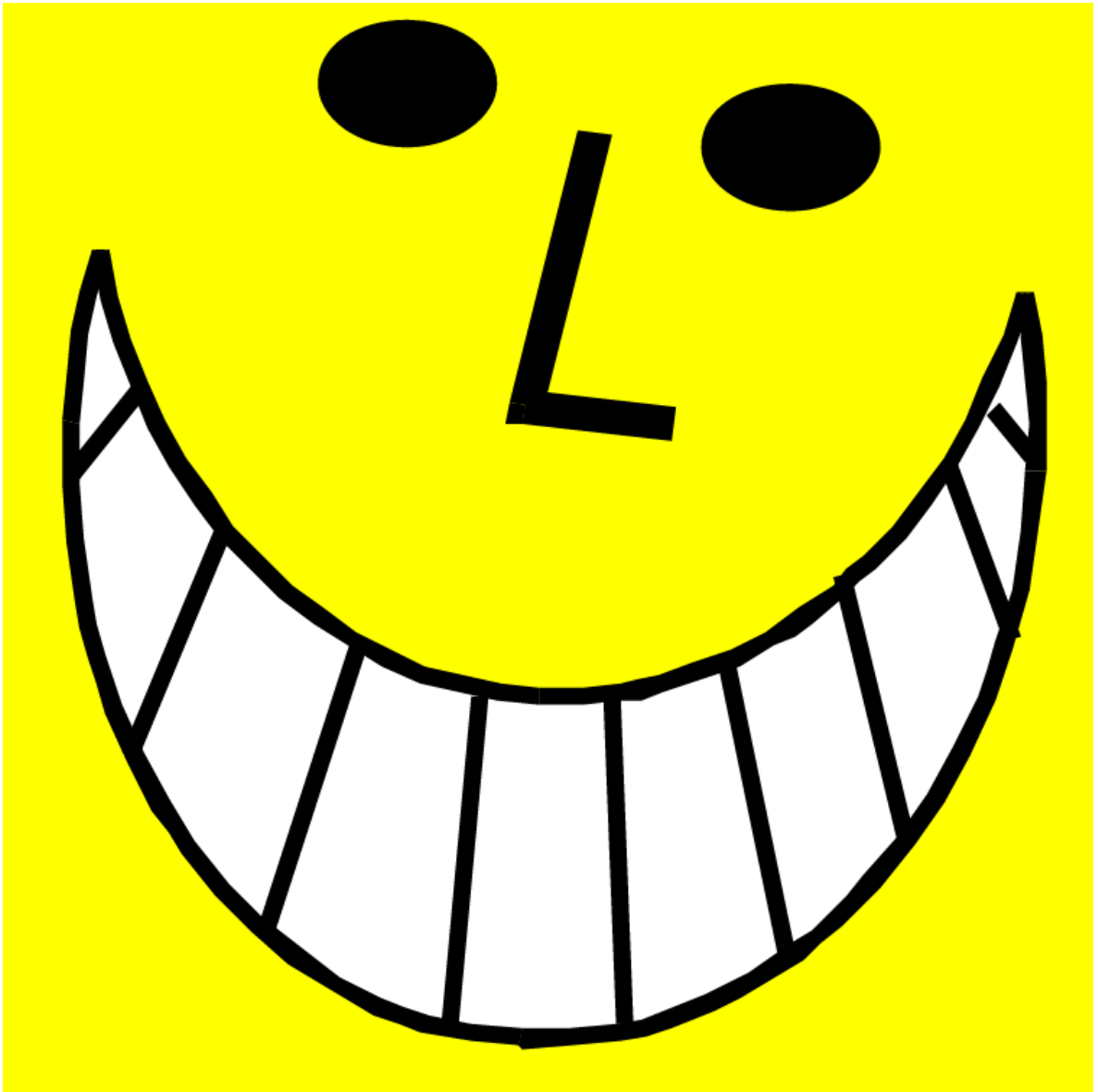
http://lgfl.skoool.co.uk/keystage4.aspx?id=315
(Select ‘The Nervous System’).



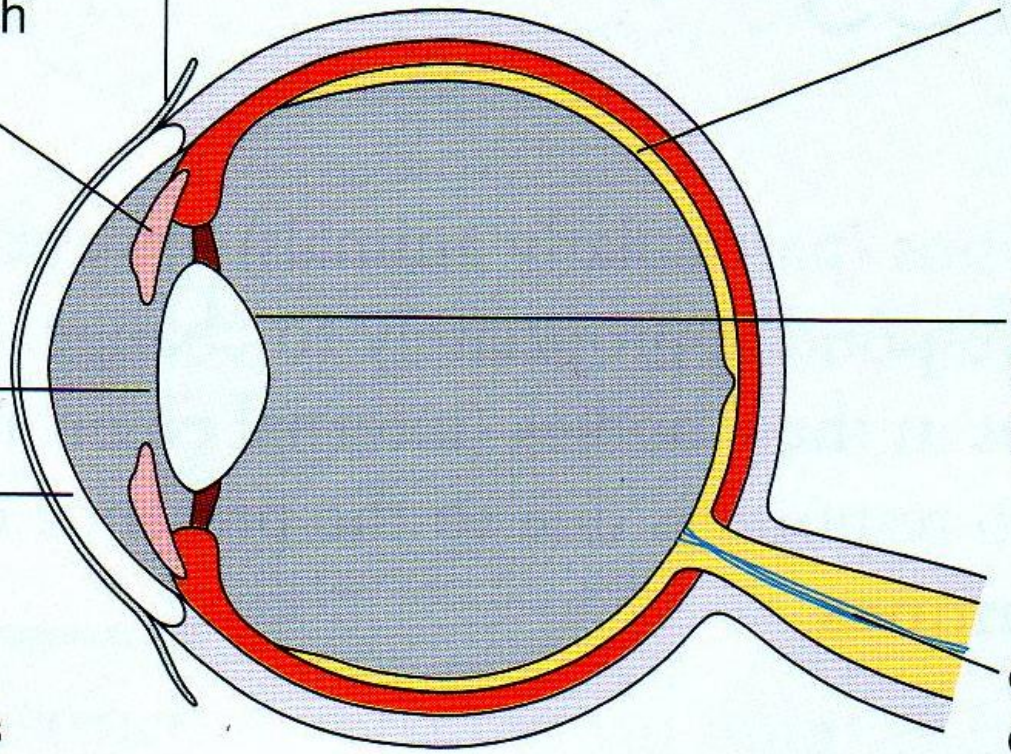
The Eye

(a receptor)

The Big Picture game



Structure and function of the eye



conjunctiva
thin transparent protective outer covering

retina
inner coat of eye where light-sensitive cells are found

iris
controls how much light enters eye

pupil
space in iris through which light passes

lens
refracts (bends) light

cornea
transparent front part of eye that allows light to enter eye; causes some refraction (bending)

optic nerve
contains neurones carrying information to the brain

The Eye

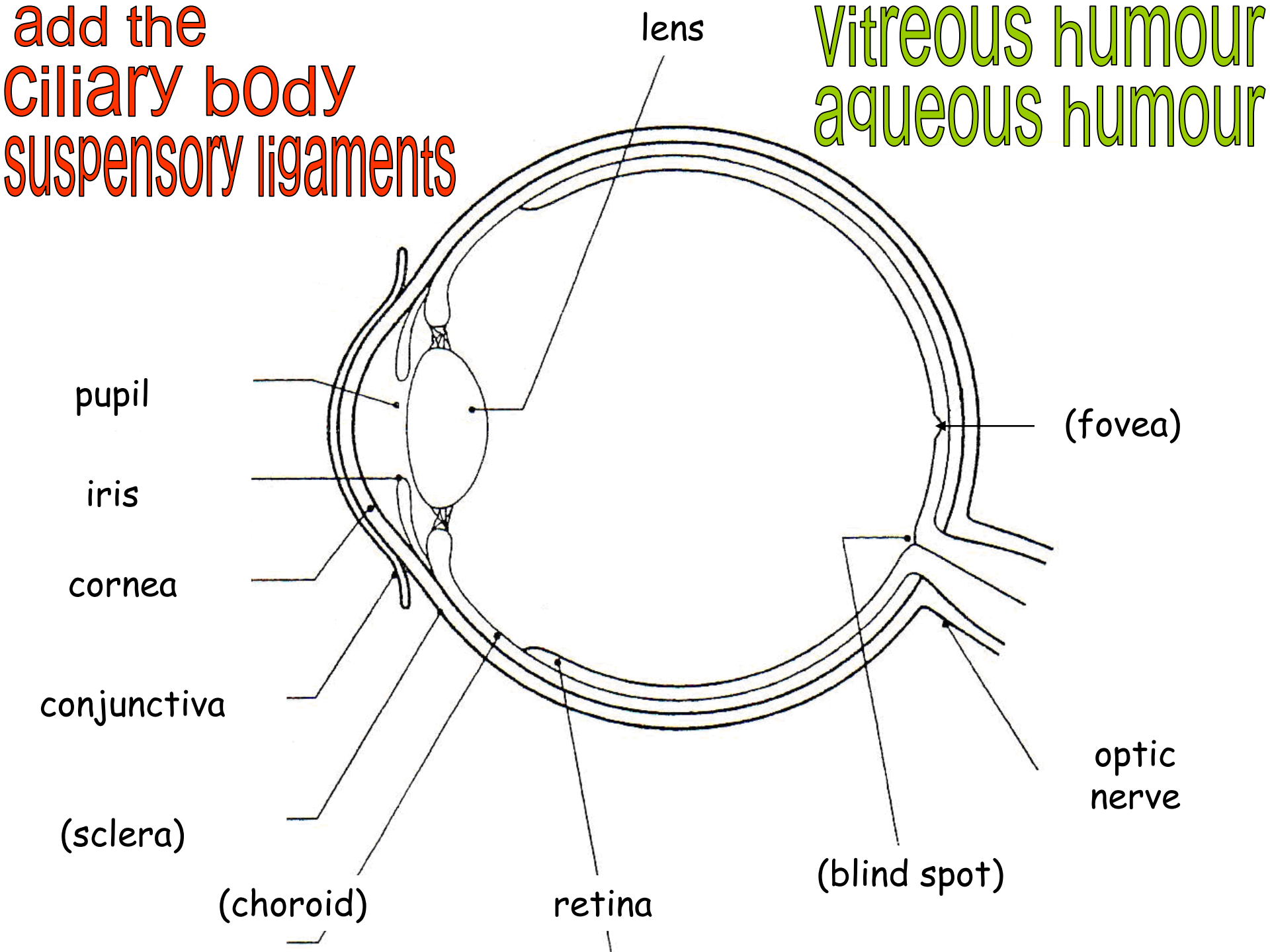
The eye is a sense organ which contains the receptors for sight.

The part of the eye which contains the receptors is the **retina**.

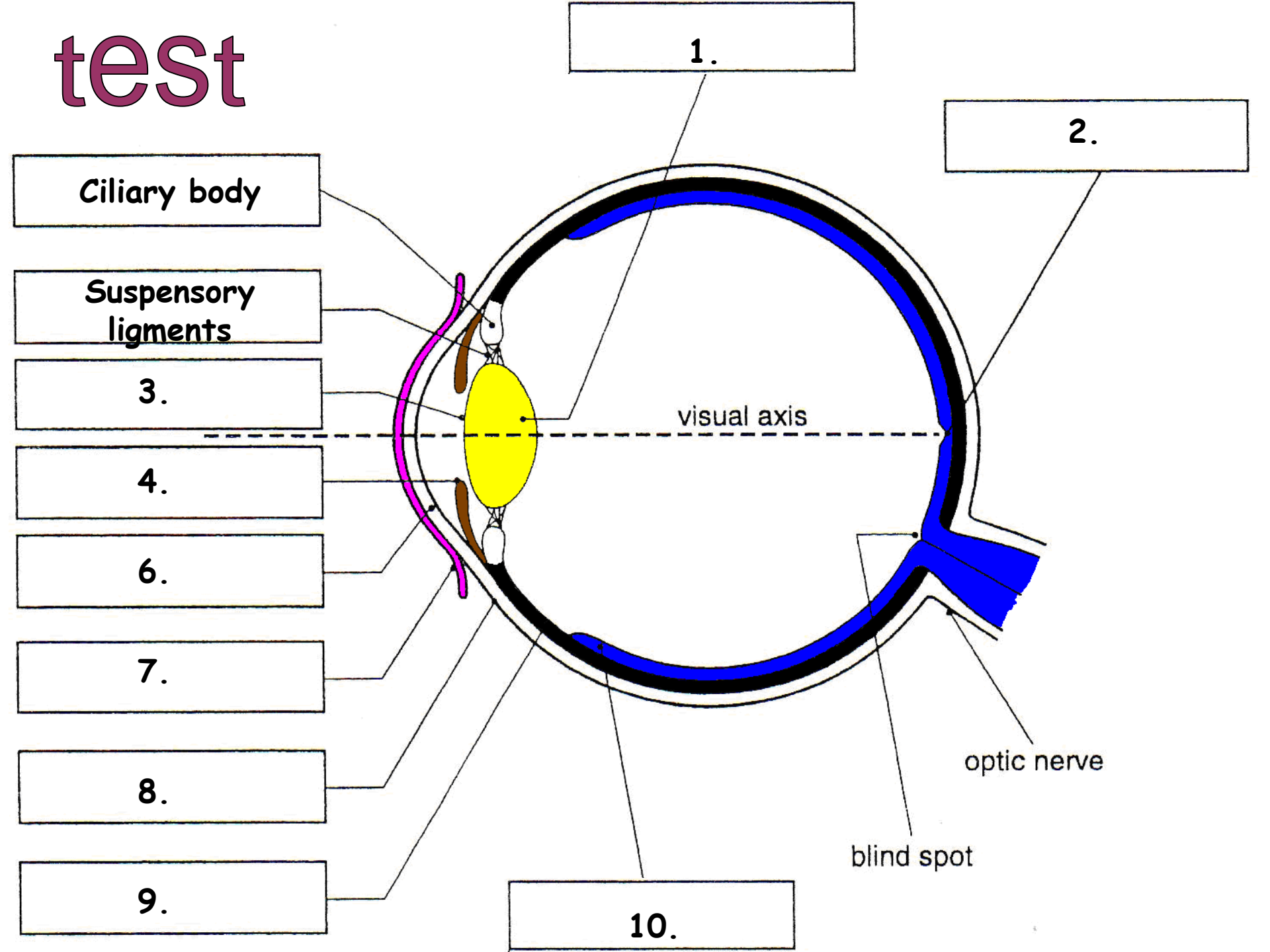
Other parts of the eye:

- protect it against damage.
- focuses light rays on the receptors in the retina.
- controls the intensity of light that enters the eye.

add the
ciliary body
suspensory ligaments



test


1.
2.
Ciliary body
Suspensory ligments
3.
visual axis
4.
6.
7.
8.
9.
optic nerve
blind spot
10.

Eye dissection

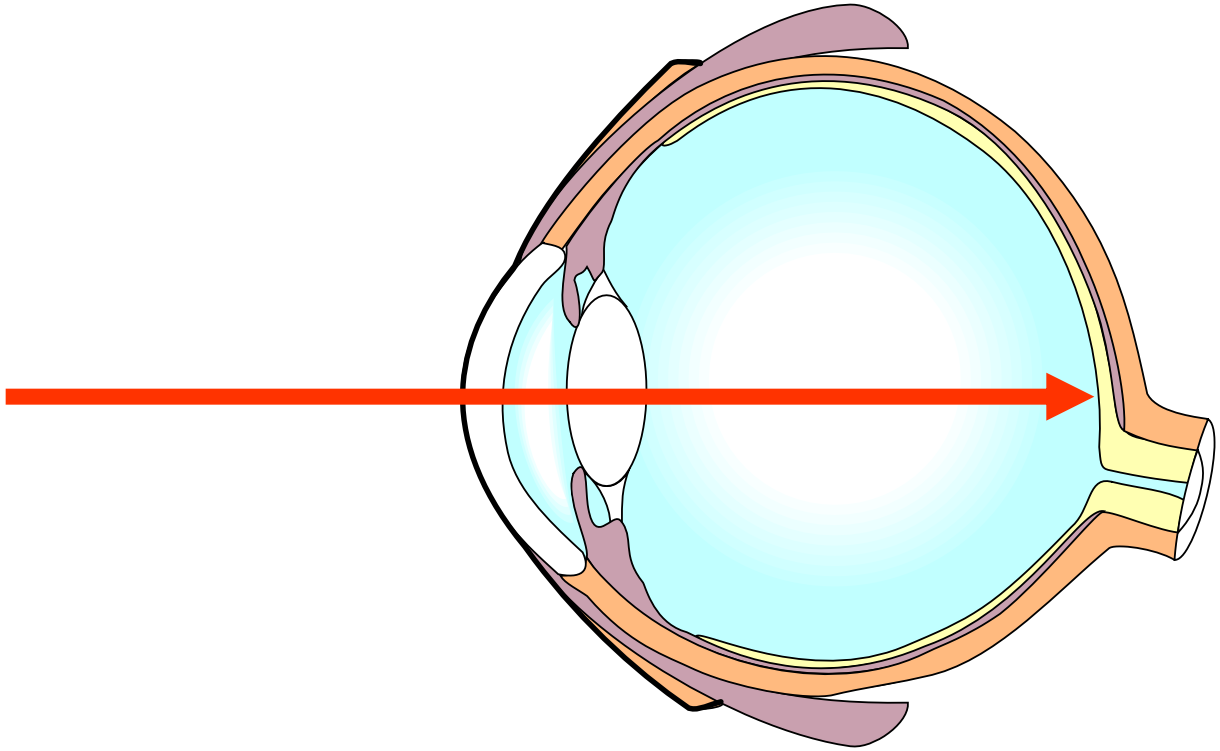
- See! You tube link

- Conjunctiva protects the cornea
- Cornea bends light entering the eye
- Pupil allows light to enter the eye
- Iris controls the size of the pupil
- Retina contains cells sensitive to light (rods = B&W, cones = colour)
- Lens changes shape to bend + focus light on the retina from near (lens fat) and far (lens thin) objects
- Optic nerve carries impulses to the brain

- **aqueous and vitreous humours**

  fill the inside of the eye giving support & shape

Passage of light through the eye



cornea → pupil → lens → retina → optic nerve → brain

THE RETINA

The retina contains **rods** which work in **dim** light and can't distinguish between colours. They are found **all over the retina.**

The retina contains **cones** which provide **colour vision**. They work in **bright** light and provide **greater detail** than rods. They are **only found at the fovea**.

EYE PROTECTION

Each eye is set in a socket called the **orbit** which protects the eye. Only the front of the eye is not surrounded by bone.

The front of the eye is covered by a thin membrane termed a **conjunctiva** which protects the parts behind it.

Tears contain the **enzyme lysozyme** which can kill bacteria.

Tears are washed across the eye by your *eyelids* every time you blink.

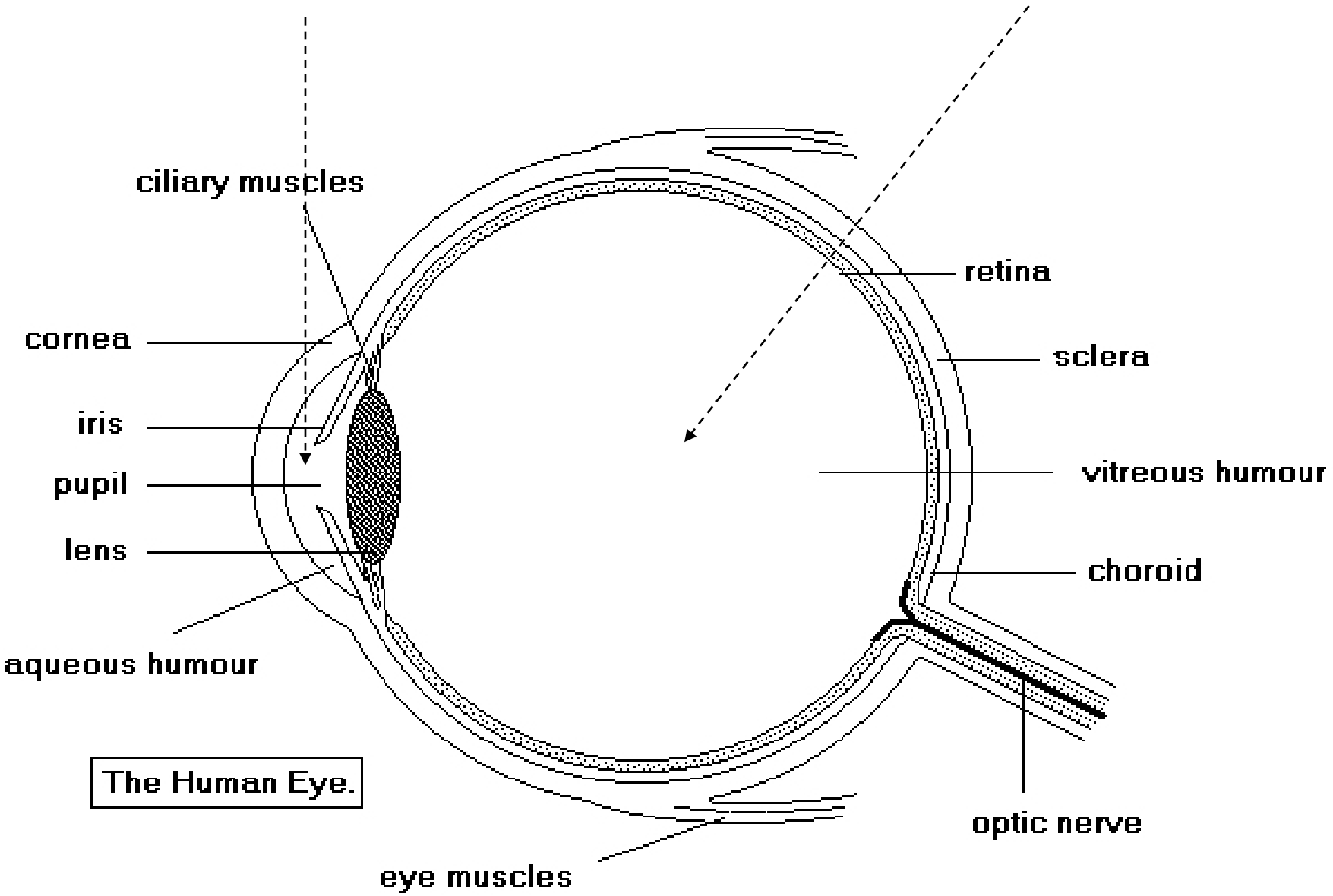

The eyelids, eyebrows and eyelashes
also help prevent dirt from landing o
the surface of your eyes.

AQUEOUS HUMOUR & VITREOUS HUMOUR

- The watery fluid between the cornea and the lens is known as the **aqueous** humour.
- The watery fluid between the lens and the retina is known as the **vitreous** humour.

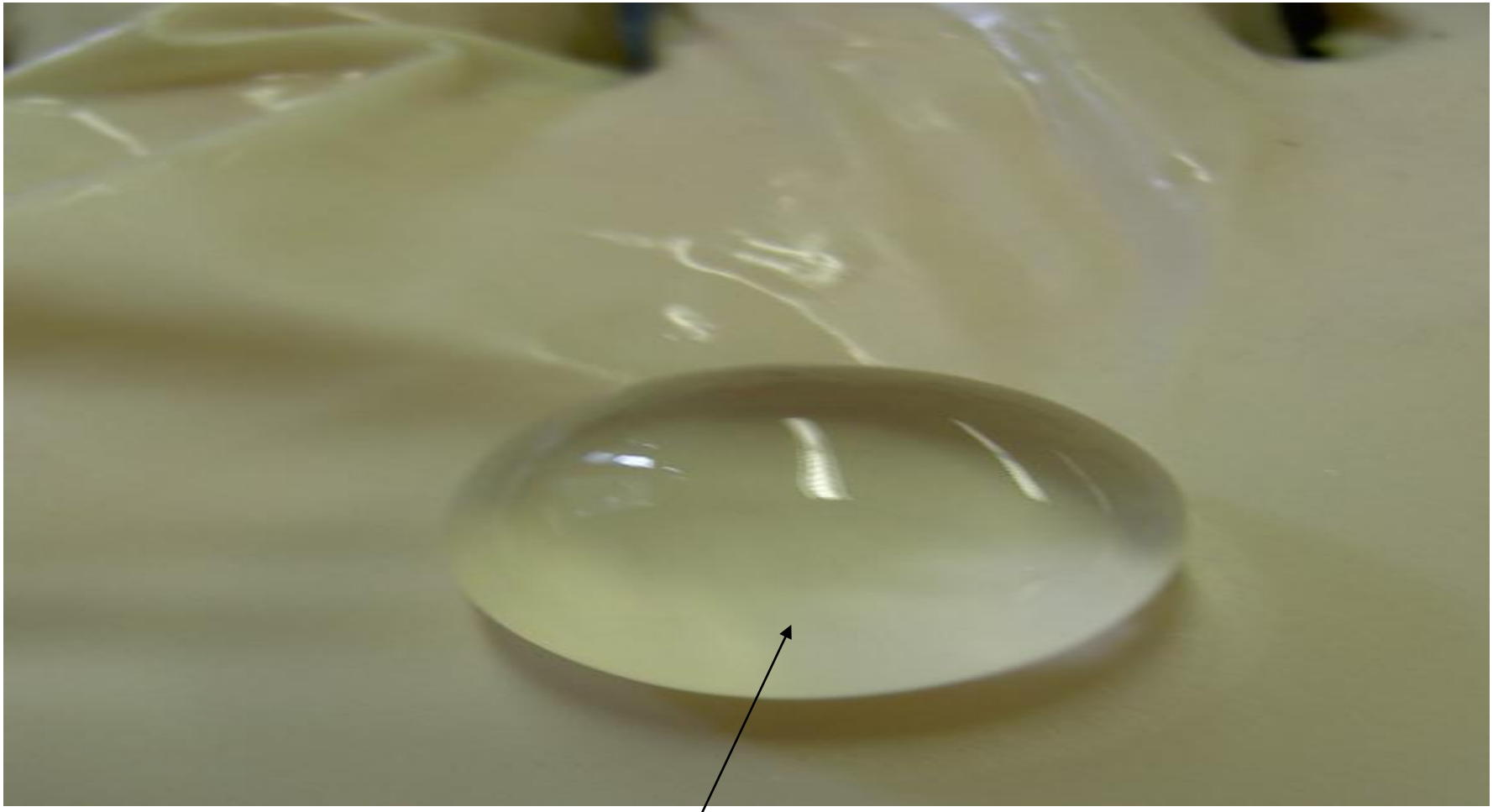
- **These keep the lens in shape, provide support and allow the light through.**

AQUEOUS HUMOUR VITREOUS HUMOUR



The Human Eye.

FUNCTION OF THE LENS



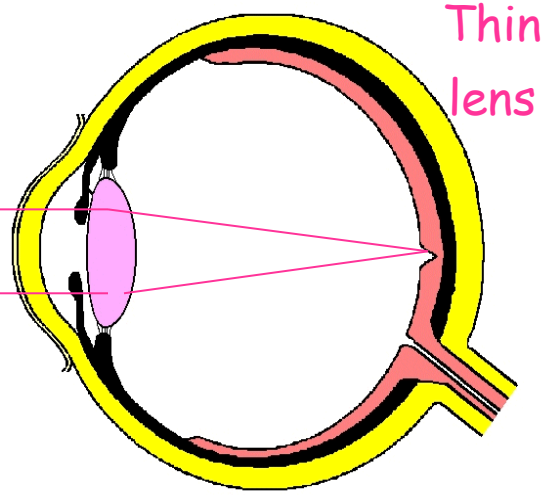
Calf lens

Focusing the image
(accommodation)

- The lens **focuses** light on to the retina.
- By **adjusting the thickness** of the lens light rays can be focused on the retina.
- The lens is **thin** when you are focusing on an object **far away**.
- The lens is **thick** when you are focusing on an object **close to you**.

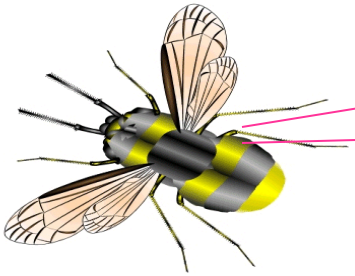
Accommodation

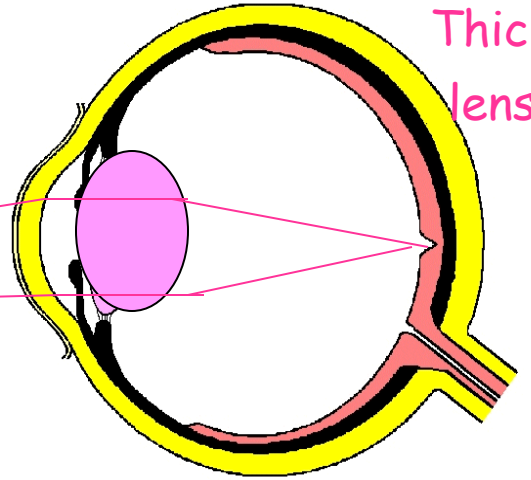
Eye focused on a distant object



Thin lens

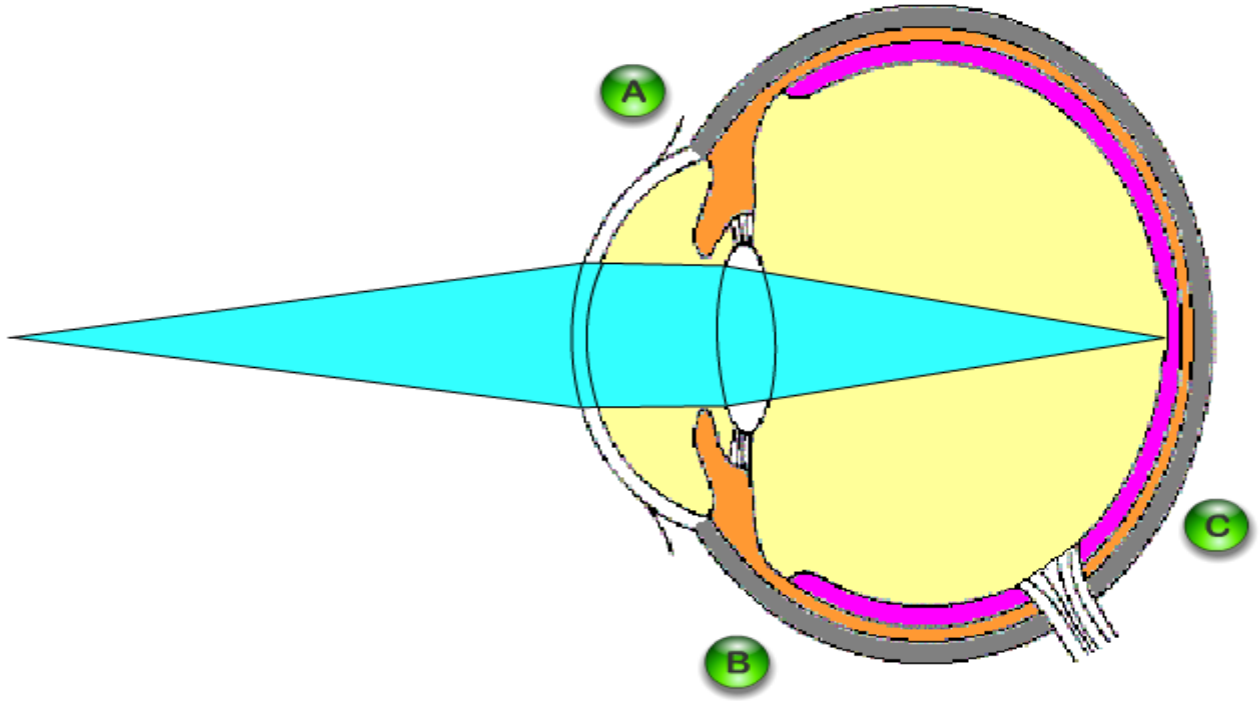
Eye focused on a near object





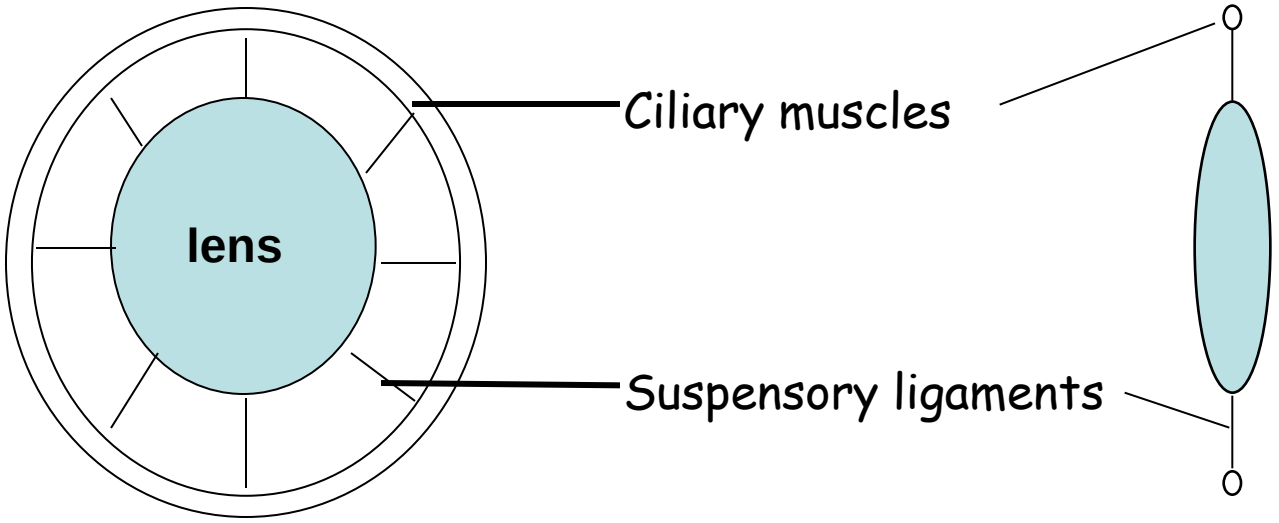
Thick lens

Accommodation animation



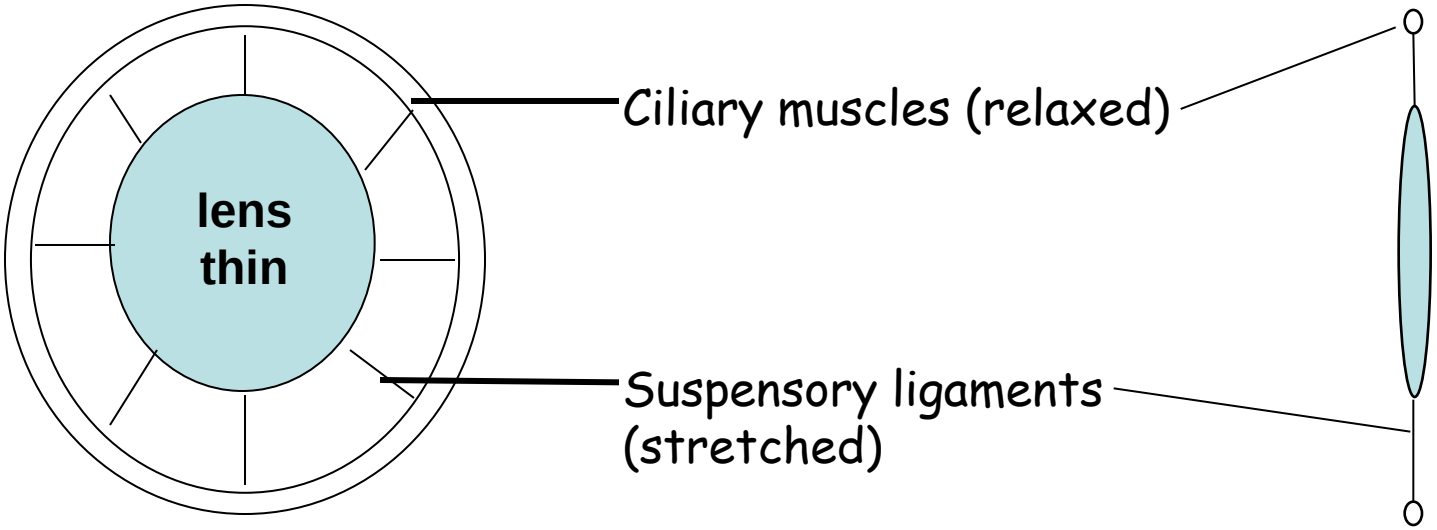
How does the lens change shape?

- The **ciliary muscle** is a ring of muscle that surrounds the lens.
- The lens is attached to the ciliary muscle by **suspensory ligaments**.



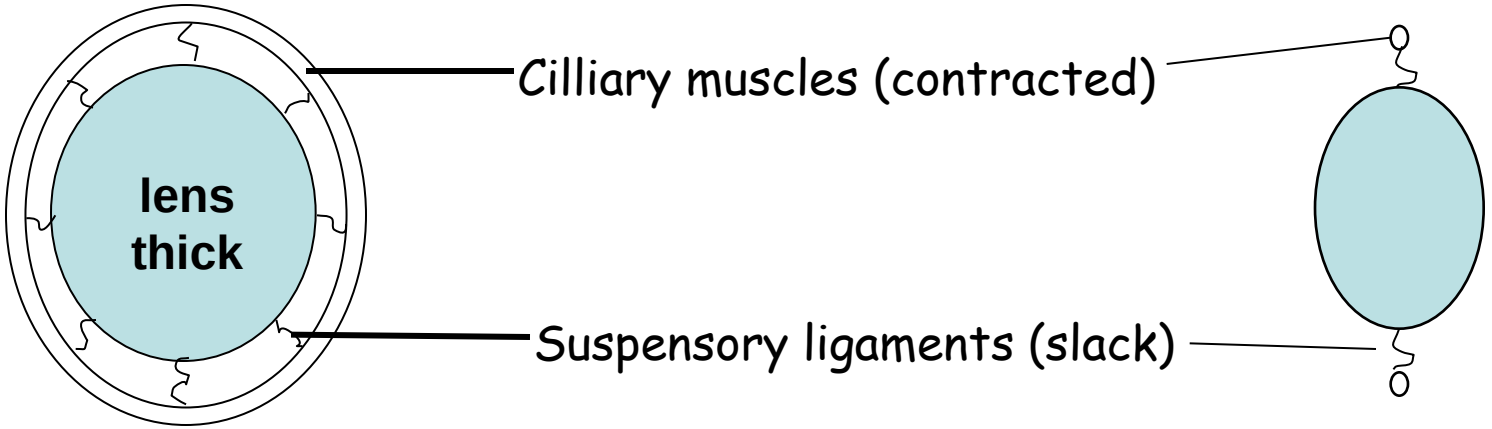
Focusing on distant objects

When an object is far away the ciliary muscle **relaxes** it springs out to give a **big diameter**. When this happens the suspensory ligaments **stretch and pull** the lens and the lens becomes **thinner**.



Focusing on near objects

When an object is **near** the ciliary muscle **contracts** to form a tight circle with a **small diameter**. The suspensory ligaments become **slack** and with less pressure on the lens it is able to spring back to its original **thick shape**.



Controlling the amount of light that enters the eye

- The muscles of the iris can contract and relax to change the **size of the pupil**.
- It contains two types of muscle the **radial** and **circular**.
- Radial muscles are like the **spokes** of a wheel moving from the edge of the pupil to the iris
- Circular muscles form **rings** within the iris around the pupil.

Controlling the amount of light that enters the eye

Too little light no image will be produced.

Too much light the cells in the retina could be damaged.

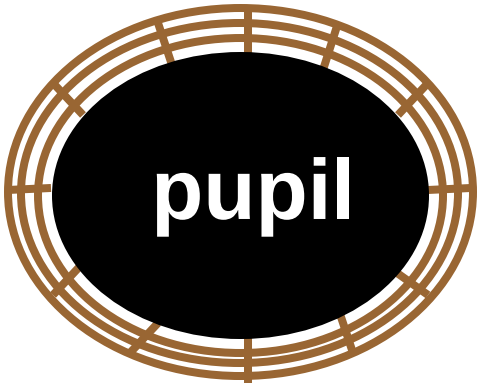
The iris adjusts the amount of light entering the eye.

The muscles of the iris relax or contract to change the size of the pupil.

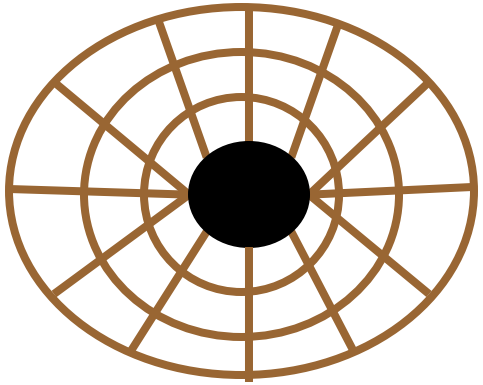
The pupil is a gap in the middle of the iris.

Controlling the amount of light that enters the eye

In dim light the circular muscles relax, the radial muscles contract and a **large pupil** results to encourage as much light to enter.



In bright light the circular muscles contract and the radial muscles relax to make the pupil small. This reduces the amount of light that enters the eye and prevents damage to the retina.



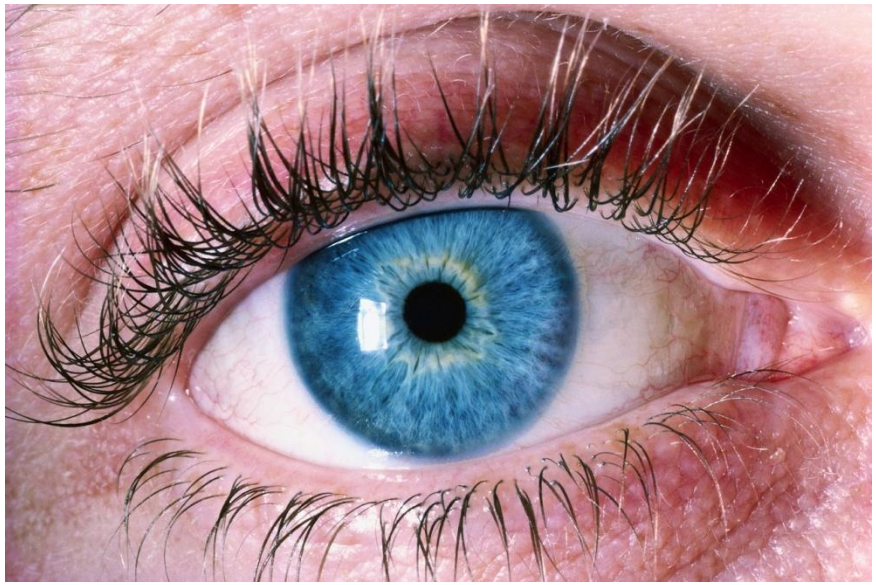
Viewing an object in different light conditions

DIM LIGHT

Pupil enlarges (dilates)
Sufficient light falls on the retina to produce an image

BRIGHT LIGHT

Pupil gets smaller (contracts)
Protects the sensitive cells in the retina from damage

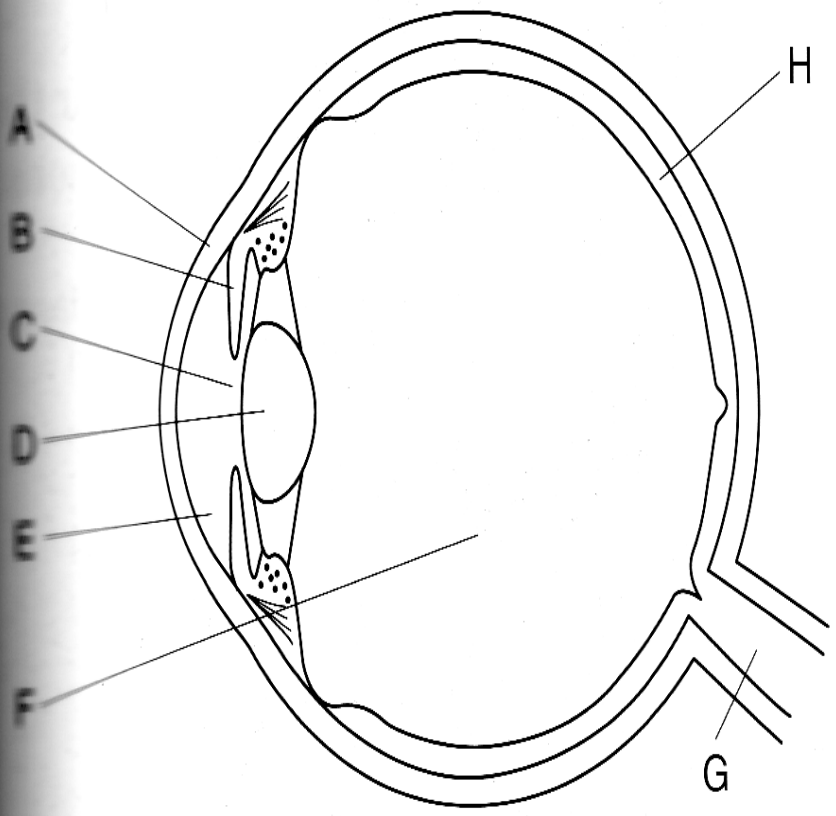


The pupil gets larger in dim light

The changing of the size of the pupil is an automatic reaction, it is known as the **pupillary reflex**.

- REVISION

The diagram shows a section through an eye.



For each sentence give the correct letter from the diagram to complete the sentence.

a) The light enters the eye through the conjunctiva and the ___.

(1 mark)

b) The ___ focuses the light on the retina.

(1 mark)

c) An image is now formed on the light sensitive cells and the ___ sends a message to the brain.

(1 mark)

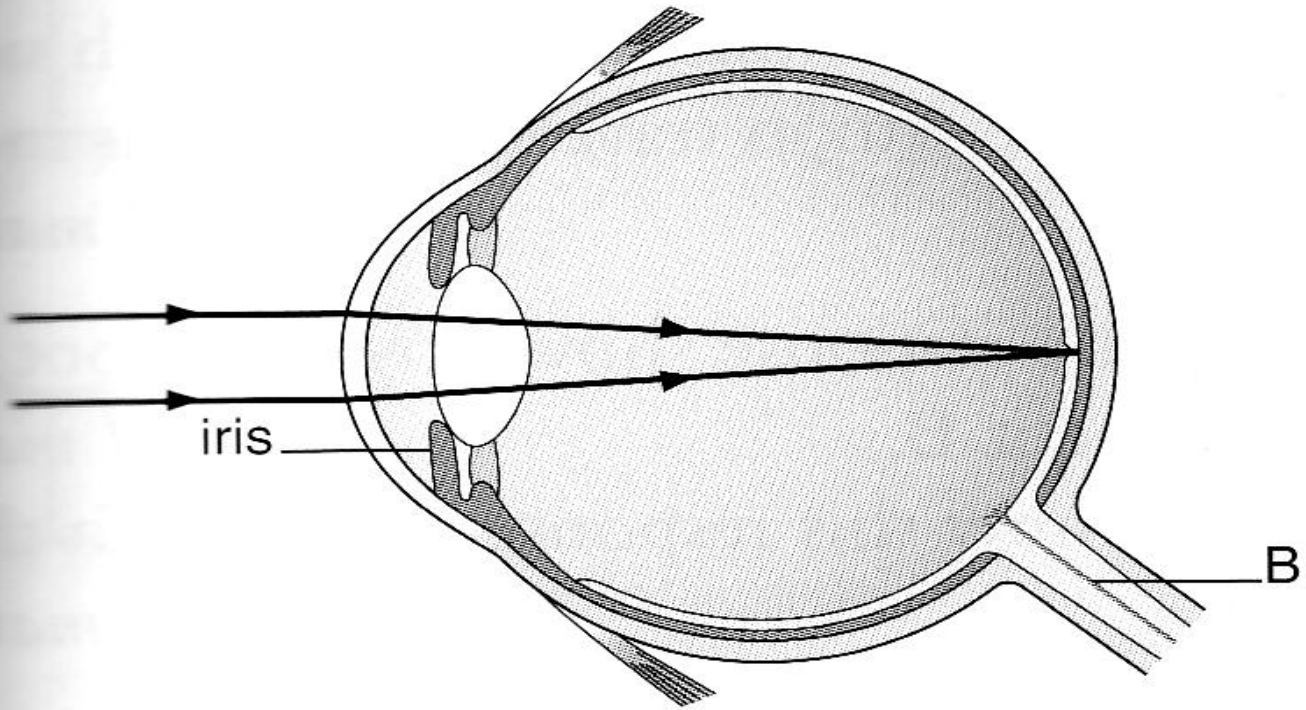
d) (i) What happens to the size of the pupil when the light intensity decreases?

(1 mark)

(ii) What is the importance of this change?

(1 mark)

1 The diagram shows a section through an eye.



a) What is the function of the iris? *(1 mark)*

b) Name part B. *(1 mark)*

c) Use the diagram and your knowledge to explain how light rays that enter the eye are focused onto the retina. *(1 mark)*

Tim and Moby

- Hormones

Examples of hormones are:

INSULIN

GLUCAGON

TESTOSTERONE

OESTROGEN

HORMONES

Not all information in the body is transmitted through **neurones**.

Hormones are chemical messengers produced by glands known as **endocrine glands.**

Hormones secreted into the **blood plasma** by the endocrine glands and are transported to the **target organs.**

INSULIN & GLUCAGON

INSULIN

Insulin is the hormone that **prevents blood glucose (sugar) becoming too high.**

A **rise in blood glucose** causes special cells in the **pancreas** to secrete insulin. This usually occurs **after a meal** especially if it is rich in carbohydrates.

It is carried in the blood to the **body cells, liver and muscle cells.**

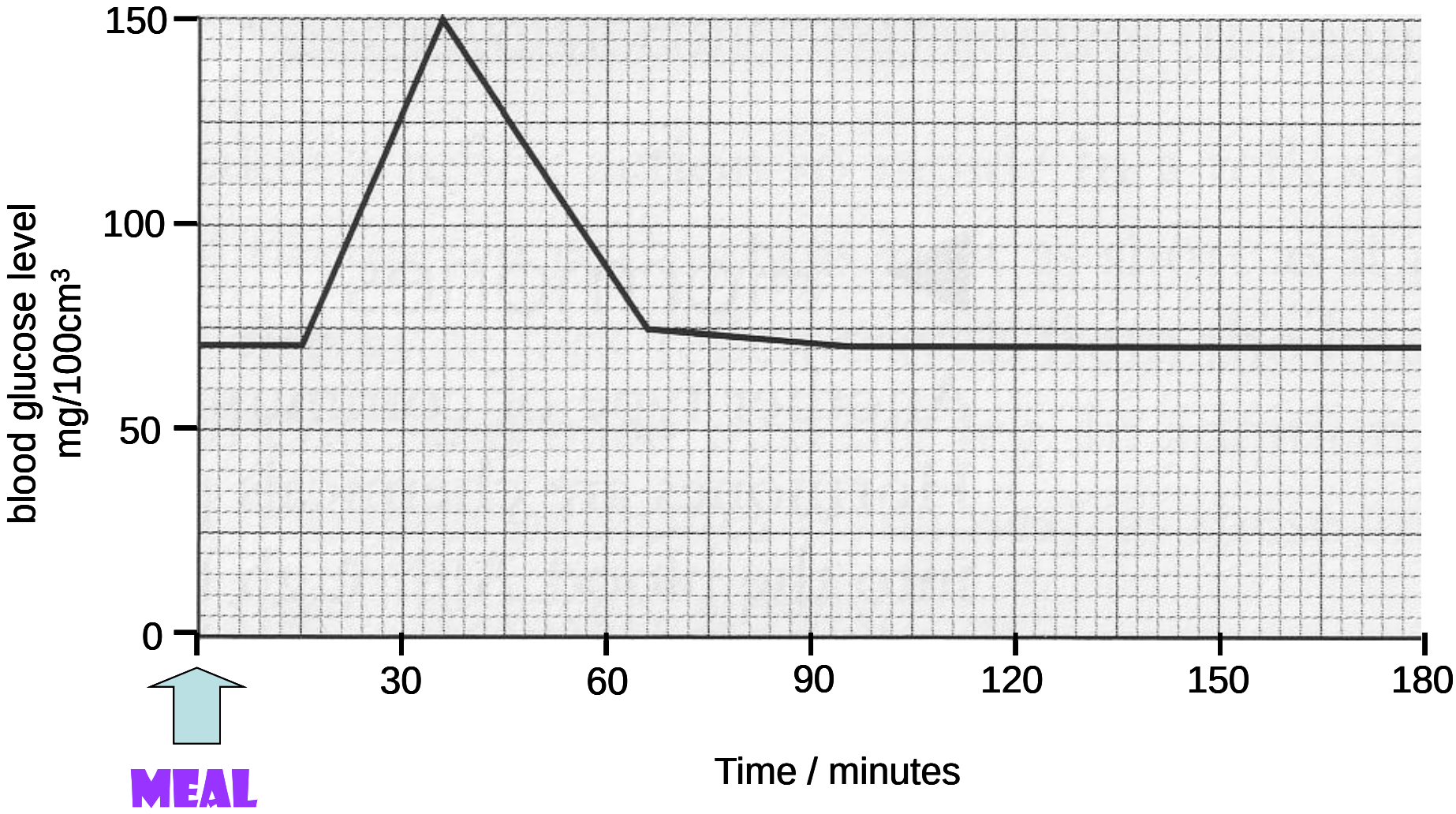
ACTION OF INSULIN

Insulin acts to reduce blood glucose levels by:

- **Increasing the uptake of glucose from the blood into the cells.**

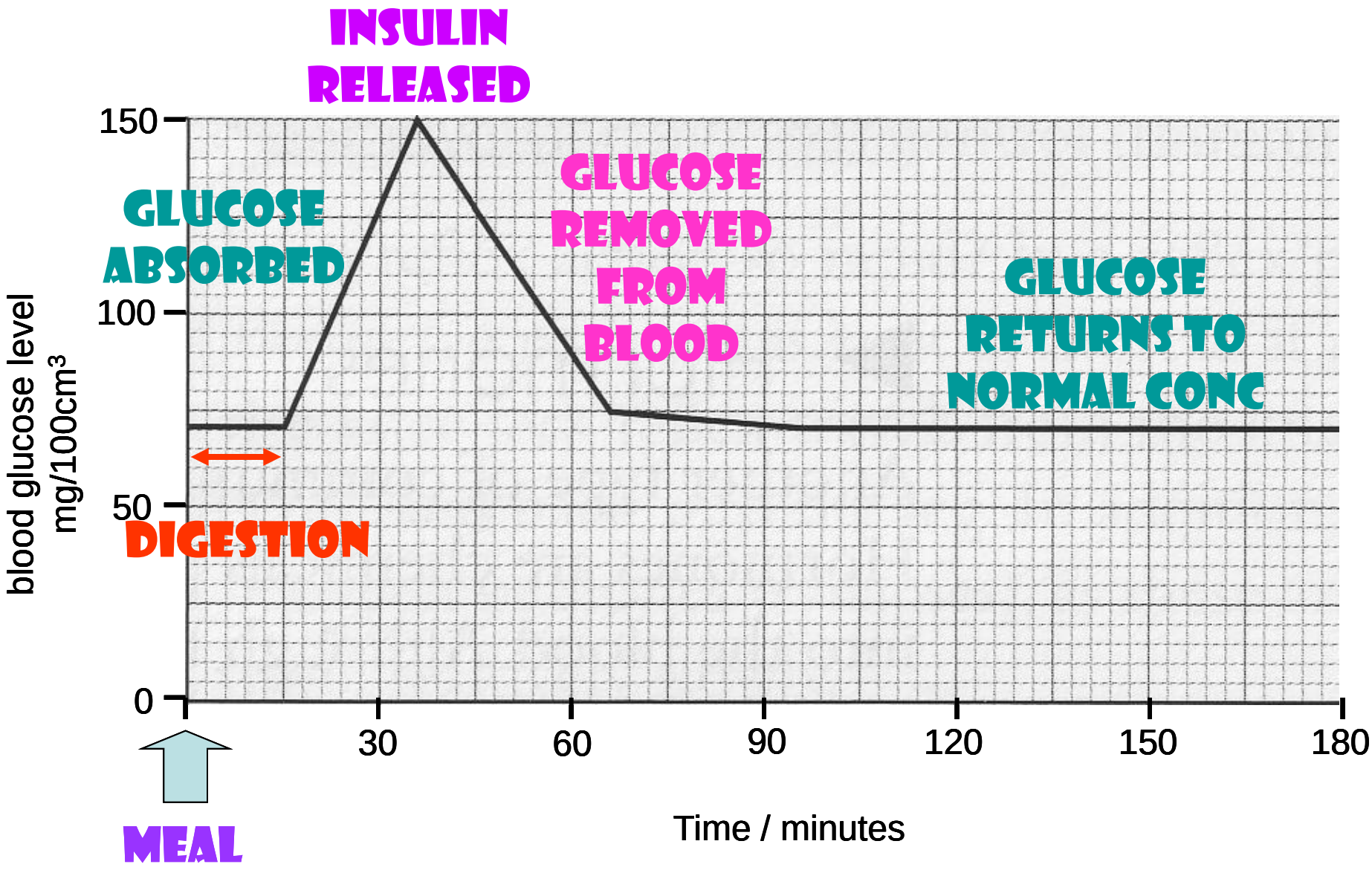
- **Converting glucose to glycogen which can be stored in the liver and muscles.**

- **Increasing the rate of respiration by the body's cells (uses glucose).**

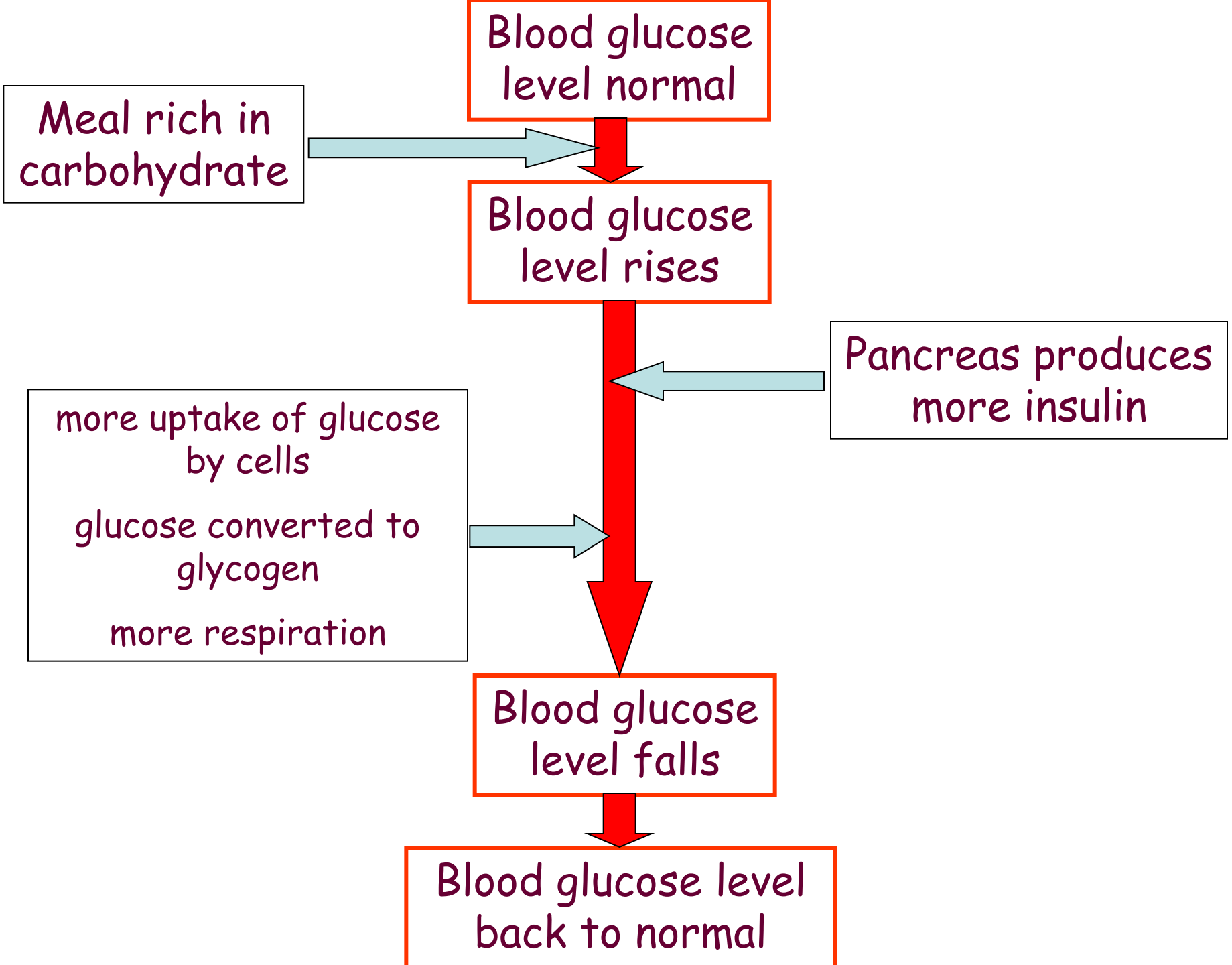


The Effect of Insulin on Blood Glucose Levels

- Which part of the meal causes this graph to be produced?
- Mark on the graph where digestion is taking place.
- What causes the rise in blood glucose level 15 minutes after the meal?
- Mark on the graph when insulin is released from the pancreas.
- Explain your answer.



The Effect of Insulin on Blood Glucose Levels


Blood glucose level normal
Meal rich in carbohydrate
Blood glucose level rises
Pancreas produces more insulin
more uptake of glucose by cells
glucose converted to glycogen
more respiration
Blood glucose level falls
Blood glucose level back to normal

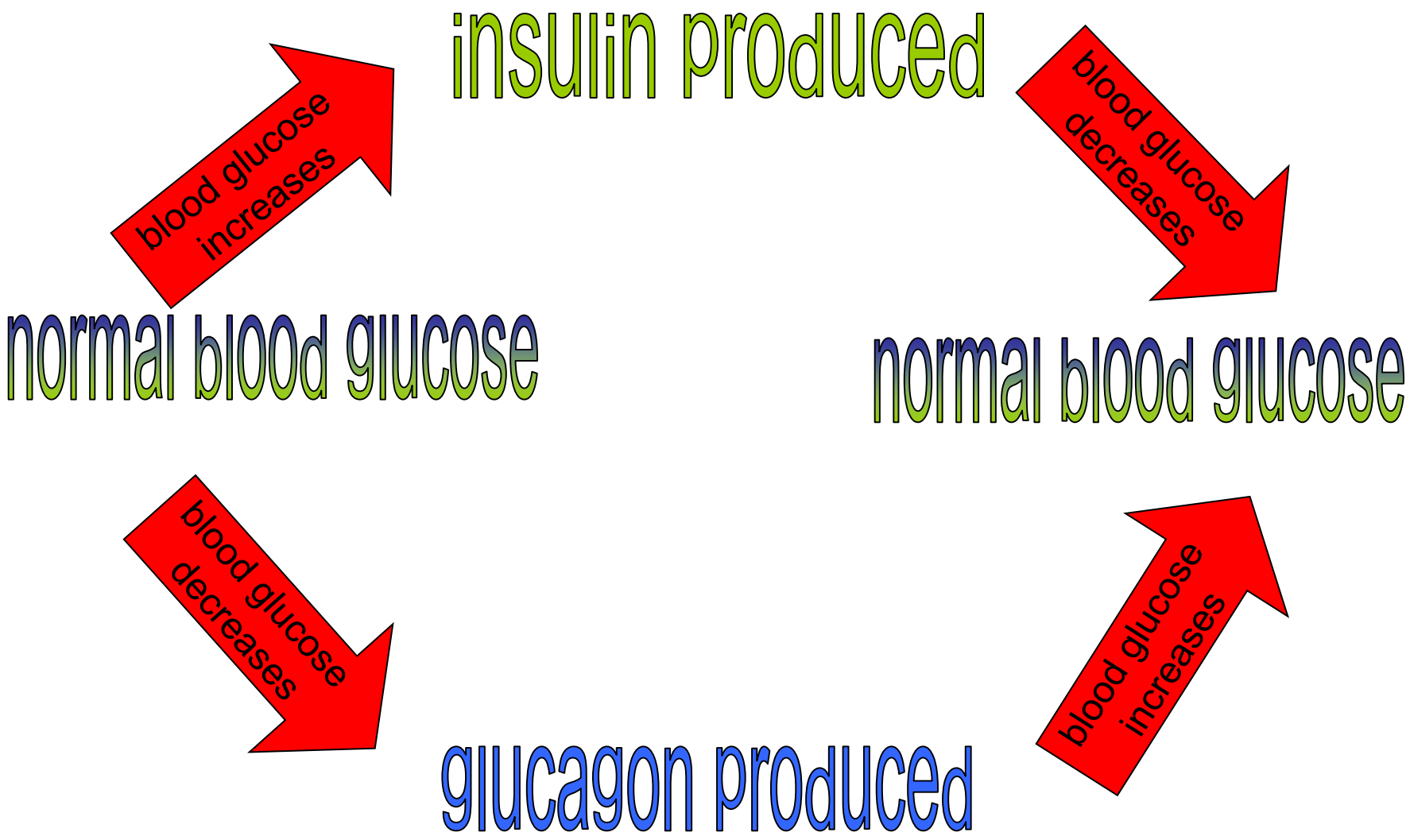
GLUCAGON

- This is a second hormone which is involved in controlling blood sugar levels.
- It is also produced by special cells in the pancreas.
- It is produced when blood glucose levels are **falling** and it acts by **reversing the changes that insulin brings about in the liver** i.e. it breaks down glycogen and releases glucose into the blood.

the control of blood glucose concentration is an example of negative feedback

Negative feedback occurs when a **change in the level of one thing** causes something to be produced **to correct the change**.

It requires a mechanism for **monitoring** the change.


insulin produced
blood glucose decreases
normal blood glucose
blood glucose increases
glucagon produced
blood glucose decreases
normal blood glucose
blood glucose increases

- The concentration of blood glucose is **constantly monitored** by cells in the pancreas
- an **increase** in glucose (after a meal)
- causes an **increase** in insulin
- which returns blood sugar level to **normal**
- a **decrease** in glucose (after exercise)
- causes an **increase** in glucagon
- which returns blood sugar level to **normal**

negative feedback

diabetes

- Occurs when the pancreas does not produce enough insulin
- Blood sugar levels can increase so high they lead to a coma and death
- Insulin is injected into the blood at mealtimes to reduce sugar levels


Important:
For demonstration only
Not to be injected
Not for treatment of diabetes
The product does not contain insulin
Novo Nordisk A/S
2880 Bagsværd, Denmark


Dexcom

symptoms

- Glucose in the urine. This happens as blood glucose levels are so high that some sugar is removed through the kidneys.
- Extreme tiredness
- Affected individuals are thirsty and as they drink so much they frequently go to the toilet.

diabetes long term damage

- Eye damage
- Heart disease

Kidney Failure

Strokes

types of diabetes

- **Type 1** diabetes is normally developed in childhood.
- **Type 2** diabetes develops in older people and has a slightly different cause as insulin is produced but stops working effectively. It is often associated with poor diet, lack of exercise and obesity.
- The number of people with Type 2 is rising-why?

Insulin: SORT

- produced in the pancreas when blood sugar levels are high
- carried to the liver and muscles in the blood
- liver and muscles take up sugar from the blood
- and stores it as glycogen
- Increased respiration by body cells uses glucose
- blood sugar levels fall & return to normal

glucagon: SORT

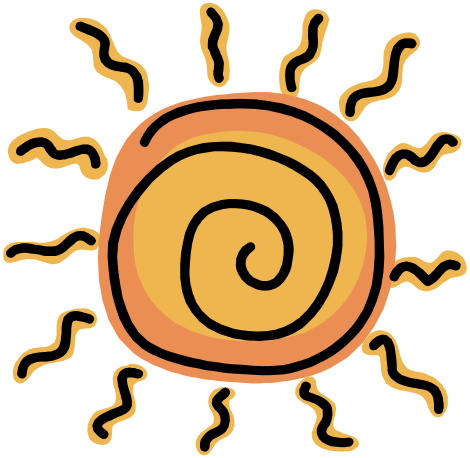
- produced in the pancreas when blood sugar levels are low
- carried to the liver and muscles in the blood
- liver and muscles convert glycogen to glucose
- glucose is released into the blood
- blood sugar levels rise & return to normal

PLANT HORMONES

Plants, like animals respond to changes in their environment in order to give them a better chance of survival.

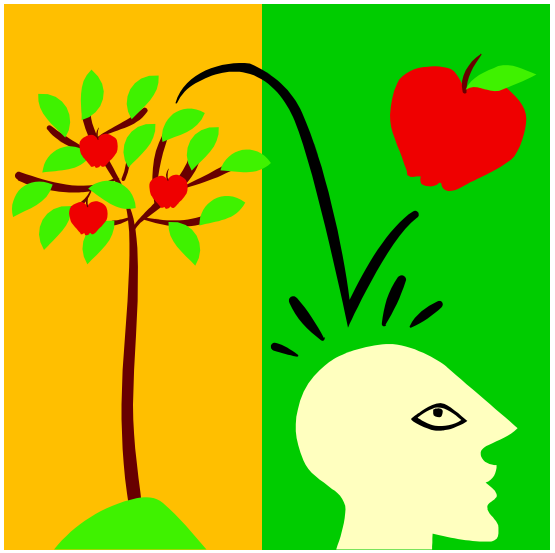
Plants respond to

light,



water,

and gravity.



Phototropism

Plants require light to make food during photosynthesis and plants will grow toward the light.

The response of a plant shoot to light is called phototropism.

Phototropism

In the plant the phototrophic response is controlled by a hormone called **auxin**.

It is produced in **shoot tips**.

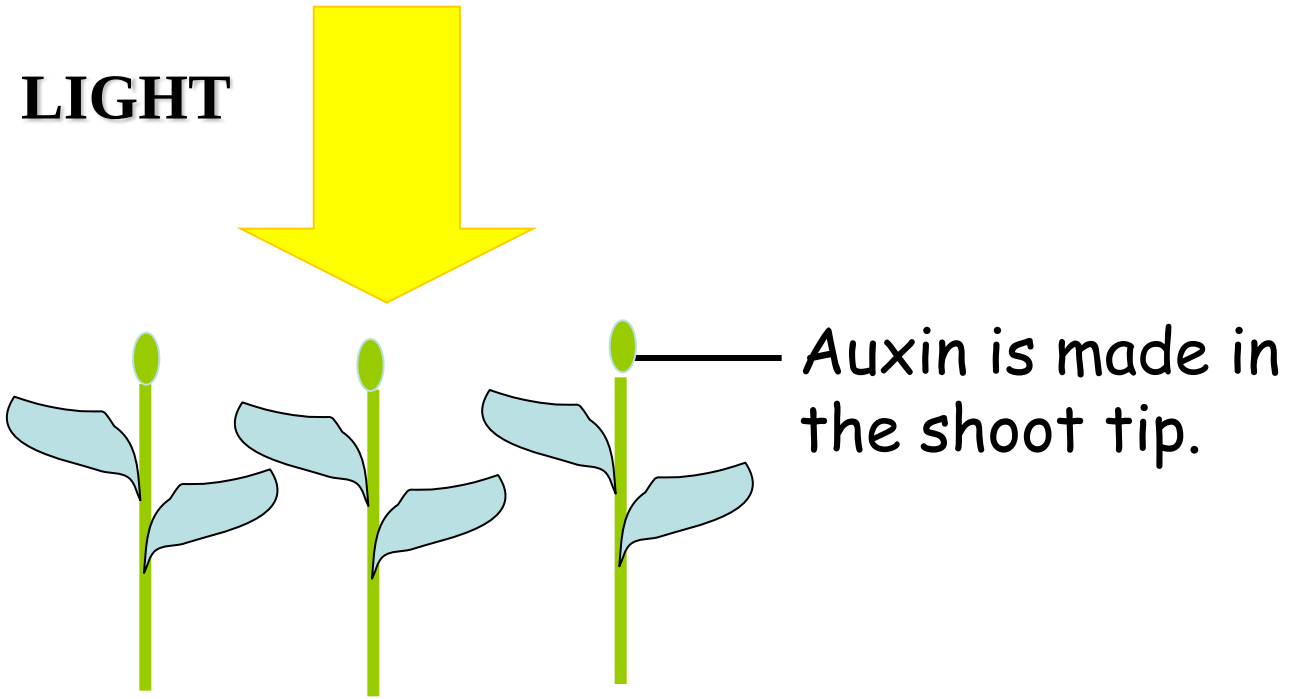
It **diffuses** from the tip to the stem and causes cells to **elongate**, resulting in growth

Auxin is **sensitive to light**.

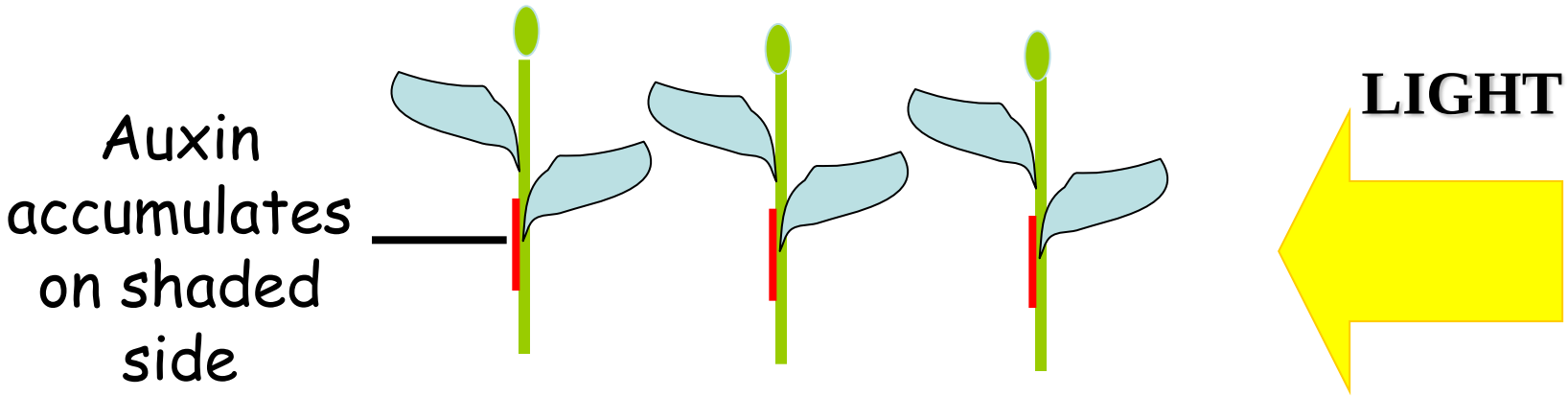
Phototropism experiments

Normally light shines from above.

Auxin diffuses **evenly** down the stem from the shoot tip to all cells and the shoot grows upwards.

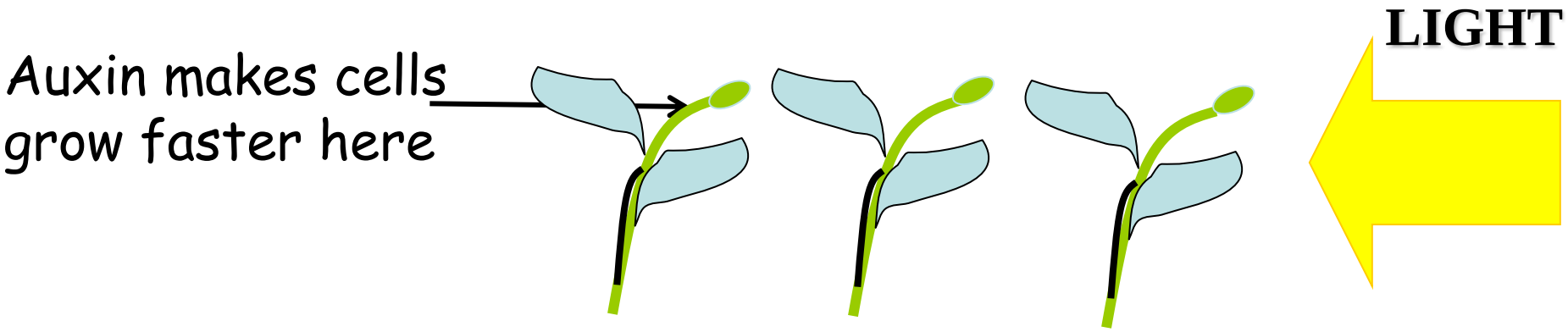


If light shines from one side (unilateral) the hormone auxin **moves away from the light and accumulates on the shaded side**.

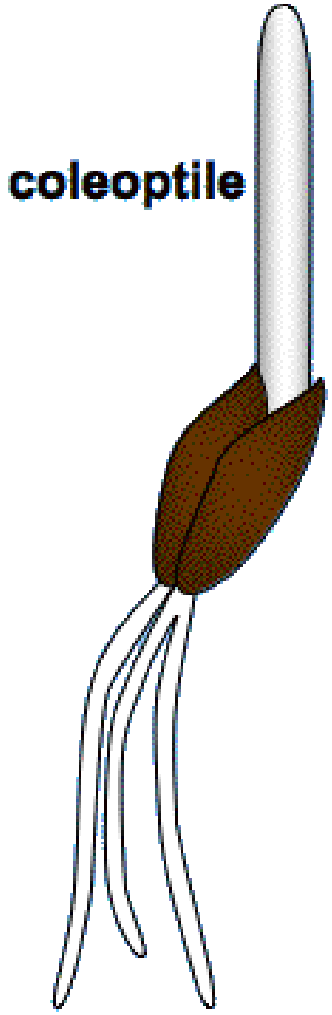


The result is that auxin causes the cells on the shaded side to **elongate and grow faster than the unshaded side**

and the shoot will **bend toward the light**.



PHOTOTROPISM EXPERIMENTS



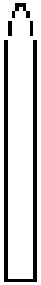
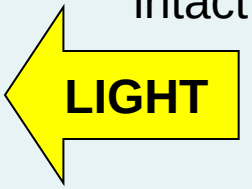
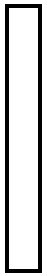
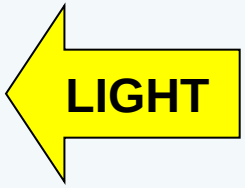
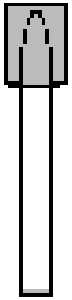
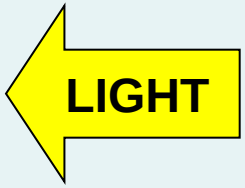
Plan a method to investigate the effect of unilateral light on the growth of oat coleoptiles.

Independent variable

Dependent variable

Controlled variables

Method

Condition	Result	Explanation
 coleoptile intact 		
 coleoptile tip removed 		
 coleoptile tip covered with foil 		

In your groups make a Tim and Moby answer to the question below

Dear Tim and Moby

‘I have heard my Science Teacher use the word phototropism would you please explain how this works’

From.

A. Uxin

Florida

The Commercial Use of Plant Hormones

Auxin is one of many plant hormones that have been identified.

Other plant hormones can be used for:

- Controlling weeds
- Rooting Powder
- Tissue culture
- Stimulation of Flowering and Fruit Formation

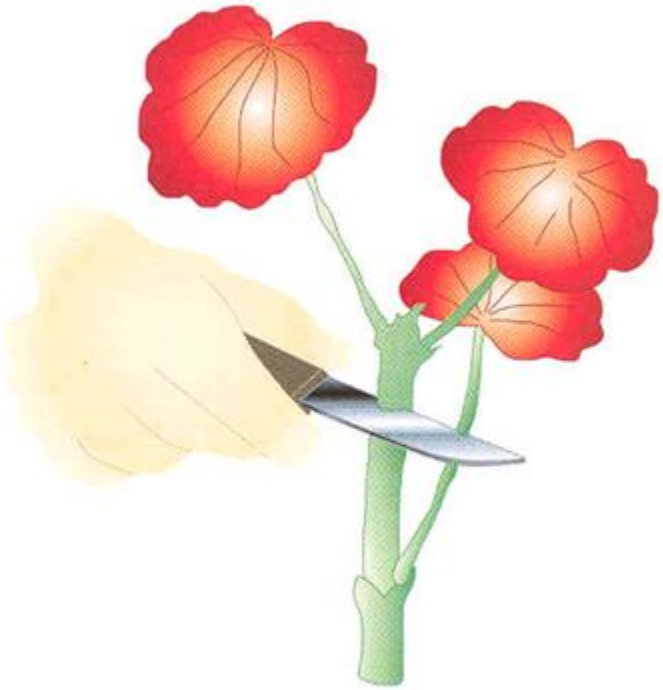
Plant hormones as **WEEDKILLERS**

Weedkillers cause death by **excessive cell growth** in the roots and stems.

They are effective as they are **selective**. This means that they are effective against **broadleaved plants** such as daisies, **but have no effect on narrow leaved plants** such as grass.

Plant Hormones in **ROOTING POWDER**

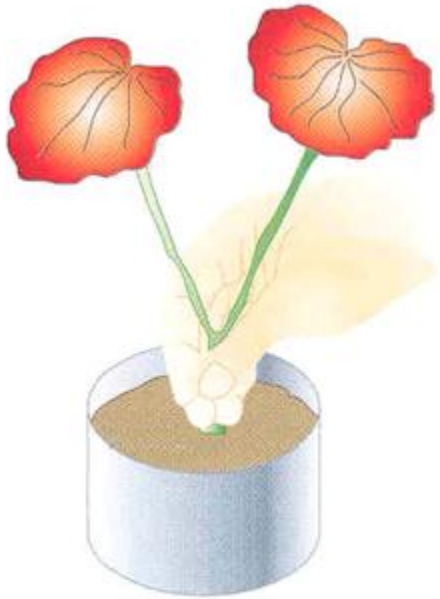
- Cuttings of plants can be taken to grow new plants. The cutting is taken dipped in **rooting powder which contains hormones** then planted in compost.
- The hormones **stimulate roots to develop** and a new plant is formed.
- Most of the leaves are removed to **reduce water loss and wilting.**



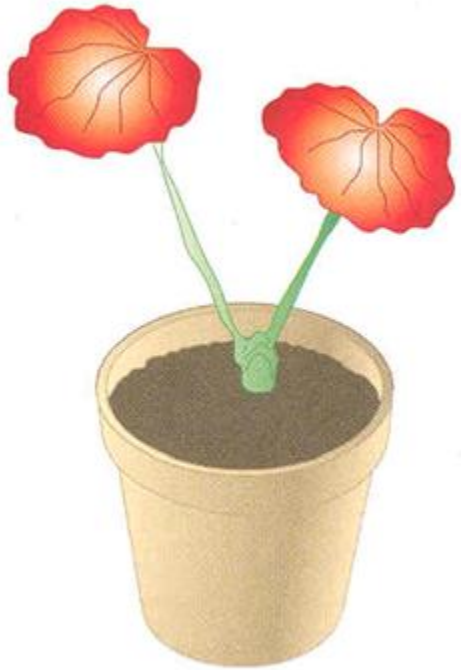
Cut a section with a few leaves

A sharp clean knife prevents infection.

Remove some of the leaves to reduce water loss from transpiration.



Dip cutting into compound that contains hormones to stimulate root growth



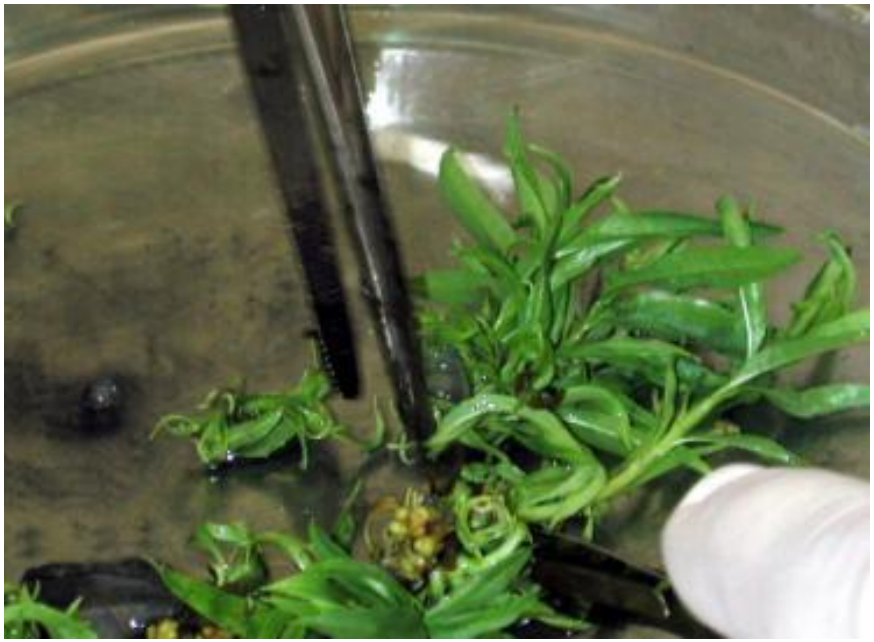
Place in compost until established

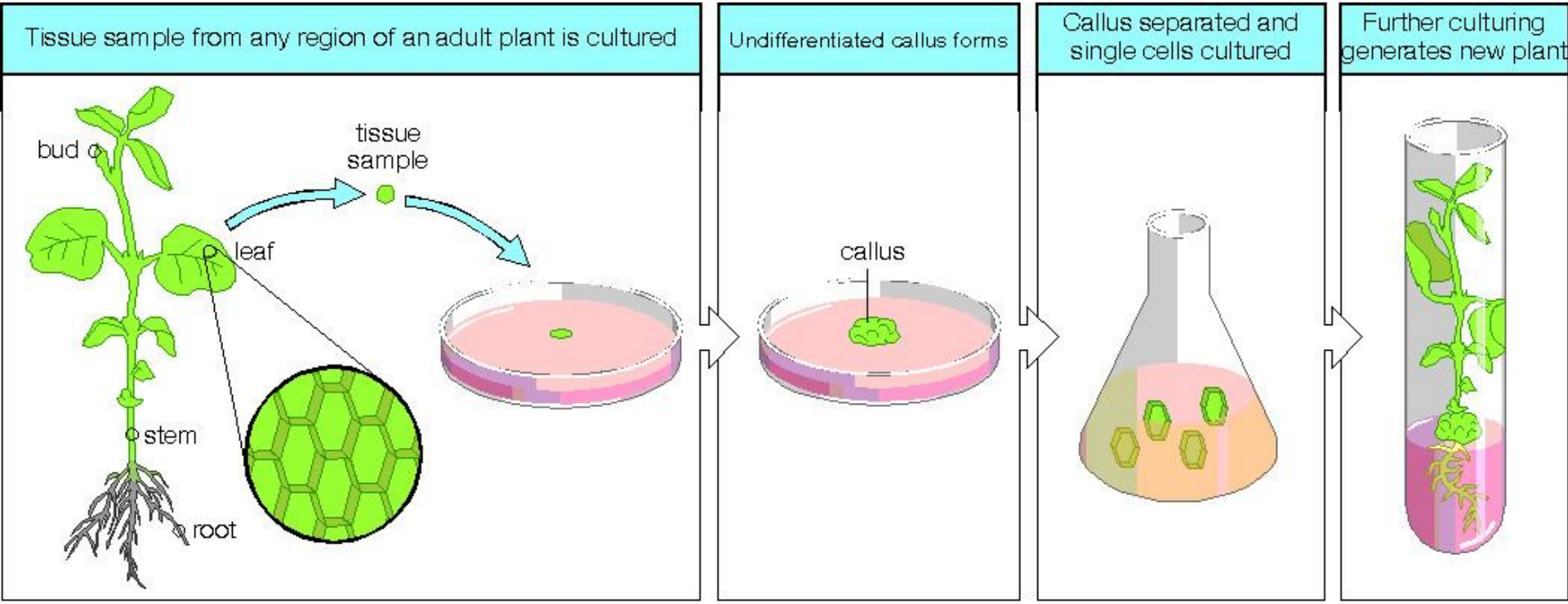
Why is this important?

Plant hormones in **TISSUE CULTURE**

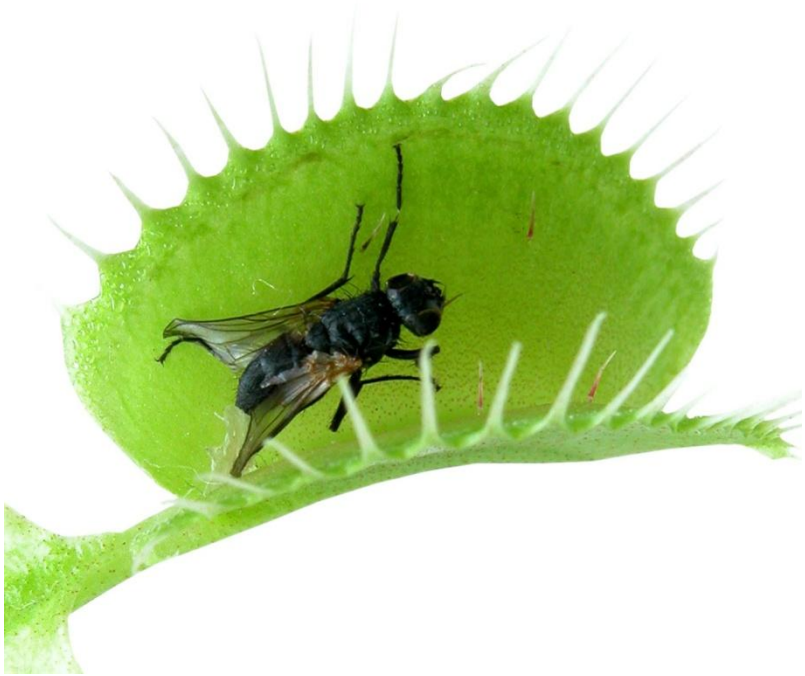
- This involves taking small sections of plant tissue (explant) and putting it onto nutrient jelly called **agar**.
- **Hormones are added** which encourage the cells to divide into an **undifferentiated callus** of cells.
- Each cell will develop **into new plants**

- Individual plants are removed carefully and placed in **new agar containing nutrients** that allow it to develop into an adult plant.




Tissue sample from any region of an adult plant is cultured
bud
tissue sample
leaf
stem
root
Undifferentiated callus forms
callus
Callus separated and single cells cultured
Further culturing generates new plant

Used to produce plants that are rare or difficult to germinate



Plant Hormones

STIMULATING FLOWER AND FRUIT PRODUCTION

Hormones can be sprayed onto flowers and fruit trees to **maximise flower and fruit production.**

In fruit growing regions of County Armagh hormones are used to act as a **substitute for pollination and fertilisation** processes.

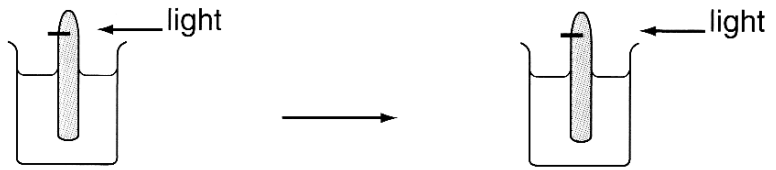
This ensures fruit production is not limited by poor pollination rates

SEEDLESS GRAPES

Naturally a grape will only develop if its ovules are **fertilised** to become seeds.

Artificially produced hormones are sprayed onto unpollinated flowers, bypassing the pollination and fertilisation process ensuring that grapes develop without seeds.

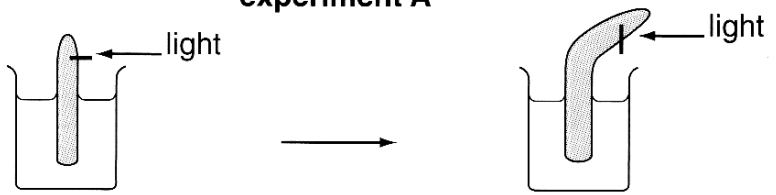
5 An experiment was carried out to investigate the effect of light shining from one side on a plant shoot.



small sheet of impermeable material placed in shaded side of shoot tip

after 5 days

experiment A



small sheet of impermeable material placed in illuminated side of shoot tip

after 5 days

experiment B

a) A plant hormone (auxin) causes the bending response. Auxin is produced in the tip and travels downwards to cause the cells to elongate. Use the results to explain which side of the shoot the auxin travels downwards in.

(2 marks)

b) i) Name the response shown by the shoot in experiment B. *(1 mark)*

ii) Explain how this response will benefit the plant. *(2 marks)*

How Scientific Theories Develop

- **These are developed in small stages by different teams of scientists using different lines of evidence.**
- The scientists **work together** (collaborate). They **research past discoveries** and each scientist **carries out their own experiments.**
- They **share ideas** by publishing their results in scientific journals.
- **Each new development in the theory is accepted (validated) by experts in the particular area.** This is known as **peer review**. This will involve different scientists **repeating** the experiments to check the findings.

An increased frequency of NK cell receptor and HLA-C group 1 combinations in early-onset type 1 diabetes.

(PMID:21909837)

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Mehers KL, Long AE, van der Slik AR, Aitken RJ, Nathwani V, Wong FS, Bain S, Gill G, Roep BO, Bingley PJ, Gillespie KM

Diabetes and Metabolism, Learning and Research, University of Bristol, Southmead Hospital, Bristol, UK.

Diabetologia [2011, 54(12):3062-70]

Type: Journal Article

DOI: 10.1007/s00125-011-2299-x

Abstract

Highlight Terms
Diseases(1) Genes/Proteins(5)

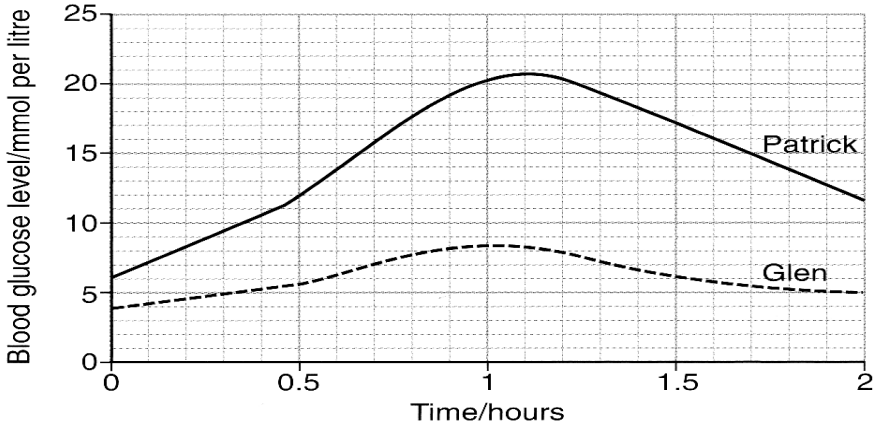
AIMS/HYPOTHESIS: Natural killer (NK) cells serve as primary immune surveillance and are partially regulated by combinations of killer immunoglobulin-like receptor (KIR) genes and their HLA class I ligands. Alterations in NK cell activity have been associated with type 1 diabetes. The aim of this study was to determine whether KIR-HLA class I gene frequency: (1) is altered in a current population with type 1 diabetes compared with healthy controls; and (2) has changed over the half century in which the incidence of type 1 diabetes has increased rapidly. METHODS: KIR-HLA class I gene frequencies were compared in 551 individuals diagnosed with type 1 diabetes ≤15 years of age (394 in a current cohort and 157 from the historical 'Golden Years' cohort) and 168 healthy controls. The overall balance of activation and inhibition was analysed using KIR-HLA genotype models.

RESULTS: Children with type 1 diabetes who were positive for KIR2DS2/KIR2DL2 and KIR2DL3 were more often homozygous for HLA-C group 1 and this effect was strongest in children diagnosed with diabetes before the age of 5 years (p = 0.003, corrected p [p (corr)] = 0.012) and (p = 0.001, p (corr) = 0.004),

Report: Rising Diabetes Costs Could Bankrupt NHS

The disease and its complications currently account for 10% (£9.8bn) of NHS spending.
But this is projected to rise to £16.9bn over the next 25 years, or 17% of the health service's funds.
Researchers at the York Health Economic Consortium also found that up to four-fifths of the cost of treating complications such as kidney failure, nerve damage, and amputation could be avoided by investing in better preventative measures and management of the condition.
The Impact Diabetes report - published in conjunction with charities **Diabetes UK**, the **Juvenile Diabetes Research Foundation** and **Sanofi Diabetes**, also looked at the indirect costs to individuals living with the condition.
It found the total associated with these extra burdens in addition to direct patient care in the UK stands at £23.7bn and is predicted to rise to £39.8bn by 2035/36.
There are around 3.8 million people living with diabetes in the UK and this is expected to increase to 6.25 million in just over two decades.
Barbara Young, chief executive of Diabetes UK, said: "This report shows that without urgent action, the already huge sums of money being spent on treating diabetes will rise to unsustainable levels that threaten to bankrupt the NHS.
"But the most shocking part of this report is the finding that almost four-fifths of NHS diabetes spending goes on treating complications that in many cases could have been prevented.
"The failure to do more to prevent these complications is both a tragedy for the people involved and a damning indictment of the failure to implement the clear and recommended solutions.
"Unless the Government and the NHS start to show real leadership on this issue, this unfolding public health disaster will only get worse."
A Department of Health spokeswoman said: "We agree that diabetes is a very serious illness and one that has a big impact on the NHS.
"That's why we are tackling the disease on three fronts.
"First, through prevention of Type 2 diabetes - encouraging people to eat well and be more active. Second, by helping people to manage their diabetes through the nine annual health care checks performed in primary care. And by better management of the condition in hospital."

3 The graph shows the changes in the blood glucose level of two boys, Patrick and Glen. Both have fasted (had no food intake) for 12 hours before taking an energy drink at time 0.



a) Compare the changes that take place in Patrick's blood glucose levels with those of Glen. Use information in the graph to support your answer.

In this question you will be assessed on your written communication skills including the use of specialist science terms. *(6 marks)*

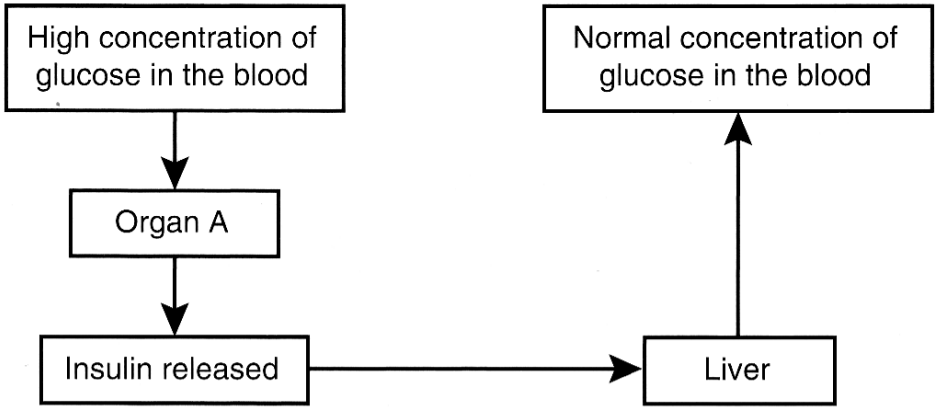
b) Explain the changes taking place in Glen's blood glucose levels. *(2 marks)*

c) Blood glucose levels above 10 mmol per litre result in glucose appearing in the urine, a symptom of diabetes.

i) Use evidence from the graph to identify which of the boys has diabetes. *(1 mark)*

ii) State another symptom of diabetes that this boy might have. *(1 mark)*

4 The diagram shows part of the mechanism that controls blood glucose concentration.



a) Name organ A. *(1 mark)*

b) Explain why the blood glucose concentration becomes high after eating a meal. *(1 mark)*

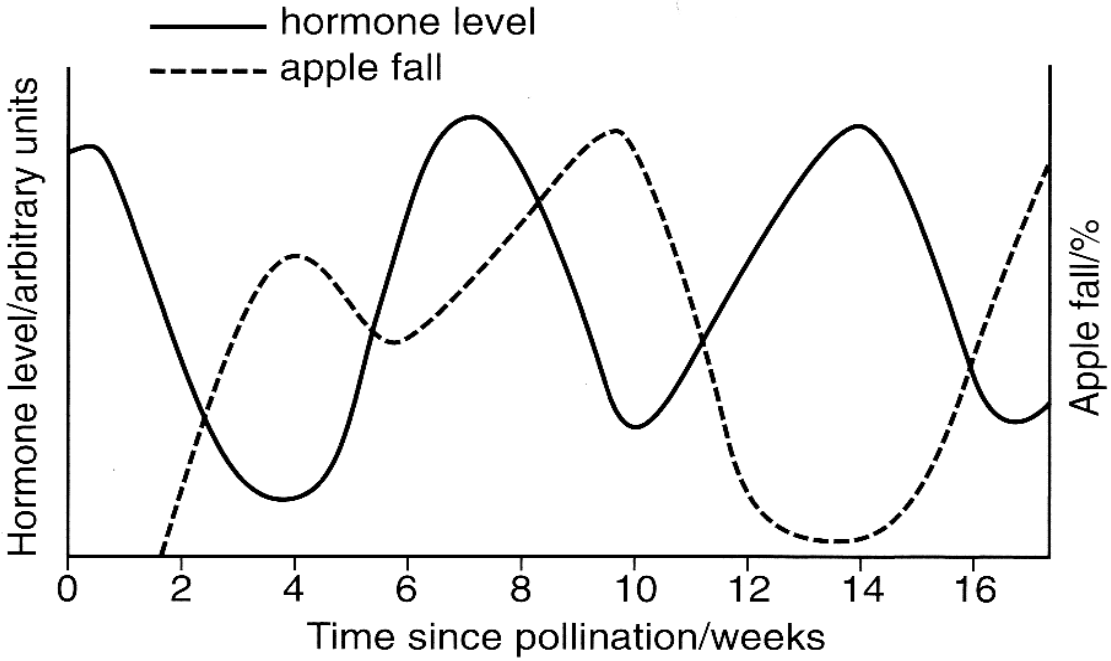
c) Describe how insulin reaches the liver. *(1 mark)*

d) Explain how insulin causes the liver to reduce the blood glucose concentration. *(3 marks)*

e) Use the information in the diagram to help explain how the control of blood glucose concentration involves a feedback mechanism. *(3 marks)*

f) Some people are unable to control their blood glucose concentration. Name this condition. *(1 mark)*

6 The graph shows the relationship between plant hormone levels and the percentage of apples to fall off the trees before harvesting.



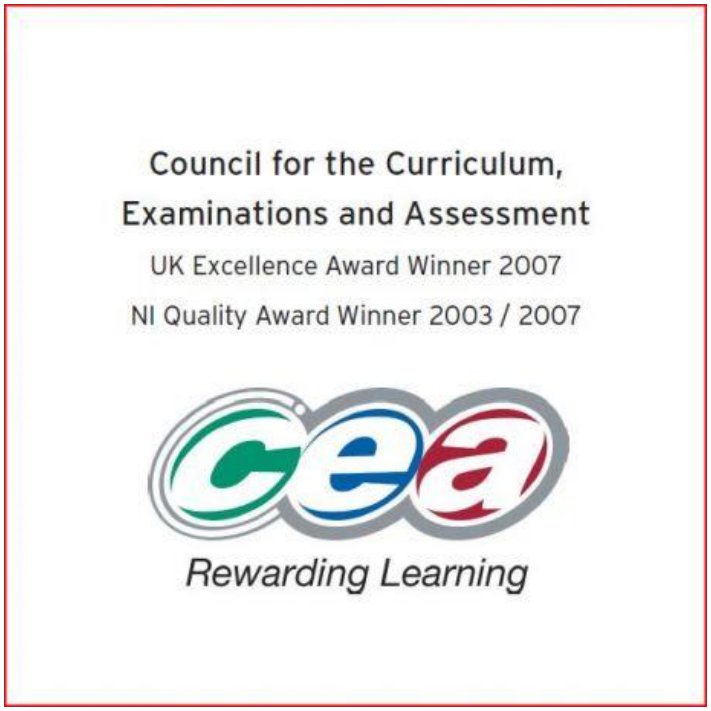
a) Describe the relationship between hormone level and the percentage of apples that fall.

(1 mark

b) Suggest **one** reason why farmers spray apple trees with artificial plant hormone. *(1 mark*

c) Give **two** other commercial applications of plant hormones. *(2 marks*

- CEA Past Paper Exam Questions



The eye is a receptor.

(a) Describe the role of a receptor.

_____

_____[1]

(b) Name the layer which contains rods and cones.

_____ [1]

(c) Suggest why nocturnal mammals have a high density of rods.

_____

_____[1]

(d) Give **two** features of the cones.

1. _____

_____[1]

2. _____

_____[1]

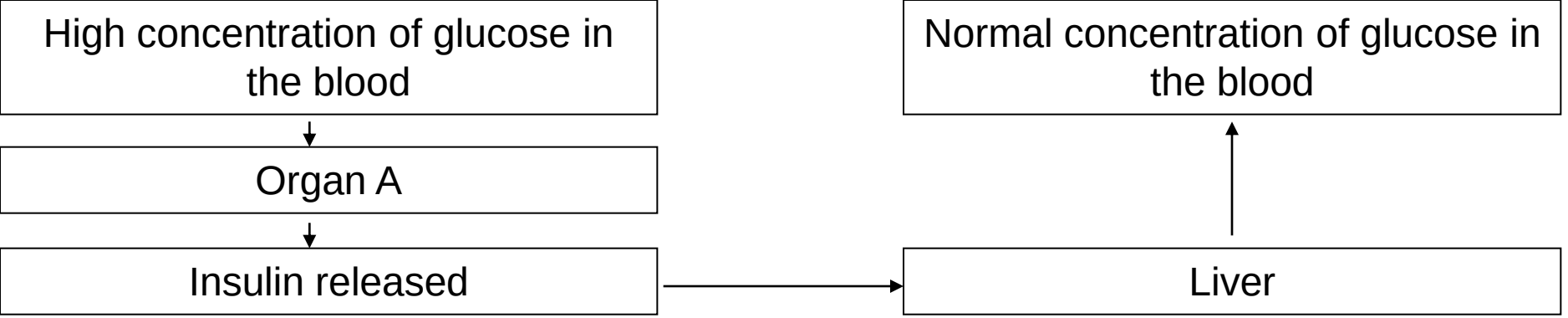
(e) Describe how the image reaches the brain.

_____

_____

_____[2]

May'10



The diagram shows part of the mechanism that controls blood glucose concentration.

(a) Name organ A.

_____ [1]

(b) Explain why the blood glucose concentration becomes high after eating a meal._____

_____[1]

(c) Describe how insulin reaches the liver.

_____

_____[1]

(d) Explain how insulin causes the liver to reduce the blood glucose concentration_____

_____

_____[3]

Use the information in the diagram to help explain how the control of blood glucose concentration involves a feedback mechanism.

_____

_____

_____

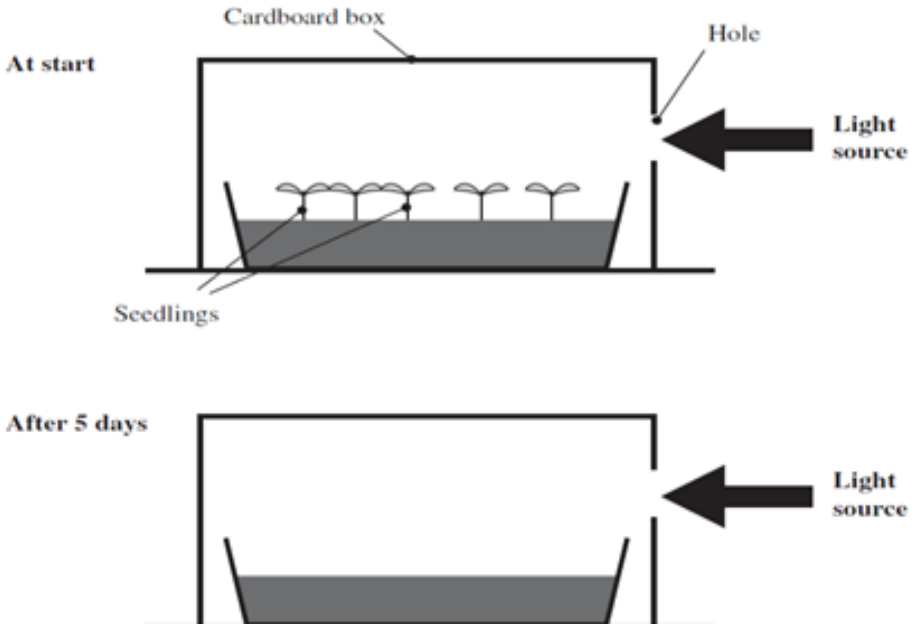
_____[2]

Some people are unable to control their blood glucose concentration.

(f) Name this condition.

_____ [1]

May'10



Complete the diagram to show the appearance of the seedlings after 5 days. [2]

(b) Name this type of growth response.

_____[1]

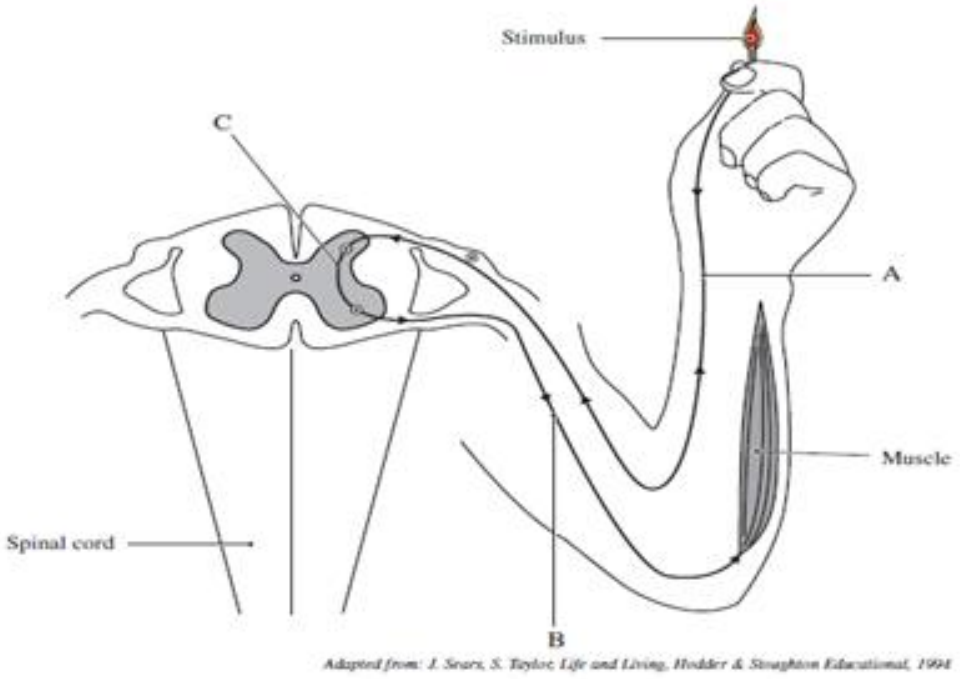
(c) Explain how this response is an advantage to the plant.

_____

_____

_____[2]

18 The diagram shows a reflex arc.



Adapted from: J. Sears, S. Taylor, Life and Living, Hodder & Stoughton Educational, 1994

(a) Name parts A, B and C.

Use the information in the diagram to help explain why a reflex arc provides a very fast response.

_____
_____
_____[2]

Hormones such as insulin are chemical messages.

(c) (i) How are hormones transported?

_____[1]

(ii) Name the organ which produces insulin.

_____[1]

(iii) Explain how insulin controls blood sugar levels.

_____
_____
_____[2]

May 09