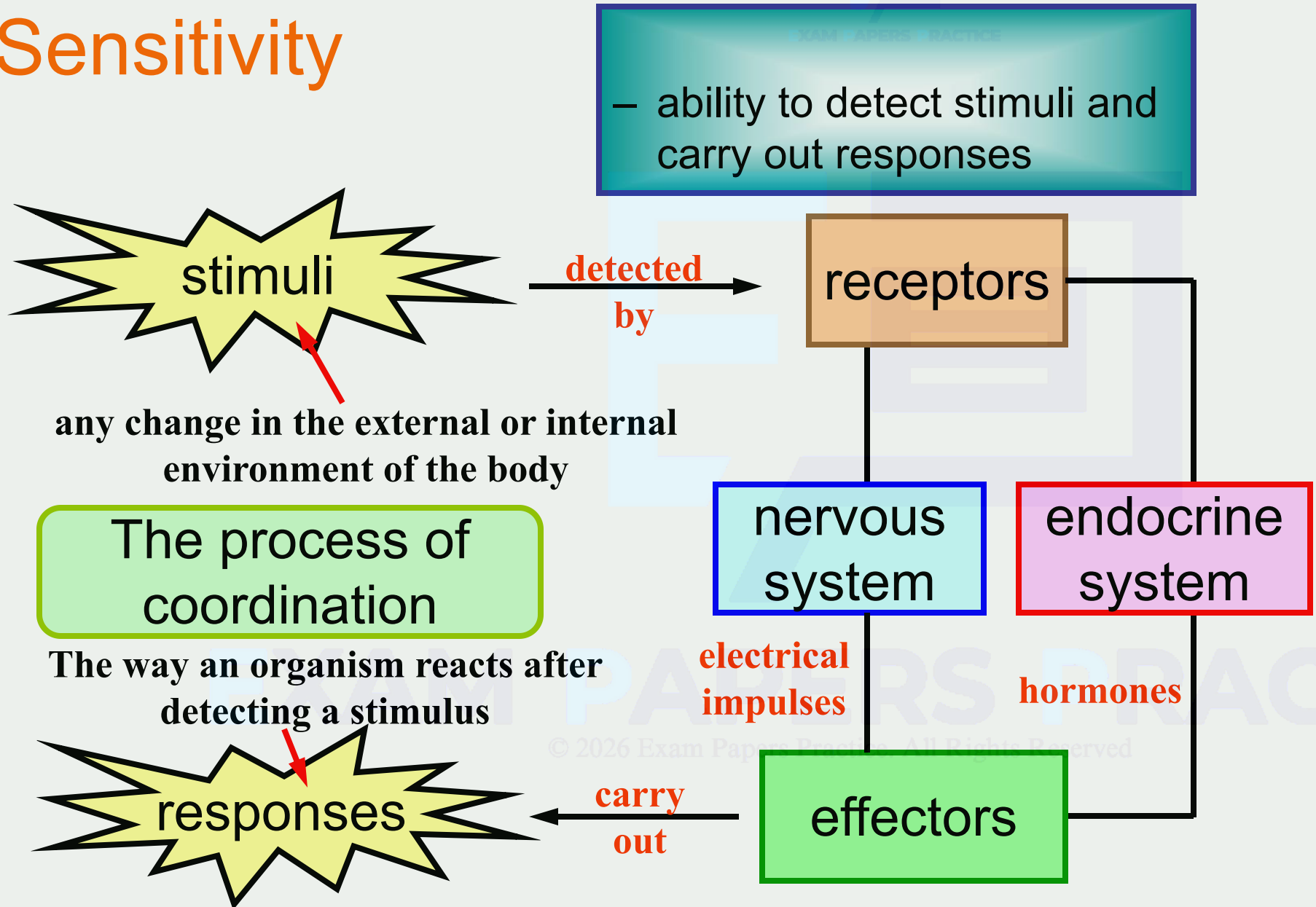


Co-ordination and response

© 2026 Exam Papers Practice. All Rights Reserved

For more help, please visit www.exampaperspractice.co.uk

Sensitivity





14.1

Nervous control in humans

© Exam Papers Practice. All Rights Reserved.

For more help, please visit www.exampaperspractice.co.uk

Human Nervous System

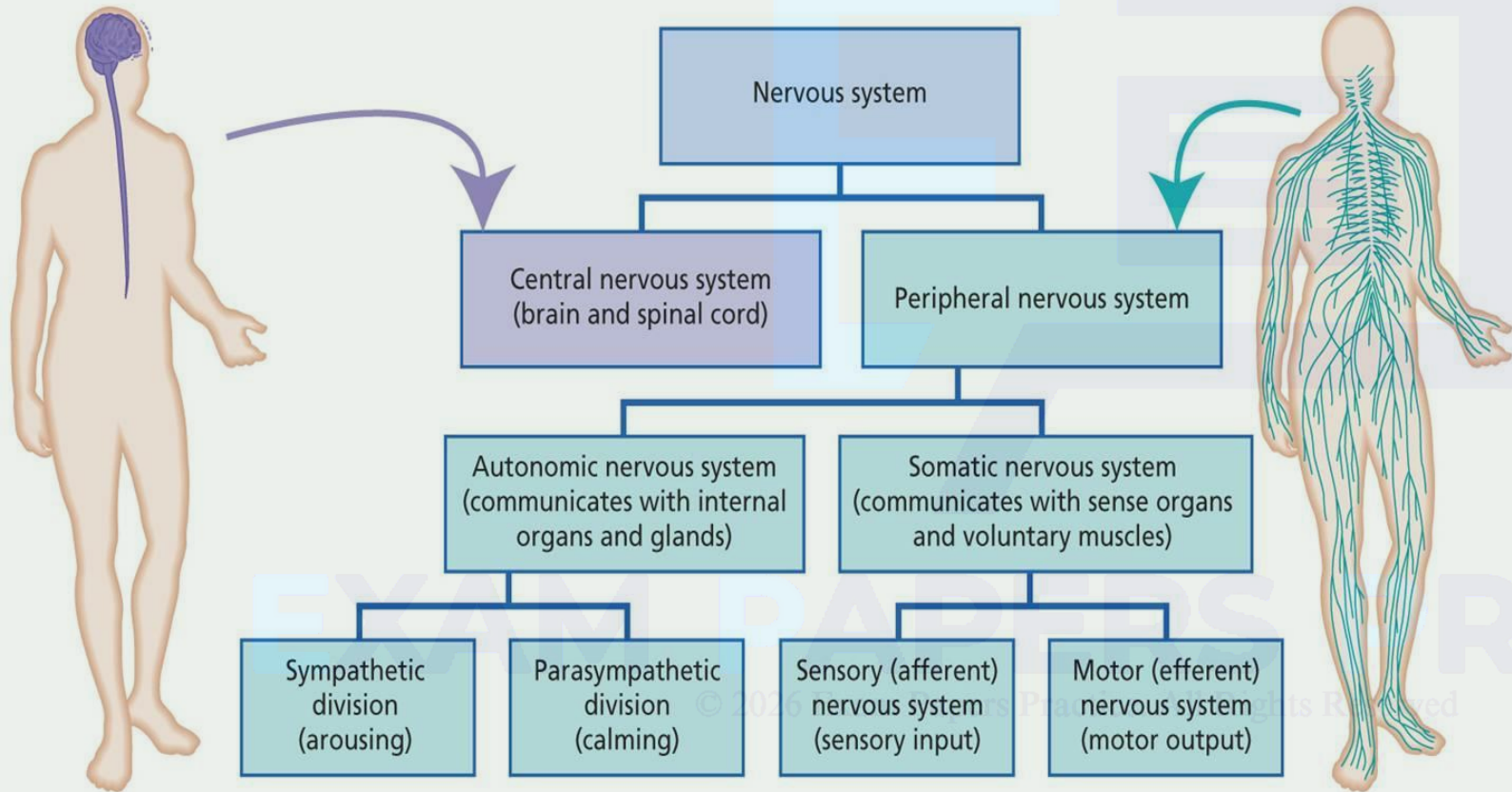
CNS

-integration and command center

PNS

-consists of **nerves**

-connect to all other parts of body



Central nervous system(CNS) 中枢神经系统
peripheral nervous system(PNS) 周围神经系统



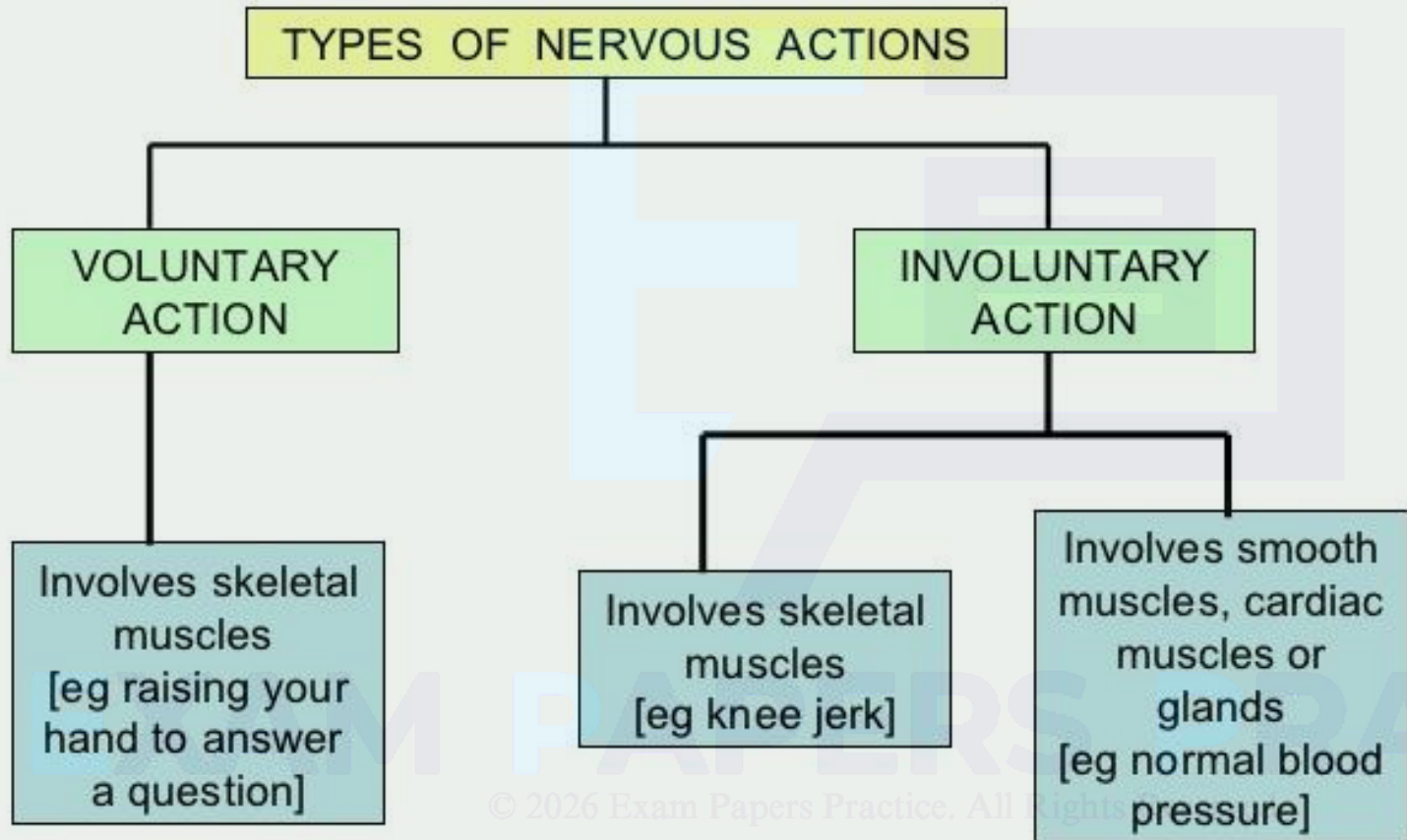
Functions:

1. Control center (coordination and regulation) of all body activities
2. Responds and adapts changes that occur both inside and outside the body (eg. Pain, temp etc.)

EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved

Actions of the body



In daily life, our body performs many different actions. These can be categorized as – **voluntary** actions and **involuntary** actions.

Involuntary Action



© 2026 Exam Papers Practice. All Rights Reserved

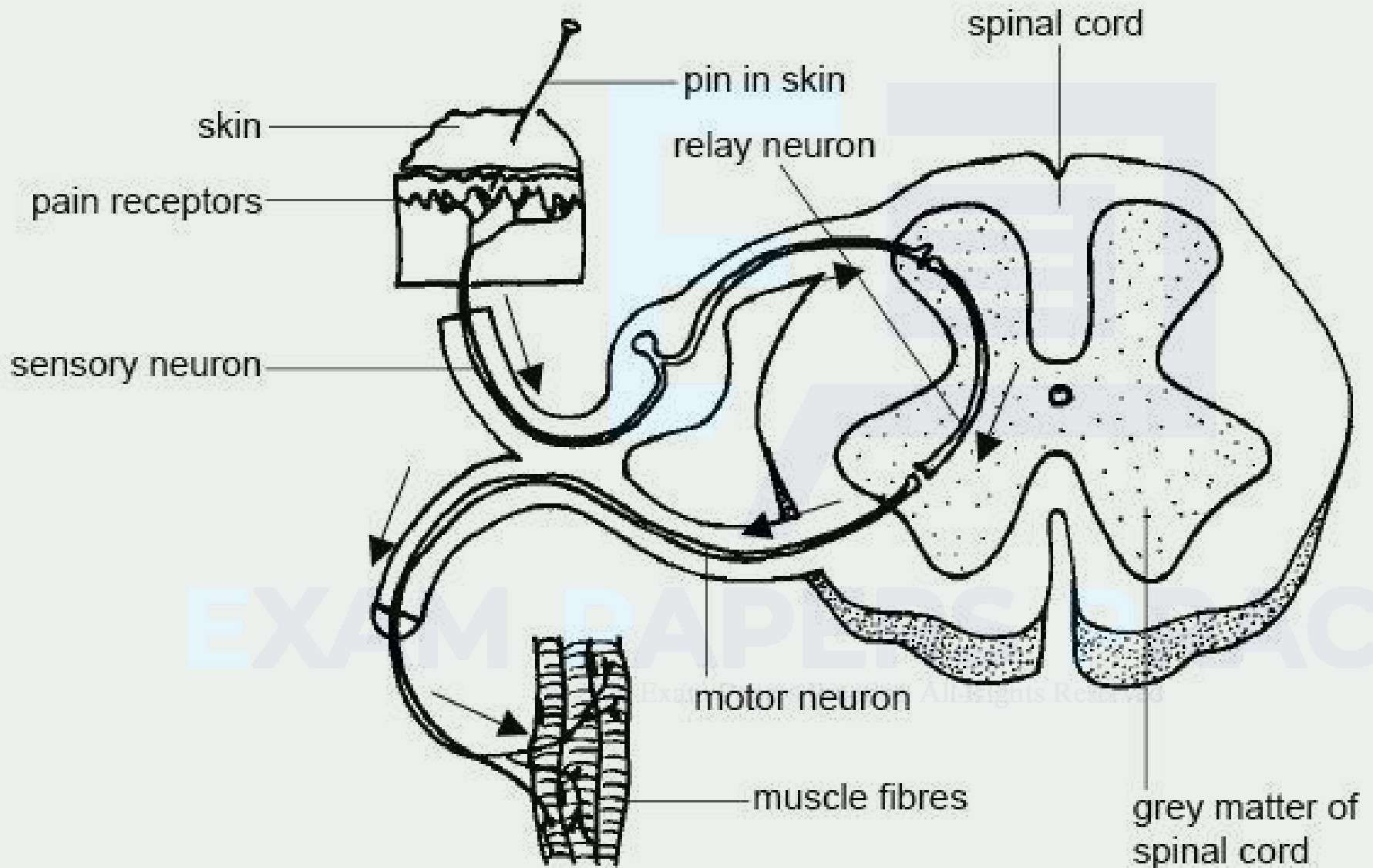
An **involuntary action** is any action which occurs without our conscious choice or will. eg. reflexes requires no conscious thought and may not always involves the brain or yawning. www.exampaperspractice.co.uk

Reflex Action

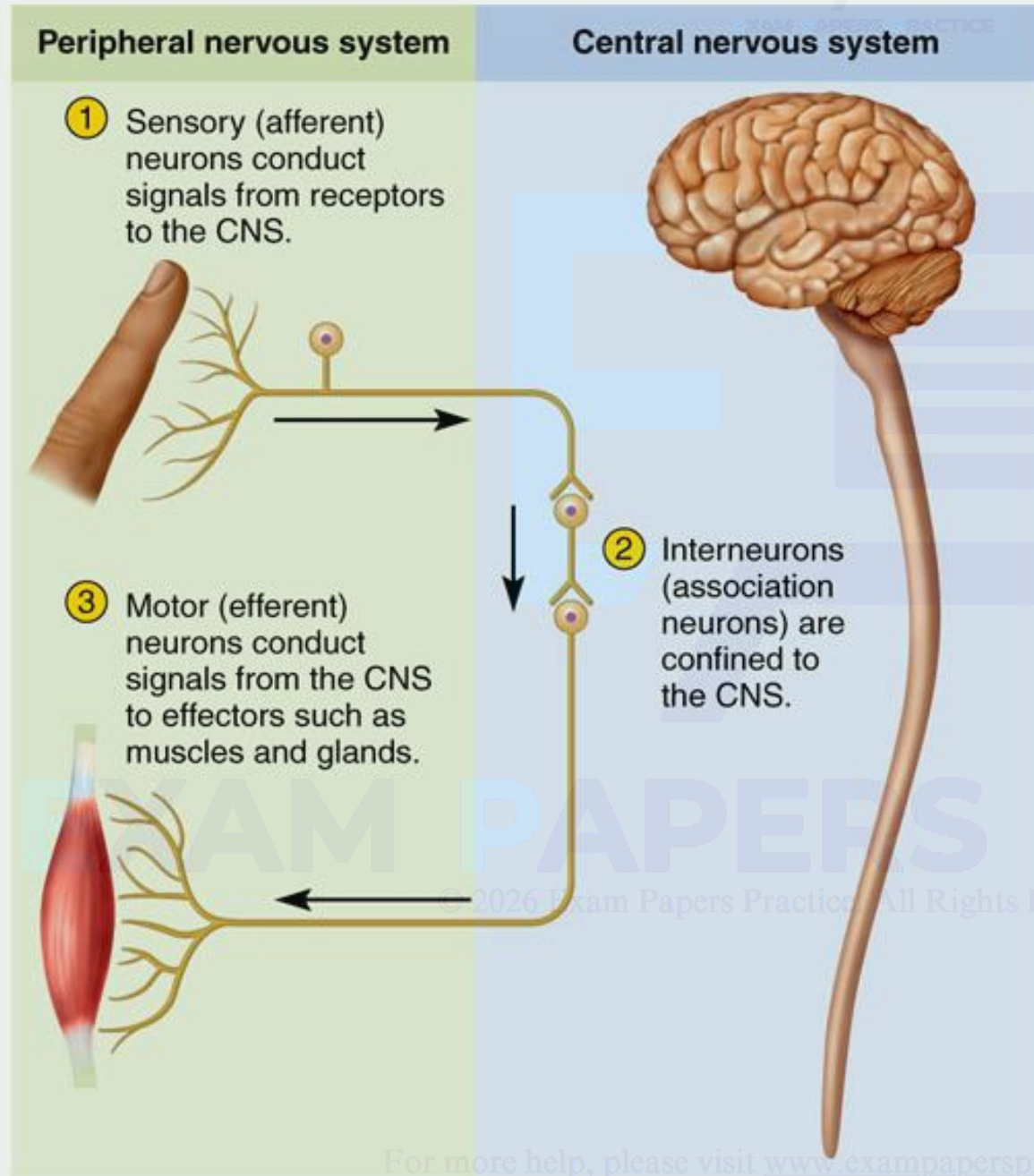


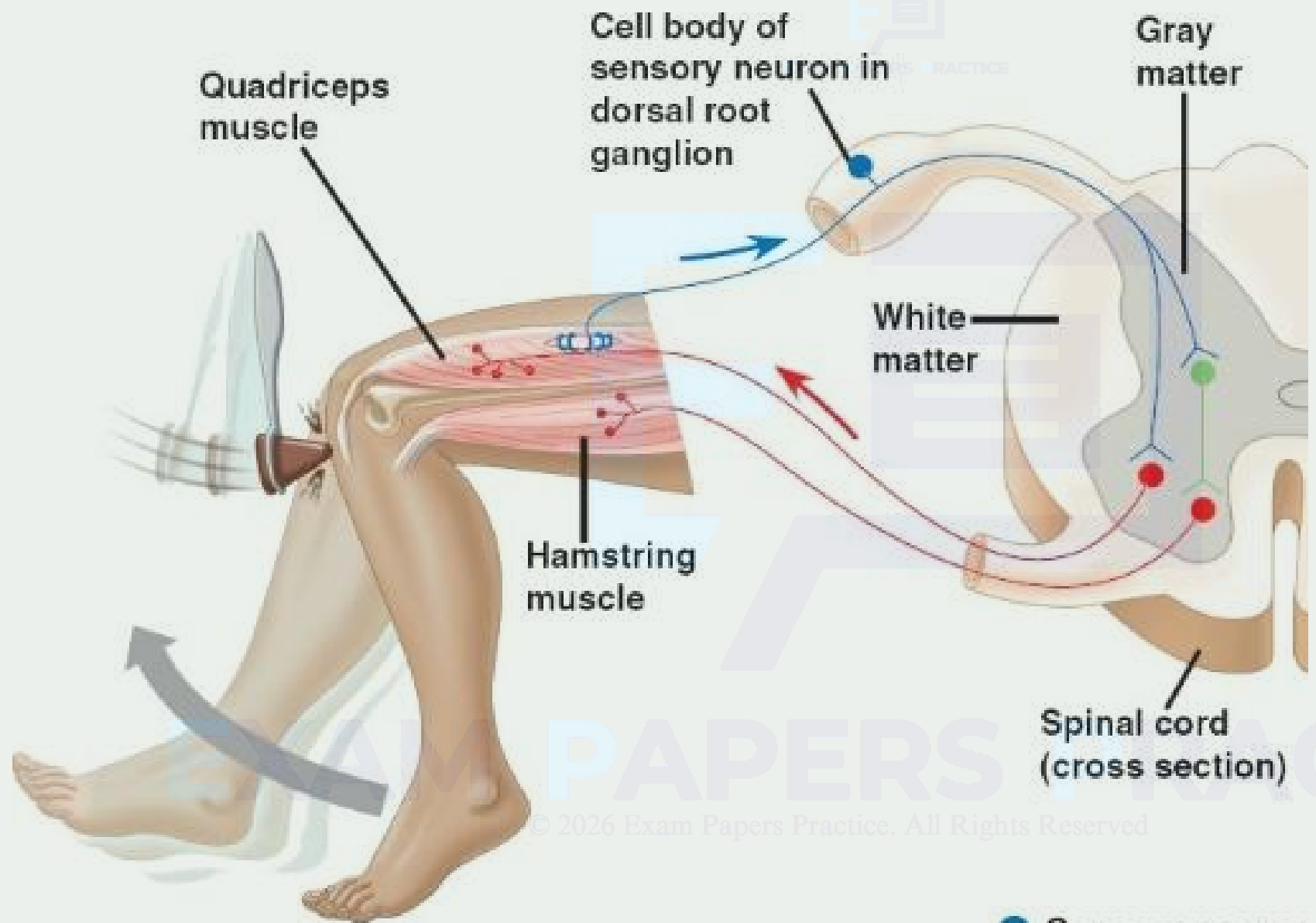
A **reflex action** is also an involuntary action. It is nearly instantaneous (very quick) movement in response to a stimulus. It is an automatic action. For example, you sneeze when dust particles or some other articles enter your nose. Reflex actions are the result of messages sent to and by the spinal cord.

Reflex Arc



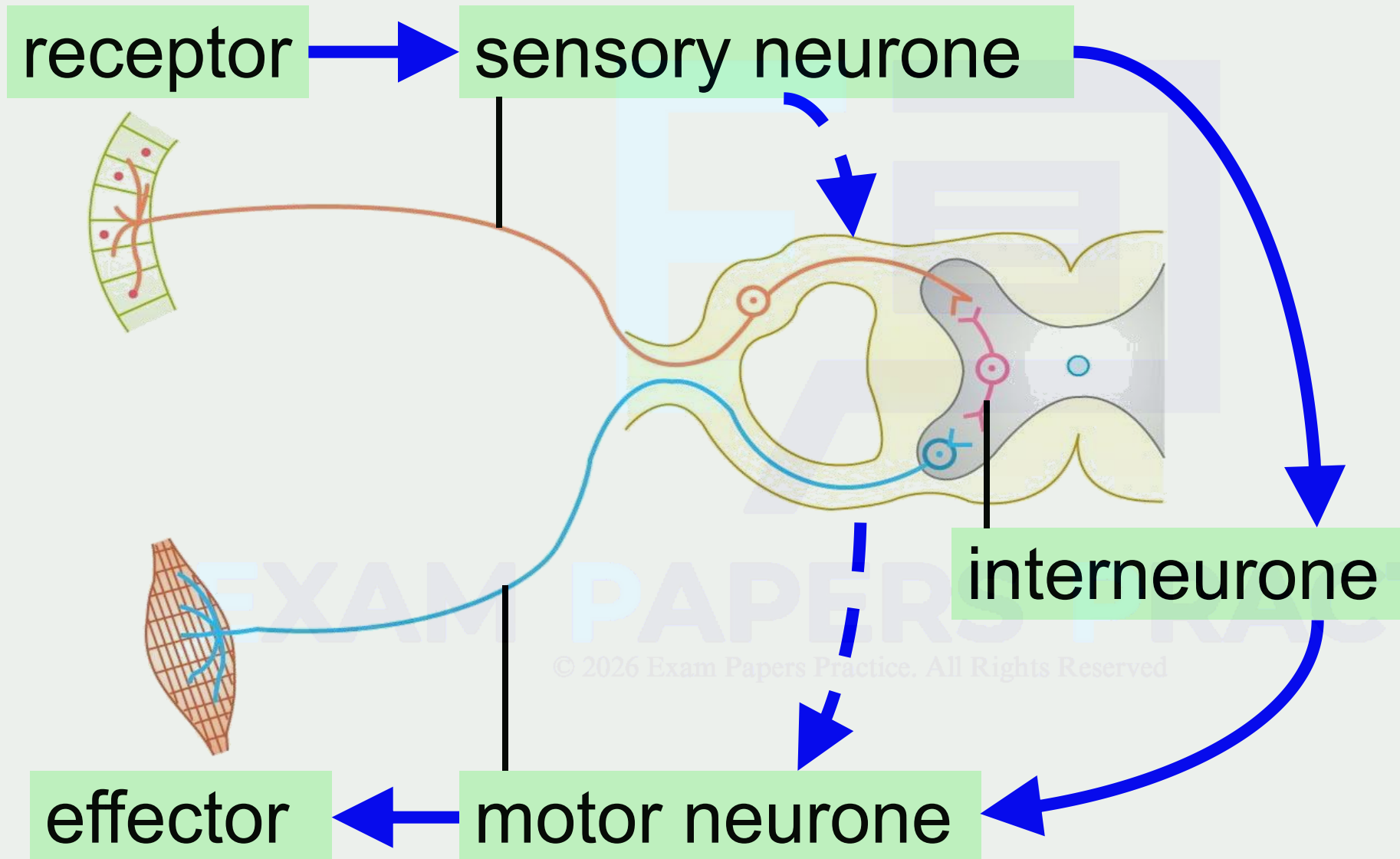
Basic Function of the Nervous System





- Sensory neuron
- Motor neuron
- Interneuron

Reflex arc



© 2026 Exam Papers Practice. All Rights Reserved

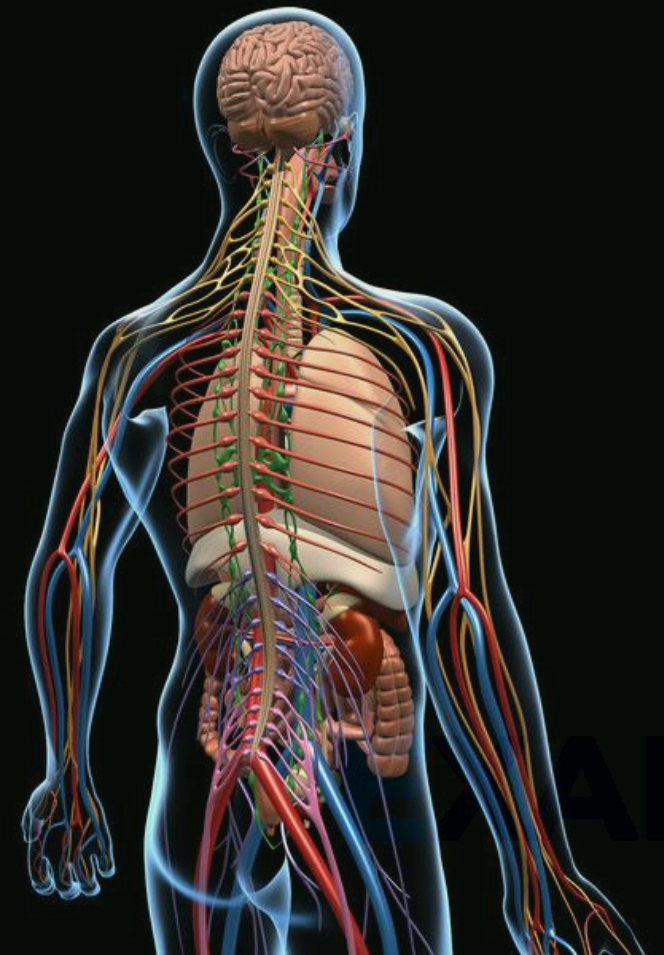
A reflex arc



EXAM PAPERS PRACTICE

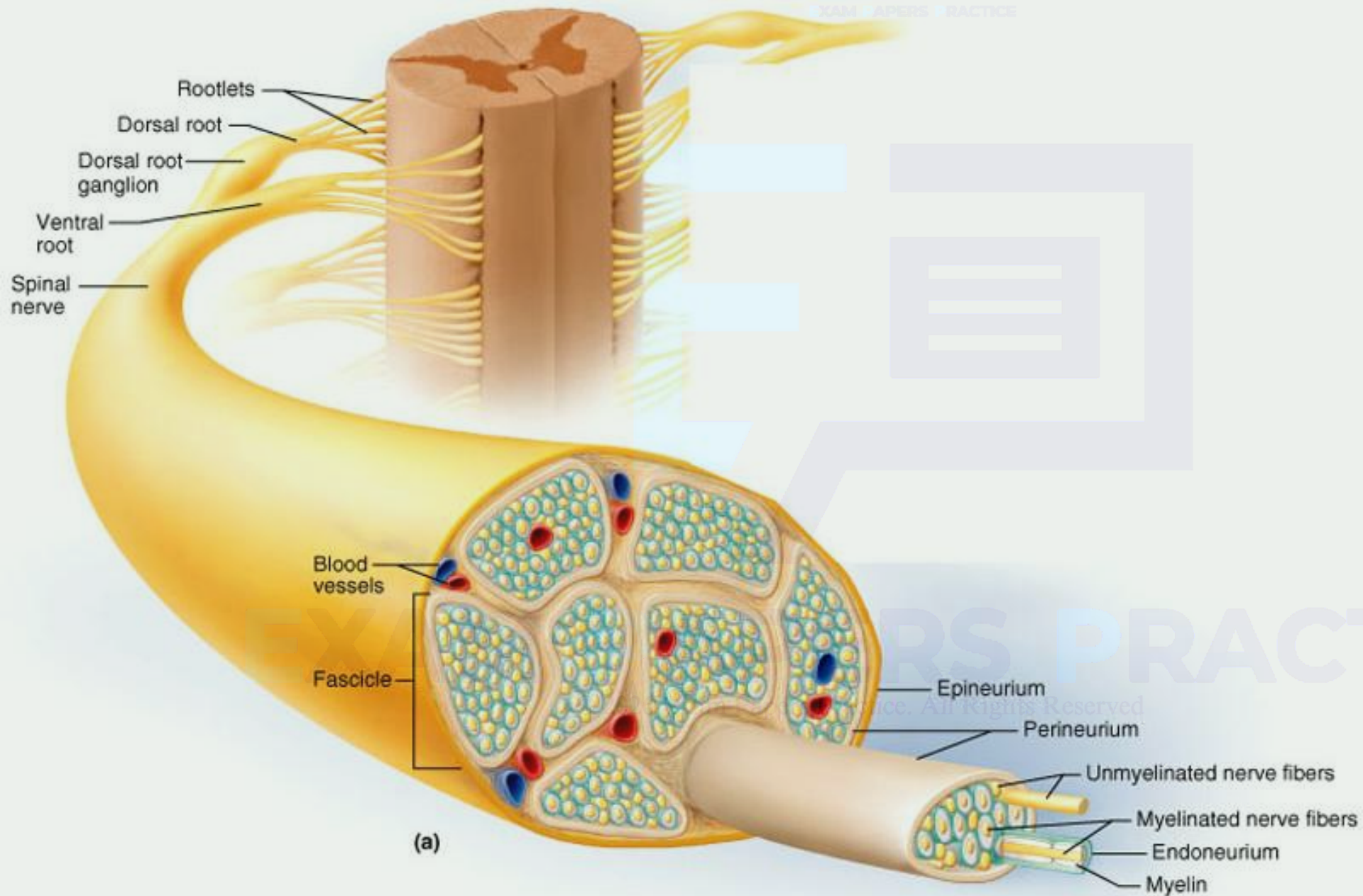
© 2026 Exam Papers Practice. All Rights Reserved





Nerves form a network of pathways for conducting information throughout the body. They transfer messages to and from the brain so that it can function efficiently. There are three kinds of nerves – **sensory, motor** and **mixed**.

Structure of a Nerve



The structure of a neurone



EXAM PAPERS PRACTICE



board
works

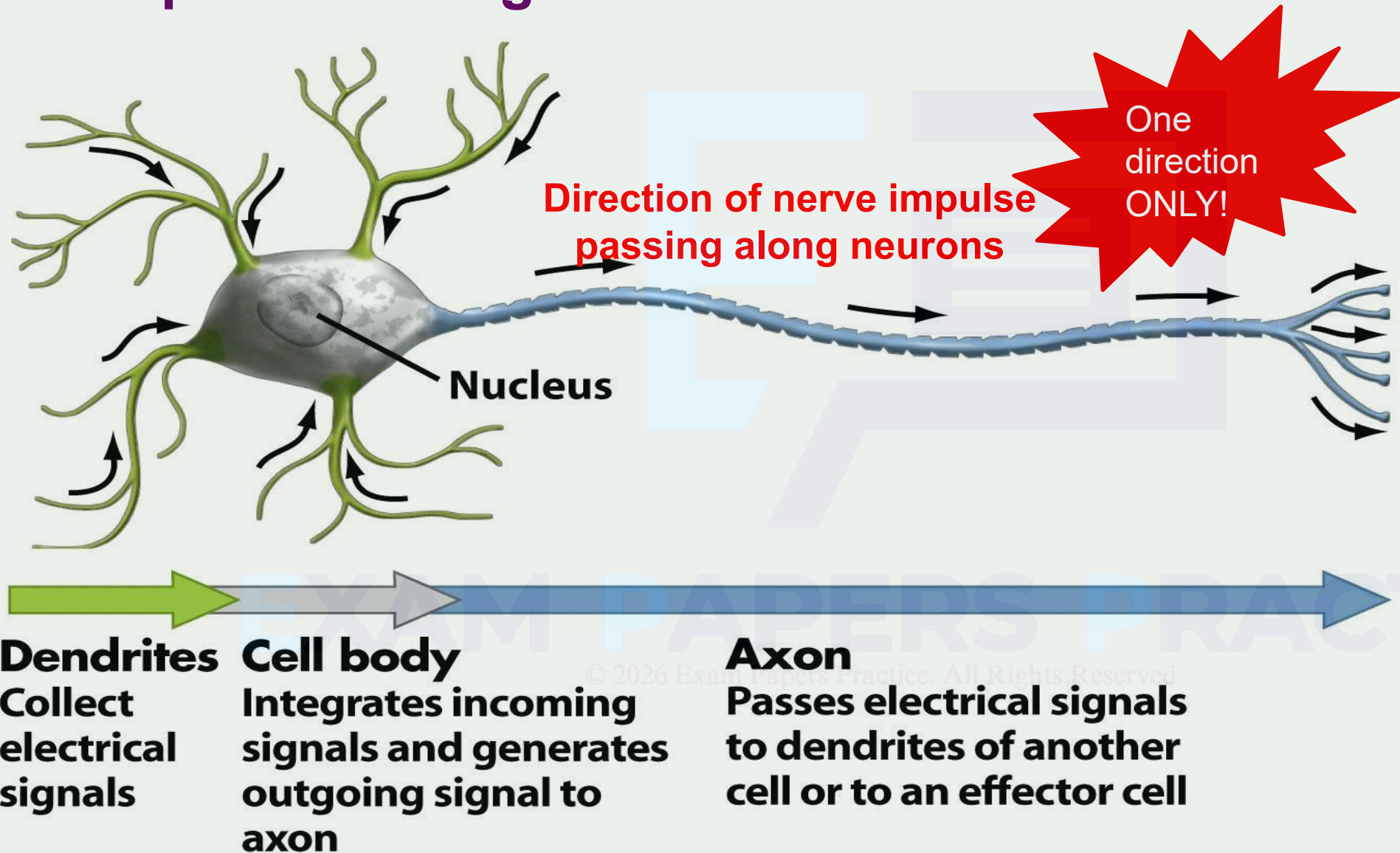


EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved



Describe a nerve impulse as an electrical signal that passes along nerve cells called neurons.



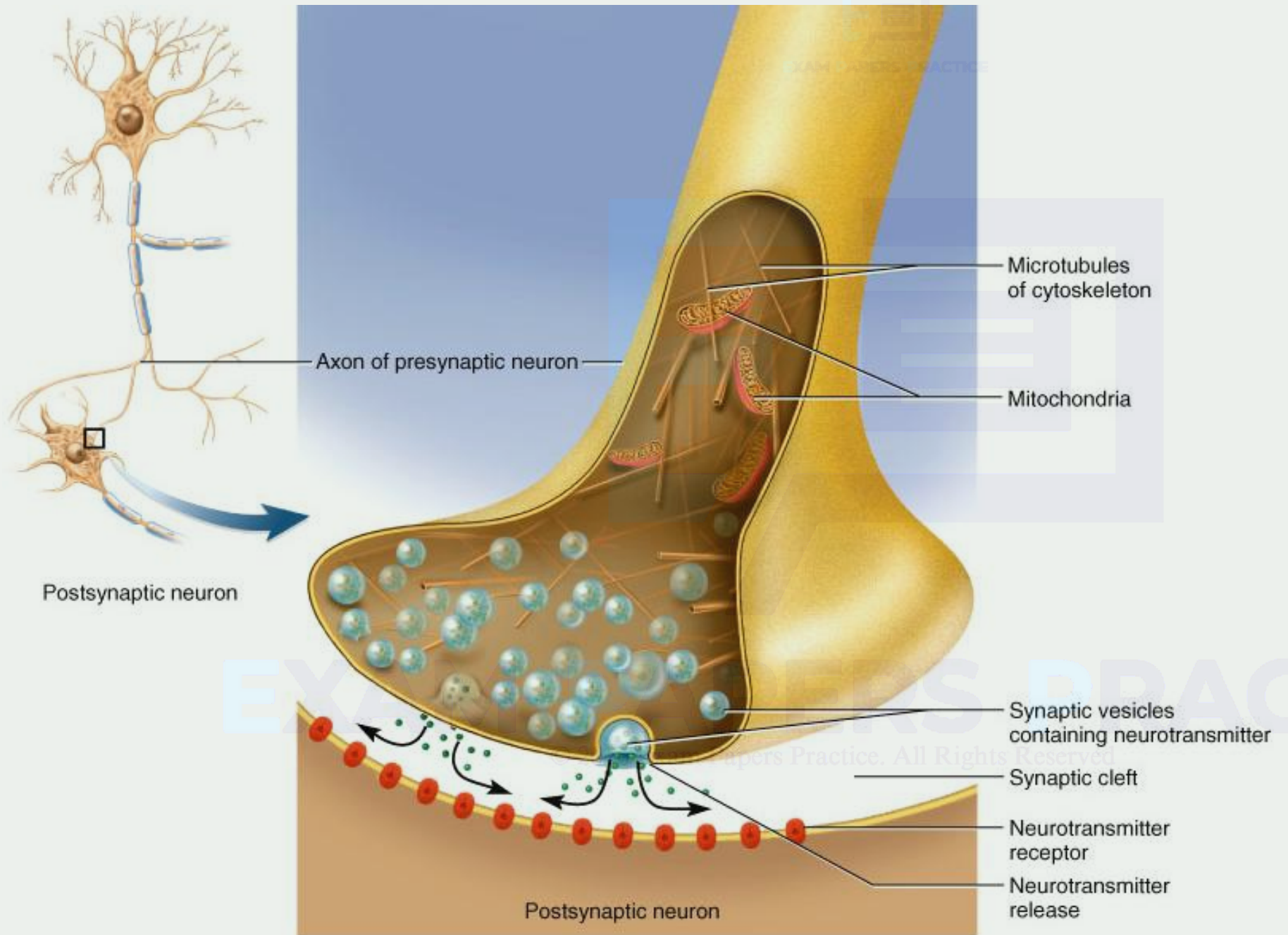
Sensory, relay and motor neurones



EXAM PAPERS PRACTICE

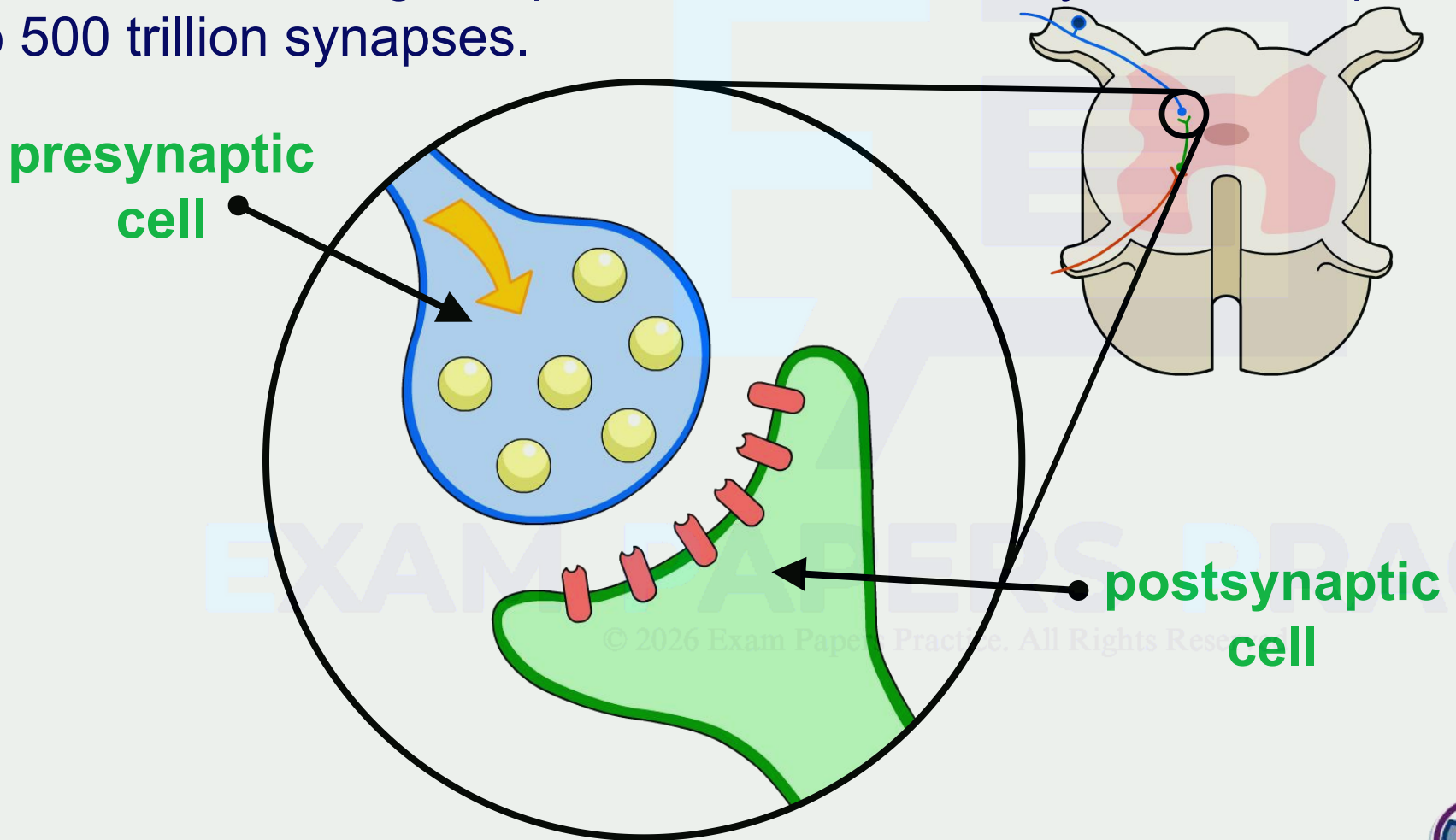
© 2026 Exam Papers Practice. All Rights Reserved





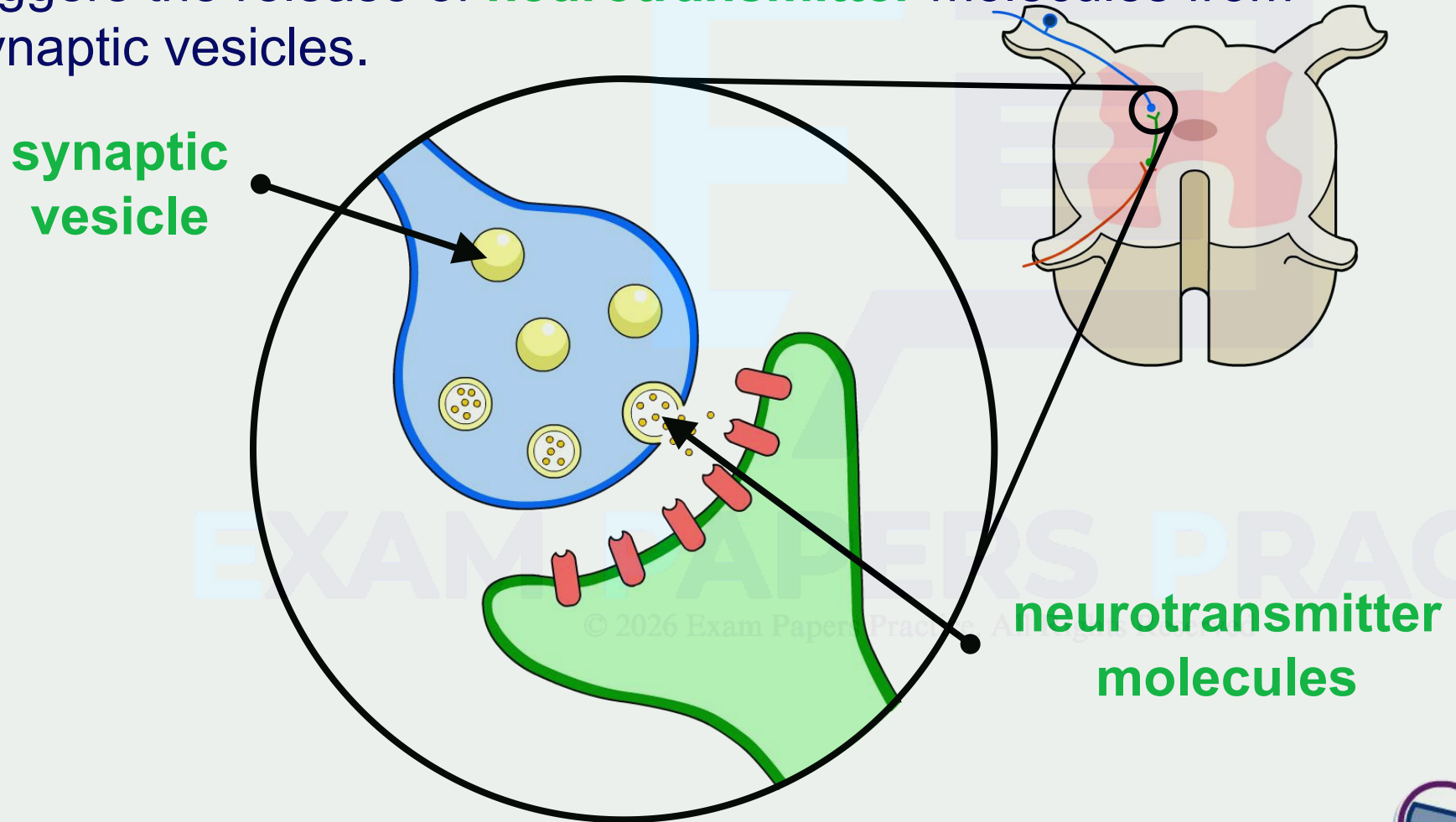
What is a synapse?

A **synapse** is a junction between two neurones across which electrical signals pass. The human body contains up to 500 trillion synapses.



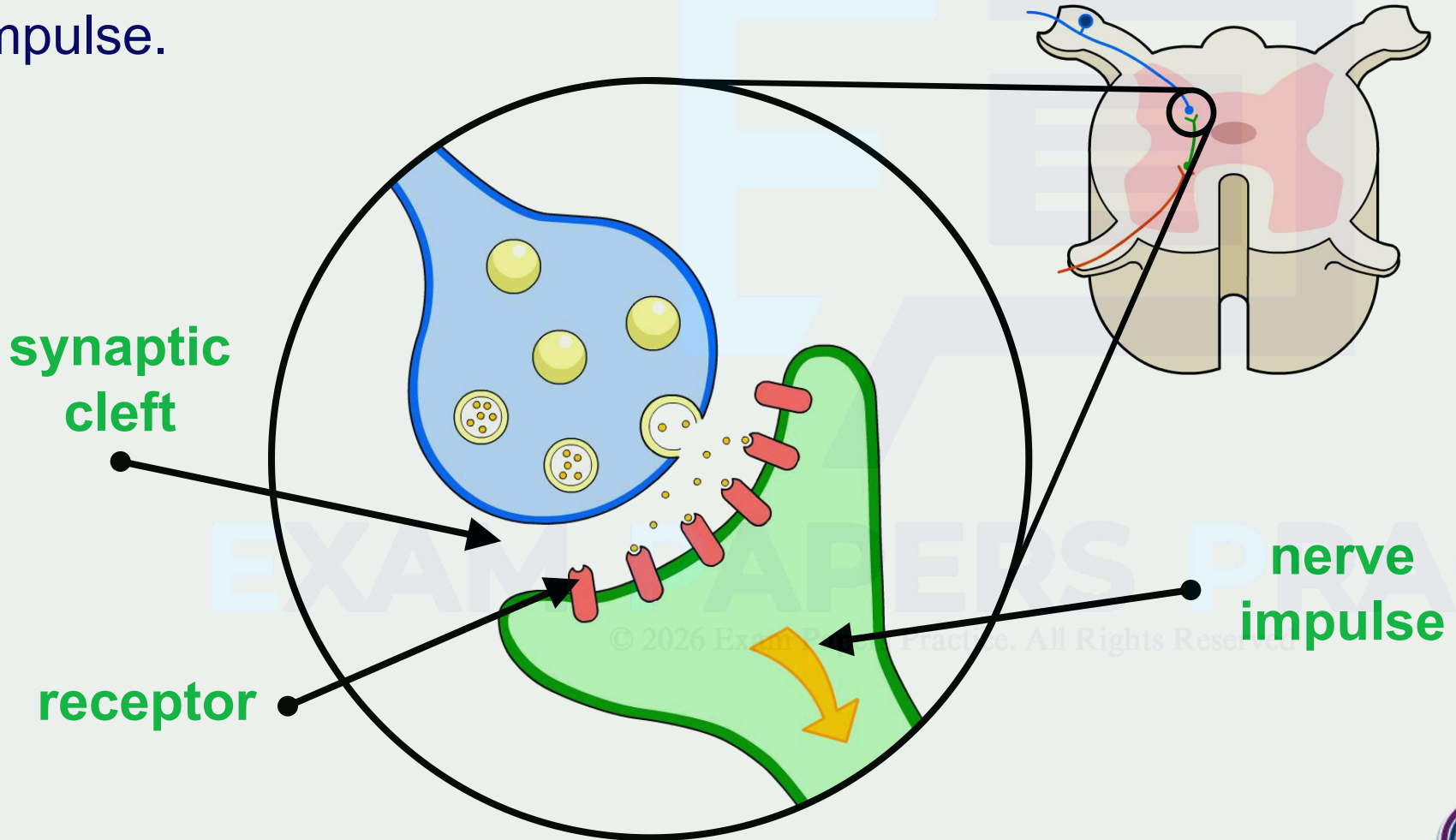
The release of neurotransmitters

When a nerve impulse arrives at the end of one neurone it triggers the release of **neurotransmitter** molecules from synaptic vesicles.



Continuing the impulse

The neurotransmitters diffuse across the **synaptic cleft** and bind with receptors on the next neurone, triggering another impulse.



Synaptic Transmission = STRBR

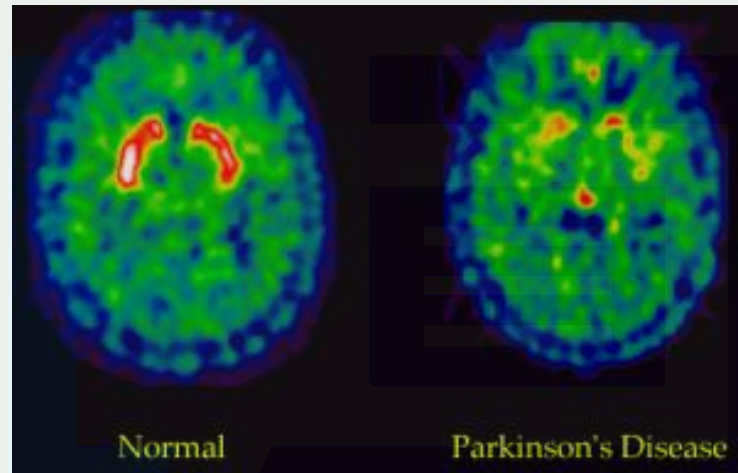
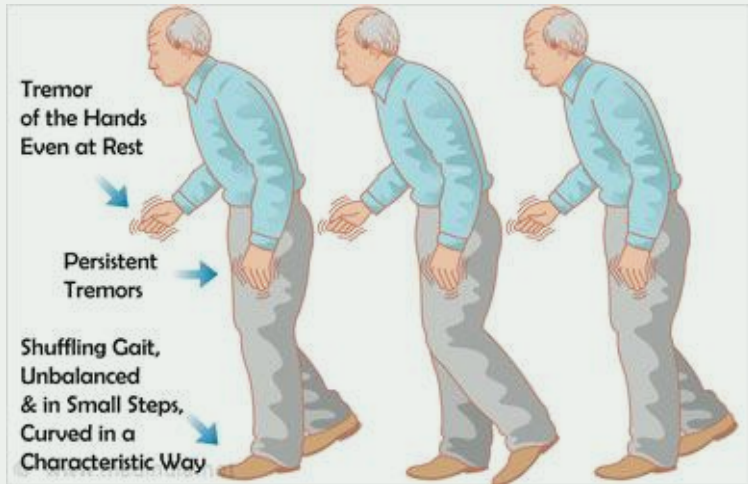
1. **S**ynthesis: making neurotransmitter (NT) from chemicals
2. **T**ransport: vesicles travel down to axon terminal
3. **R**elease: an impulse triggers release of NT into synaptic gap
4. **B**inding: NT diffuses across and bind with receptor causing impulse to continue
5. **R**emoval: reuptake (recycle NT) + breakdown (into smaller pieces to be reused in synthesis)

Common Neurological Disorders and Diseases

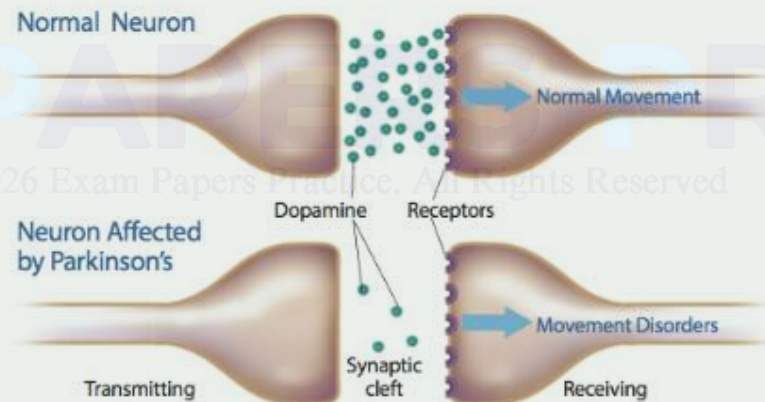
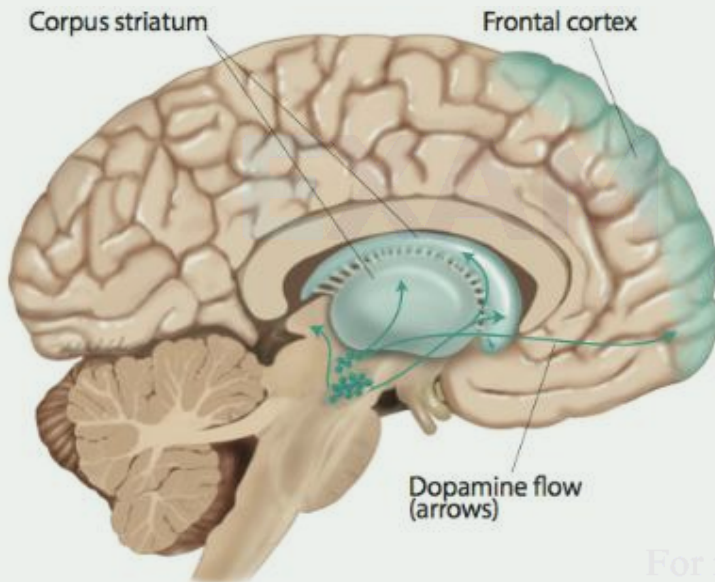
Disease/Disorder	Description
Alzheimer's disease	Progressive, degenerative disease of the brain
Amyotrophic lateral sclerosis (ALS)	Lou Gehrig's disease Degeneration of neurons in the spinal cord and brain
Epilepsy and seizures	Occurs as a result of bursts of electrical signals that disrupt normal brain functioning
Multiple sclerosis (MS)	Chronic disease of CNS Myelin is destroyed
Parkinson's disease	Progressive and degenerative <i>motor</i> system disorder
Stroke	Brain cells die because of an inadequate blood flow; “brain attack”

Parkinson's Disease

-not enough NT made to transmit message from brain to muscles



Red areas show where chemicals are stored



Alzheimer's Disease

You would have strange emotional behavior and dementia. Thinking and judgement skills would be weak.

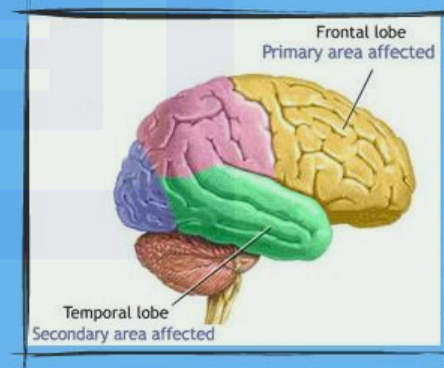
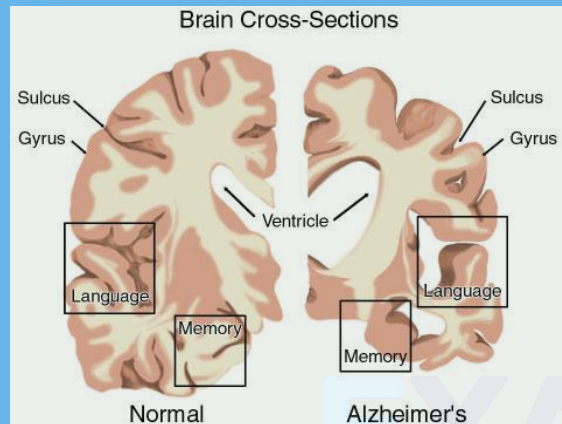
A disease that is progressive of the brain and it causes severe loss of memory.

What would my life be like if I had Alzheimer's?

What is Alzheimer's?

Alzheimer's occurs mainly in people with old age and it can be linked genetically.

Could I get Alzheimer's?



Unfortunately there is no cure but there are medicines to slow the progression down. But nothing can completely rid the disease.

In the famous movie The Notebook a lady named Allie suffers from Alzheimer's and her husband Noah visits her to try to recap her memory.

How can it be cured or treated?

There is a website which people with Alzheimer's can visit for info and support.
http://www.alz.org/alzheimers_disease_what_is_alzheimers.asp

To get diagnosed for Alzheimer's you must get a complete physical and mental exam. Then they can rule it out with a blood test or an MRI.

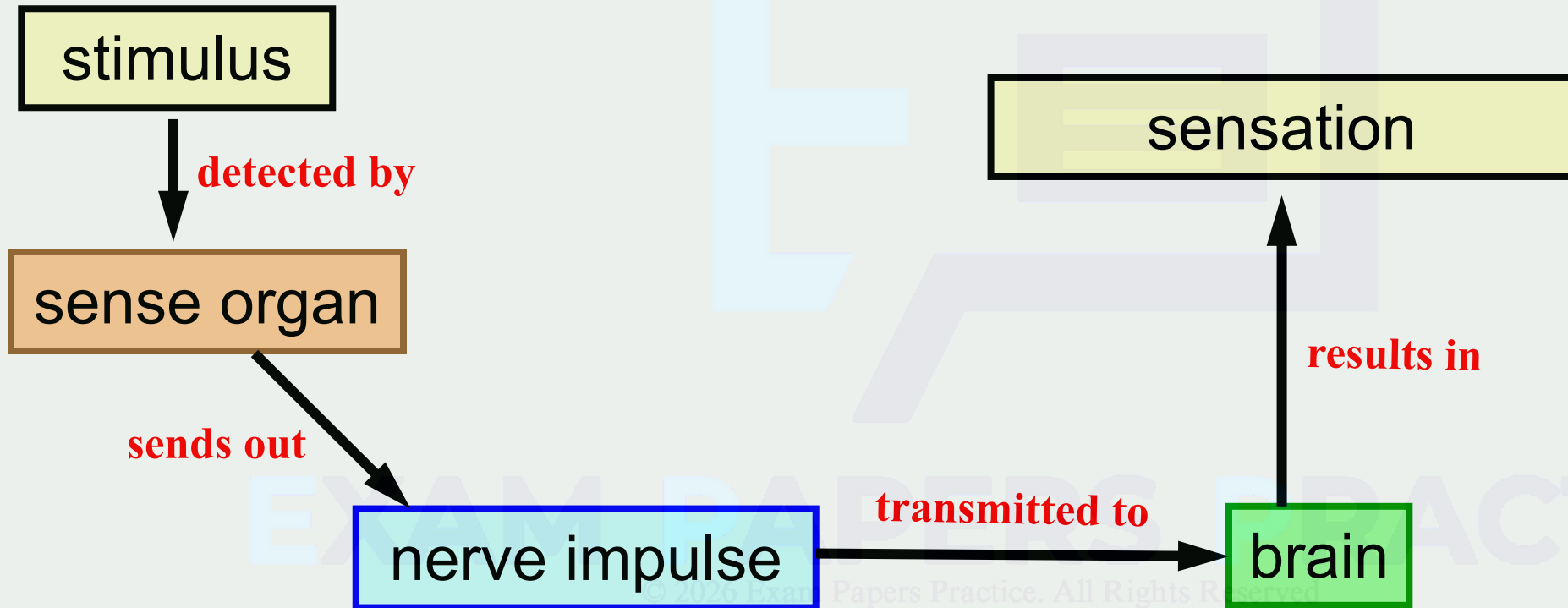
DID YOU KNOW?!



14.2

Sense organs

Detection of the environment by mammals

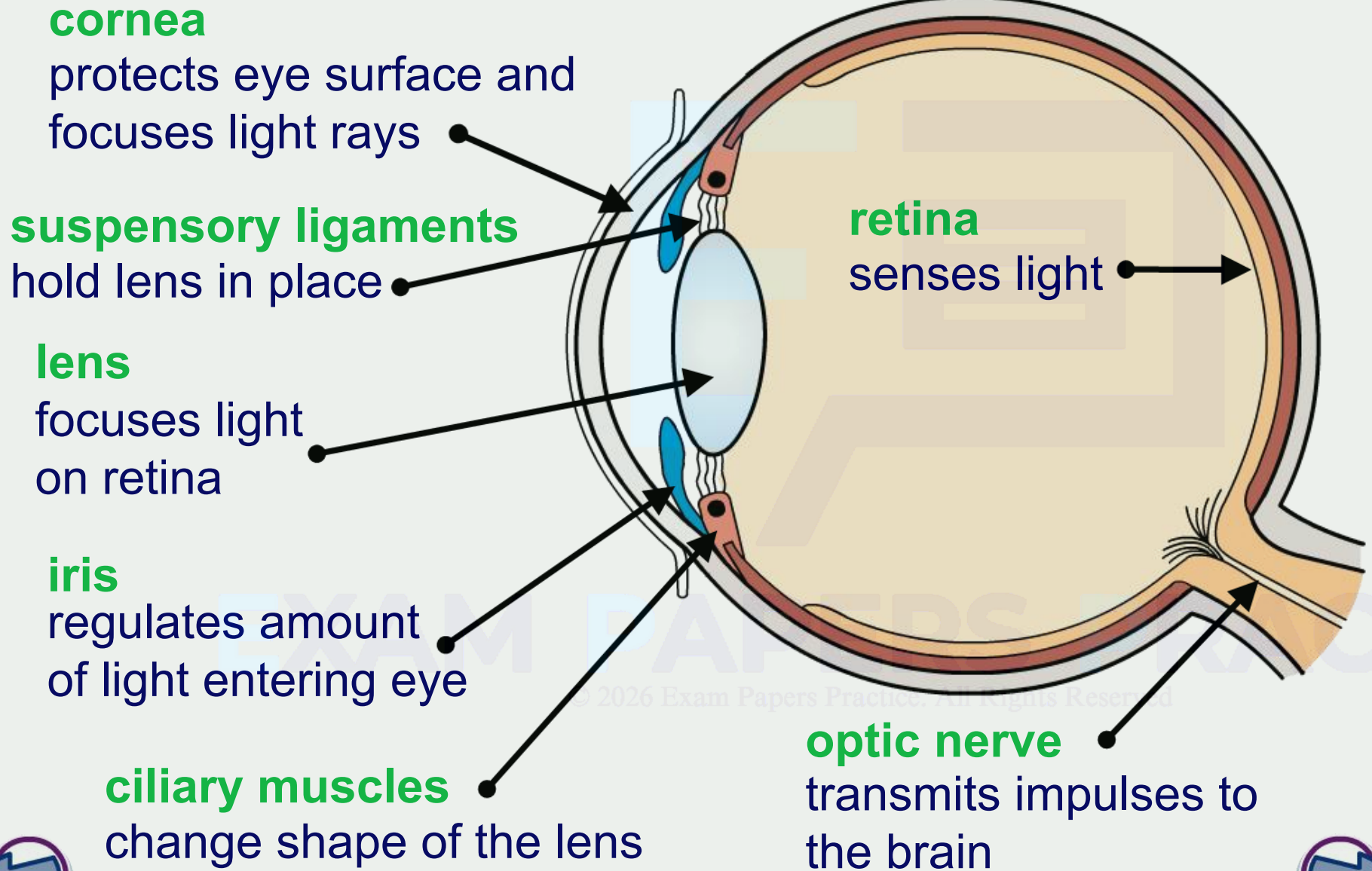


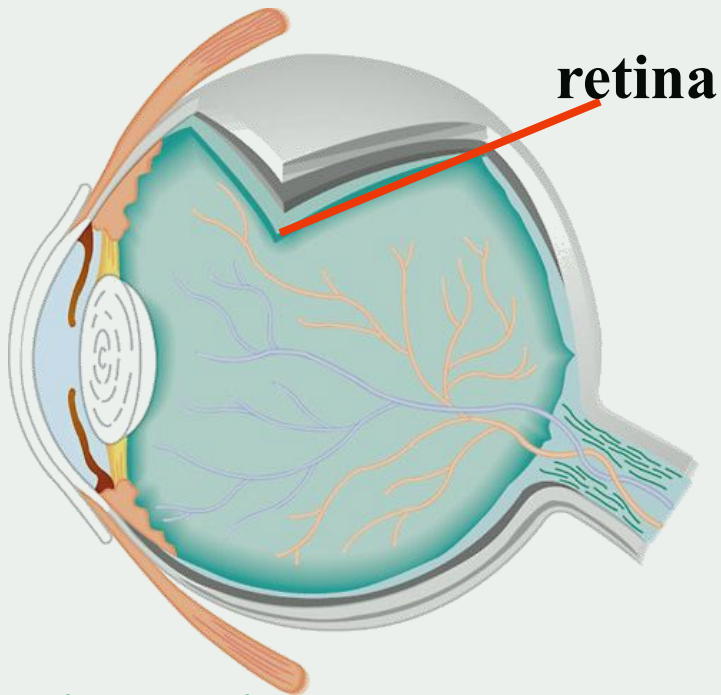
Detection of the environment by mammals

sense organ	stimulus	sensation
Eye	Light	Sight
Ear	Sound Movement	Hearing Movement of the body, balance
Nose	Chemicals in air	Smell
Tongue	Chemicals in food	Taste
Skin	Touch, pain, pressure Temperature	Texture, pain, pressure Heat or cold



Inside the eye





vertical section through the eyeball

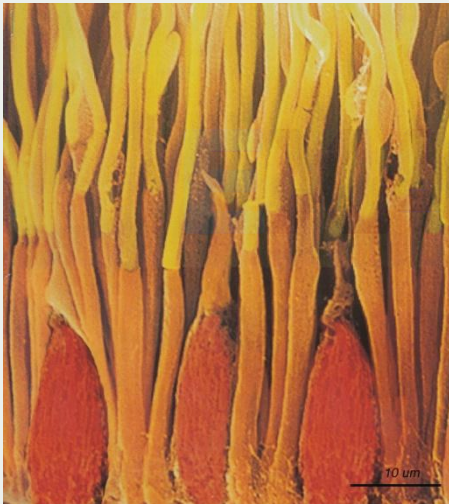
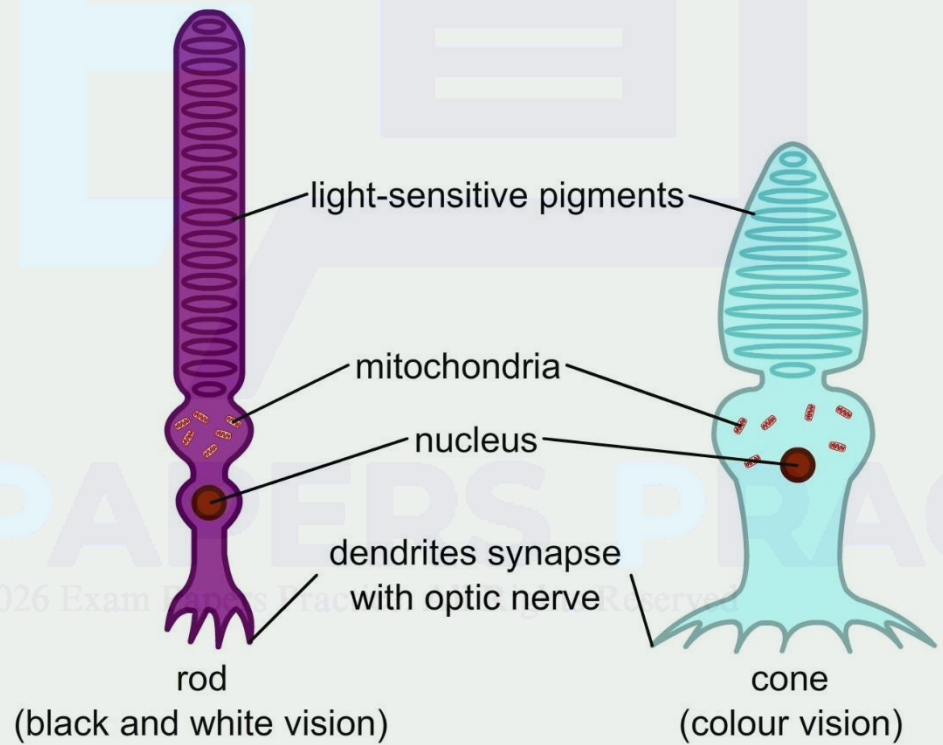
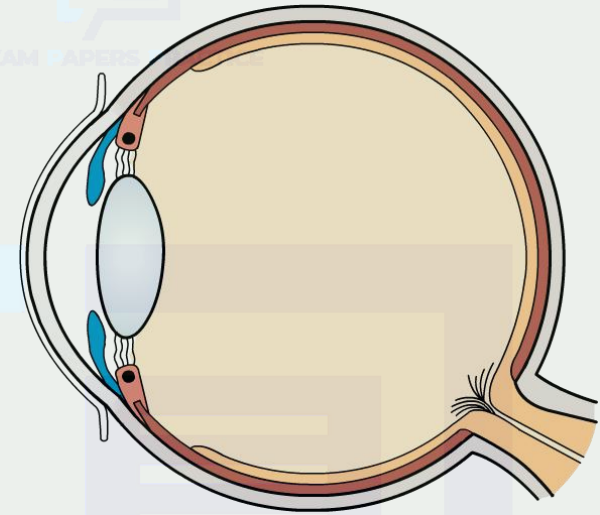
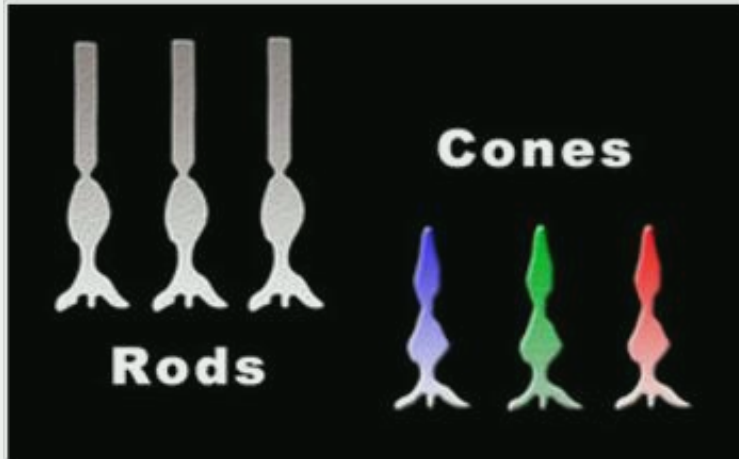


Fig1b: Scanning electron micrograph of the rods and cones of the primate retina. Image adapted from one by Ralph C. Eagle/Photo Researchers, Inc.

contains **rods** for black and white vision, and **cones** for colour vision



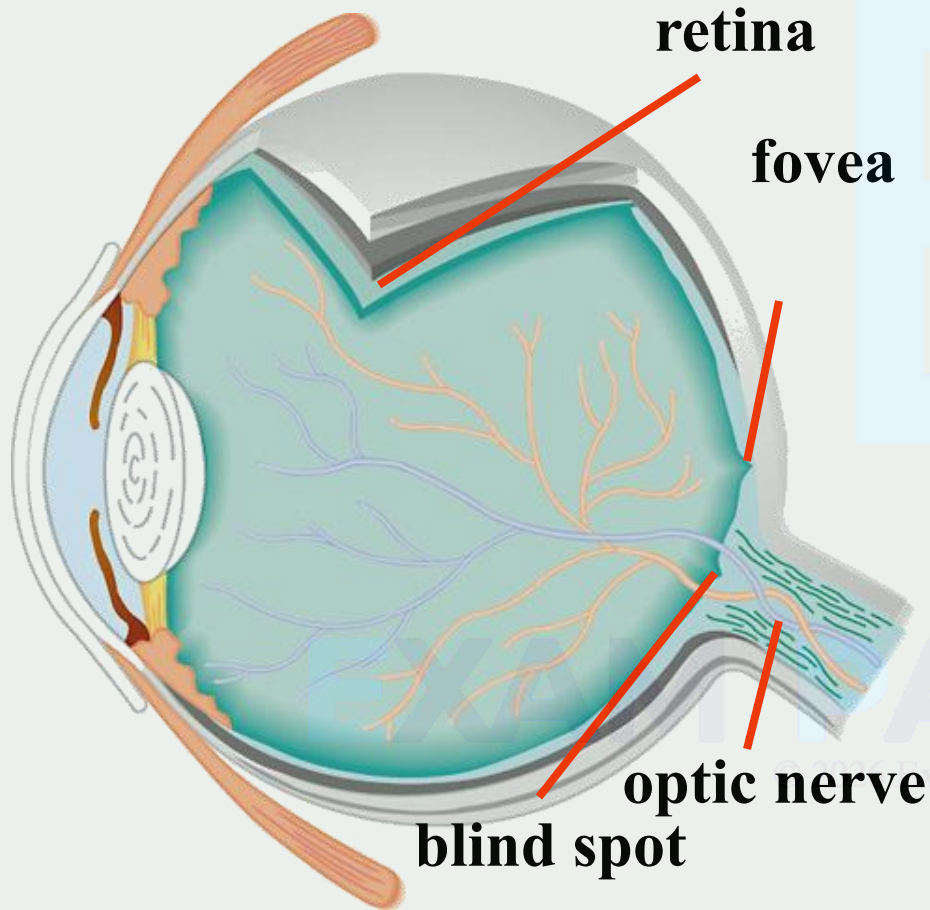
© ABPI 2013



	Function	Distribution	Comments
Rods	Sensitive to low light intensity. Detect shades of grey	Found throughout the retina, but none in the centre of the fovea or in the blind spot	Provide us with night vision, when we can recognise shapes but not colours
Cones	Sensitive only to high light intensity. Detect colour (don't operate in poor light)	Concentrated in the fovea	There are three types, sensitive to red, green and blue light

Internal structures of the eyeball

Inner layer



vertical section through the eyeball

Retina

two special regions

— Fovea and blind spot

at Fovea— sharpest vision;
most concentrated with
cones and no rods

at blind spot — no cones
or rods; the place where
optic nerve leaves the eye



3 The image will be detected by rods and cones which cause nerve impulses

1 Light from the object is refracted and focused onto the retina

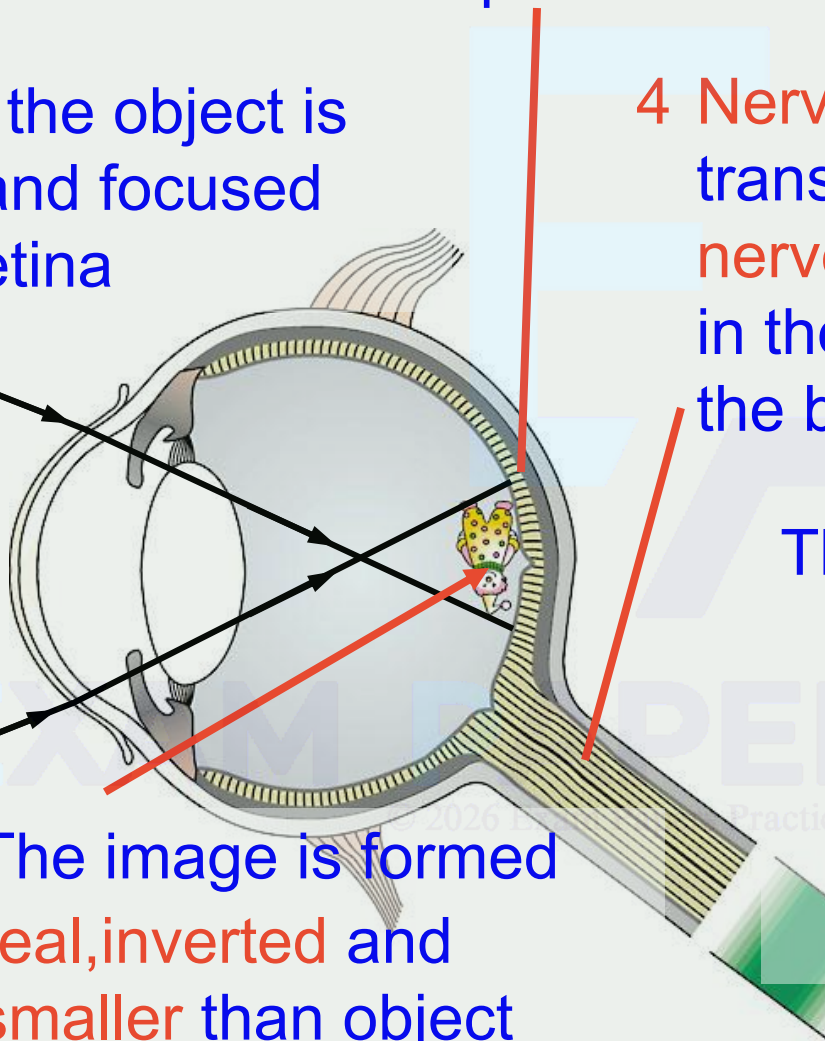


2 The image is formed

- real, inverted and smaller than object

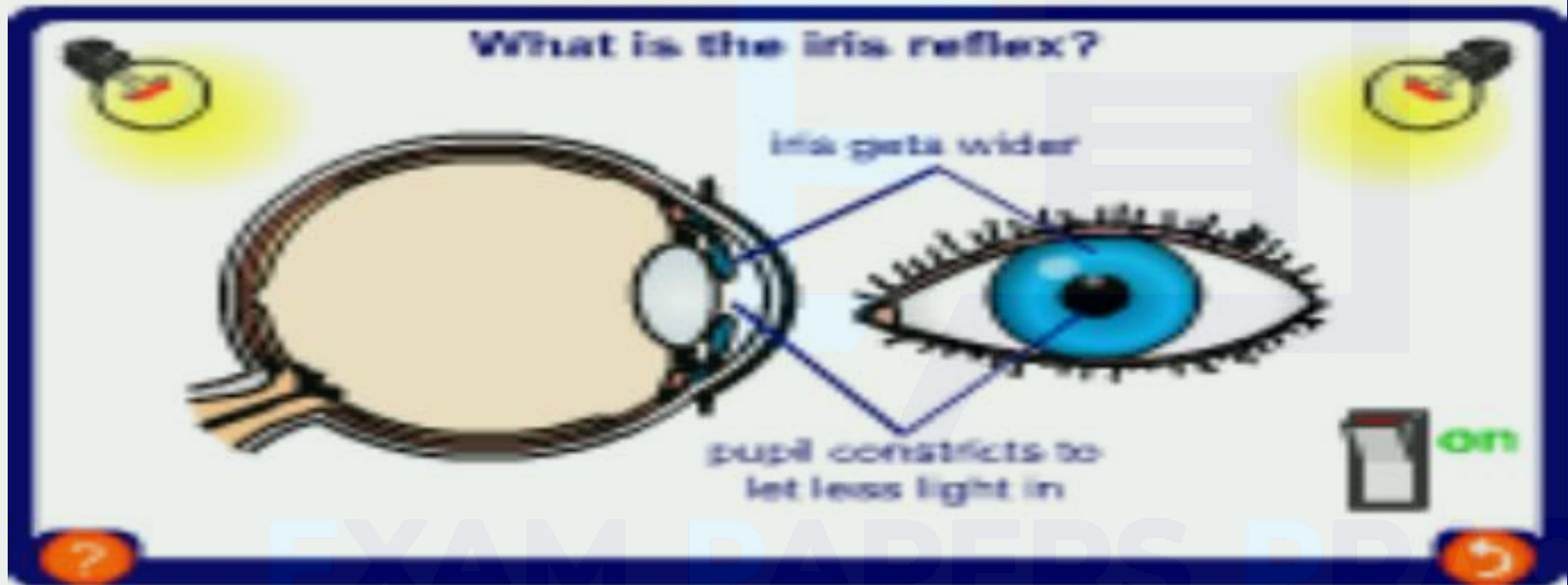
4 Nerve impulses are transmitted along optic nerve to the optic centre in the cerebral cortex of the brain

The optic centre in the brain interprets the nerve impulses and 'sees' an upright image of the object in brain





The iris reflex



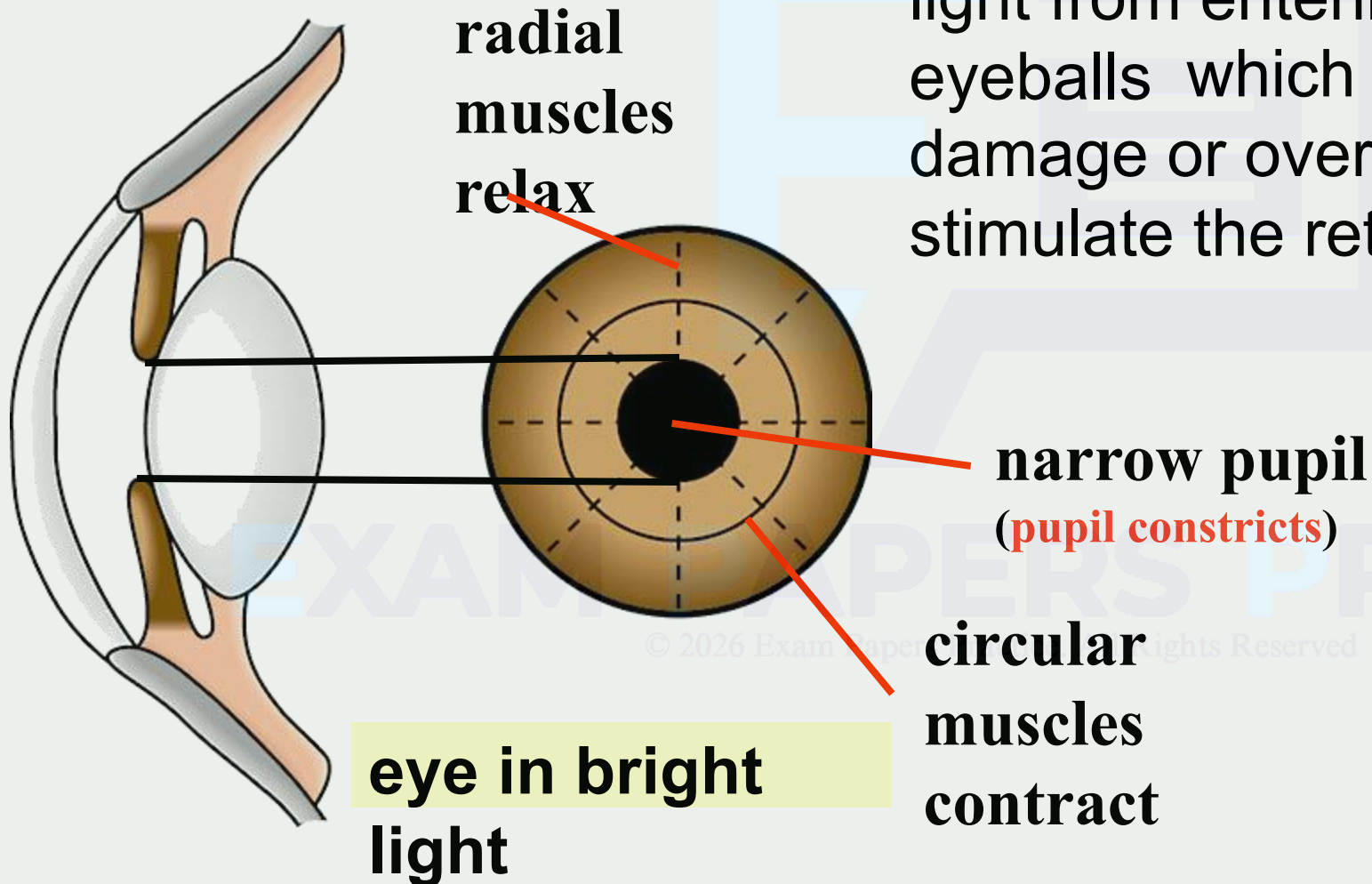
© 2026 Exam Papers Practice. All Rights Reserved



Internal structures of the eyeball

2 The iris and pupil

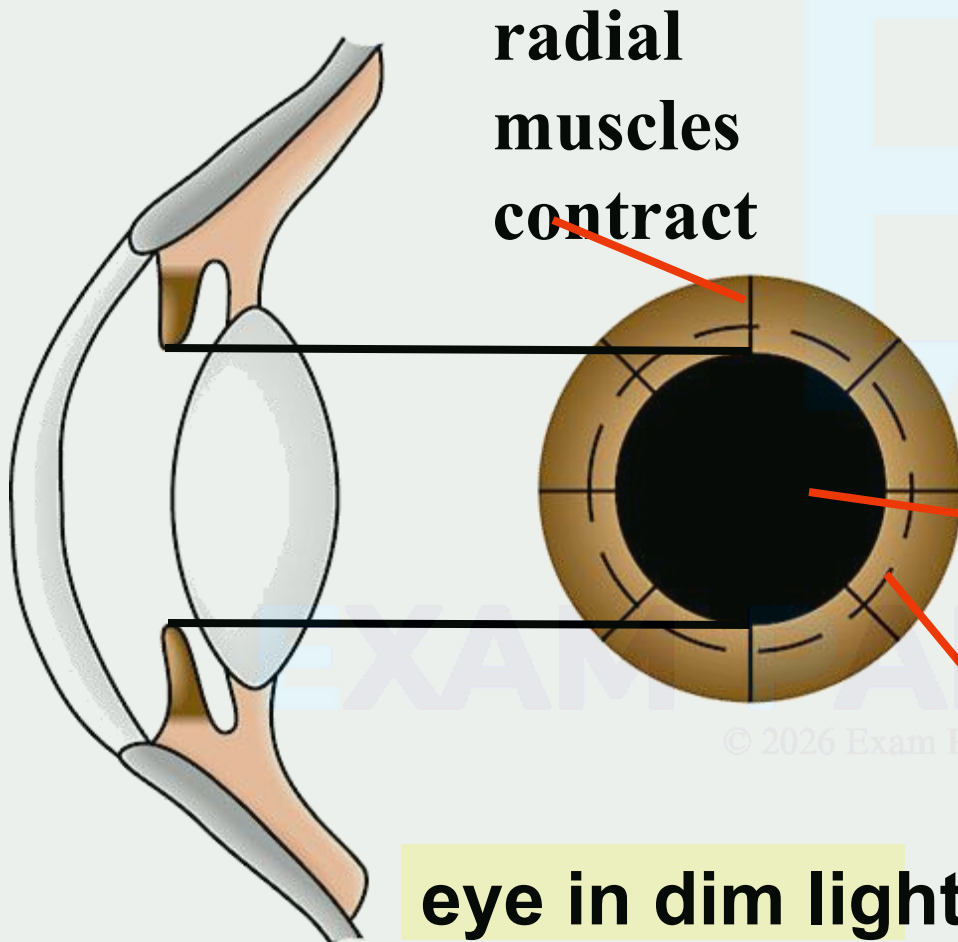
To prevent too much light from entering the eyeballs which may damage or over-stimulate the retina



Internal structures of the eyeball

2 The iris and pupil

More light is allowed to enter the eye helping a clear image to form at low light intensity



wide pupil
(pupil dilates)

**circular
muscles
relax**

eye in dim light



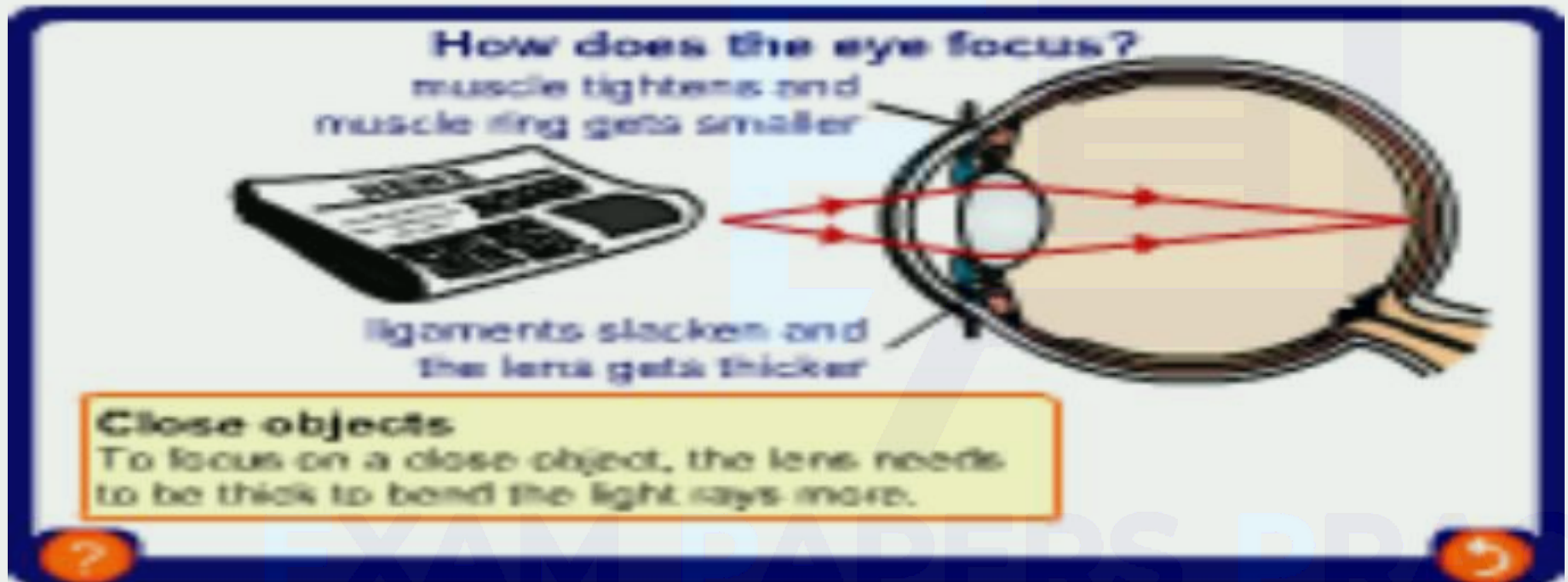
15.5 How does the eye focus near and distant objects?

Accommodation — **by** controlling the thickness of lens

The ability of the eye to focus objects at different distances onto the retina

- thicker (near object)
- thinner (distant object)

Accommodation



© 2026 Exam Papers Practice. All Rights Reserved



Focusing on near objects

This is why the eyes become tired after too much reading!

1 Circular ciliary muscles contract

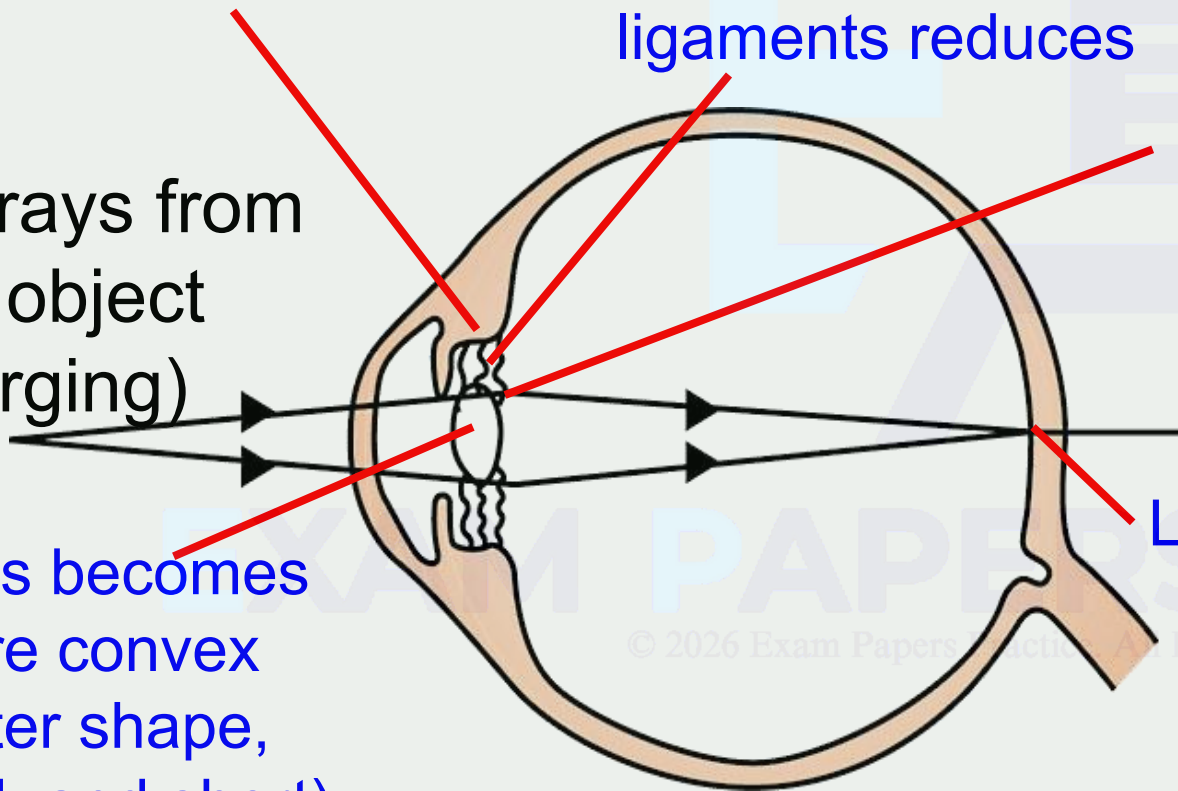
2 Tension in suspensory ligaments reduces

light rays from near object (diverging)

4 Light is refracted more by the lens

3 Lens becomes more convex (fatter shape, thick and short)

Light is focused on the yellow spot



Focusing on distant objects

This is how the eyes are when resting!

1 Circular ciliary muscles relax

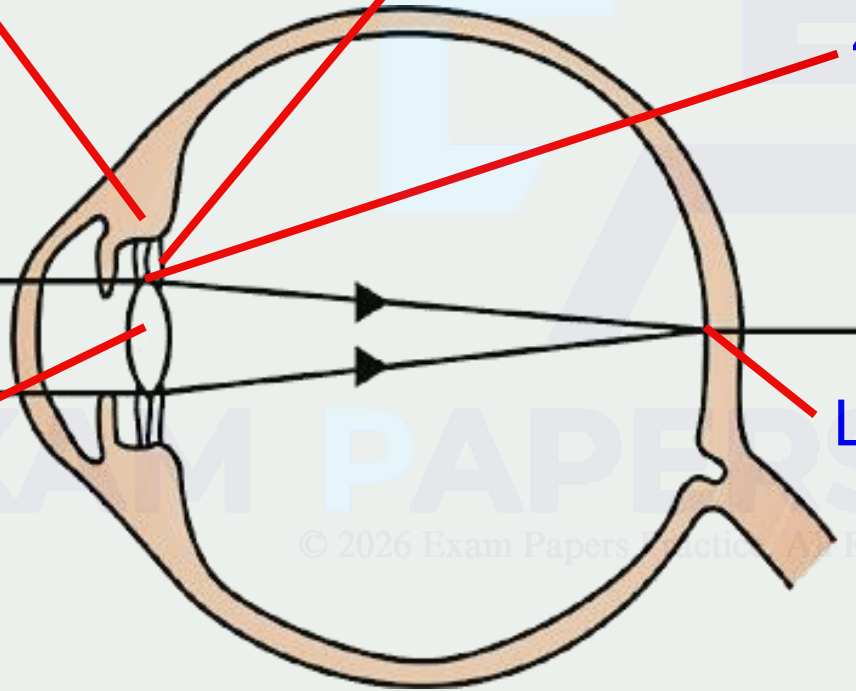
2 Tension in suspensory ligaments increases

light rays from distant object (parallel)

4 Light is refracted a little by the lens

3 Lens becomes less convex (thin and wide)

Light is focused on the yellow spot



side view

Normal vision

E
F P
T O Z
L P E D
P E C F D
E D F C Z P

F E L O P Z D
D E F P O T E C

L E F O D P C T
P E F L Y C D O
P E F L Y C D O

E
F P
T O Z
L P E D
P E C F D
E D F C Z P

F E L O P Z D
D E F P O T E C

L E F O D P C T
P E F L Y C D O
P E F L Y C D O

E
F P
T O Z
L P E D
P E C F D
E D F C Z P

F E L O P Z D
D E F P O T E C

L E F O D P C T
P E F L Y C D O
P E F L Y C D O

E
F P
T O Z
L P E D
P E C F D
E D F C Z P

F E L O P Z D
D E F P O T E C

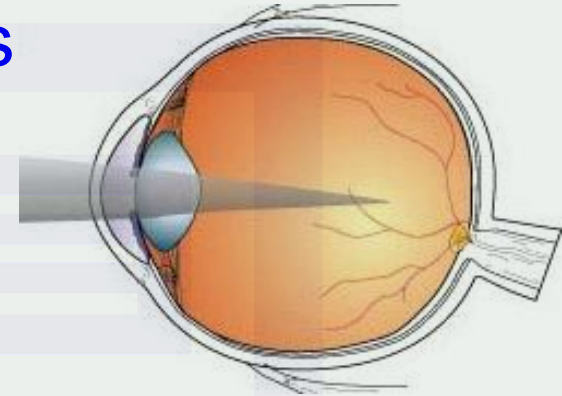
L E F O D P C T
P E F L Y C D O
P E F L Y C D O

Above: Diagram illustrating blurred vision due to either hypermetropia or myopia

Short sight

- The image of distant object is formed **in front of the retina** because of two reasons

can be corrected
by concave lens

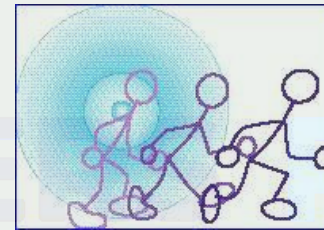


1 Lens too convex



cause (lens too convex) and
correction of short sight

2 Eyeball too long

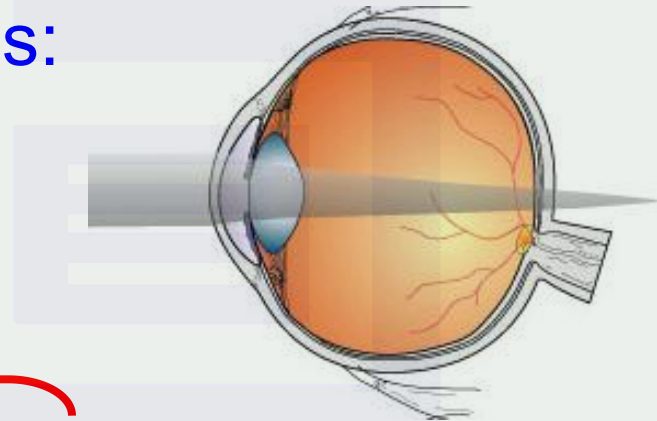


cause (eyeball too long) and
correction of short sight

Long sight

- The image of nearby object is formed **behind the retina** because of two reasons:

can be corrected
by convex lens

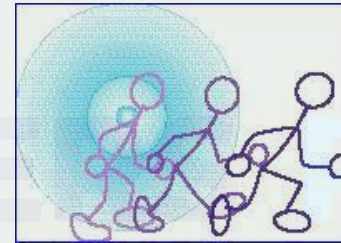


1 Lens not convex enough



causes (lens not convex enough)
and correction of long sight

2 Eyeball too short



causes (eyeball too short)
and correction of long sight

© 2026 Exam Papers Practice. All Rights Reserved

Colour blindness

Colour blindness

- reduced number of / some defects in one or more of the 3 types of cone cells
- inherited

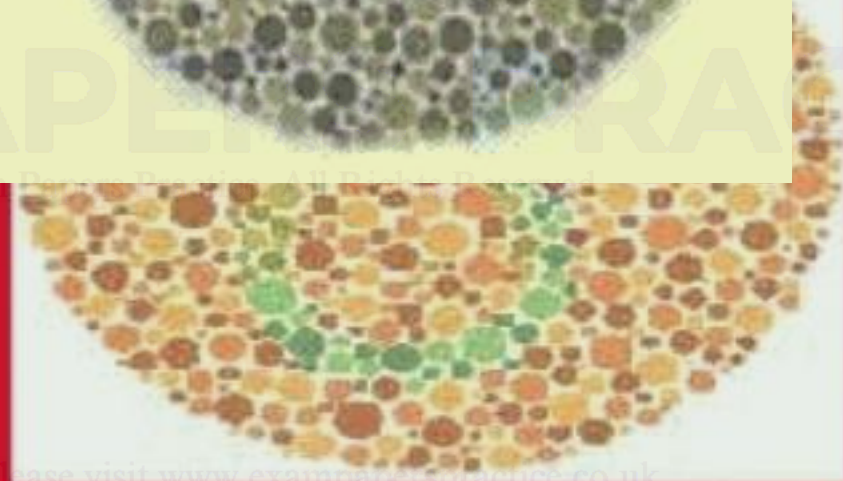
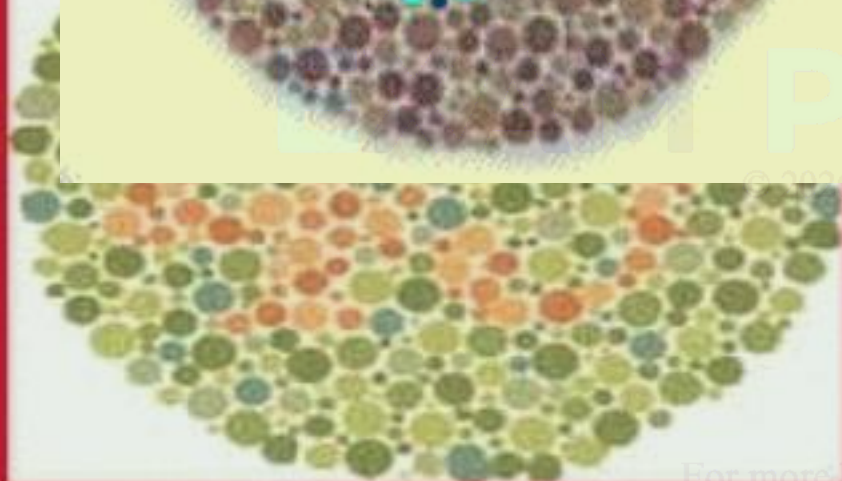
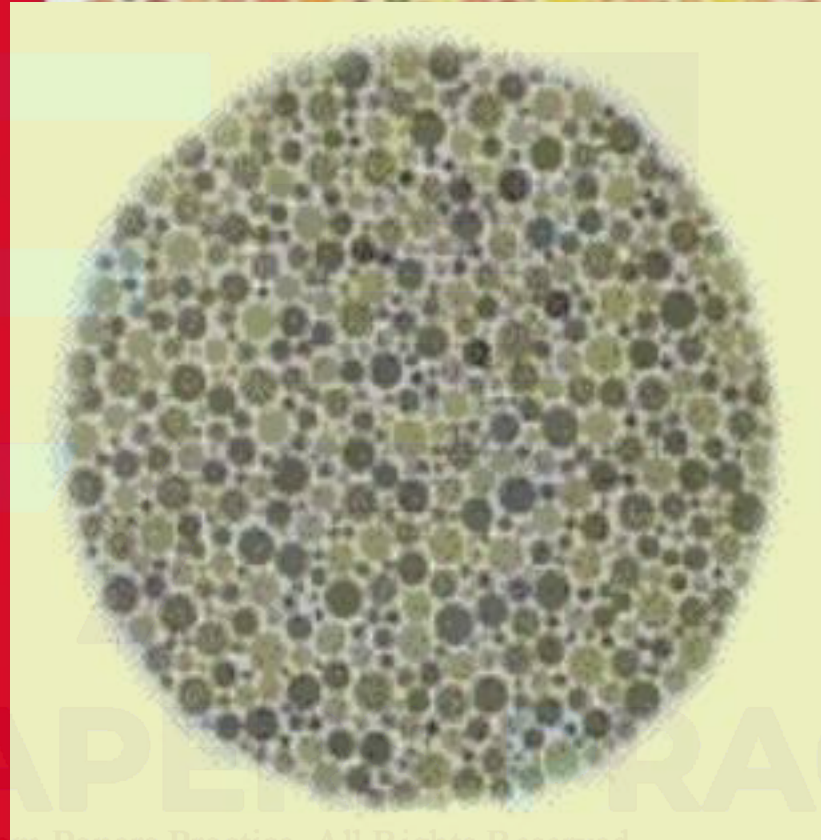
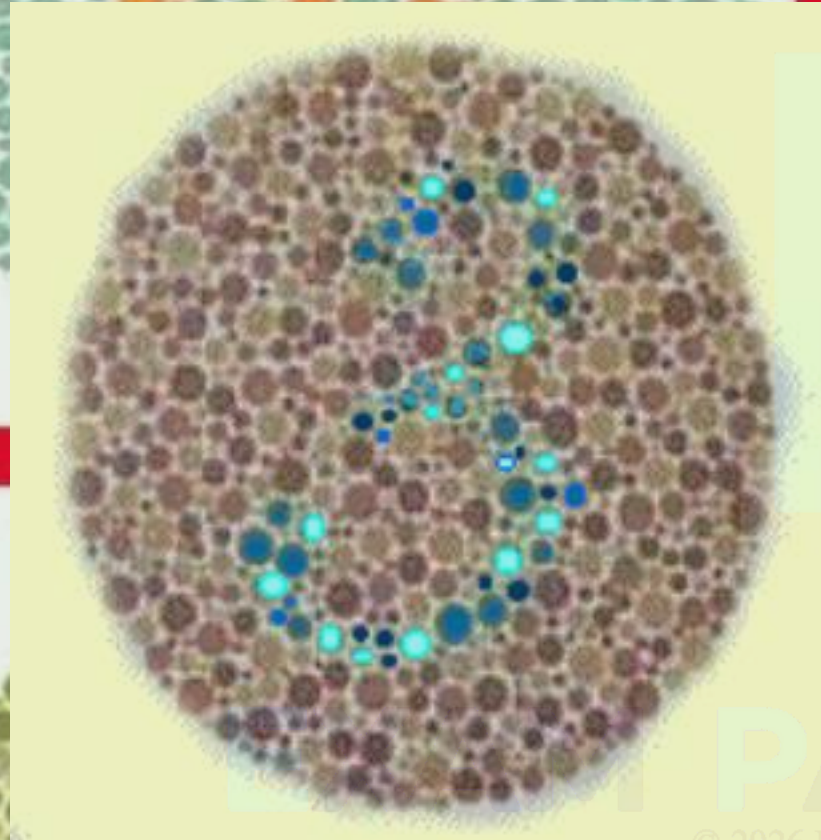
*Human beings seldom have **total colour blindness**. **Red-green colour blindness** is the most common form.*



normal eyesight



with colour blindness



Colour Vision

The retina contains **two** main types of light sensitive cells:

Rods are found all over the **retina**. They are very **light** sensitive and give us **night** vision. The image is black and white (**monochrome**) and **low** definition (lacks detail).

Cones are concentrated mainly at the **fovea**. There are **three** different types of cone, sensitive to **red**, **blue** and **green** light and are responsible for giving us high definition **colour** vision. They are **less** sensitive than rods and so only work in **good** light.

© 2026 Exam Papers Practice. All Rights Reserved



14.3

Hormones in humans

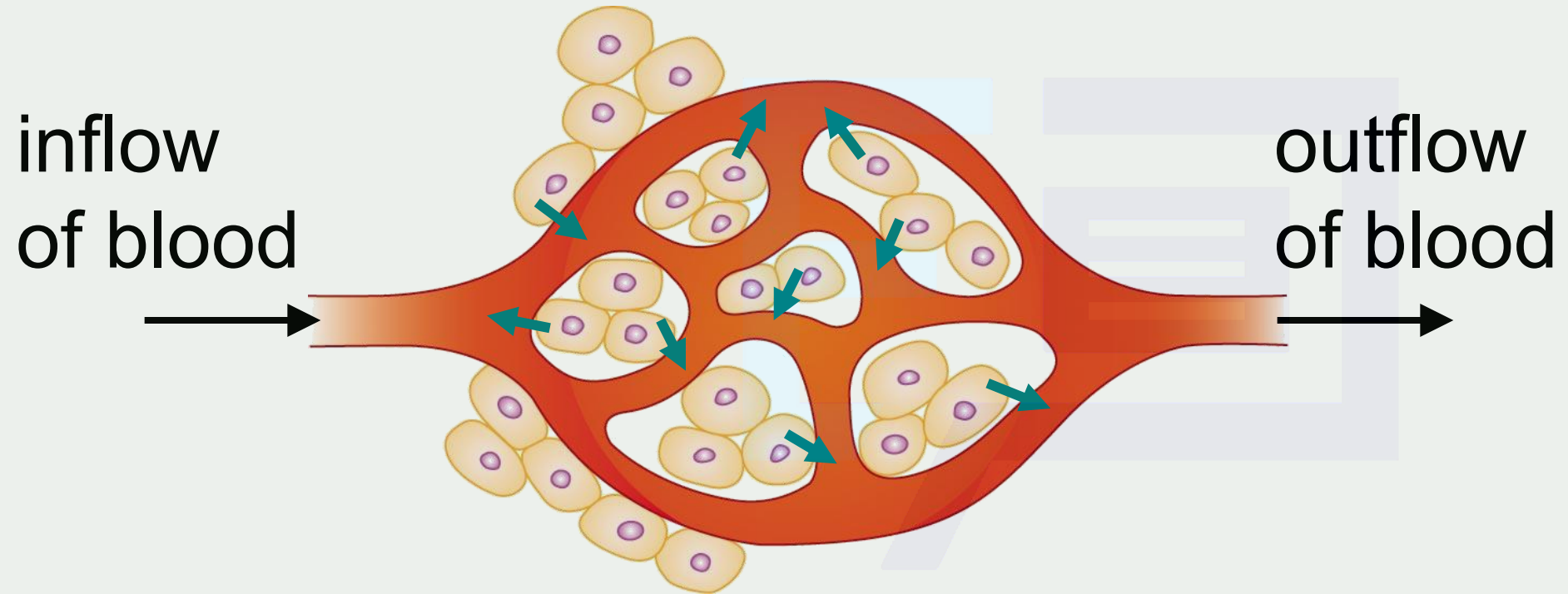
Syllabus Statements

- Define a hormone as a chemical substance, produced by a gland and carried by the blood, which alters the activity of one or more specific target organs
- Identify specific endocrine glands and their secretions, limited to adrenal glands and adrenaline, pancreas and insulin, testes and testosterone and ovaries and oestrogen
- Describe adrenaline as the hormone secreted in 'fight or flight' situations and its effects, limited to increased breathing and pulse rate and widened pupils
- Give examples of situations in which adrenaline secretion increases
- State the functions of insulin, oestrogen and testosterone

- Discuss the role of the hormone adrenaline in the chemical control of metabolic activity, including increasing the blood glucose concentration and pulse rate
- Compare nervous and hormonal control systems in terms of speed and longevity of action

© 2026 Exam Papers Practice. All Rights Reserved

Endocrine glands

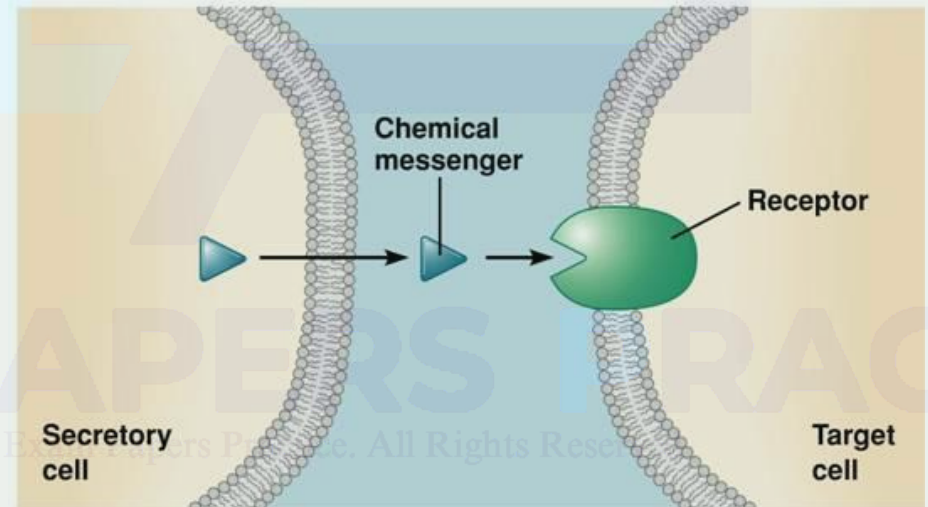


- richly supplied with capillaries
- produce **hormones** which diffuse directly into blood

Hormonal coordination

Hormones

- **chemical messengers** that only act on specific target cells / organs
- important to **regulation of body processes and internal environment**



(b) Communication via chemical messengers

The endocrine system

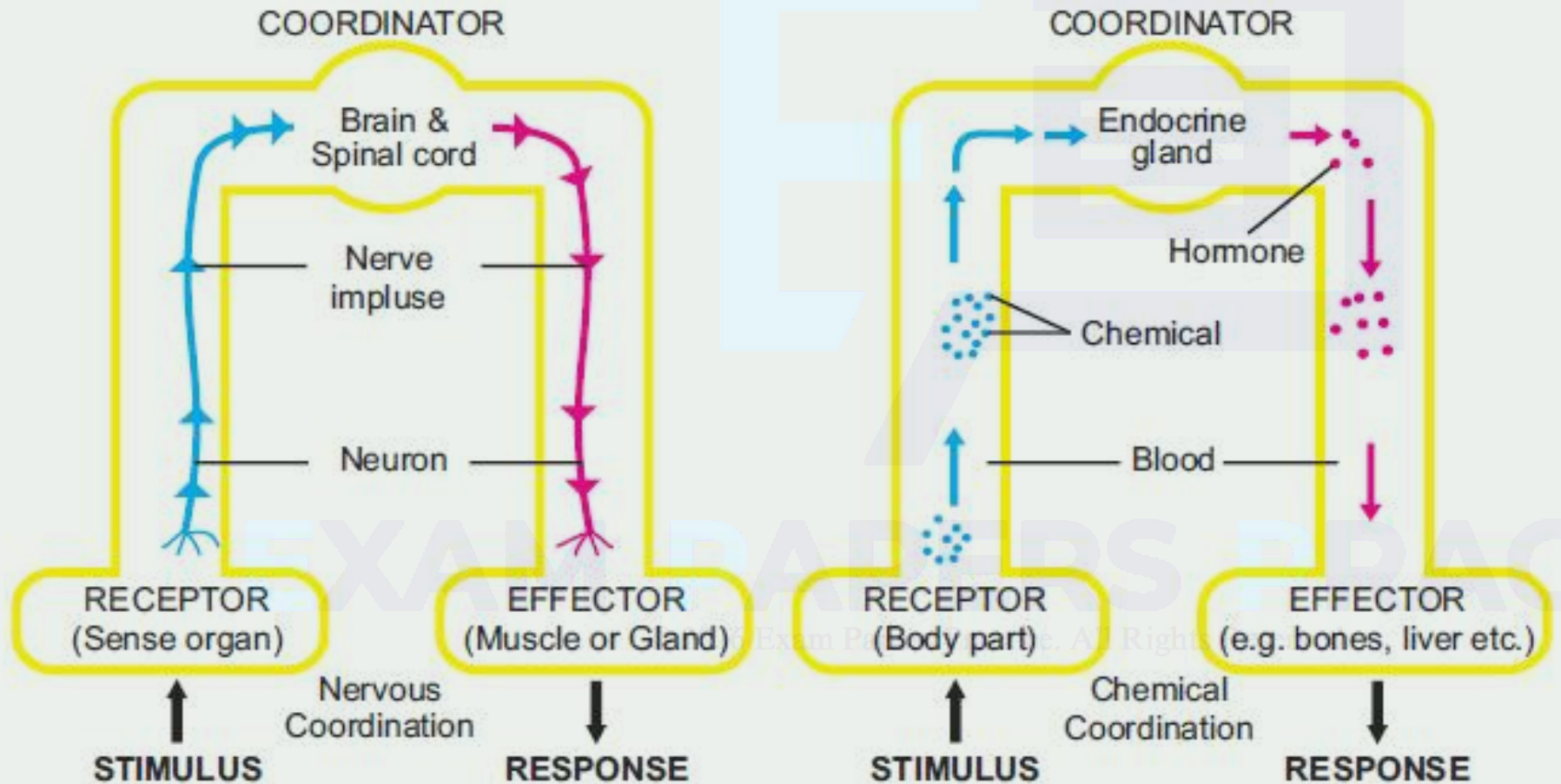


EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved



Nervous and Chemical coordination



Nervous or endocrine control?

The nervous system and endocrine system are both involved in controlling the internal conditions of a mammal.

	nervous control	endocrine control
signal type	electrical (action potential)	chemical (hormones)
speed of signal	reach the target cells in milliseconds	relatively slow, travelling in the bloodstream
duration of signal	short lasting	long lasting

© 2026 Exam Papers Practice. All Rights Reserved

When do you think endocrine control would be advantageous over nervous control?

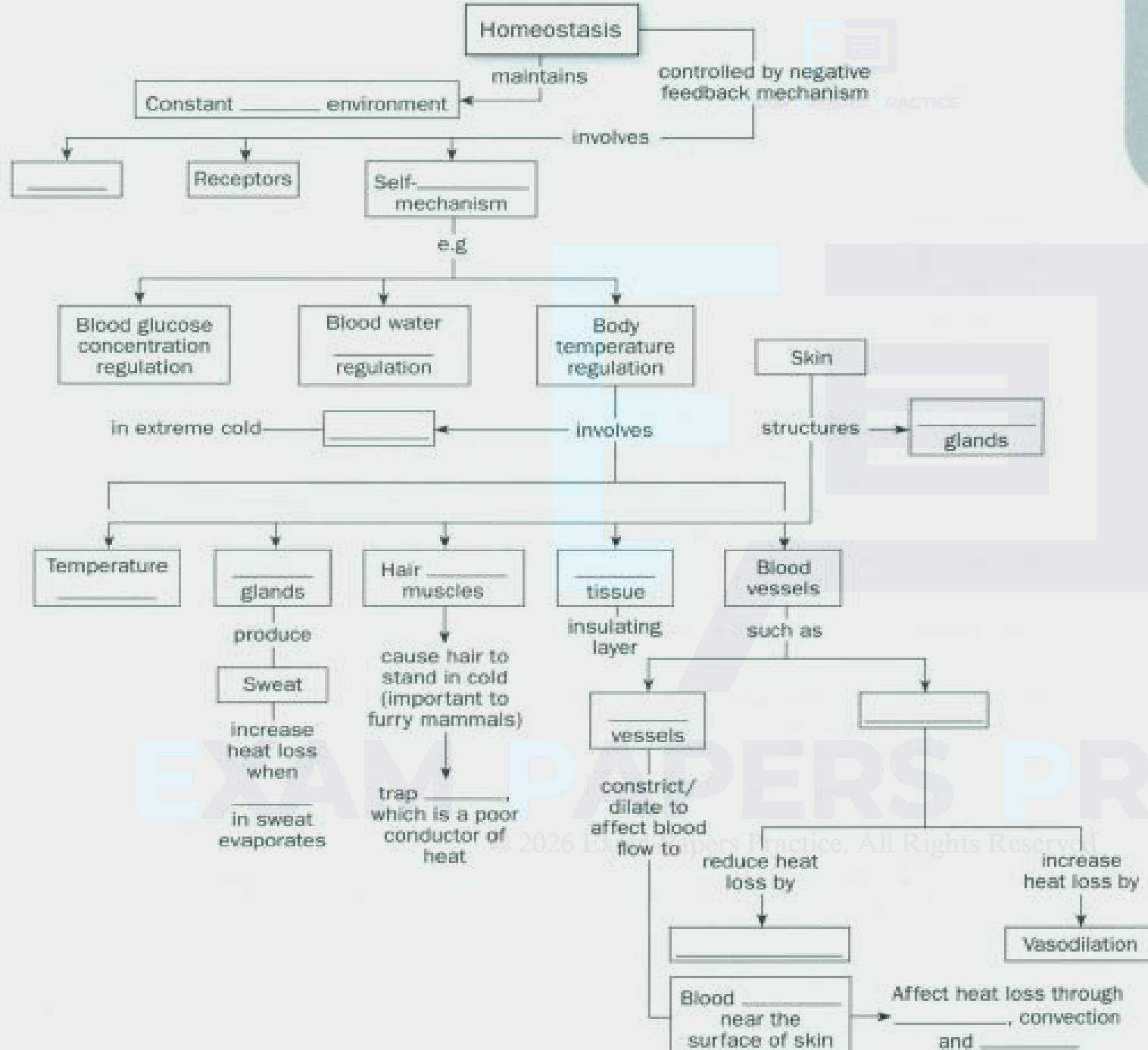
14.4

Homeostasis

Syllabus Statements

- Define homeostasis as the maintenance of a constant internal environment
- Name and identify on a diagram of the skin: hairs, hair erector muscles, sweat glands, receptors, sensory neurones, blood vessels and fatty tissue
- Describe the maintenance of a constant internal body temperature in humans in terms of insulation, sweating, shivering and the role of the brain (limited to blood temperature receptors and coordination)

- Explain that homeostasis is the control of internal conditions within set limits
- Explain the concept of control by negative feedback
- Describe the control of the glucose concentration of the blood by the liver and the roles of insulin and glucagon from the pancreas
- Outline the symptoms and treatment of Type 1 diabetes (detail of β cells is not required)
- Describe the maintenance of a constant internal body temperature in humans in terms of vasodilation and vasoconstriction of arterioles supplying skin surface capillaries



What is Homeostasis?

Homeostasis – involves maintaining a constant environment in the body

- Homeostasis makes sure our body has the correct levels of.....

Temperature

Water

Oxygen

Carbon dioxide

Blood sugar

Why is homeostasis important?

Enzyme activity – Enzymes operate best over a specific range of conditions. By maintaining pH and temperature in the body all enzyme-linked reactions proceed efficiently.

Cell size – Changes in the **water potential** of the blood will affect the amount of water in the tissue fluid and cells. This could cause animal cells to **desiccate**, or swell and burst.

Independence from external conditions – Animals with a constant internal environment can maintain a constant level of activity regardless of their environment.





What are the organs of homeostasis?

brain

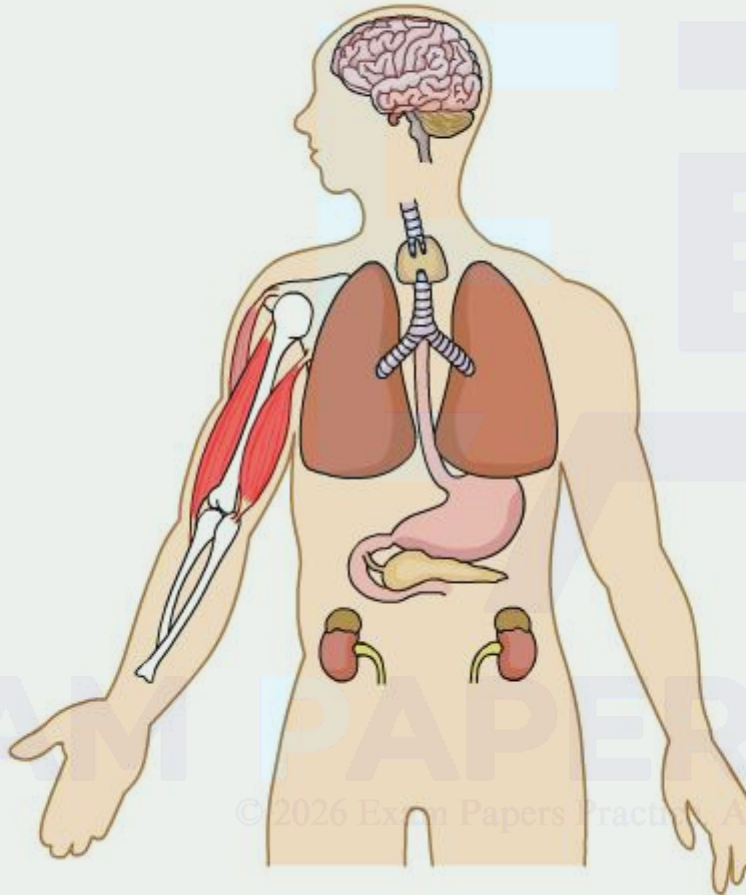
lungs

muscles

pancreas

skin

kidneys

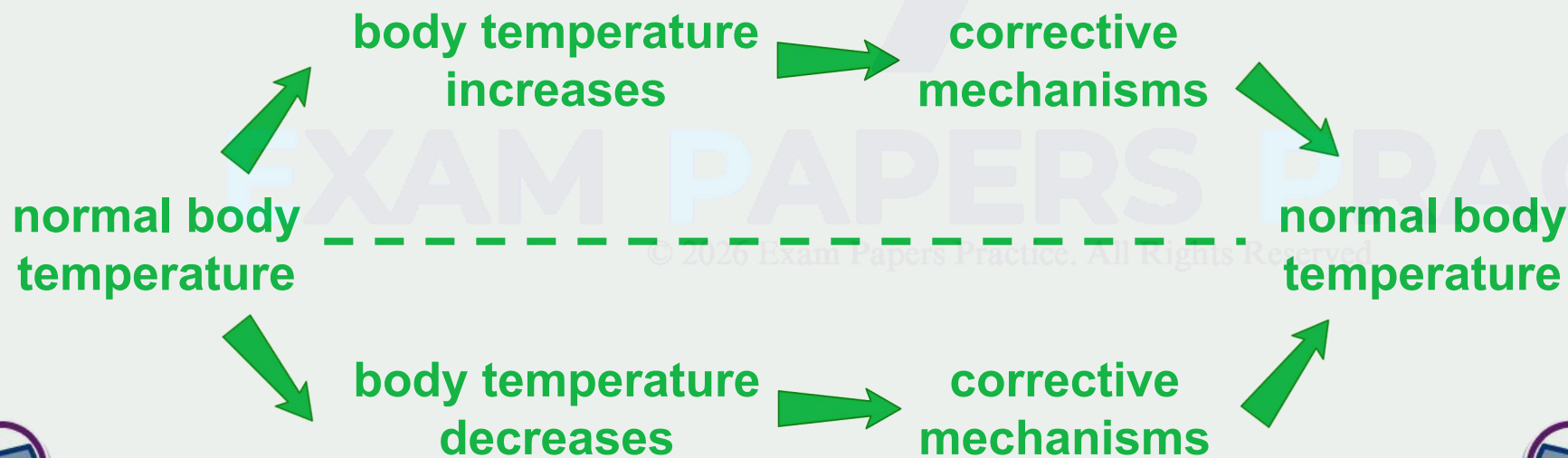


Negative feedback

To maintain their internal environment organisms need a **self regulating mechanism**. In most animals this is achieved by **negative feedback**.

Negative feedback works by initiating corrective mechanisms whenever the internal environment deviates from its normal or acceptable level.

Thermoregulation: an example of a negative feedback loop



The importance of the skin



EXAM PAPERS PRACTICE



board
works



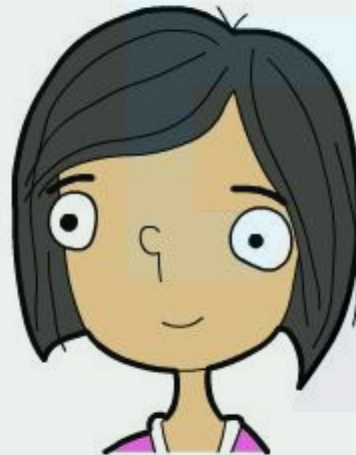
EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved





How does negative feedback control body temperature?



EXAM PAPERS PRACTICE

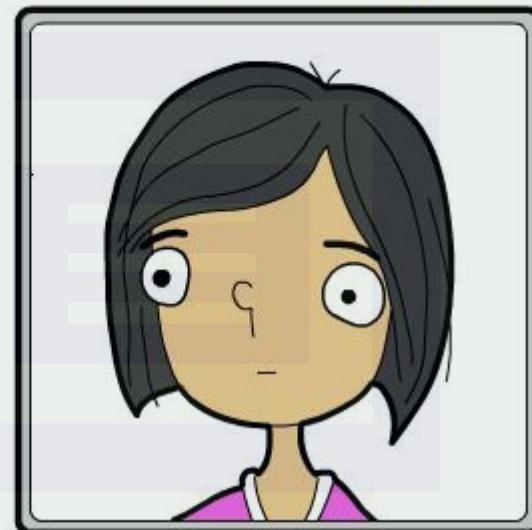
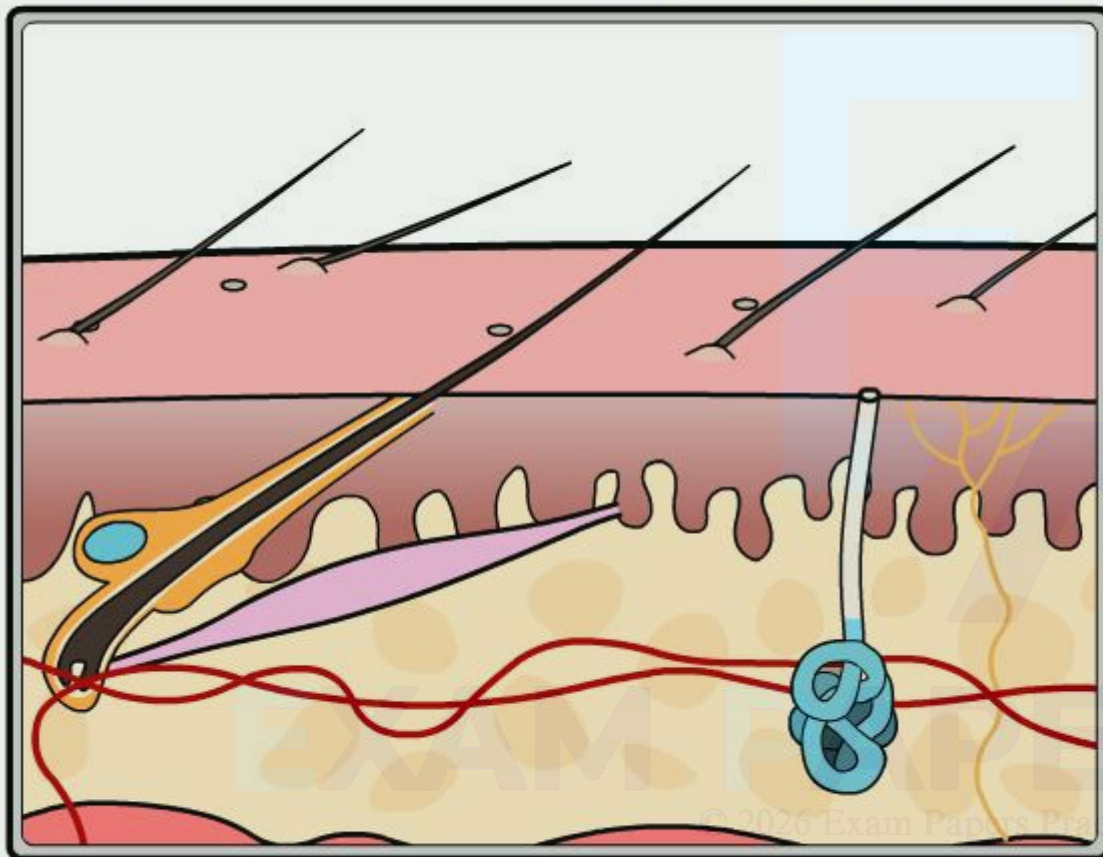
© 2026 Exam Papers Practice. All Rights Reserved



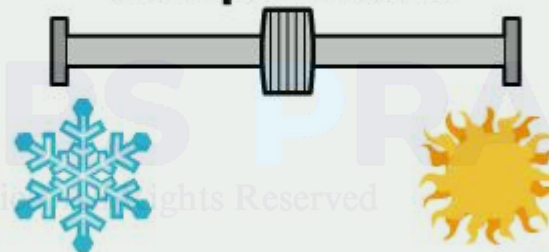
--	--	--	--	--



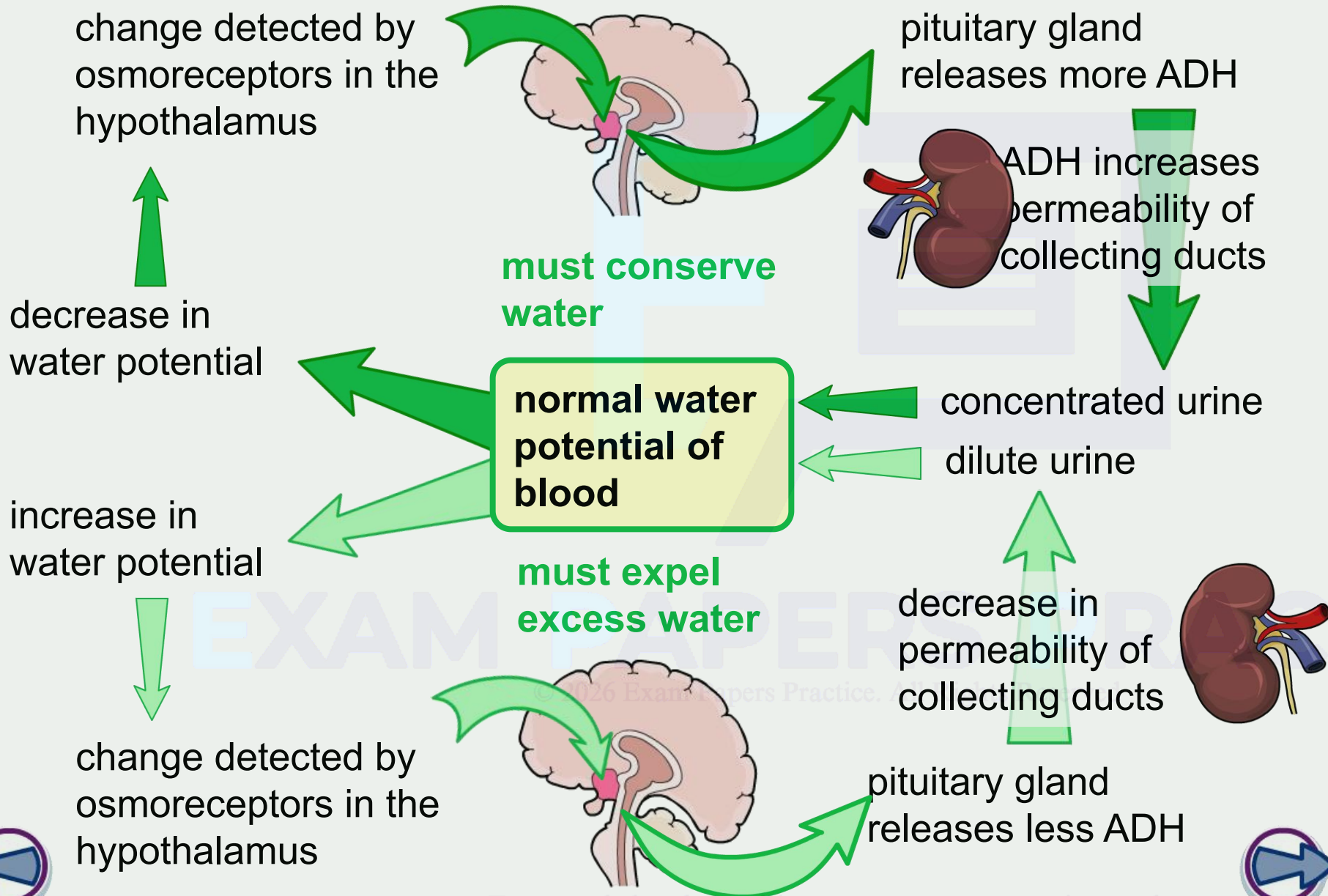
How does skin respond to temperature change?



temperature



Osmoregulation



How do the kidneys work?



What are the missing words about osmoregulation?

1a. When the salt concentration of the blood is too high it means that the body contains too water.

1b. High salt concentration stimulates receptors in the , and ADH is secreted by the .

1c. ADH triggers thirst, so water is drunk.

1d. The kidneys reabsorb water, so quantities of urine are produced.

© 2026 Exam Papers Practice. All Rights Reserved



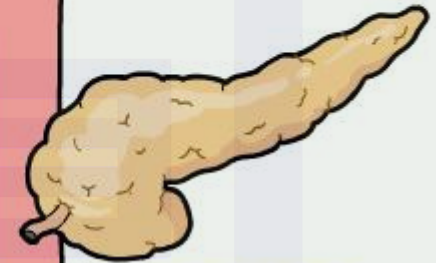
solve



How does the body control blood glucose levels?

Click "**start**" to find out how the body controls the level of blood glucose.

start



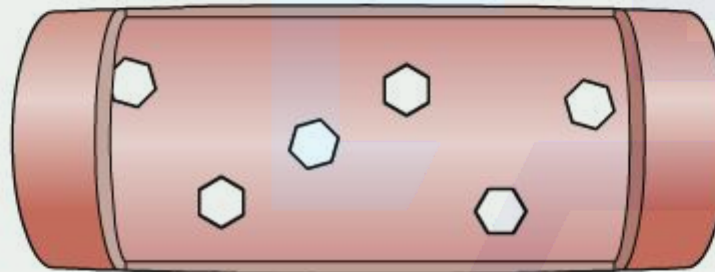
pancreas



liver



How does negative feedback control blood glucose?



EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved



--	--	--	--	--



Diabetes – type 1

Diabetes mellitus is a disorder that affects the body's ability to regulate blood glucose levels. There are two different types – type 1 and type 2.



Type 1 diabetes, also known as **insulin-dependent** diabetes, normally occurs suddenly in childhood.

The body is not able to produce its own insulin. This is thought to be caused by the immune system attacking the insulin-producing **beta cells**.

© 2026 Exam Papers Practice. All Rights Reserved

Type 1 diabetes can be controlled with regular insulin injections and the careful management of diet and exercise.

What happens if glucose is not regulated?

If the body does not regulate blood glucose concentration, it can become too high or too low, causing serious problems.

Hyperglycaemia occurs when the blood glucose concentration becomes too high. This can lower the **water potential** of the blood, which can create osmotic problems that can cause dehydration. Symptoms include thirst, frequent urination, glucose in the urine and ultimately coma.

Hypoglycaemia occurs when the blood glucose concentration becomes too low. This can result in cells being deprived of energy. Symptoms include nausea, loss of concentration and ultimately coma.





14.5

Tropic Responses

EXAM PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved

For more help, please visit www.exampaperspractice.co.uk

Syllabus Statements

- Define gravitropism as a response in which parts of a plant grow towards or away from gravity
- Define phototropism as a response in which parts of a plant grow towards or away from the direction from which light is coming
- Investigate gravitropism and phototropism in shoots and roots

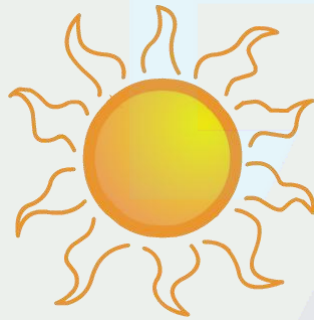
- Explain phototropism and gravitropism of a shoot as examples of the chemical control of plant growth
- Explain the role of auxin in controlling shoot growth, limited to: – auxin made in shoot tip (only) – auxin spreads through the plant from the shoot tip – auxin is unequally distributed in response to light and gravity – auxin stimulates cell elongation
- Describe the use in weedkillers of the synthetic plant hormone 2,4-D

What do plants respond to?

Plants are very sensitive and their growth is affected by their environmental conditions.

Any condition that affects plant growth is called a **stimulus**.

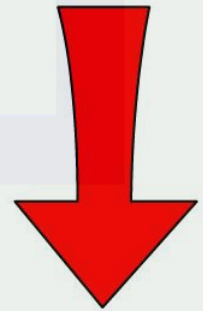
What are **three types of stimuli** that plants respond to?



light



water



gravity

Which stimulus will have the **strongest** effect on the plant?

What is a tropism?

A **tropism** is a growth movement in response to a stimulus. Plants grow towards or away from stimuli.

A growth movement **towards** a stimulus is called a **positive tropism**.

What is growth away from a stimulus called?



A growth movement **away from** a stimulus is called a **negative tropism**.

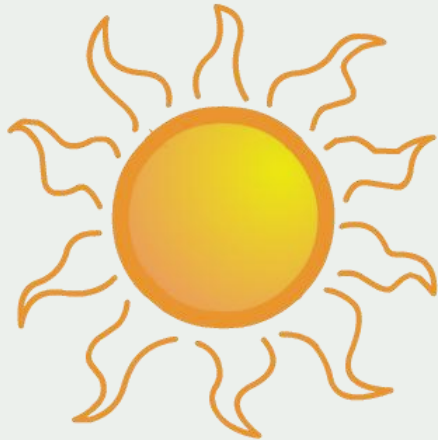


© 2026 Exam Papers Practice. All Rights Reserved
Will all the parts of a plant respond to a stimulus in the same way?

Are there different types of tropisms?

Plant responses to stimuli are given specific names:

light



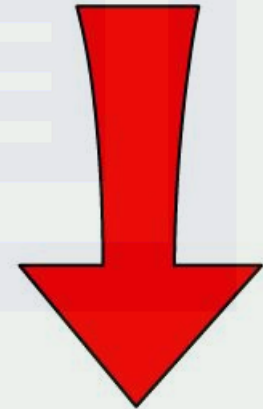
phototropism

water



hydrotropism

gravity



gravitropism

What do the names of each tropism mean?

Which parts of a plant respond to these different stimuli?

Phototropism experiment



EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved



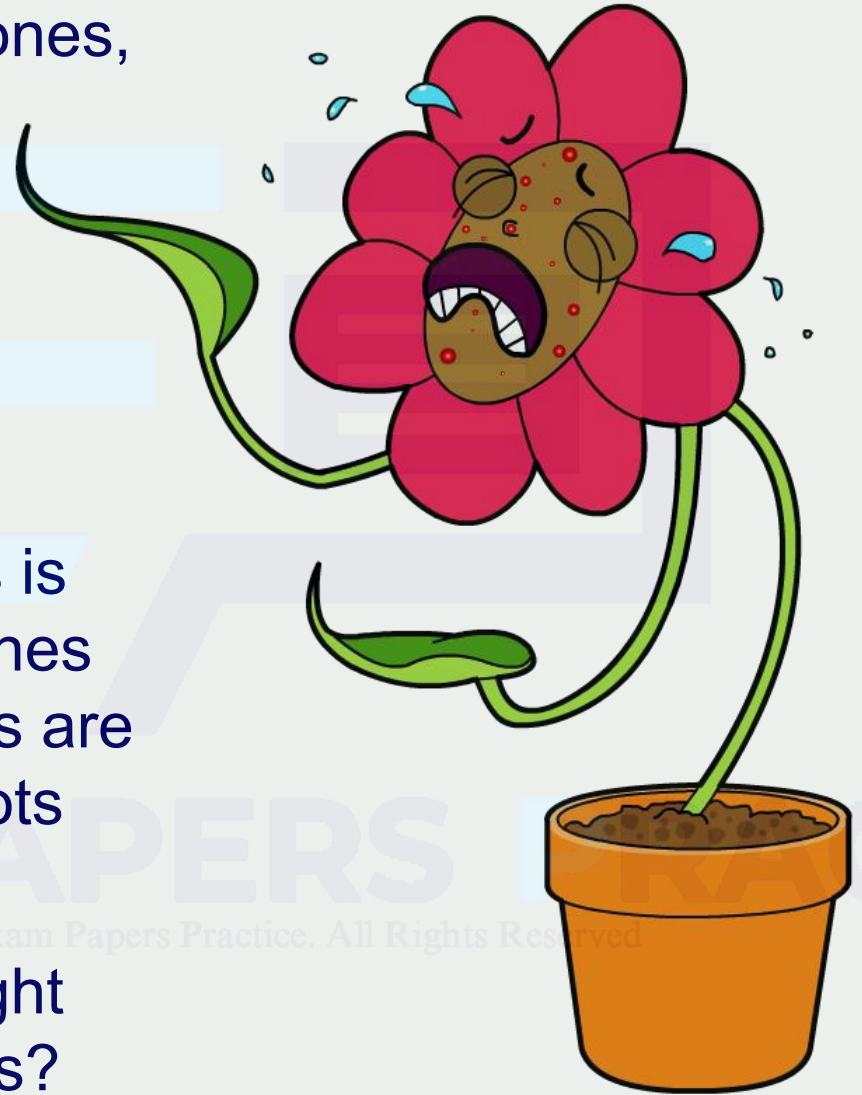
Do plants have hormones too?

Like humans, plants use hormones, (chemical messengers) to control their development.

Hormones produced by plants control growth, flowering and fruit ripening.

The growth of shoots and roots is controlled by a group of hormones called **auxins**. These chemicals are produced in the tips of the shoots and roots.

What environmental stimuli might cause a plant to produce auxins?



© 2026 Exam Papers Practice. All Rights Reserved

Hormones and phototropism



EXAM PAPERS PRACTICE

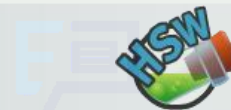


EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved



Discovery of auxins



EXAM PAPERS PRACTICE



EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved





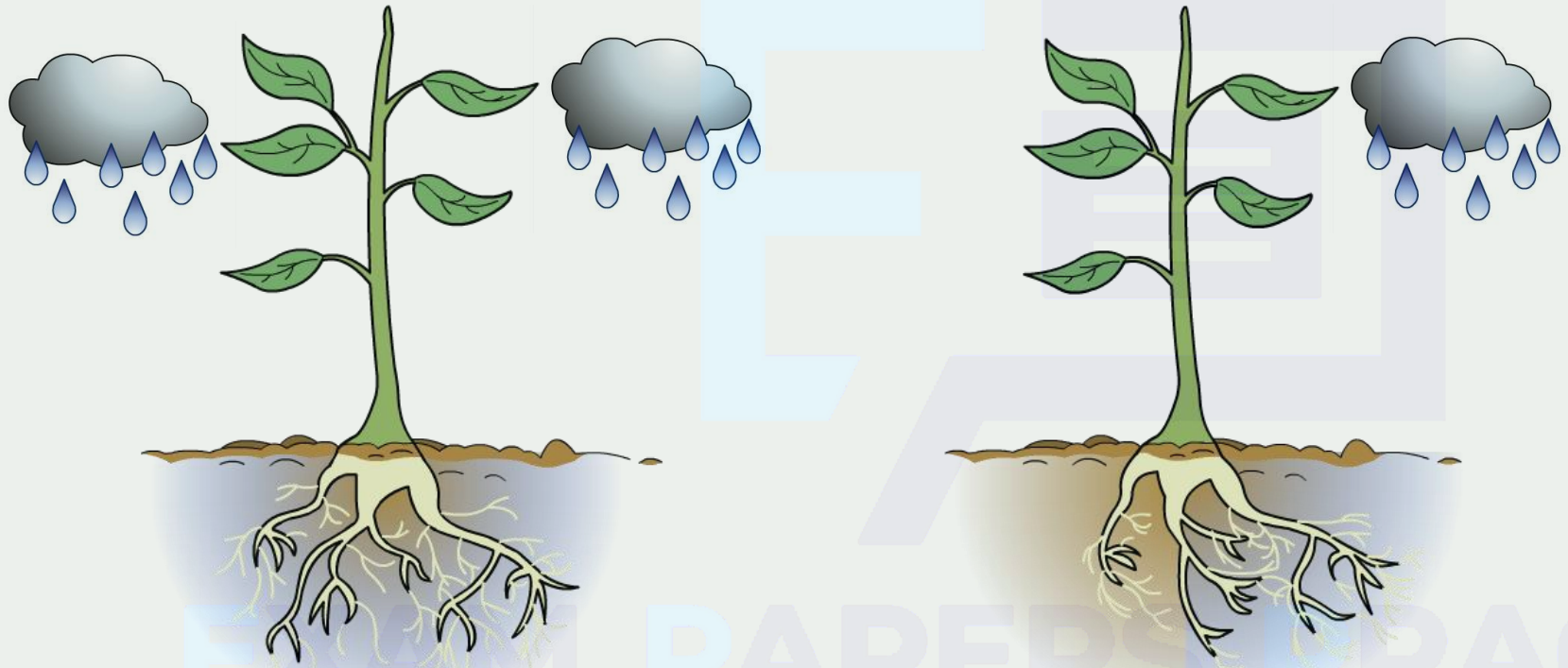
EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved



How do roots respond to water?

Roots always grow **towards** water, which is a positive tropism.

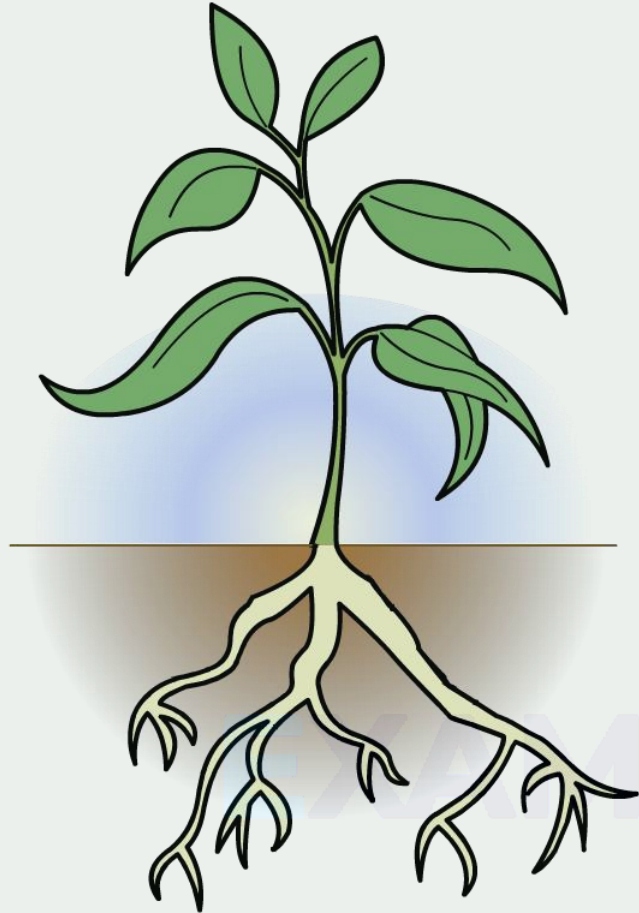


Roots will grow sideways, or even upwards, towards water. Roots always have a **stronger response to water** than gravity to ensure that a plant gets the water it needs.



How do roots and shoots respond to stimuli?

Plant stimuli affect certain parts of the plant in different ways.



- Shoots grow **towards** sunlight. They are **positively phototropic**.
- Shoots grow **away** from gravity. They are **negatively gravitropic**.
- Roots grow **away** from sunlight. They are **negatively phototropic**.
- Roots grow **towards** gravity. They are **positively gravitropic**.

What experiments can be used to test these ideas?



Tropisms and auxins – true or false?



EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved

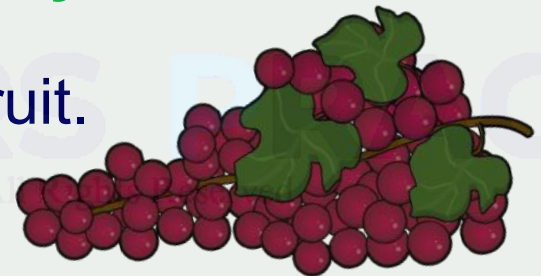
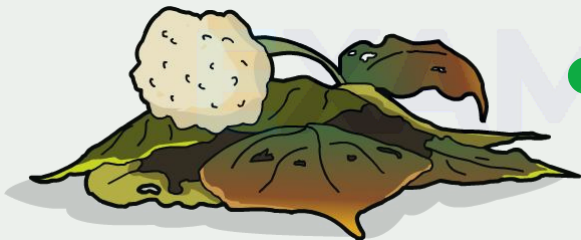
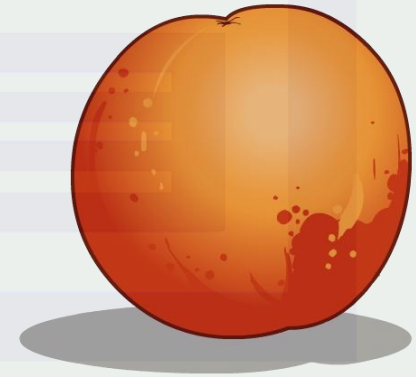


How can plant hormones be used?

Plant hormones are naturally-occurring chemicals, but they can also be produced synthetically for uses in gardening and agriculture, such as:



- growing cuttings
- ripening fruit
- killing weeds.
- controlling **dormancy**
- making seedless fruit.



Why are these purposes useful for gardeners and farmers?

How are cuttings grown?

A cutting is a part of plant that is removed from the main shoot.
Do cuttings have everything they need to grow?

A cutting does not have roots and so has no supply of water or minerals.

To stimulate root growth, cuttings are dipped into **rooting powder**.

This contains **plant growth hormones**.

Cuttings are genetically identical to the parent plant.
This allows growers to copy successful plants.



Growing plant cuttings



EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved



How do plant hormones kill weeds?

Weeds are unwelcome plants that **compete** with the plants being grown by gardeners and farmers.

However, many chemicals that are potential weedkillers are toxic to animals and humans, as well as plants.

Plant hormones can be used instead to make weedkillers that only affect certain plants.

Most weeds have broad leaves. Cereals, which have narrow leaves, can be protected from weeds by using weedkillers that only effect the growth of broad-leaved plants.





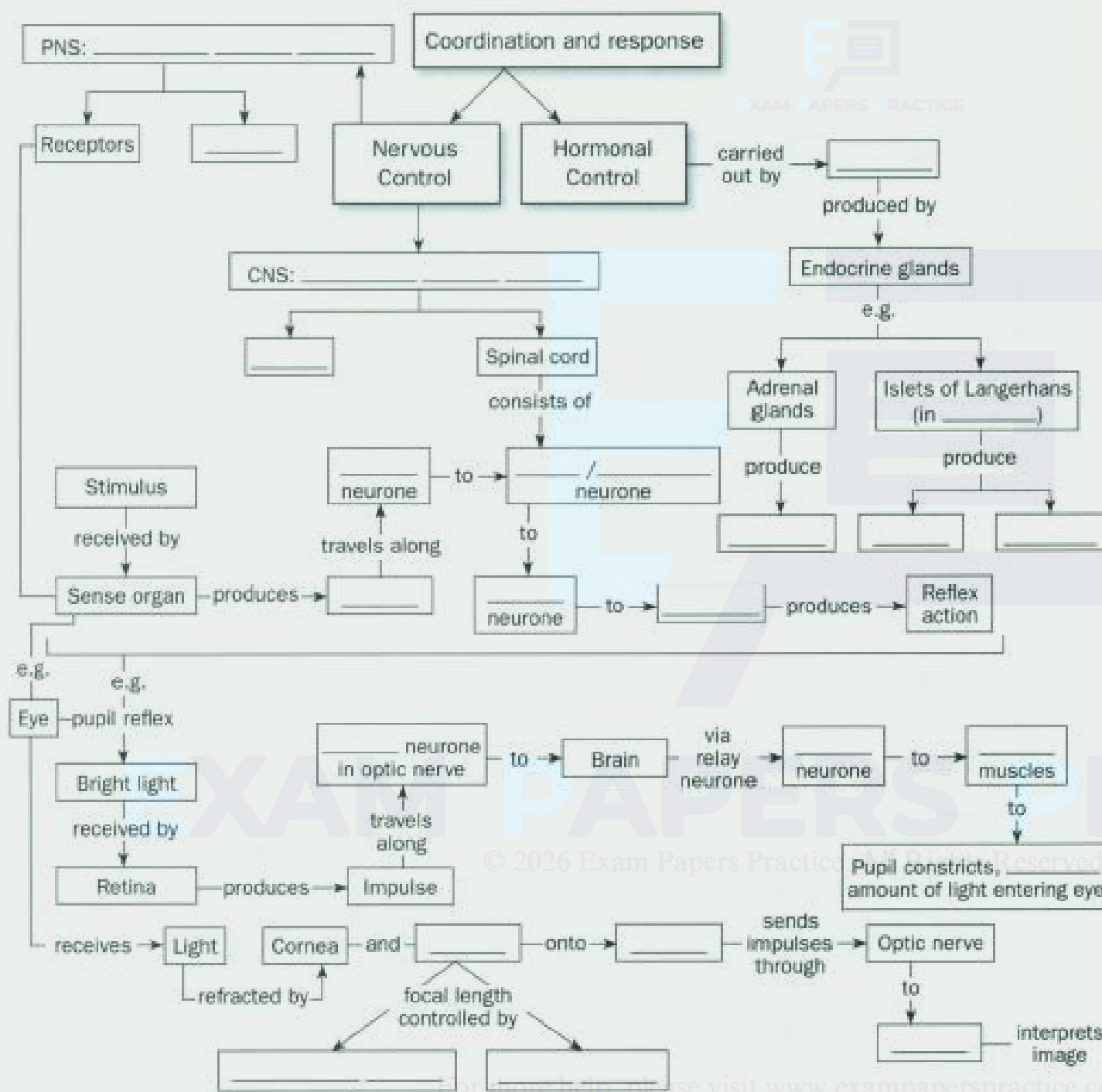
EXAM PAPERS PRACTICE



EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved





© 2026 Exam Papers Practice



EXAM PAPERS PRACTICE



EXAM PAPERS PRACTICE

© 2026 Exam Papers Practice. All Rights Reserved

