



LIFE SCIENCES

**SUMMARY &
TEACHING TOOL**



PAPER 1 2025

DIAGNOSTIC REPORT



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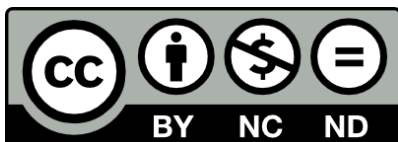


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2025 LIFE SCIENCES NSC PAPER 1

Life Sciences Paper 1

SUMMARY & TEACHING TOOL

Let's work through the paper and look at the problem areas as identified in the 2025 NSC Diagnostic Report.

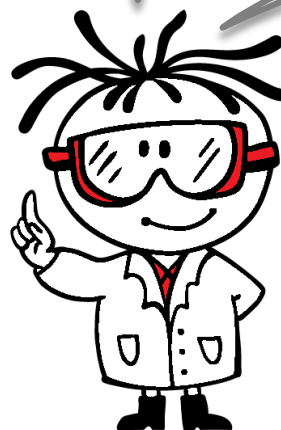
Commentary from the Diagnostic Report is noted in grey blocks like the one below. Use these to guide discussions.

Candidates confused the pupillary mechanism and accommodation.

In some cases, revision or application options will be provided and can be identified by this symbol:

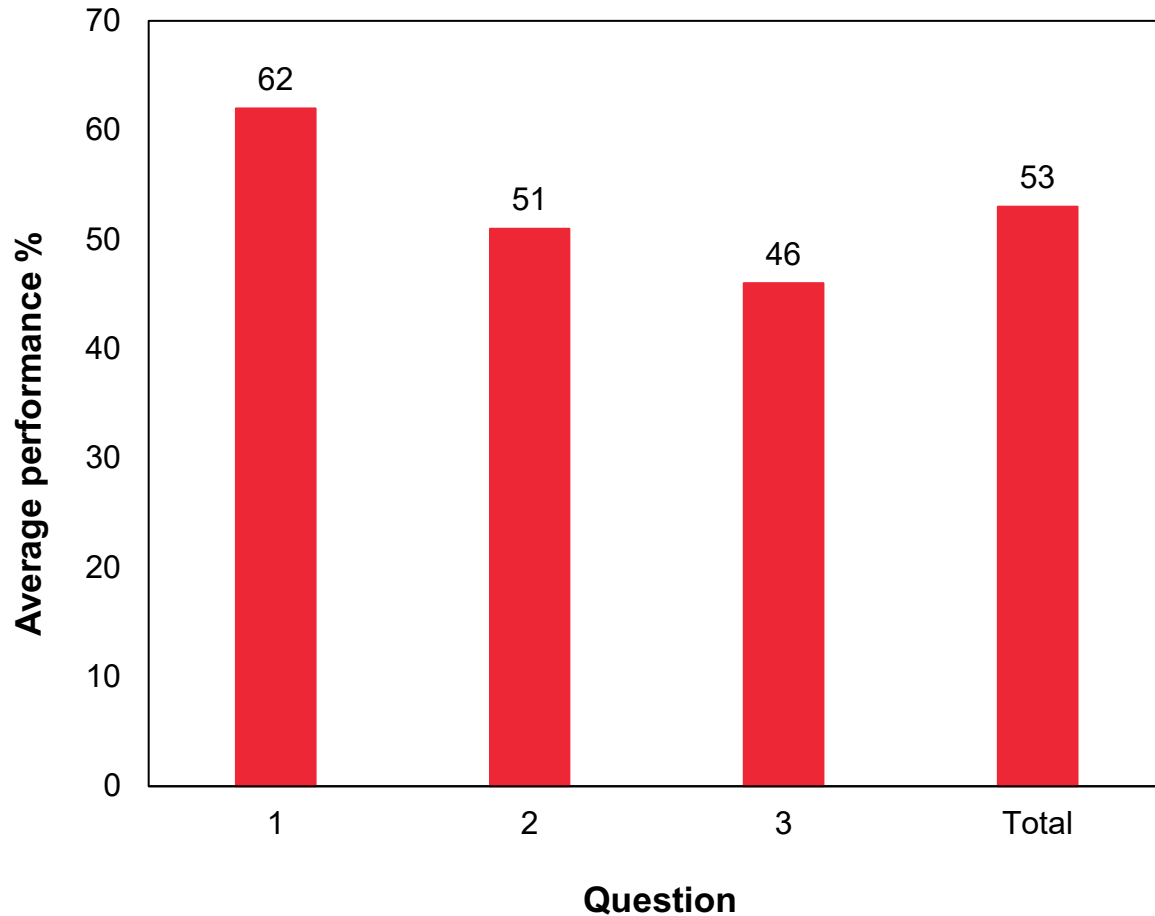


Click to go to the specific section.



2025 LIFE SCIENCES NSC PAPER 1

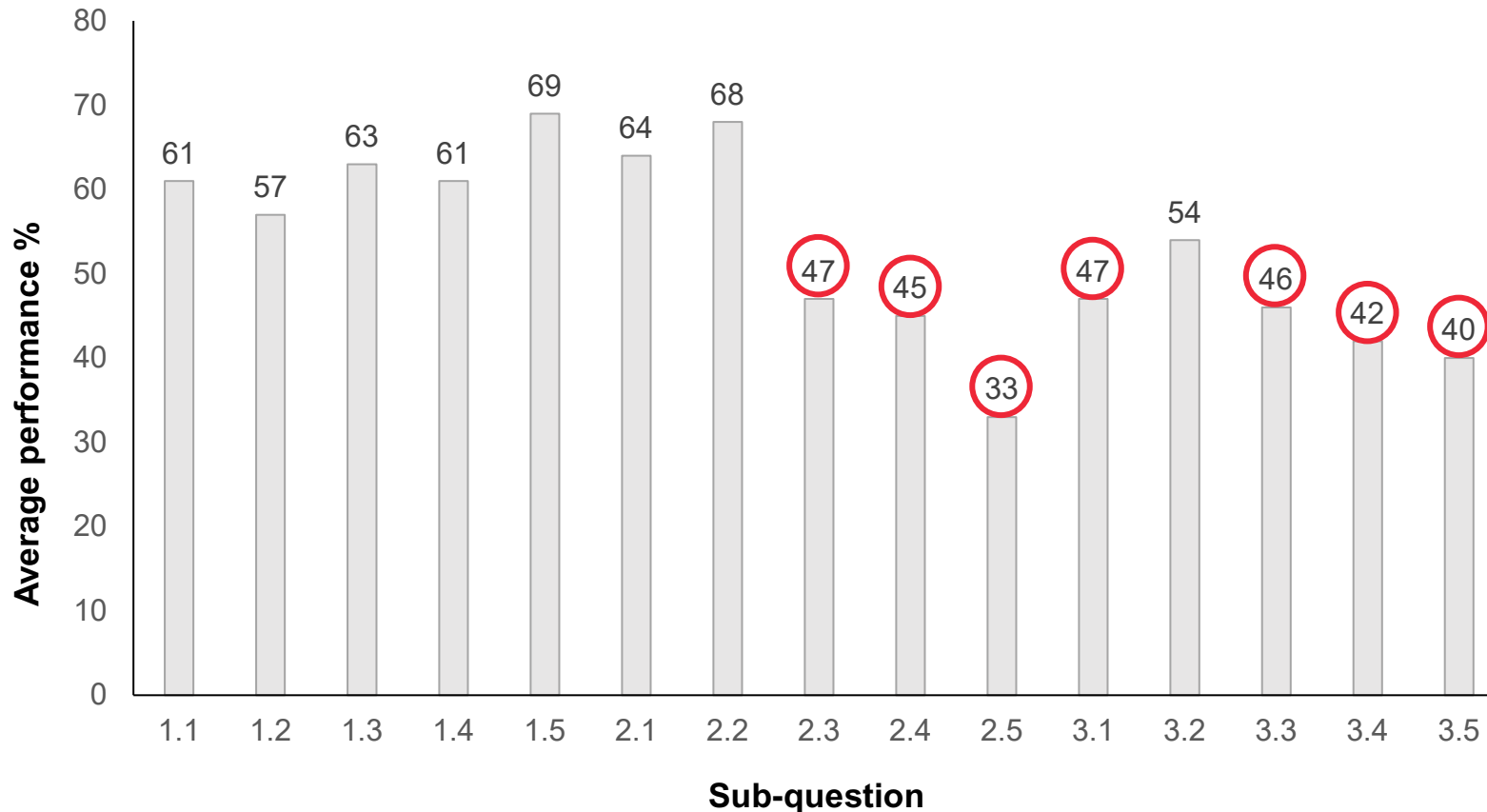
Average performance **per question**



Question	Topics
1	Multiple choice, Terminology, Matching items, Responding to the environment (plants), Responding to the environment (humans)
2	Reproductive strategies, Male reproductive system, Female reproductive system (menstrual cycle), Homeostasis (thermoregulation), Endocrine system (scientific investigation)
3	Human eye (disorder), Human nervous system (brain and reflex arc), Human eye (accommodation), Human ear (balance and hearing), Homeostatic control of blood glucose levels (scientific investigation)

2025 LIFE SCIENCES NSC PAPER 1

Average performance **per sub-question**



Problem areas

- 2.3 Menstruation
- 2.4 Homeostasis – Thermoregulation
- 2.5 Investigation – Growth Hormone
- 3.1 Eye defect – Astigmatism
- 3.3 Eye accommodation
- 3.4 Hearing and balance
- 3.5 Investigation – Insulin treatment

2025 LIFE SCIENCES NSC PAPER 1

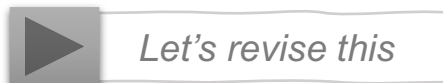
General Comments

! Correct **spelling** is very important

- ovulation✓ vs evolution✗
- Multiple sclerosis✓ vs Multiply sclerosis✗
- testosterone✓ vs testone✗

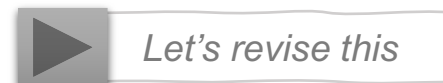
! Emphasise difference between **commonly confused terms**

- choroid vs chorion
- axon vs auxin



! Emphasise difference between **closely related structures**

- ciliary muscles vs circular muscles
- ciliary muscle vs ciliary body



! **Scientific investigations** still require attention

- Covered in detail in previous diagnostic reports
- Increase exposure and practical application during formal and informal assessments

Revised in 2023
Paper 1 Diagnostic
Report T & L Tool

! Note

- Practice **basic mathematical skills**, e.g. % increase/decrease, addition, subtraction, division, etc.
- Always bring a calculator, pencil and ruler along to the exams
- Do not use **unaccredited abbreviations**, e.g. ANS✗ for Autonomic Nervous System
- Never use abbreviations in QUESTION 1.2 Terminology – the instruction is ‘give the **biological term...**’

SECTION A – Multiple Choice

1.1.1 The hormone that prepares the body for an emergency is ...

Gr 12 LS
Part 1 p. 76
(2025 ed.)

- A aldosterone
- B progesterone
- C adrenalin
- D prolactin

1.1.2 Which ONE of the following are functions of the placenta?

Gr 12 LS
Part 1 p. 26
(2025 ed.)

- A Excretion and nutrition
- B Gaseous exchange and protection against mechanical injury
- C Nutrition and temperature regulation
- D Temperature regulation and excretion

1.1.3 The table below shows the reaction time of four learners to a stimulus.

Gr 12 LS
Part 1 p. 43
(2025 ed.)

NAME OF LEARNER	REACTION TIME (SECONDS)
Temisha	0,7
Luke	0,6
Anika	0,8
Jordy	0,4

Which ONE of the following learners demonstrates the fastest response to the stimulus?

- A Temisha
- B Luke
- C Anika
- D Jordy

1.1.4 A high level of thyroxin in the blood will stimulate the ...

Gr 12 LS
Part 1 p. 73
(2025 ed.)

- A pituitary gland to secrete less TSH.
- B thyroid gland to secrete more TSH.
- C pituitary gland to secrete more TSH.
- D thyroid gland to secrete more thyroxin.

SECTION A – Multiple Choice

1.1.1 The hormone that prepares the body for an emergency is ...

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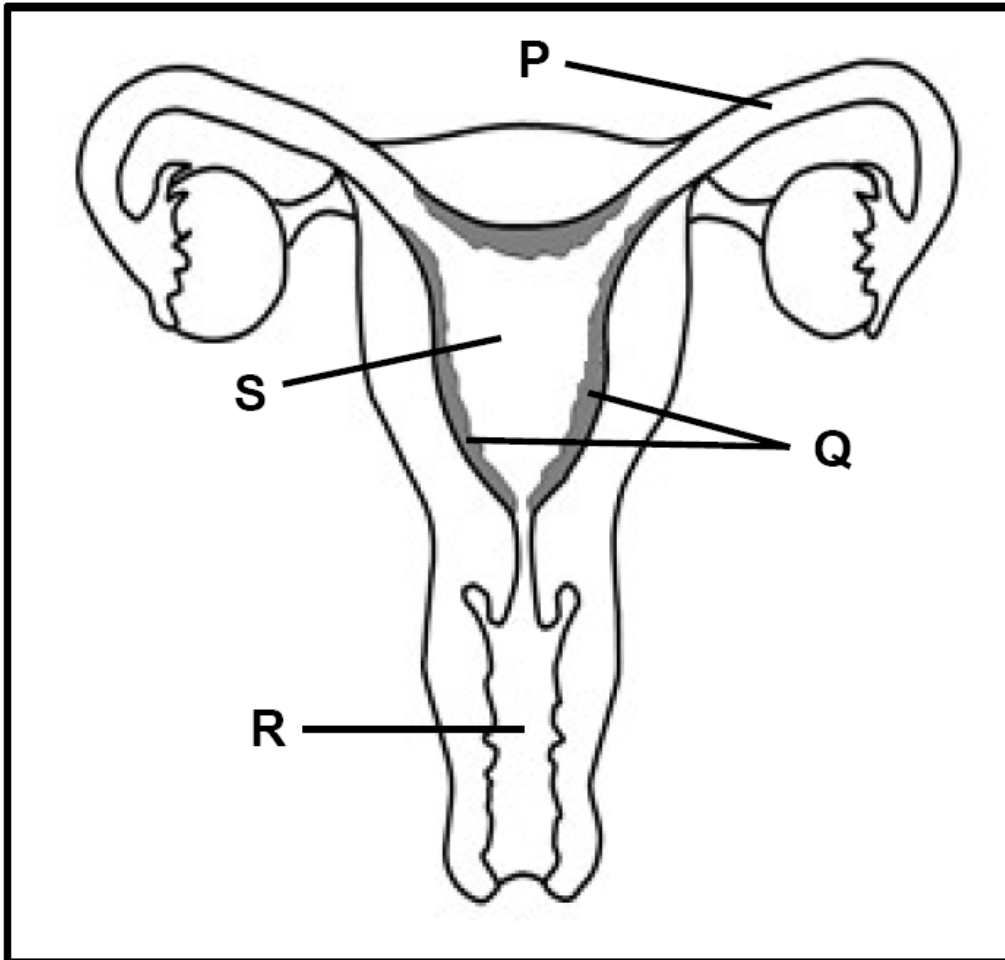
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- A pituitary gland to secrete less TSH.
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- D thyroid gland to secrete more thyroxin.

SECTION A – Multiple Choice

QUESTIONS 1.1.5 AND 1.1.6 ARE BASED ON THE DIAGRAM OF THE FEMALE REPRODUCTIVE SYSTEM



1.1.5

Which ONE of the following combinations is CORRECT for a normal pregnancy?

Gr 12 LS
Part 1 p. 13
(2025 ed.)

	SITE OF FERTILISATION	SITE OF IMPLANTATION
A	P	S
B	S	Q
C	P	Q
D	R	P

1.1.6

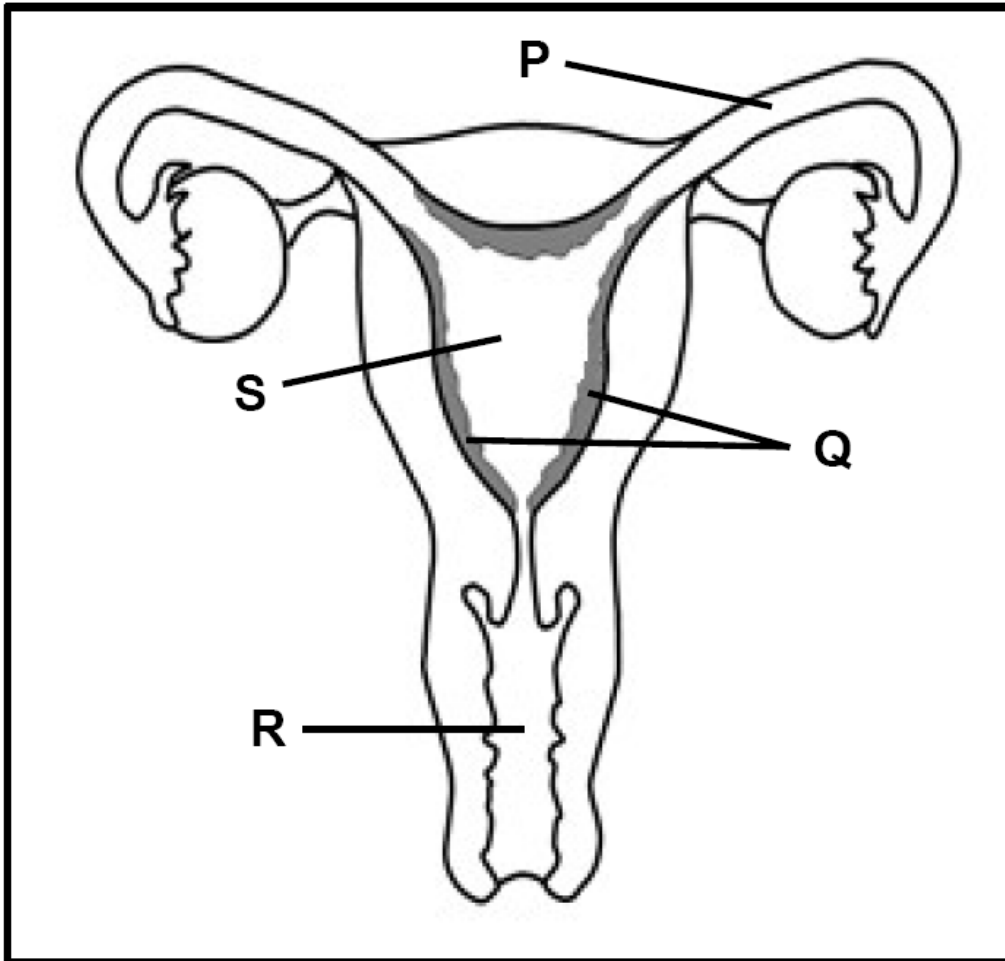
In which part does the zygote develop into a morula?

Gr 12 LS
Part 1 p. 24
(2025 ed.)

- A S
- B Q
- C R
- D P

SECTION A – Multiple Choice

QUESTIONS 1.1.5 AND 1.1.6 ARE BASED ON THE DIAGRAM OF THE FEMALE REPRODUCTIVE SYSTEM



1.1.5

Which ONE of the following combinations is CORRECT for a normal pregnancy?

	SITE OF FERTILISATION	SITE OF IMPLANTATION
A	P	S
B	S	Q
C	P	Q
D	R	P

1.1.6

In which part does the zygote develop into a morula?

- A S
- B Q
- C R
- D P

SECTION A – Multiple Choice

1.1.7

The following is a list of male reproductive parts:

*Gr 12 LS
Part 1 p. 10
(2025 ed.)*

- (i) Prostate gland
- (ii) Seminal vesicle
- (iii) Urethra
- (iv) Cowper's gland

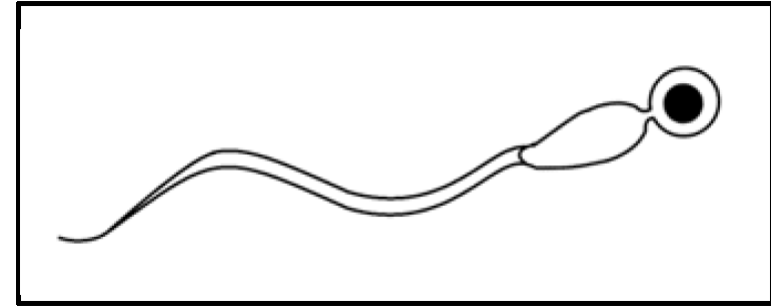
Which ONE of the following combinations is responsible for the formation of semen?

- A (i) and (ii) only
- B (i), (ii) and (iv) only
- C (ii) and (iii) only
- D (i) and (iv) only

1.1.8

The diagram below represents a human sperm.

*Gr 12 LS
Part 1 p. 17
(2025 ed.)*



This sperm is NOT structurally suitable for fertilisation because of the ...

- A absence of a nucleus to provide genetic material.
- B absence of an acrosome to improve motility.
- C presence of a long tail for the movement of the sperm.
- D absence of mitochondria to provide energy.

SECTION A – Multiple Choice

1.1.7

The following is a list of male reproductive parts:

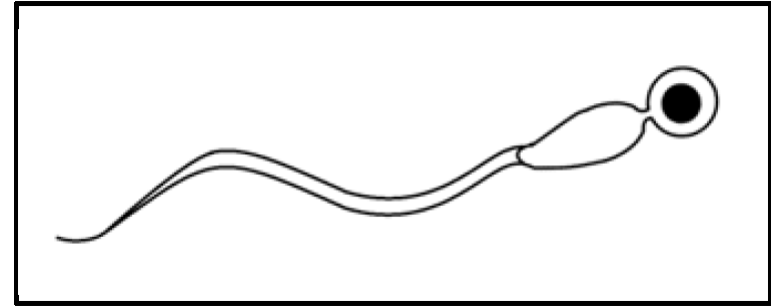
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- A absence of a nucleus to provide genetic material.
- B absence of an acrosome to improve motility.
- C presence of a long tail for the movement of the sperm.
- D absence of mitochondria to provide energy.

Candidates selected B instead of D (correct) – candidates associated the round-headed sperm with lack of acrosome affecting motility, failing to link structure to function for fertilisation – the key skill being assessed

SECTION A – Multiple Choice

1.1.9

The following is a list of growth responses in plants:

*Gr 12 LS
Part 1 p. 89
(2025 ed.)*

- (i) Plants grow straight upwards
- (ii) No upward growth
- (iii) Increased number of lateral branches
- (iv) Stems bend towards unilateral light

Which ONE of the following combinations describes the growth responses that occur when apical buds of plants are removed?

- A (i), (ii) and (iii) only
- B (ii) and (iii) only
- C (i) and (iv) only
- D (i), (ii), (iii) and (iv)

1.1.10

Which ONE of the following is CORRECT for a person who exercises on a hot day without taking in any liquids

*Gr 12 LS
Part 1 p. 81
(2025 ed.)*

- A Increased ADH secretion and increased permeability of renal tubules.
- B Increased ADH secretion and the production of dilute urine.
- C Decreased ADH secretion and increased permeability of renal tubules.
- D Decreased ADH secretion and the production of concentrated urine.

SECTION A – Multiple Choice

1.1.9

The following is a list of growth responses in plants:

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1.1.10

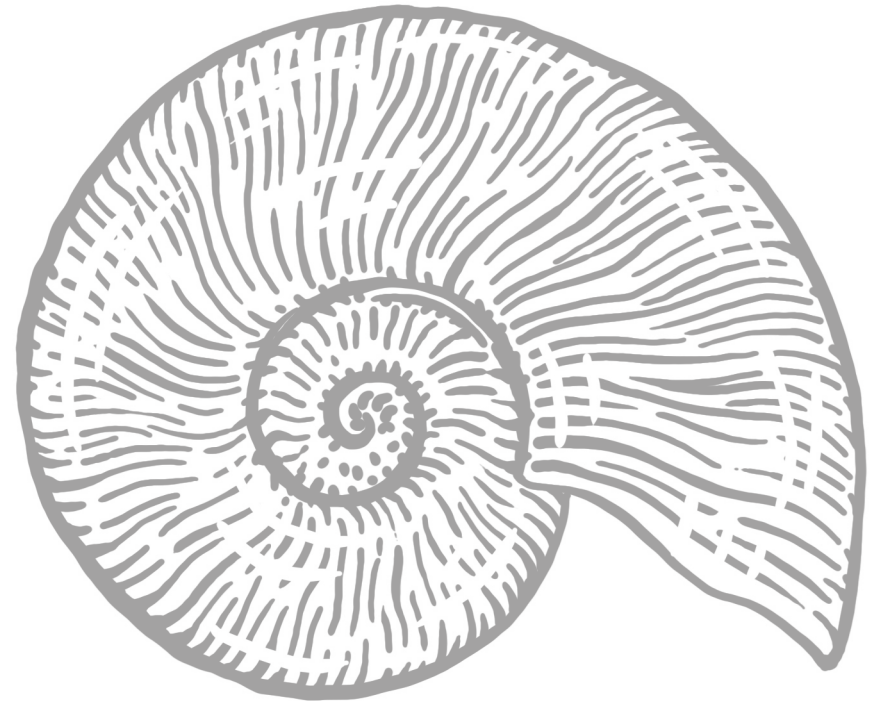
Which ONE of the following is CORRECT for a person who exercises on a hot day without taking in any liquids

- A Increased ADH secretion and increased permeability of renal tubules.
- B Increased ADH secretion and the production of dilute urine.
- C Decreased ADH secretion and increased permeability of renal tubules.
- D Decreased ADH secretion and the production of concentrated urine.

SECTION A – Terminology

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.8) in the ANSWER BOOK.

- 1.2.1 The ovarian hormone that is secreted by the corpus luteum.
- 1.2.2 The eye defect that is characterised by a cloudy lens.
- 1.2.3 The production of ova by meiosis.
- 1.2.4 The part of the retina that contains no rods and cones.
- 1.2.5 The release of an ovum from the ovary.
- 1.2.6 The extra-embryonic membrane that plays a role in the formation of the placenta.
- 1.2.7 A plant hormone responsible for seed dormancy.
- 1.2.8 The maintenance of a constant internal environment within narrow limits.



SECTION A – Terminology

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- 1.2.6 The extra-embryonic membrane that plays a role in the formation of the placenta.
- 1.2.7 A plant hormone responsible for seed dormancy.
- 1.2.8 The maintenance of a constant internal environment within narrow limits.

Memorandum

progesterone✓

cataracts✓

oogenesis✓

blind spot✓

ovulation✓

chorion✓

abscisic acid✓

homeostasis✓

Common misconceptions & Errors

Provided *astigmatism*✗

Provided *ovulation*✗ | *ovarian cycle*✗

Provided *yellow spot* ✗

Provided *menstrual*✗ | *ovarian cycle*✗

Provided *chorionic villi*✗ | *amnion*✗ | *choroid*✗

Provided *gibberellins*✗ | *auxins*✗

Provided *negative feedback*✗



Let's understand the difference

SECTION A – Item/statement columns

Indicate whether each of the descriptions in COLUMN I apply to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	The hormone responsible for the development of secondary sexual characteristics during puberty	A: Oestrogen B: Testosterone
1.3.2	Plays a role in the pupillary mechanism	A: Ciliary muscles B: Radial muscles
1.3.3	A plant defence mechanism	A: Thorns B: Chemicals

Gr 12 LS Part 1 p. 15 (2025 ed.)

Gr 12 LS Part 1 p. 58 (2025 ed.)

Gr 12 LS Part 1 p. 95 (2025 ed.)



SECTION A – Item/statement columns

Indicate whether each of the descriptions in COLUMN I apply to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	The hormone responsible for the development of secondary sexual characteristics during puberty	A: Oestrogen B: Testosterone
1.3.2	Plays a role in the pupillary mechanism	A: Ciliary muscles B: Radial muscles
1.3.3	A plant defence mechanism	A: Thorns B: Chemicals

Memorandum

Both A and B ✓✓

B only ✓✓

Both A and B ✓✓

Common misconceptions & Errors

Candidates did not understand that the **description in Column I** is stated in the **singular but can apply to both** items in Column II.

They lost marks for **not providing the answers in the correct format**,

i.e. A ONLY

B ONLY

BOTH A AND B

NONE

SECTION A – Plant responses

1.4

The diagrams represent different plant responses caused by hormones.

1.4.1 Give the LETTER(S) of the diagram(s) that represent a response due to:

(a) Abscisic acid

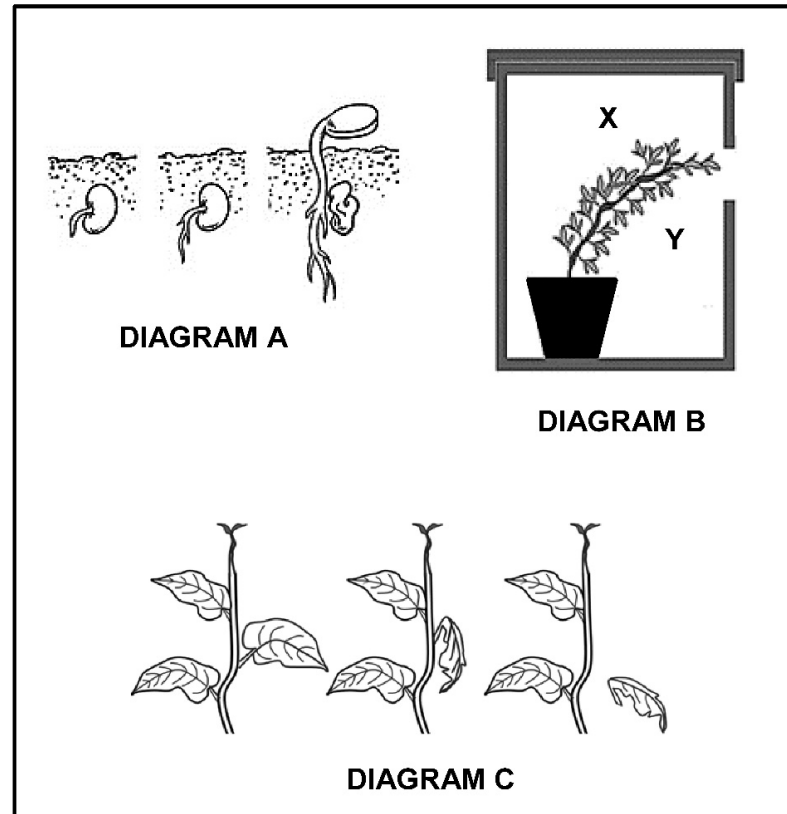
(b) Auxins

(c) Gibberellins

1.4.2 Identify the growth response shown:

(a) By the roots in diagram **A**

(b) In diagram **B**



Common misconceptions & Errors

SECTION A – Plant responses

1.4

The diagrams represent different plant responses caused by hormones.

1.4.1 Give the LETTER(S) of the diagram(s) that represent a response due to:

(a) Absciscic acid

C ✓

(1)

(b) Auxins

A ✓ and B ✓

(2)

(c) Gibberellins

A ✓

(1)

1.4.2 Identify the growth response shown:

(a) By the roots in diagram A

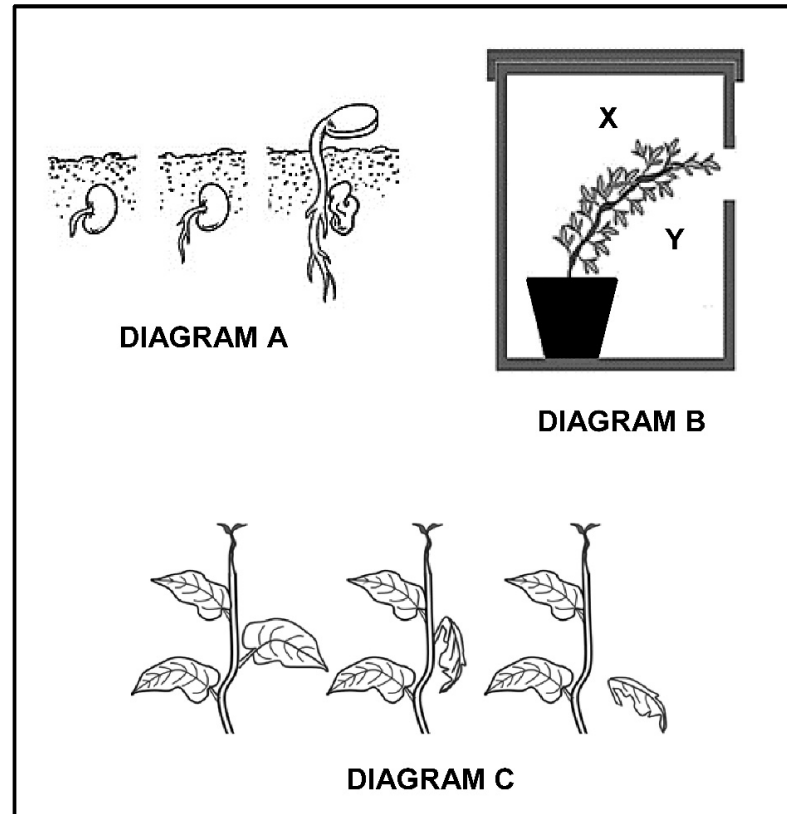
geotropism/gravitropism ✓

(1)

(b) In diagram B

phototropism ✓

(1)



Common misconceptions & Errors

1.4.1(b) Candidates ignored the mark allocation, failing to realise that two responses were required.

SECTION A – Plant responses

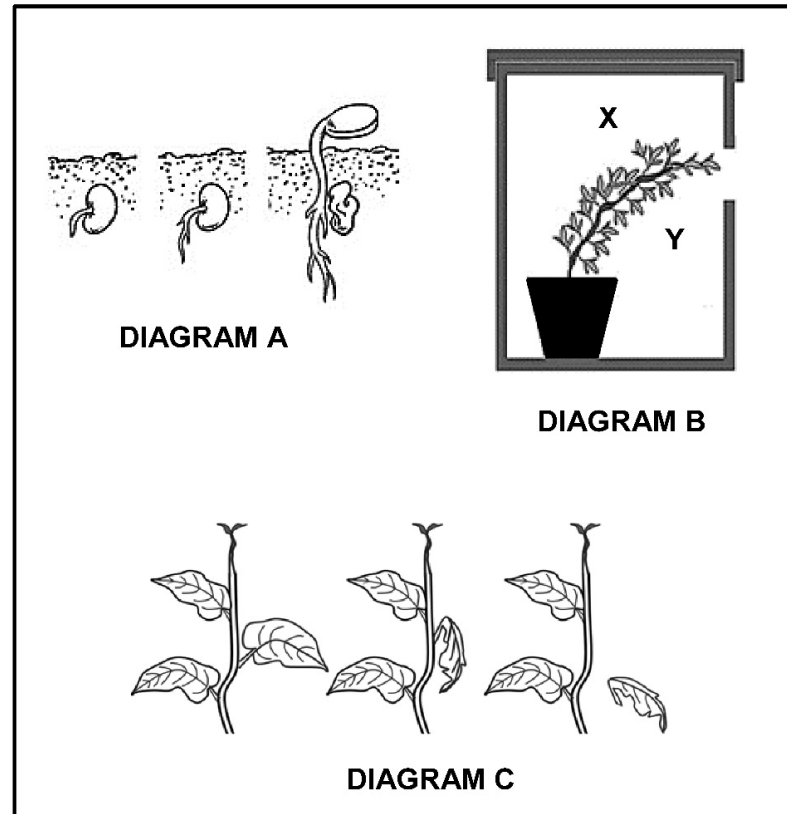
1.4

The diagrams represent different plant responses caused by hormones.

1.4.3 Using **X** and **Y** in diagram **B**, state which side of the stem has the highest:

(a) Concentration of auxins

(b) Rate of cell division



Common misconceptions & Errors

SECTION A – Plant responses

1.4

The diagrams represent different plant responses caused by hormones.

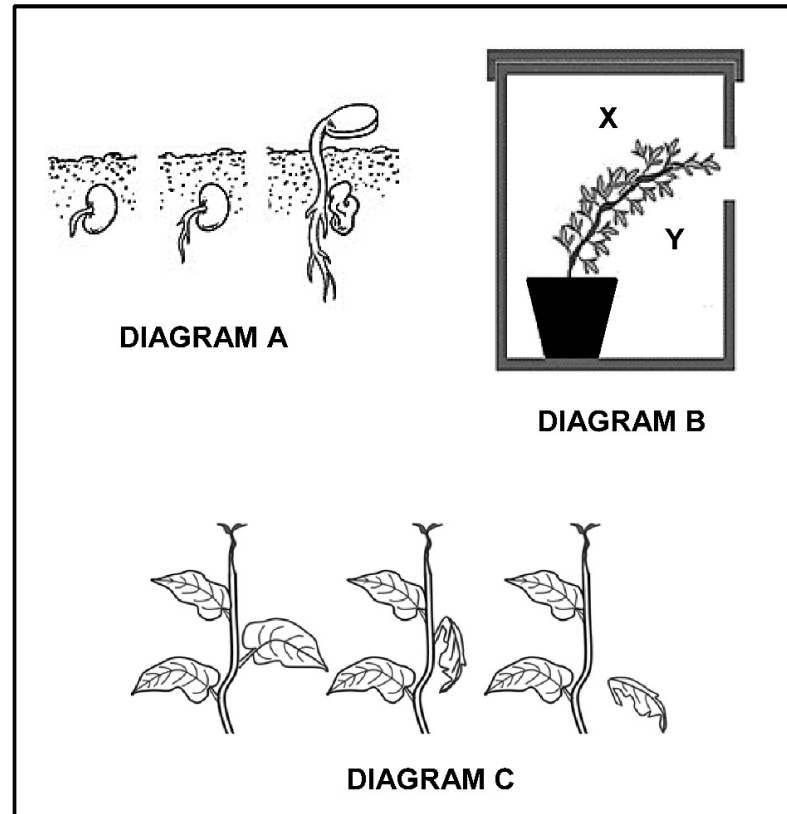
1.4.3 Using **X** and **Y** in diagram **B**, state which side of the stem has the highest:

(a) Concentration of auxins

X ✓ (1)

(b) Rate of cell division

X ✓ (1)



Common misconceptions & Errors

SECTION A – Structure of a neuron

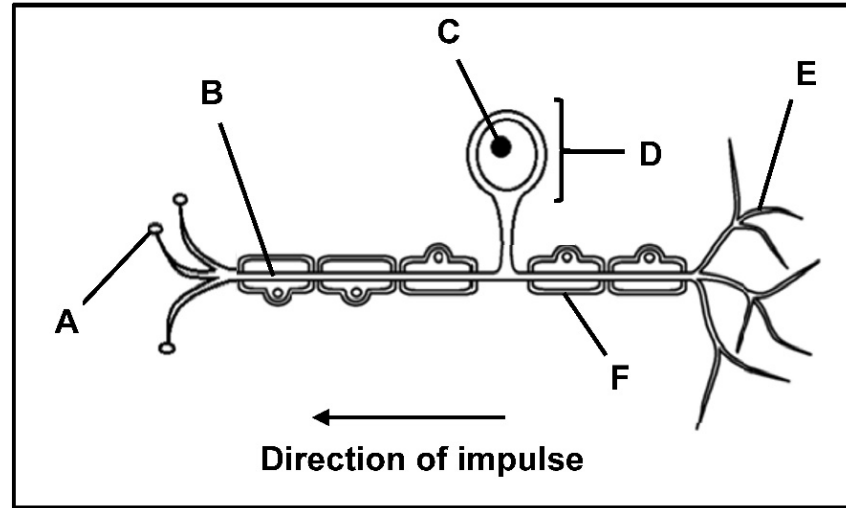
1.5

The diagram shows the structure of a neuron.

1.5.1 Name the type of neuron represented by the diagram.

1.5.2 Identify part:

- (a) **B**
- (b) **D**
- (c) **E**



Common misconceptions & Errors

SECTION A – Structure of a neuron

1.5

The diagram shows the structure of a neuron.

1.5.1 Name the type of neuron represented by the diagram.

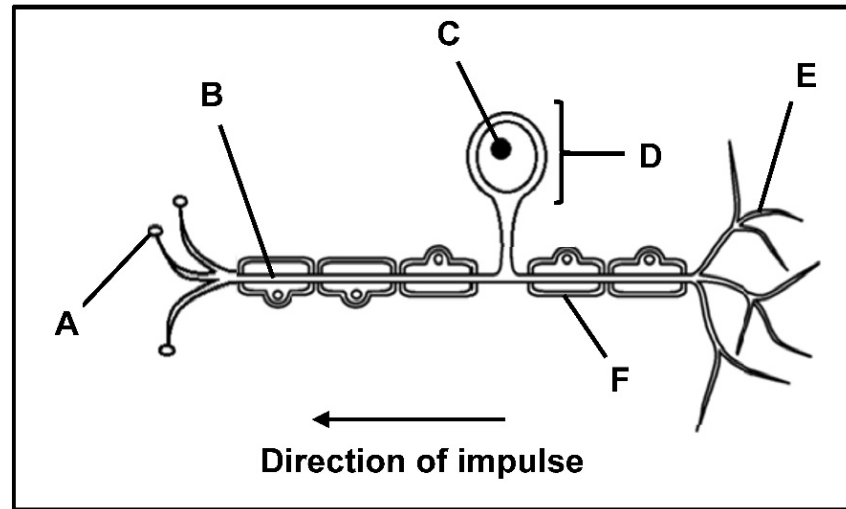
sensory ✓ neuron (1)

1.5.2 Identify part:

(a) B axon ✓ (1)

(b) D cell body ✓ (1)

(c) E dendrite ✓ (1)



Common misconceptions & Errors

1.5.1 Candidates provided unipolar ✗, multipolar ✗ or efferent neuron ✗.

NOTE

According to the Gr 12 Exam Guidelines, the only neuron classification learners need to know is based on their functions, i.e. sensory neurons or motor neurons.



SECTION A – Structure of a neuron

1.5

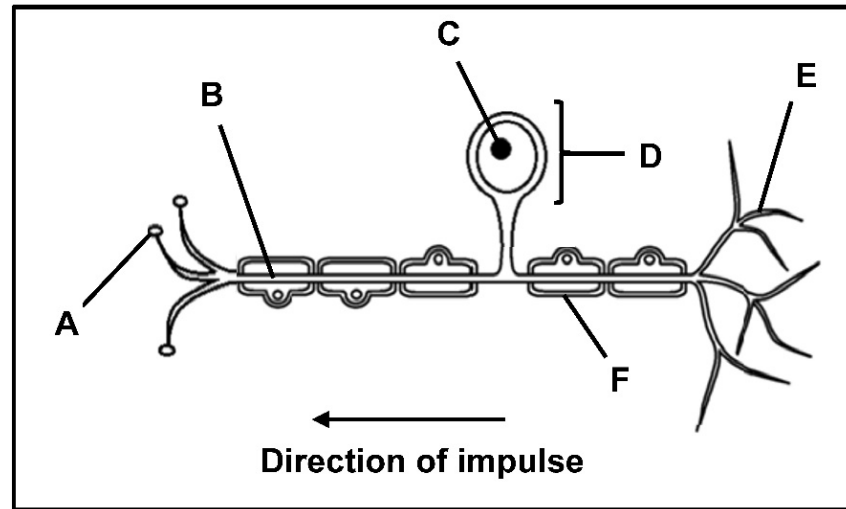
The diagram shows the structure of a neuron.

1.5.3 Give the LETTER of the part that:

(a) Contains the genetic material of the neuron

(b) Insulates the neuron

(c) Makes synaptic contact with an interneuron



Common misconceptions & Errors

1.5.4 Name the disorder that is associated with the degeneration of part F.

SECTION A – Structure of a neuron

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The diagram shows the structure of a neuron.

1.5.3 Give the LETTER of the part that:

(a) Contains the genetic material of the neuron

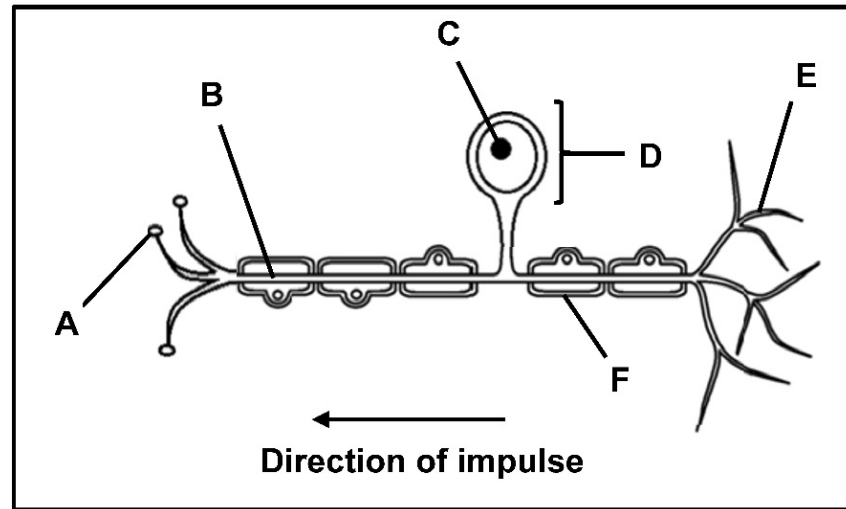
C ✓ (1)

(b) Insulates the neuron

F ✓ (1)

(c) Makes synaptic contact with an interneuron

A ✓ (1)



Common misconceptions & Errors

1.5.4 Candidates did not have a good knowledge of disorders and wrote **Alzheimer's disease** ✘.

1.5.4 Name the disorder that is associated with the degeneration of part F.

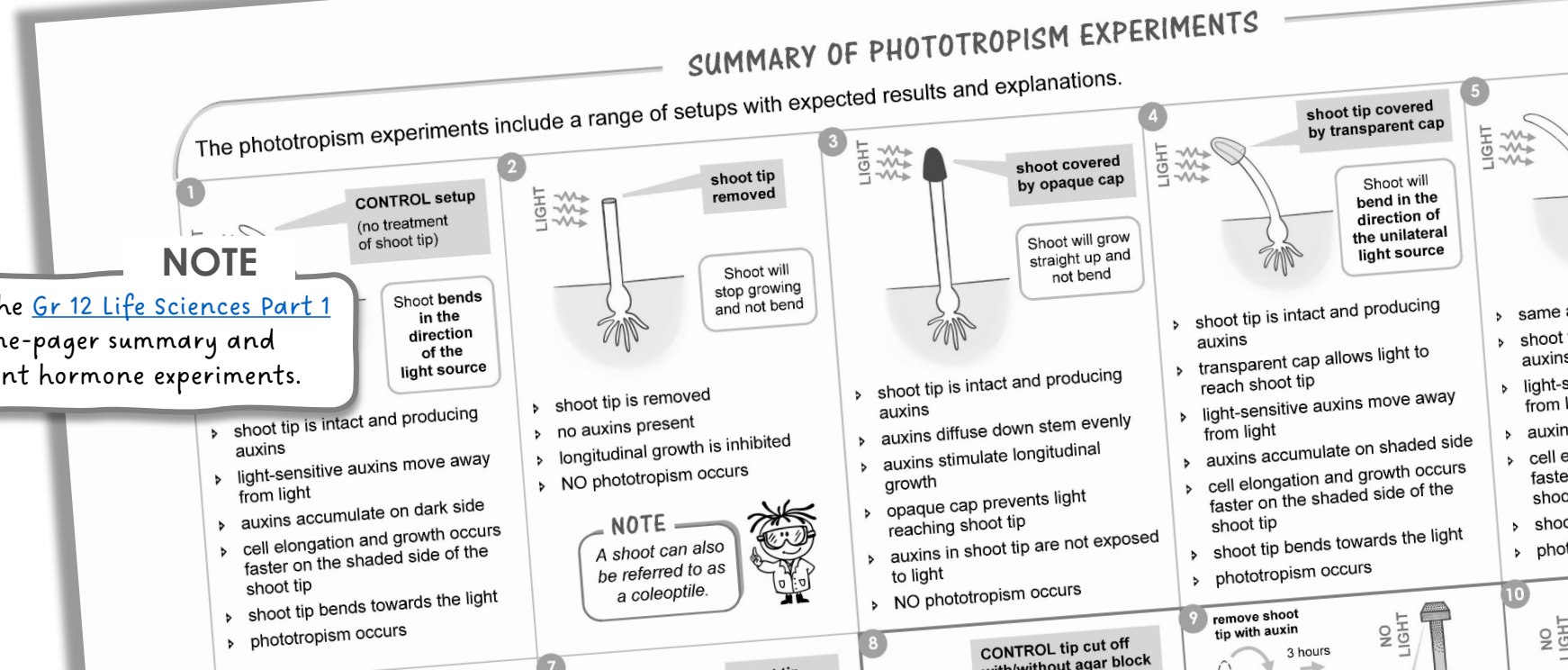
Multiple sclerosis / MS ✓ (1)

SECTION A – Suggestions for improvement

- ✓ The topic on **plant hormones** needs more attention.
 - Ensure learners understand the **effects** and **functions** of the **3 plant hormones**.
 - The topic also lends itself well **to scientific investigations** and **practical activities**.
- ✓ Learners must be made aware that **diagrams may not always appear as they are in their textbooks**.
 - Q1.5 shows the direction of the impulse from right to left, whereas some textbooks show it as left to right.



NOTE
The 2025 edition of the [Gr 12 Life Sciences Part 1](#) offers a useful one-pager summary and explanations of plant hormone experiments.



SECTION B – Bird eggs and development

- 2.1** In bird eggs, the yolk is the main source of energy for the developing embryo. The table provides information about the eggs of some bird types.

TYPE OF BIRD	AVERAGE % OF YOLK IN THE EGG
Goose	35,1
Eagle	12,0
Duck	35,4
Vulture	14,0
Chicken	31,9
Pigeon	17,9

2.1.1 Explain why we may conclude that ducks display precocial development.

2.1.2 Name the THREE bird types that would have a higher degree of parental care.

2.1.3 Give a reason for your answer to QUESTION 2.1.2.

Common misconceptions & Errors

SECTION B – Bird eggs and development

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Vulture	14,0
Chicken	31,9
Pigeon	17,9

2.1.1 Explain why we may conclude that ducks display precocial development.

- The egg has a high percentage (%) of yolk✓* therefore it
- contains more energy✓/nutrients
- The hatchling will be well developed✓ making it (more) independent (compulsory mark* + any 2)

2.1.2 Name the THREE bird types that would have a higher degree of parental care.

- Eagle✓
- Vulture✓
- Pigeon✓

(first 3)

2.1.3 Give a reason for your answer to QUESTION 2.1.2.

- the eggs have a lower percentage (%) of yolk✓ therefore
- the hatchlings will not be fully developed✓

(2)

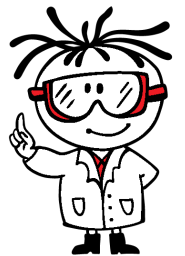
Common misconceptions & Errors

2.1.1 & 2.1.3 Candidates **did not read the stem of the question**: *the yolk is the main source of energy for the developing embryo*'.

They were unable to respond correctly, **merely quoting values from the table and not explaining the significance** of these values for parental care/development.

NOTE

An understanding of yolk and different types of development was thoroughly covered on [slide 50 of the 2024 Paper 1 Diagnostic Report Teaching & Learning Tool](#).



SECTION B – Male reproductive system

2.2

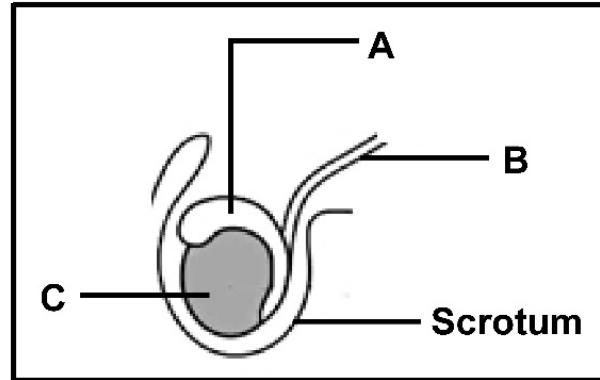
The diagram shows a part of the male reproductive system.

2.2.1 Give the LETTER and the NAME of the:

(a) Gland that secretes testosterone

(a) Part that stores sperm until maturation

2.2.2 Explain the role of the scrotum in sperm production.



Common misconceptions & Errors

SECTION B – Male reproductive system

2.2

The diagram shows a part of the male reproductive system.

2.2.1 Give the LETTER and the NAME of the:

(a) Gland that secretes testosterone

C ✓ Testis ✓ (2)

(a) Part that stores sperm until maturation

A ✓ Epididymis ✓ (2)

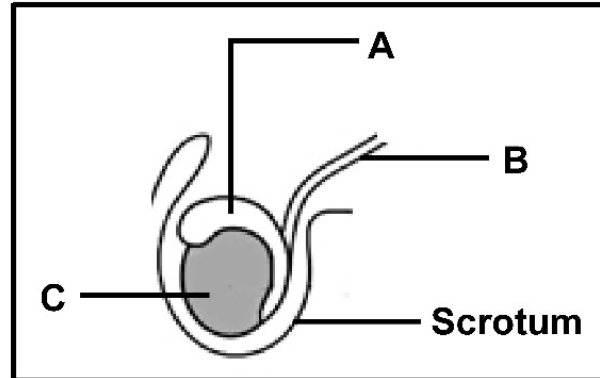
2.2.2 Explain the role of the scrotum in sperm production.

- it maintains the temperature of the testes/part C lower than body temperature ✓
- to ensure the production of good quality / quantity of sperm ✓

OR

- it protects the testes from (mechanical) injury ✓ to ensure the
- production of good quality / quantity of sperm ✓

(2)



Common misconceptions & Errors

2.2.1 Candidates **did not follow instructions**: Give the **LETTER** and the **NAME**.

2.2.2 Candidates **provided a description** and **not an explanation**.

NOTE

Describe means 'How something happens'.
Explain means 'How something happens AND why it happens'.

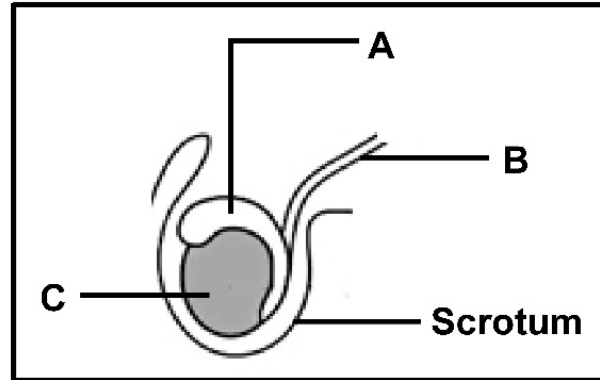


SECTION B – Male reproductive system

2.2

The diagram shows a part of the male reproductive system.

2.2.3 Name and describe the process of sperm production.



Common misconceptions & Errors

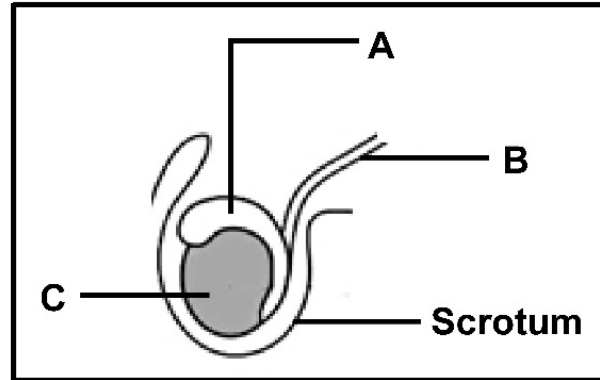
SECTION B – Male reproductive system

2.2

The diagram shows a part of the male reproductive system.

2.2.3 Name and describe the process of sperm production.

- Spermatogenesis✓*
- under the influence of testosterone✓
- diploid cells✓
- in the seminiferous tubules✓/testes
- undergo meiosis✓
- to form haploid (sperm) cells✓



compulsory mark* + any 4

NOTE

The answer you see here appears exactly like this in the Gr 12 Exam Guidelines and is the full process that learners must know.



Common misconceptions & Errors

2.2.3 Candidates **did not follow instructions**: *Name and describe...*

They lost the compulsory mark for the name of the process.

The **detailed description of spermatogenesis is no longer required**, i.e. there is no need to explain the spermatogonia, spermatocyte, spermatid, etc.

The emphasis is on the role of meiosis in gametogenesis – hence the **inclusion of 'haploid' and 'diploid' in the answer is crucial**.

SECTION B – Menstrual cycle

2.3

The thickness of the endometrium varies throughout the menstrual cycle of a female.

The table shows the results recorded for a woman who had her endometrial thickness monitored for a particular menstrual cycle.

DAY OF THE MENSTRUAL CYCLE	THICKNESS OF THE ENDOMETRIUM (mm)
0	14
7	3
14	5
21	13
28	16

2.3.1 Referring to ovarian hormones, explain the:

- (a) Decrease in thickness of the endometrium from day 0 to day 7

- (b) Increase in thickness of the endometrium from day 7 to day 14

Common misconceptions & Errors

SECTION B – Menstrual cycle

2.3

The thickness of the endometrium varies throughout the menstrual cycle of a female.

The table shows the results recorded for a woman who had her endometrial thickness monitored for a particular menstrual cycle.

DAY OF THE MENSTRUAL CYCLE	THICKNESS OF THE ENDOMETRIUM (mm)
0	14
7	3
14	5
21	13
28	16

2.3.1 Referring to ovarian hormones, explain the:

(a) Decrease in thickness of the endometrium from day 0 to day 7

- the corpus luteum degenerates✓ therefore
- the progesterone levels decrease✓
- the endometrium is no longer maintained✓/ menstruation occurs (3)

(b) Increase in thickness of the endometrium from day 7 to day 14

- the Graafian follicle✓ secretes
- oestrogen✓ which increases the endometrium thickness (2)

Common misconceptions & Errors

2.3.1 Candidates only described the change represented by the data, without giving reasons for the change, i.e. did not explain.

Candidates only considered the working of ONE ovarian hormone, instead of both, i.e. progesterone in (a) AND oestrogen in (b).

SECTION B – Menstrual cycle

2.3

The thickness of the endometrium varies throughout the menstrual cycle of a female.

The table shows the results recorded for a woman who had her endometrial thickness monitored for a particular menstrual cycle.

DAY OF THE MENSTRUAL CYCLE	THICKNESS OF THE ENDOMETRIUM (mm)
0	14
7	3
14	5
21	13
28	16

2.3.2 Describe changes in the endometrium that cause it to become thicker.

2.3.3 State the significance of the change in endometrium thickness described in QUESTION 2.3.2.

2.3.4 Draw a bar graph to show the results in the table.

Common misconceptions & Errors

SECTION B – Menstrual cycle

2.3

The thickness of the endometrium varies throughout the menstrual cycle of a female.

The table shows the results recorded for a woman who had her endometrial thickness monitored for a particular menstrual cycle.

DAY OF THE MENSTRUAL CYCLE	THICKNESS OF THE ENDOMETRIUM (mm)
0	14
7	3
14	5
21	13
28	16

2.3.2 Describe changes in the endometrium that cause it to become thicker.

- it becomes more vascular ✓ and
- more glandular ✓

(2)

2.3.3 State the significance of the change in endometrium thickness described in QUESTION 2.3.2.

It allows for implantation ✓ of the embryo / the development of the placenta / increased blood supply for nutrition of the developing embryo (1)

2.3.4 Draw a bar graph to show the results in the table.

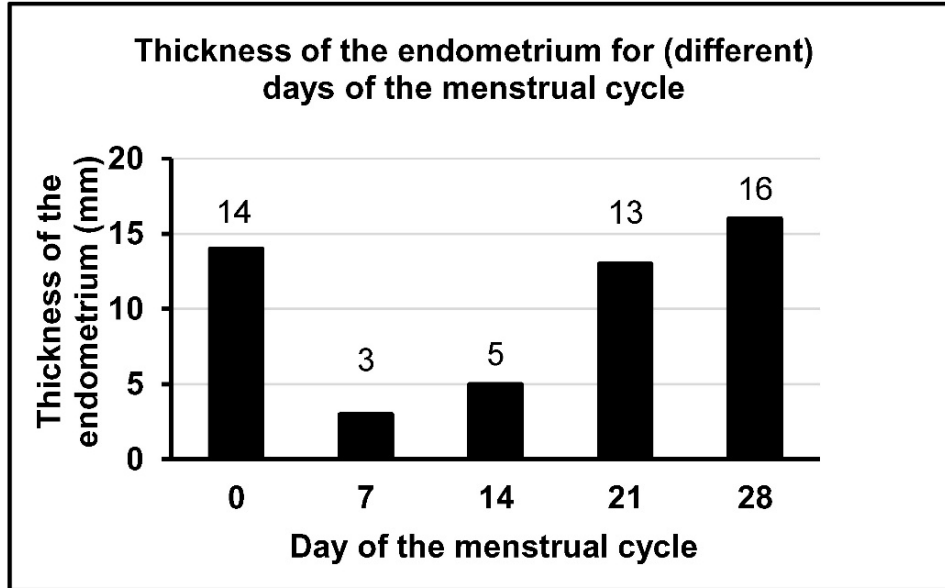
Common misconceptions & Errors

2.3.2 Candidates were unable to quantify the changes to the endometrium, i.e. **MORE vascular and MORE glandular**.

2.3.3 Candidates provided 'maintains pregnancy' ✗ which is too vague, i.e. elaborate on HOW it maintains pregnancy.

SECTION B – Menstrual cycle

2.3



Criteria for marking the graph:

Criteria	Mark allocation
Type of graph: Bar graph is drawn (T)	1
Caption of the graph includes both variables (C)	1
Correct labels for X-axis and Y-axis and correct unit for Y-axis (L)	1
Equal space and width of bars for X-axis and correct scale for Y-axis (S)	1
Plotting: (P)	
1 - 4 co-ordinates are plotted correctly	1
All 5 co-ordinates are plotted correctly	2

(6)

Common misconceptions & Errors

2.3.4 Candidates lost marks for:

- **incorrect caption** – the data was discontinuous (only specific days were given), yet candidates wrote 'over 28-day cycle'
- **not labelling day 0** on the X-axis
- **adding a range on the X-axis**, when the data was discontinuous
- **not using a ruler** – drawing irregular width bars/spaces
- transposing/**swopping the axes**
- **not indicating units** on the label of the Y-axis

NOTE

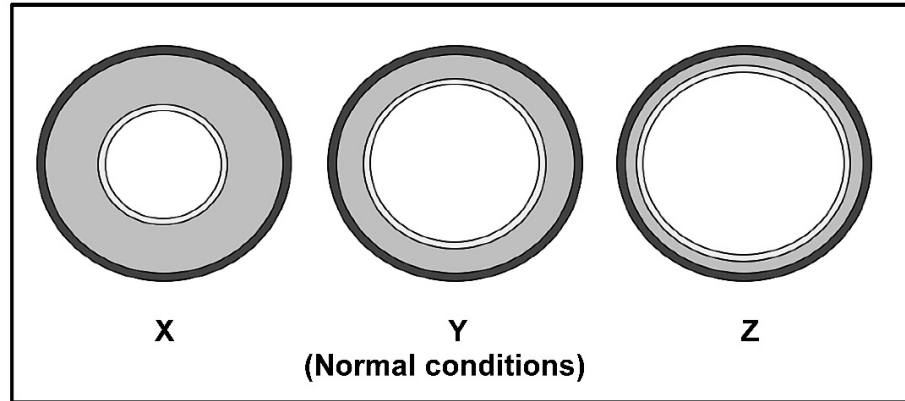
Graphing skills for Life Sciences were thoroughly revised on slide 47 of the [2023 Paper 1 Diagnostic Report Teaching & Learning Tool](#).



SECTION B – Thermoregulation

2.4

The diagrams represent the differences in the diameter of an arteriole (small artery) close to the surface of the skin. These differences are due to changes that occur during thermoregulation under different environmental conditions. Diagram **Y** shows the arteriole under normal conditions:



Common misconceptions & Errors

2.4.1 Name the part of the brain that controls thermoregulation.

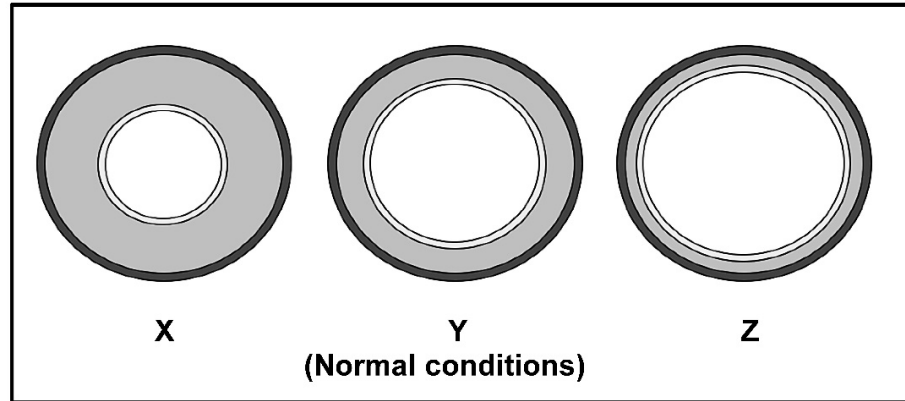
2.4.2 Give the LETTER of the diagram which represents the arteriole on a cold day.

2.4.3 Explain the significance of the change in the diameter of the arteriole from normal conditions to the condition in diagram **Z**.

SECTION B – Thermoregulation

2.4

The diagrams represent the differences in the diameter of an **arteriole (small artery)** close to the surface **of the skin**. These differences are due to changes that occur during thermoregulation under different environmental conditions. Diagram **Y** shows the arteriole under normal conditions:



2.4.1 Name the part of the brain that controls thermoregulation.

Hypothalamus ✓ (1)

2.4.2 Give the LETTER of the diagram which represents the arteriole on a cold day.

(Diagram) X ✓ (1)

2.4.3 Explain the significance of the change in the **diameter of the arteriole** from normal conditions to the condition in diagram **Z**.

- the arteriole dilates ✓ / vasodilation took place
 - more blood flows to (the surface of) the skin ✓ and
 - more heat is lost ✓ / more radiation occurs to
 - decrease/regulate the body temperature ✓
- (4)

Common misconceptions & Errors

2.4 Candidates **did not read the stem** of the question which clearly states the **pictures are of arterioles** in the skin NOT the pupillary mechanism. ✗

2.4.3 Candidates **included the description of the sweat gland** which was **irrelevant to the context** of the question.

Candidates did not specify that **MORE blood** flows to the skin on a hot day. Blood always flows to the skin, but on a hot day **more blood flows to the skin**.

SECTION B – Growth hormone investigation

2.5

Idiopathic Short Stature (ISS) describes a condition where children have normal birth height, but grow slowly and do not reach the expected height for their age group. This condition is NOT due to malnutrition or different lifestyles. Scientists investigated the effect of added growth hormone on the height of children with ISS.

The procedure was as follows:

- Consent was obtained from the parents of a group of two-year-old boys with ISS.
- The boys were divided into two groups.
- The participants in Group **A** received human growth hormone at a daily dosage of 0,028 mg per kg of body weight.
- The participants in Group **B** did not receive the hormone treatment.
- The height of the participants was measured and recorded monthly until each participant reached the age of 18 years.

At 18 years of age, the average height in Group **A** was 8 cm more than that in Group **B**.

2.5.1 State the dependent variable of this investigation.

2.5.2 List THREE variables that were kept constant and which contributed to the validity of the investigation.

Common misconceptions & Errors

SECTION B – Growth hormone investigation

2.5 Idiopathic Short Stature (ISS) describes a condition where children have normal birth height, but grow slowly and do not reach the expected height for their age group. This condition is NOT due to malnutrition or different lifestyles. Scientists investigated

AIM: the effect of **added growth hormone** on the **height** of children with ISS.

independent variable

dependent variable

The procedure was as follows:

- Consent was obtained from the parents of a group of two-year-old boys with ISS.
- The boys were divided into two groups.
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- The height of the participants was measured and recorded monthly until each participant reached the age of 18 years.

At 18 years of age, the average height in Group **A** was 8 cm more than that in Group **B**.

2.5.1 State the **dependent variable** of this investigation.

height✓

(1)

2.5.2 List THREE variables that were kept constant and which contributed to the validity of the investigation.

- gender✓/ only boys participated
- all (the boys) had ISS✓
- age✓/ all (the boys) were 2-years old
- duration of investigation✓

(first 3)

Common misconceptions & Errors

2.5.1 Candidates lost marks because they **could not identify a variable** or wrote 'average height'× instead of just **'height'**

REMEMBER

Always use the **AIM** of the investigation to identify the variables!



2.5.2 Candidates **incorrectly wrote** '2 years old'× instead of 'age'

SECTION B – Growth hormone investigation

2.5

Idiopathic Short Stature (ISS) describes a condition where children have normal birth height, but grow slowly and do not reach the expected height for their age group. This condition is NOT due to malnutrition or different lifestyles. Scientists investigated the effect of added growth hormone on the height of children with ISS.

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- The height of the participants was measured and recorded monthly until each participant reached the age of 18 years.

At 18 years of age, the average height in Group **A** was 8 cm more than that in Group **B**.

2.5.3 Explain the purpose of Group **B** in this investigation.

Common misconceptions & Errors

SECTION B – Growth hormone investigation

2.5

Idiopathic Short Stature (ISS) describes a condition where children have normal birth height, but grow slowly and do not reach the expected height for their age group. This condition is NOT due to malnutrition or different lifestyles. Scientists investigated the effect of added growth hormone on the height of children with ISS.

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- The height of the participants was measured and recorded monthly until each participant reached the age of 18 years.

At 18 years of age, the average height in Group **A** was 8 cm more than that in Group **B**.

2.5.3 Explain the purpose of Group **B** in this investigation.

To prove that the added growth hormone caused the change in the height of the boys and not any other factor ✓✓

(2)

Common misconceptions & Errors

2.5.3 Candidates gave generic explanations, rather than using the specific data for this investigation.

REMEMBER

Group B is the control group. The purpose of a control group is always to prove that the independent variable caused the results, and not some other unknown factor.

By removing the independent variable from the control group, we can see its effects by comparing the results of the control group and experimental group.

HOWEVER – always specify WHAT the independent variable is for the specific investigation.



SECTION B – Growth hormone investigation

2.5

Idiopathic Short Stature (ISS) describes a condition where children have normal birth height, but grow slowly and do not reach the expected height for their age group. This condition is NOT due to malnutrition or different lifestyles. Scientists investigated the effect of added growth hormone on the height of children with ISS.

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- The height of the participants was measured and recorded monthly until each participant reached the age of 18 years.

At 18 years of age, the average height in Group **A** was 8 cm more than that in Group **B**.

2.5.4 Calculate the daily amount of added human growth hormone that was given to a boy with a mass of 25 kg. Show ALL your working, INCLUDING the correct unit.

Common misconceptions & Errors

SECTION B – Growth hormone investigation

2.5

Idiopathic Short Stature (ISS) describes a condition where children have normal birth height, but grow slowly and do not reach the expected height for their age group. This condition is NOT due to malnutrition or different lifestyles. Scientists investigated the effect of added growth hormone on the height of children with ISS.

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At 18 years of age, the average height in Group **A** was 8 cm more than that in Group **B**.

2.5.4 Calculate the daily amount of added human growth hormone that was given to a boy with a mass of 25 kg. Show ALL your working, INCLUDING the correct unit.

$$\begin{aligned} &(25 \times 0,028) \checkmark \\ &= 0,7 \checkmark \text{ mg} \checkmark \end{aligned}$$

(3)

Common misconceptions & Errors

2.5.4 Candidates lost marks for **not including the unit of measurement**, or **including an incorrect unit**, even though it was requested in the question.

Some candidates expected the answer to be a percentage and **incorrectly included a 'x 100'** to their calculations.

NOTE

Calculations for Life Sciences were thoroughly revised on [slide 70](#) of the [2023 Paper 1 Diagnostic Report Teaching & Learning Tool](#).



SECTION B – Growth hormone investigation

2.5

Idiopathic Short Stature (ISS) describes a condition where children have normal birth height, but grow slowly and do not reach the expected height for their age group. This condition is NOT due to malnutrition or different lifestyles. Scientists investigated the effect of added growth hormone on the height of children with ISS.

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- The height of the participants was measured and recorded monthly until each participant reached the age of 18 years.

At 18 years of age, the average height in Group **A** was 8 cm more than that in Group **B**.

2.5.5 Give a conclusion for this investigation.

Common misconceptions & Errors

SECTION B – Growth hormone investigation

2.5 Idiopathic Short Stature (ISS) describes a condition where children have normal birth height, but grow slowly and do not reach the expected height for their age group. This condition is NOT due to malnutrition or different lifestyles. Scientists investigated the **effect of added growth hormone on the height of children with ISS**.

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- The height of the participants was measured and recorded monthly until each participant reached the age of 18 years.

At 18 years of age, the average height in Group **A** was 8 cm more than that in Group **B**.

2.5.5 Give a conclusion for this investigation.

Added growth hormone causes an increase in the height of children with ISS ✓✓

Common misconceptions & Errors

2.5.5 Candidates were unable to correctly write a **conclusion that included both variables** and that **was based on the results of the investigation**.

They also incorrectly stated 'growth hormone' instead of '**added growth hormone**'.

NOTE

(2) Scientific Investigations were thoroughly revised on slide 70 of the [2023 Paper 1 Diagnostic Report Teaching & Learning Tool](#).



SECTION B QUESTION 2 – Suggestions for improvement

☑ In **physiological processes**, it is crucial to **quantify the process**, e.g.: MORE blood flows, LESS water is excreted, HIGHER progesterone levels occur, etc. :

- **MORE** blood flows...
- **LESS** water is excreted...
- **HIGHER** progesterone levels occur...

NOTE

These processes **ALWAYS** occur. Changes in the internal/external environment will cause them to occur MORE/LESS.



☑ **Writing captions for graphs** is an important skill. The caption should:

- include **both variables**
- **speak directly to the data** presented
- **identify** for which **country, year, etc.** the data is representative

NOTE

Graphing skills for Life Sciences were thoroughly revised on **slide 47** of the [2023 Paper 1 Diagnostic Report Teaching & Learning Tool](#).

☑ Make sure to **emphasise** the different **events/hormones** of the **ovarian vs uterine cycle** of the menstrual cycle.



Let's revise this

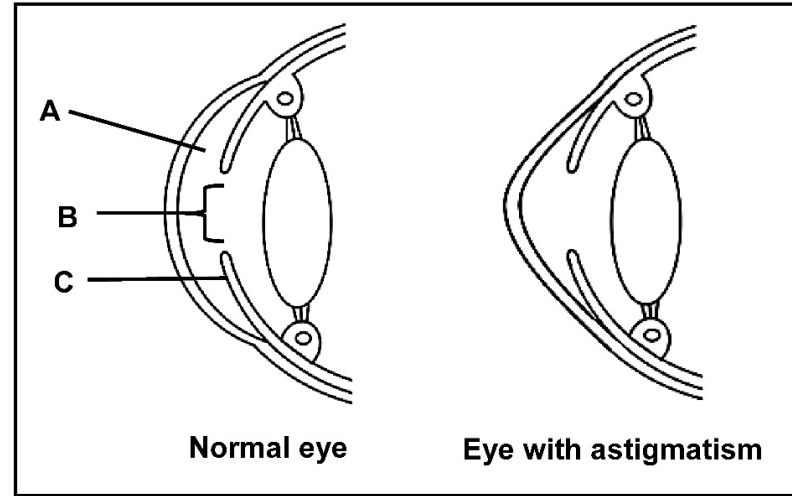
SECTION B – Eye structure and astigmatism

3.1

The diagrams represent the structure of a normal eye and that of an eye with astigmatism.

3.1.1 Identify:

- (a) Fluid **A**
- (b) Part **B**
- (c) Part **C**



Common misconceptions & Errors

3.1.2 Describe the appearance of the cornea of an eye with astigmatism.

SECTION B – Eye structure and astigmatism

3.1

The diagrams represent the structure of a normal eye and that of an eye with astigmatism.

3.1.1 Identify:

(a) Fluid **A**

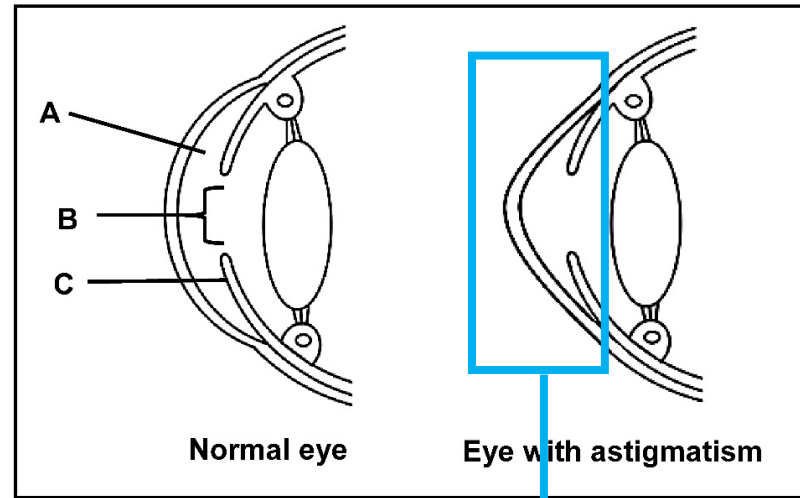
aqueous humour ✓ (1)

(b) Part **B**

pupil ✓ (1)

(c) Part **C**

iris ✓ (1)



3.1.2 Describe the appearance of the cornea of an eye with astigmatism.

It is not evenly curved ✓ / rounded

(1)

Common misconceptions & Errors

3.1.1 (a) Candidates **lost marks for:**

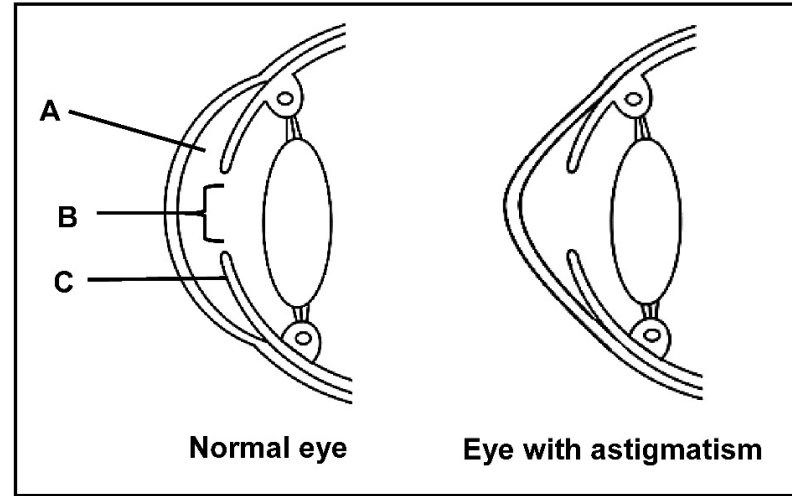
- incorrect **spelling** of 'aqueous'
- writing '**vitreous** humour' ✗ instead of 'aqueous humour'
- Writing 'aqueous **fluid**' ✗ instead of 'aqueous humour'

3.1.2 Candidates **could not provide an adequate description** of the appearance of the **astigmatic cornea**.

SECTION B – Eye structure and astigmatism

3.1

The diagrams represent the structure of a normal eye and that of an eye with astigmatism.



Common misconceptions & Errors

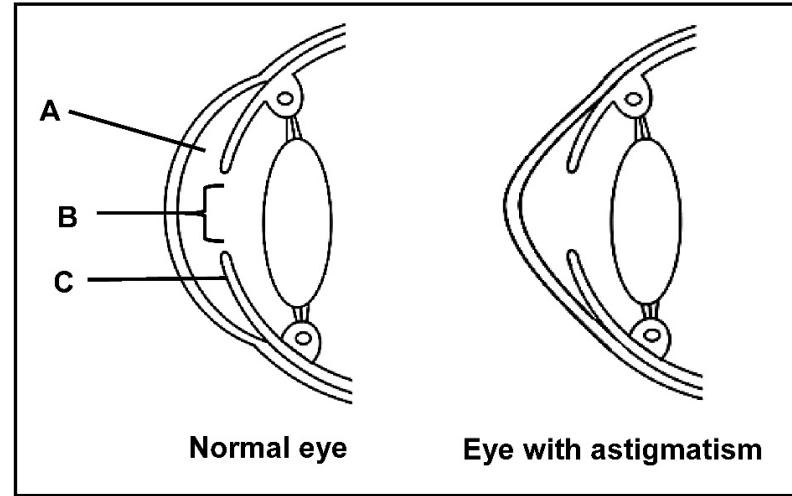
3.1.3 Explain how astigmatism affects vision.

3.1.4 Give ONE treatment for astigmatism.

SECTION B – Eye structure and astigmatism

3.1

The diagrams represent the structure of a normal eye and that of an eye with astigmatism.



3.1.3 Explain how astigmatism affects vision.

- the light is refracted unevenly✓/ in different directions and
- does not focus on the retina✓
- forming a blurred image✓

(3)

3.1.4 Give ONE treatment for astigmatism.

- laser✓
- surgery✓
- glasses✓/spectacles/lenses

(first 1)

Common misconceptions & Errors

3.1.3 Candidates **lost marks** because they:

- confused 'refraction' and 'reflection'
- confused **astigmatism** with **cataracts**
- were **unable to make the link** between an **unevenly shaped** cornea and the **effect on vision**

3.1.4 Candidates **confused disorders** and indicated the treatments for short-/long-sightedness or cataracts.

SECTION B – Human nervous system

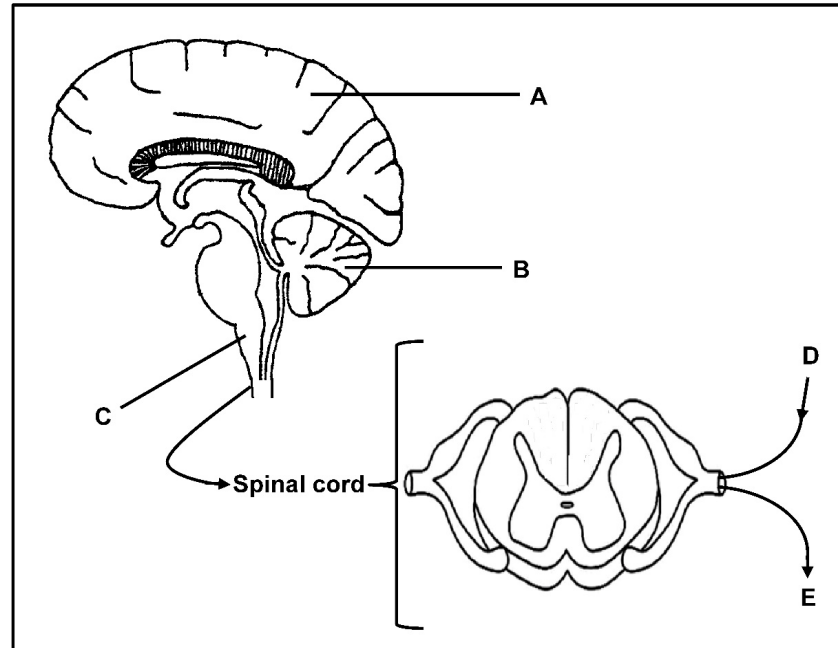
3.2

The diagrams show parts of the human nervous system.

3.2.1 Name the branch of the nervous system represented by the parts shown.

3.2.2 Give the LETTER and NAME of the part responsible for:

- (a) Balance and coordination
- (b) Control of breathing
- (c) Control of skeletal muscles



Common misconceptions & Errors

SECTION B – Human nervous system

3.2

The diagrams show parts of the human nervous system.

3.2.1 Name the branch of the nervous system represented by the parts shown.

Central nervous system ✓ (1)

3.2.2 Give the LETTER and NAME of the part responsible for:

(a) Balance and coordination

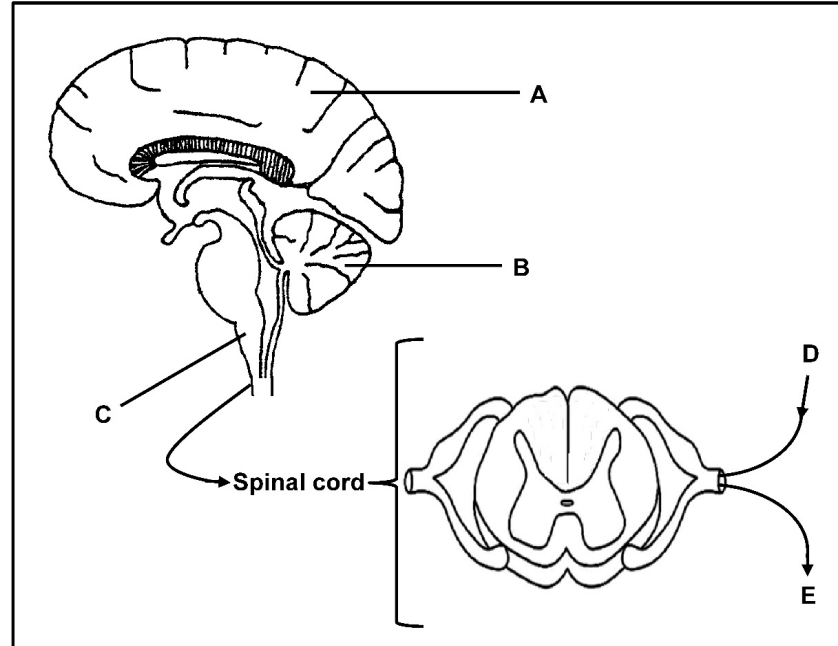
B ✓ – cerebellum ✓ (2)

(b) Control of breathing

C ✓ – medulla oblongata ✓ (2)

(c) Control of skeletal muscles

A ✓ – cerebrum ✓ (2)



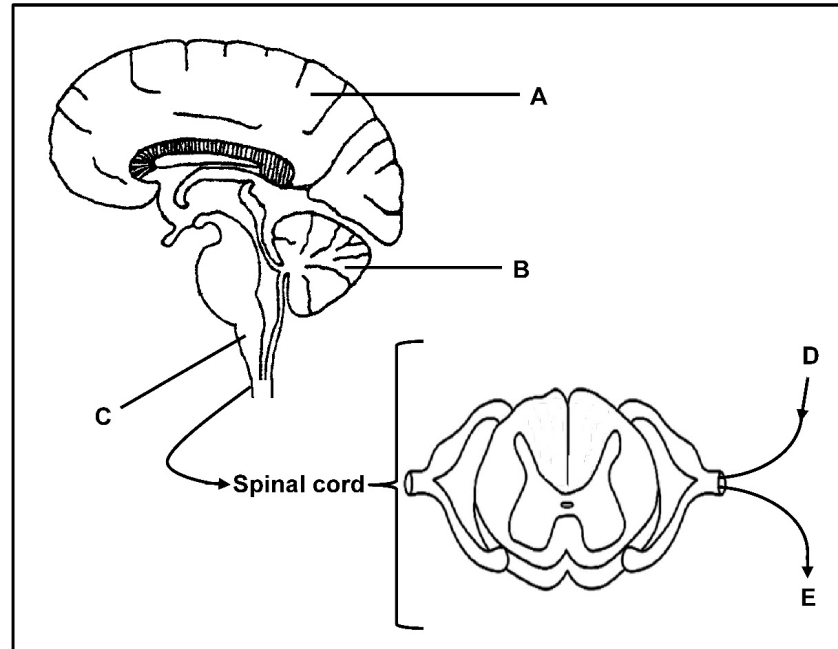
Common misconceptions & Errors

3.2.1 Candidates **only wrote 'central'x** instead of the full name **'central nervous system.'**

SECTION B – Human nervous system

3.2 The diagrams show parts of the human nervous system.

3.2.3 Describe the pathway of an impulse from part **D** through the spinal cord to part **E**, to bring about a reflex action.



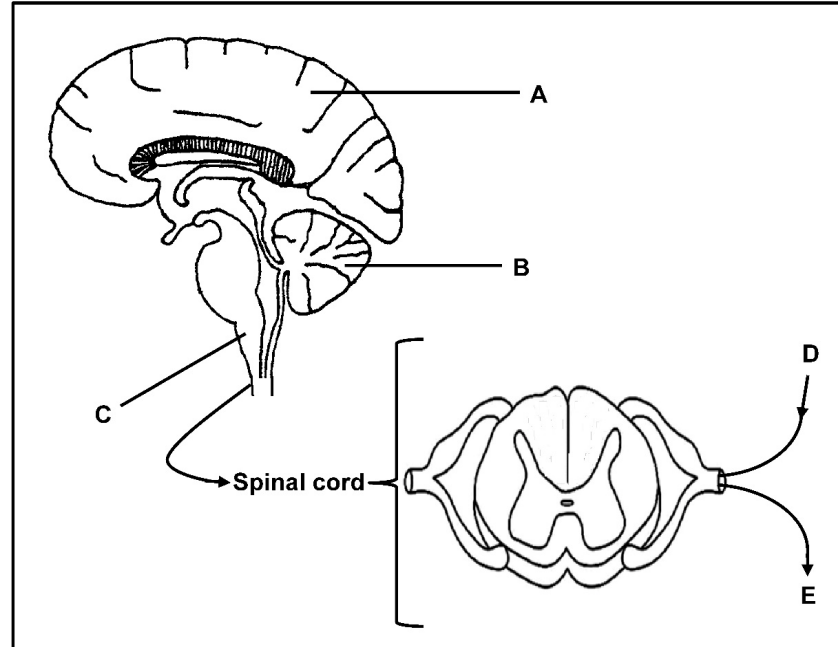
Common misconceptions & Errors

SECTION B – Human nervous system

3.2

The diagrams show parts of the human nervous system.

3.2.3 Describe the pathway of an impulse from part **D** through the spinal cord to part **E**, to bring about a reflex action.



- (the impulse) is transmitted by the sensory neuron✓
- via the dorsal root of the spinal nerve✓ to
- the interneuron✓ and to
- the motor neuron✓
- by synaptic✓ contact
- it is then transmitted via the ventral root (of the spinal nerve)✓
- to the effector✓ which brings about the reflex action

(any 6)

Common misconceptions & Errors

3.2.3 The question/memo was taken **directly from the exam guidelines**, yet candidates still **lost marks for**:

- referring to the **dorsal and ventral roots** as being **part of the spinal cord**✗ instead of the spinal nerve
- said a **stimulus is transmitted**✗ instead of an impulse
- failed to refer to the **synapses** and **effector** at all



Let's practice this

SECTION B – Eye accommodation

3.3 Describe how the human eye ACCOMMODATES for distant vision.

Common misconceptions & Errors

SECTION B – Eye accommodation

3.3 Describe how the human eye ACCOMMODATES for distant vision.

- ciliary muscles relax✓
- suspensory ligaments become taut✓/ tension on the lens increases
- the lens becomes less convex✓ causing
- light to be refracted less✓
- to form a clear image on the retina✓

(5)

Common misconceptions & Errors

3.3 Candidates **lost marks when they:**

- **confused accommodation with pupillary mechanism**✗
- stated that the '**suspensory ligaments contract**'✗ (it is not a muscle and cannot contract), instead of '**become taut**'
- **confused ciliary muscle and circular muscle**
- wrote accounts for **both near and distant vision** – only the first one was marked
- referred to '**less light is refracted**'✗ (amount of light) instead of '**light is less refracted**' (degree of refraction)



Let's revise accommodation vs pupillary mechanism

SECTION B – Structure of the human ear

3.4 The diagram shows the structure of the human ear.

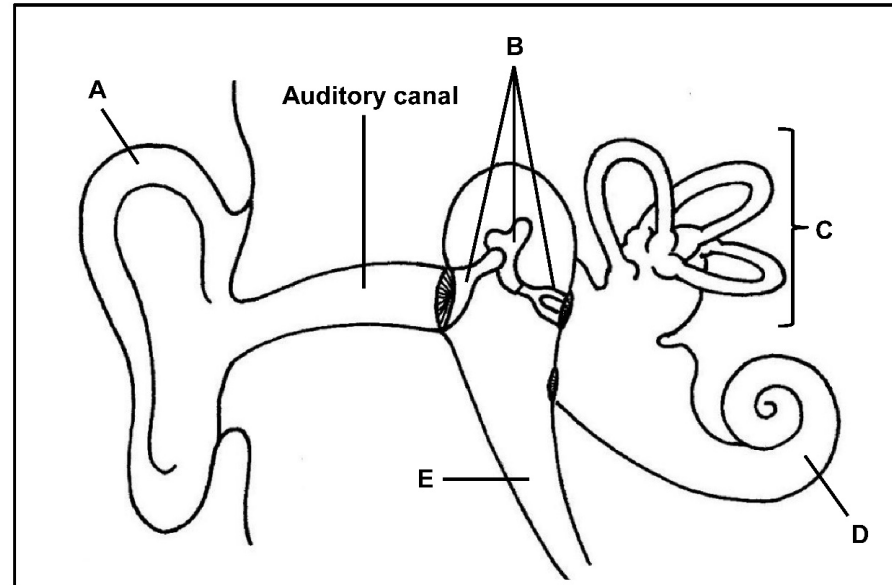
3.4.1 Identify part:

(a) **A**

(b) **B**

3.4.2 Give the LETTERS of TWO parts that are normally filled with fluid.

3.4.3 Describe how balance is restored when there is a change in the speed and direction of head movement.



Common misconceptions & Errors

SECTION B – Structure of the human ear

3.4

The diagram shows the structure of the human ear.

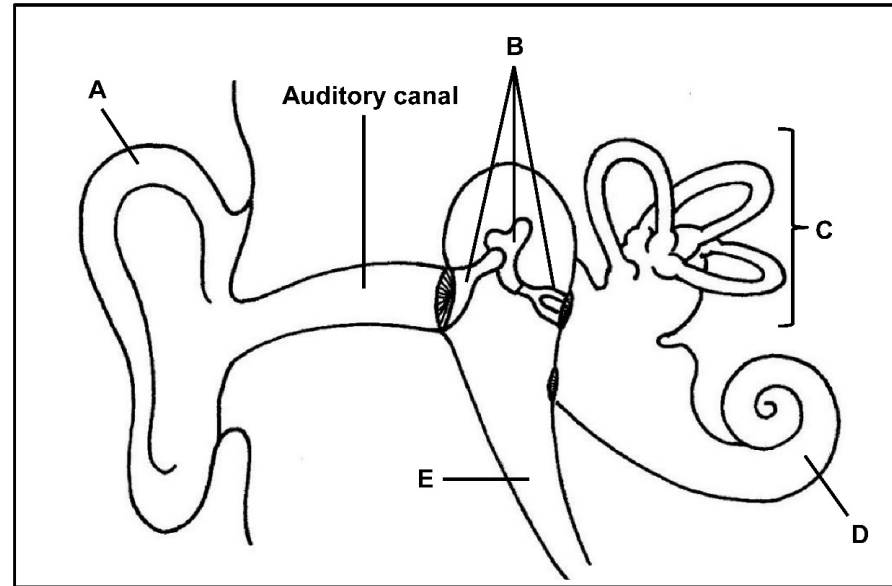
3.4.1 Identify part:

(a) **A** Pinna ✓ (1)

(b) **B** Ossicles ✓ (1)

3.4.2 Give the LETTERS of TWO parts that are normally filled with fluid.

C ✓ and **D** ✓ (2)



Common misconceptions & Errors

3.4.3 Candidates **struggled to describe** the **maintenance of balance** in the ear.



3.4.3 Describe how balance is restored when there is a change in the speed and direction of head movement.

- cristae are stimulated ✓ and
- convert the stimulus to an impulse ✓ which
- is sent via the auditory nerve ✓
- to the cerebellum ✓ for interpretation
- impulses are sent to the skeletal muscles ✓ to restore balance

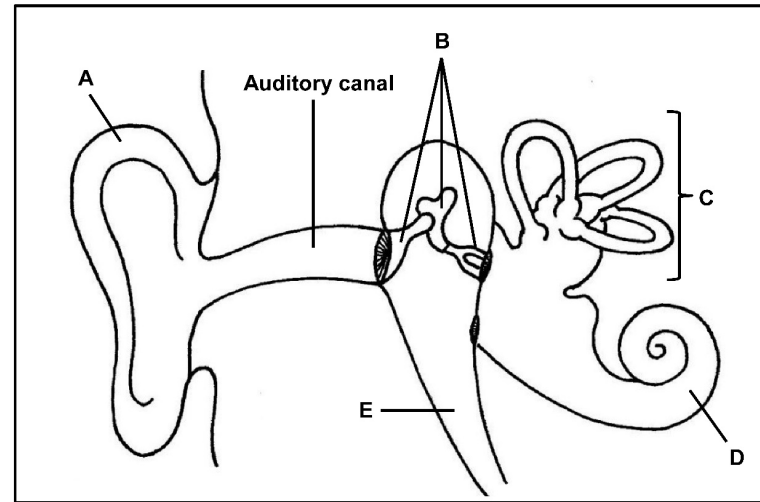
(5)

SECTION B – Structure of the human ear

3.4

3.4.4 When a person is exposed to loud noise over a long period, it may lead to noise-induced hearing loss (NIHL), which is caused by damage to the hair cells in the organ of Corti. These cells are not repaired when damaged. Placing earplugs in the auditory canal can prevent damage to the hair cells. Explain how:

(a) Damage to the hair cells in the organ of Corti can lead to hearing loss



Common misconceptions & Errors

(b) Earplugs can prevent damage to the hair cells in the organ of Corti

SECTION B – Structure of the human ear

3.4

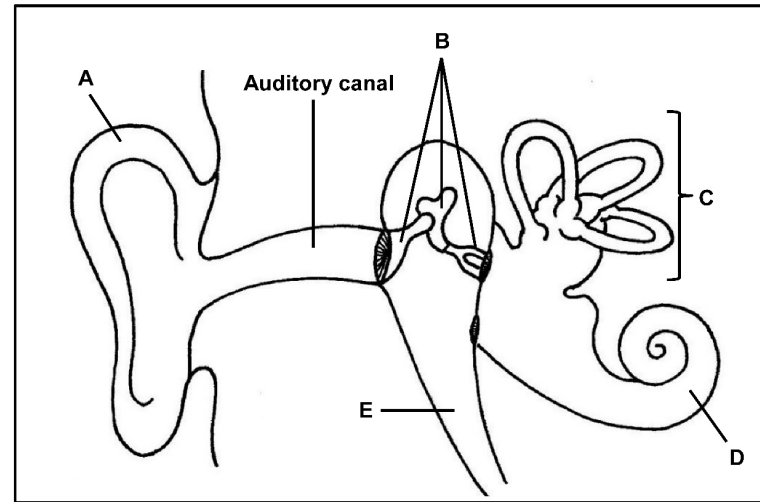
3.4.4 When a person is exposed to loud noise over a long period, it may lead to noise-induced hearing loss (NIHL), which is caused by damage to the hair cells in the organ of Corti. These cells are not repaired when damaged. Placing earplugs in the auditory canal can prevent damage to the hair cells. Explain how:

(a) Damage to the hair cells in the organ of Corti can lead to hearing loss

- fewer/no stimuli will be converted to impulses ✓
- fewer/no impulses will be sent to the cerebrum ✓ to be interpreted (2)

(b) Earplugs can prevent damage to the hair cells in the organ of Corti

- the earplugs limit the sound waves in the auditory canal ✓ / reaching the tympanic membrane ✓
- fewer vibrations are formed in the middle ear ✓
- fewer pressure waves are formed in the cochlea ✓ to prevent damage (3)



Common misconceptions & Errors

3.4.4 Candidates could not apply their knowledge of the hearing process to a new scenario where there is hearing loss.

They used colloquial language instead of scientific language.

They mentioned the 'noise' or 'sound' entering the ear, but did not show an understanding of how sound waves entered the auditory canal and were converted into vibrations as they moved through the middle ear and pressure waves as they moved through the inner ear.

NOTE

Movement of a sound stimulus through the ear was thoroughly revised on slide 20 of the [2023 Paper 1 Diagnostic Report Teaching & Learning Tool](#).



THE
ANSWER
SERIES Your Key to Exam Success

SECTION B – Insulin and Diabetes

3.5

The graph shows the insulin levels of three people over a 23-hour period, who were treated as follows:

Person A:

A healthy person who received no treatment

Person B:

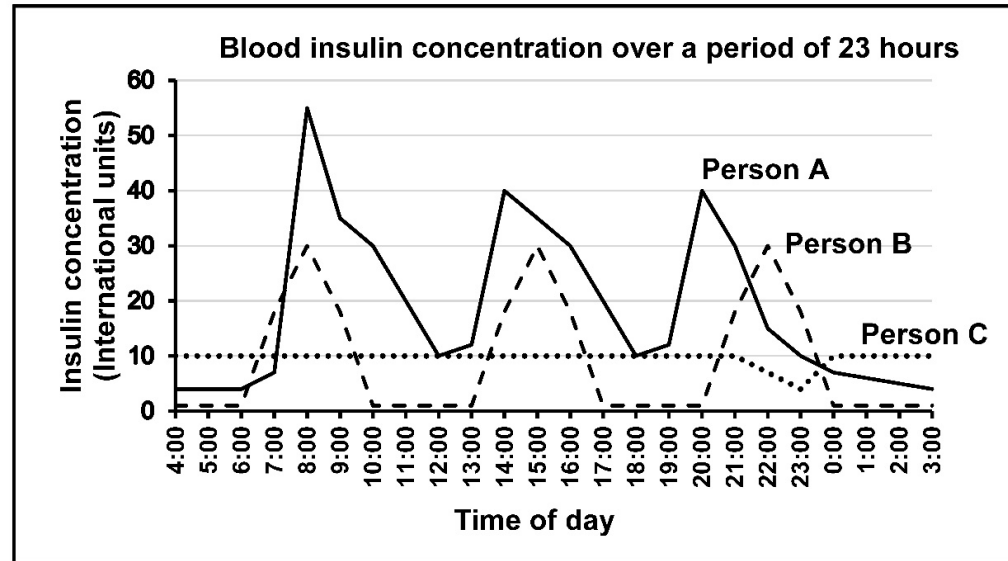
A person with diabetes mellitus who received a rapid-acting insulin injection before each meal

Person C: A person with diabetes mellitus who received a daily injection, containing long-acting insulin, at 23:00

All three people received the same meals at the same time of the day.

3.5.1 Name the organ that secretes insulin.

3.5.2 State the number of meals that were eaten during the 23-hour period.



Common misconceptions & Errors

SECTION B – Insulin and Diabetes

3.5

The graph shows the insulin levels of three people over a 23-hour period, who were treated as follows:

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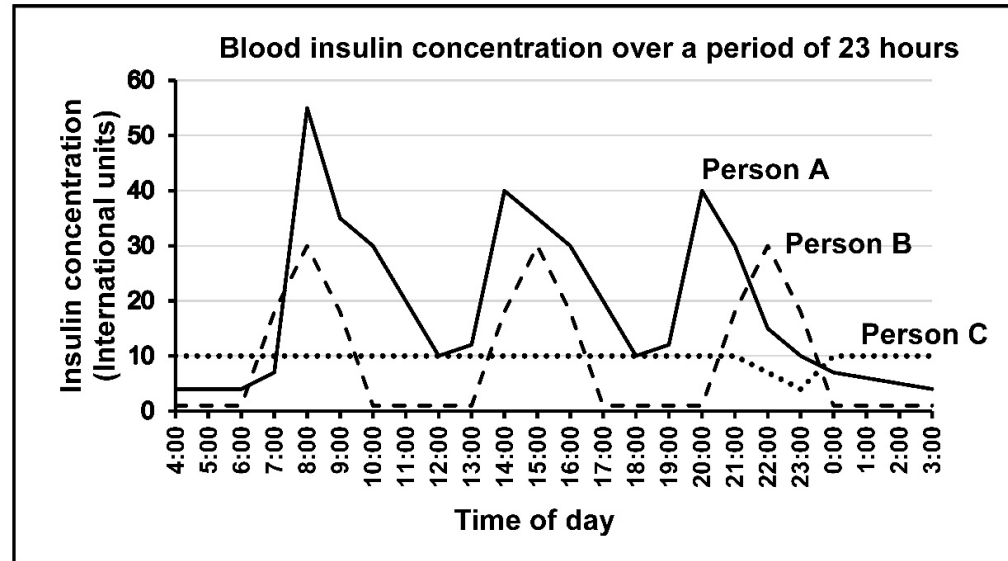
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Person C: A person with diabetes mellitus who received a daily injection, containing long-acting insulin, at 23:00

All three people received the same meals at the same time of the day.



Common misconceptions & Errors

3.5.1 Candidates identified **cells** (Islets of Langerhans) × instead of an **organ** (pancreas) as asked.

3.5.1 Name the organ that secretes insulin.

Pancreas ✓

(1)

3.5.2 State the number of meals that were eaten during the 23-hour period.

Three ✓/nine

(1)

SECTION B – Insulin and Diabetes

3.5

The graph shows the insulin levels of three people over a 23-hour period, who were treated as follows:

Person **A**:

A healthy person who received no treatment

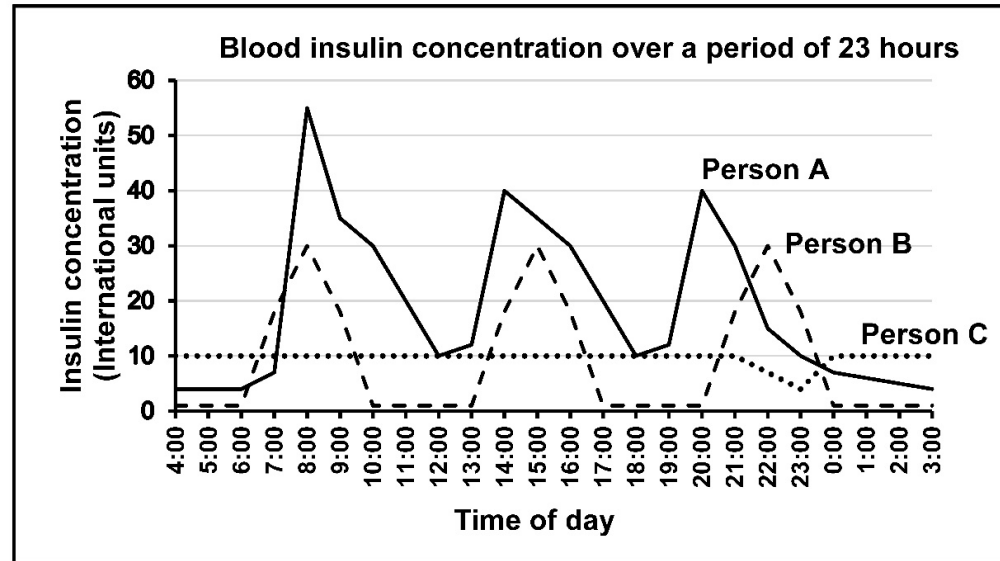
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All three people received the same meals at the same time of the day.

3.5.3 Tabulate TWO differences between long-acting insulin treatment and rapid-acting insulin treatment over the 23-hour period.



Common misconceptions & Errors

SECTION B – Insulin and Diabetes

3.5

3.5.3 Tabulate TWO differences between long-acting insulin treatment and rapid-acting insulin treatment over the 23-hour period.

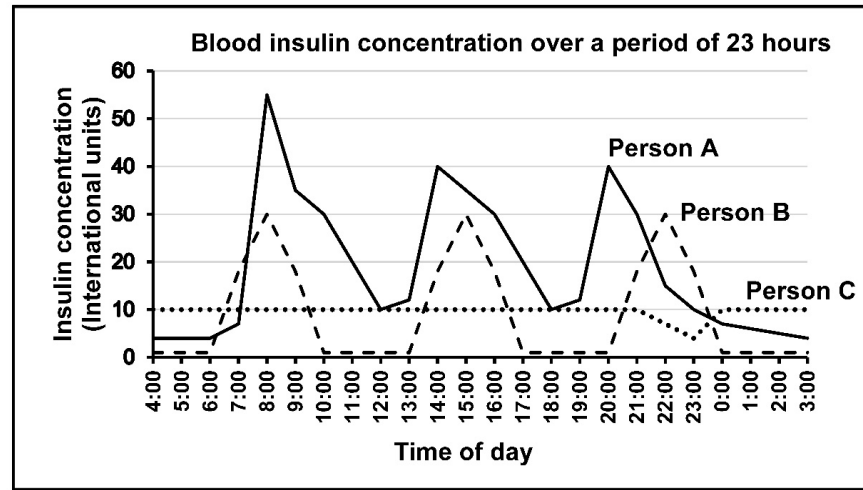


Table (1) + any (2 x 2) = (5); first 2 only

LONG-ACTING INSULIN TREATMENT	RAPID-ACTING INSULIN TREATMENT
One injection ✓ is given over 23 hours	Three injections ✓ are given over 23 hours
The injection is given at 23:00 ✓	An injection is given before every meal ✓
The injection causes a lower concentration of insulin ✓ / 10 international units	The injections causes a higher concentration of insulin ✓ / 30 international units
The concentration of insulin in the blood remains constant for long periods of time ✓ / 20 hours	The concentration of insulin in the blood fluctuates ✓ / increases and drops
Long lasting effect ✓	Lasts a shorter amount of time ✓
Insulin concentration takes 1 hour to increase to its peak ✓	Insulin concentration takes 2 hours to increase to its peak ✓

Common misconceptions & Errors

3.5.3 Question required candidates to derive two conclusions from a graph and then tabulate the differences between the two conclusions. Lost marks due to:

- differences/comparisons given **not** always correlating correctly
- referring to 'glucose levels' rather than 'insulin levels'
- describing insulin levels at **specific times** rather than the **overall effect of the treatment**
- stating that long-acting insulin lasted a long time and rapid-acting insulin acted quickly – this was a description of the type of insulin, **not differences in the effect of the treatment**

SECTION B – Insulin and Diabetes

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The graph shows the insulin levels of three people over a 23-hour period, who were treated as follows:

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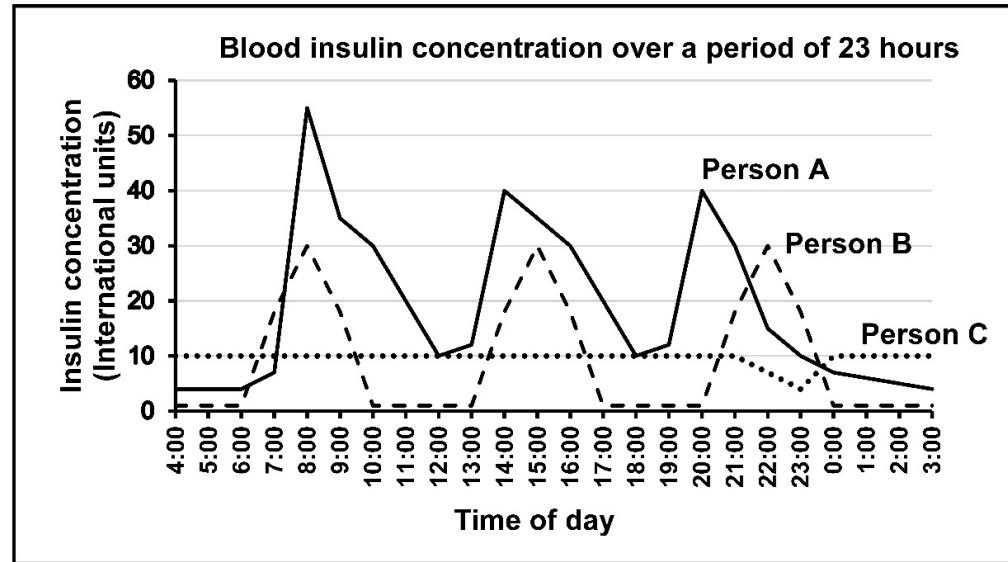
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All three people received the same meals at the same time of the day.

3.5.4 Name the type of insulin treatment that is similar to insulin secretion in a healthy person.



Common misconceptions & Errors

SECTION B – Insulin and Diabetes

3.5

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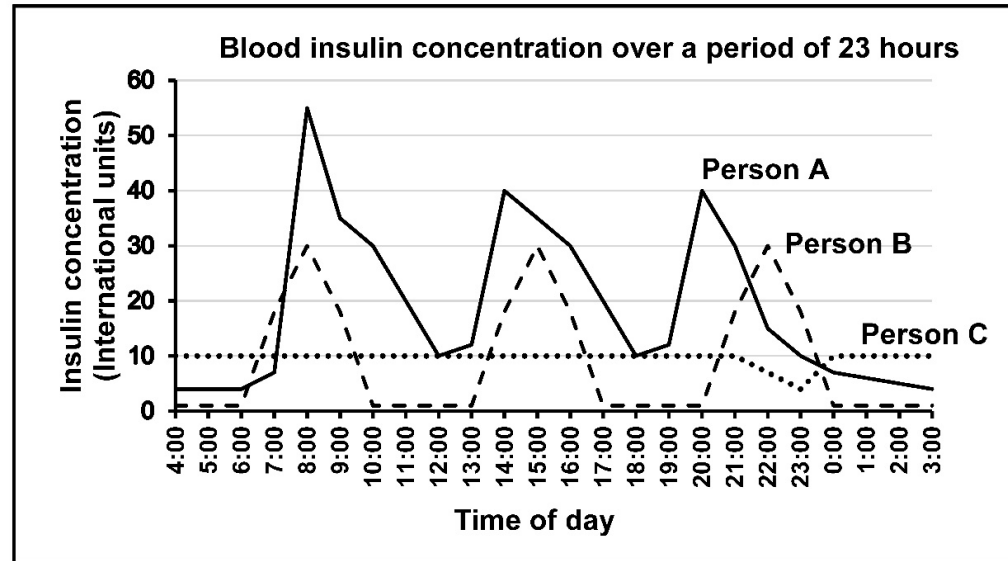
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All three people received the same meals at the same time of the day.

3.5.4 Name the type of insulin treatment that is similar to insulin secretion in a healthy person.

rapid-acting ✓ insulin

(1)



Common misconceptions & Errors

SECTION B – Insulin and Diabetes

3.5

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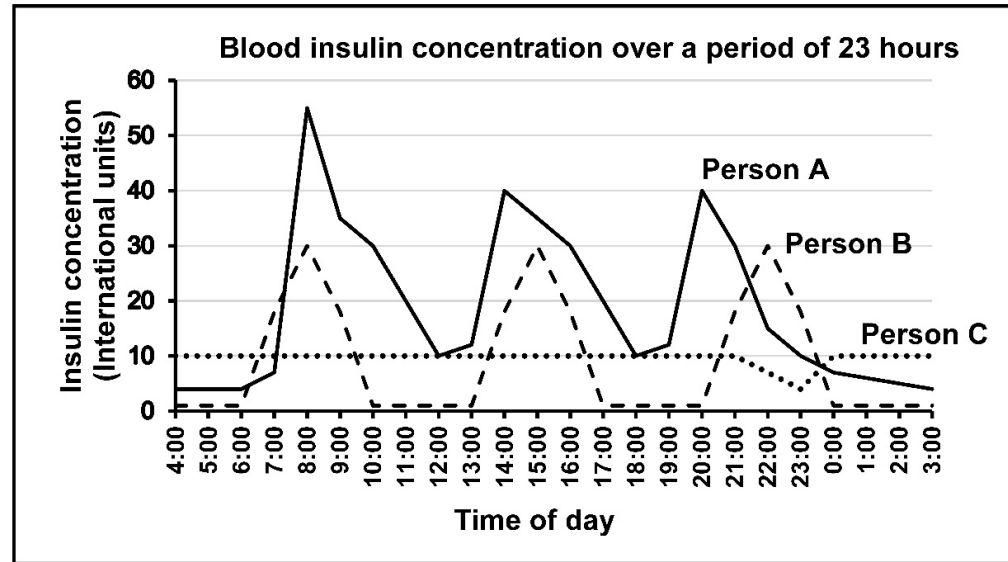
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All three people received the same meals at the same time of the day.

3.5.5 Explain why person **B** may experience a lack of energy after receiving a rapid-acting insulin injection if NO meal is taken.



Common misconceptions & Errors

SECTION B – Insulin and Diabetes

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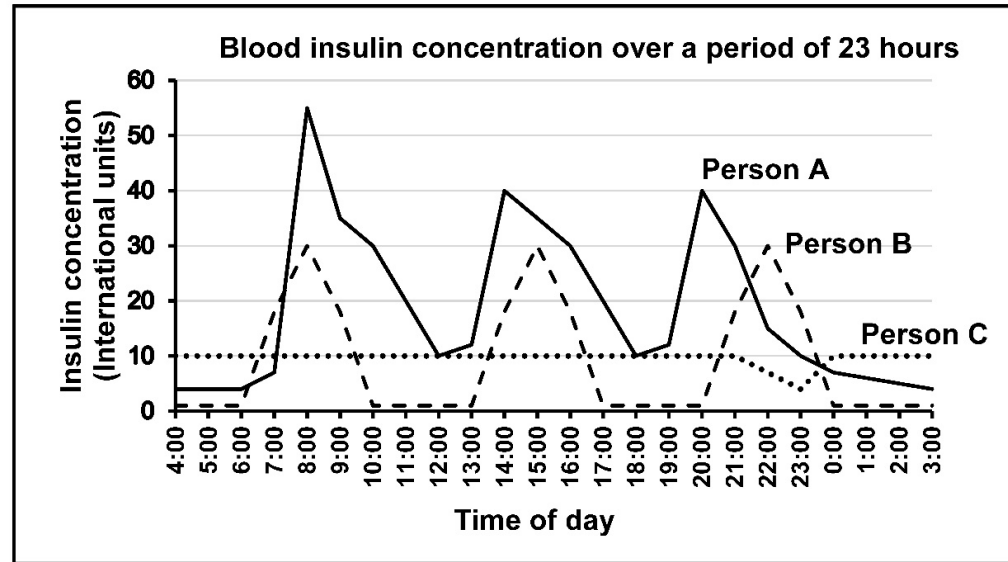
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Person B:

A person with diabetes mellitus who received a rapid-acting insulin injection before each meal

Person C: A person with diabetes mellitus who received a daily injection, containing long-acting insulin, at 23:00

All three people received the same meals at the same time of the day.



Common misconceptions & Errors

3.5.5 Candidates could not predict the effect of insulin on already low blood glucose levels.

They incorrectly wrote:

- Glycogen is converted into glucose~~x~~
- Glucagon~~x~~ instead of glycogen

They could not make the link between low glucose levels and cellular respiration.

3.5.5 Explain why person B may experience a lack of energy after receiving a rapid-acting insulin injection if NO meal is taken.

- the insulin will reduce the glucose level even further✓/ glucose is converted to glycogen / increased glucose uptake by cells
- there is less glucose available for cellular respiration✓

(2)

SECTION B QUESTION 3 – Suggestions for improvement

- ☑ More practice is needed in **identifying disorders** and **stating a cause/effect relationship**.
Apply the following format

- **Identify** the **structure**
- **Identify** its **function**
- Consider **how the function is affected** when the structure is **damaged**
- Consider **how** the disorder may be **treated/corrected**

NOTE

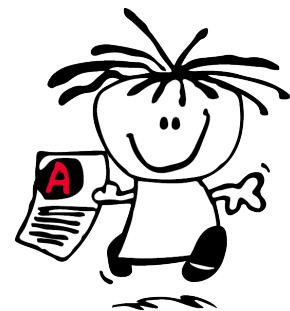
Cause-and-effect questions were thoroughly covered on slide 93 of the [2024 Paper 1 Diagnostic Report Teaching & Learning Tool](#).



- ☑ Provide **more opportunities** for learners to practice **tabulating**.

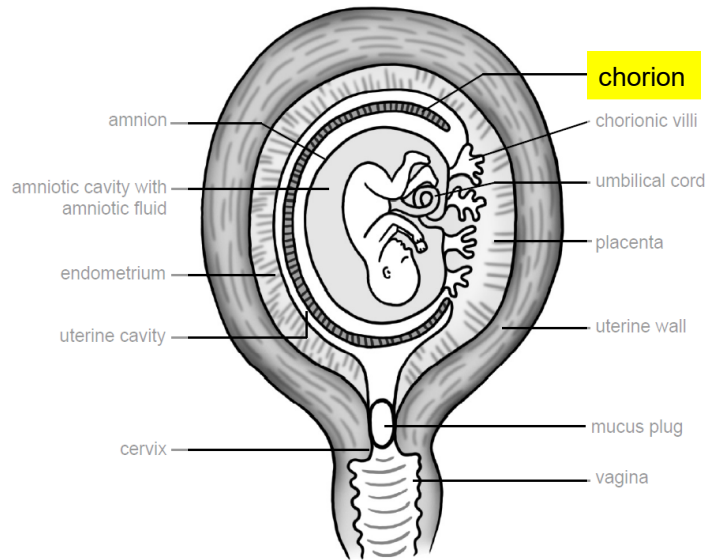
- A feature mentioned in the **first column**, must **correspond to** its comparison statement in the **same row of the second column**

END

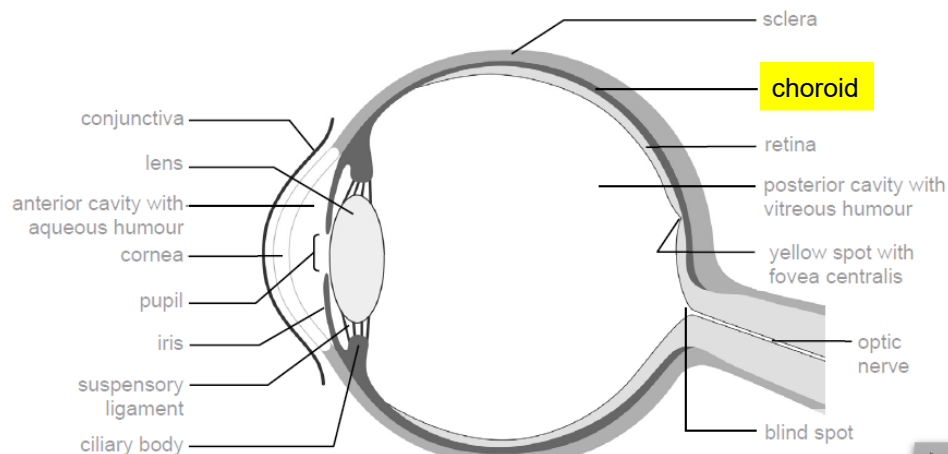


THE
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COMMONLY CONFUSED TERMS – chorion and choroid



Developing foetus enclosed by embryonic membranes (amnion and chorion)



Internal structure of the eye

Extracts from *The Answer Series*
Grade 12 Life Sciences Part 1
(2022 ed.) p. 25 & 55

Chorion

- ✓ The outermost extra-embryonic membrane surrounding the embryo.
- ✓ The chorion develops finger-like projections called chorionic villi that grow into the endometrium during implantation.

Choroid

- ✓ A thin, darkly pigmented, vascular layer in the eye.
- ✓ The pigment absorbs excess light rays to prevent internal reflection in the eye.
- ✓ The blood vessels supply oxygen and nutrients to the cells and remove waste products.

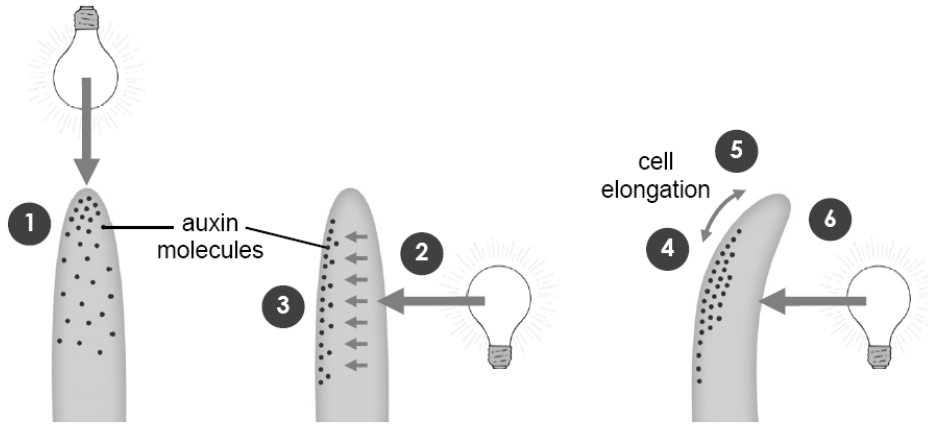


Continue learning – auxin vs axon



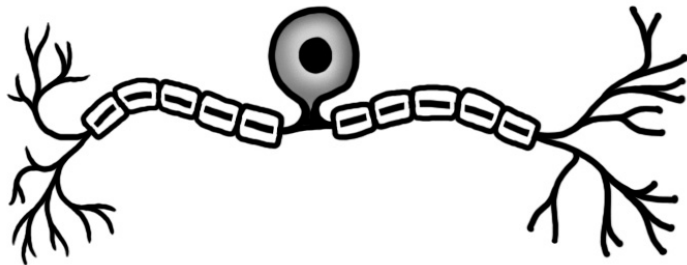
COMMONLY CONFUSED TERMS – auxin vs axon

Extract from *The Answer Series*
Grade 12 Life Sciences P1 (2025 ed.)
p. 34 & 88



Auxin

- ✓ A group of **light sensitive plant hormones** that are mainly produced in the apical meristem of stems.



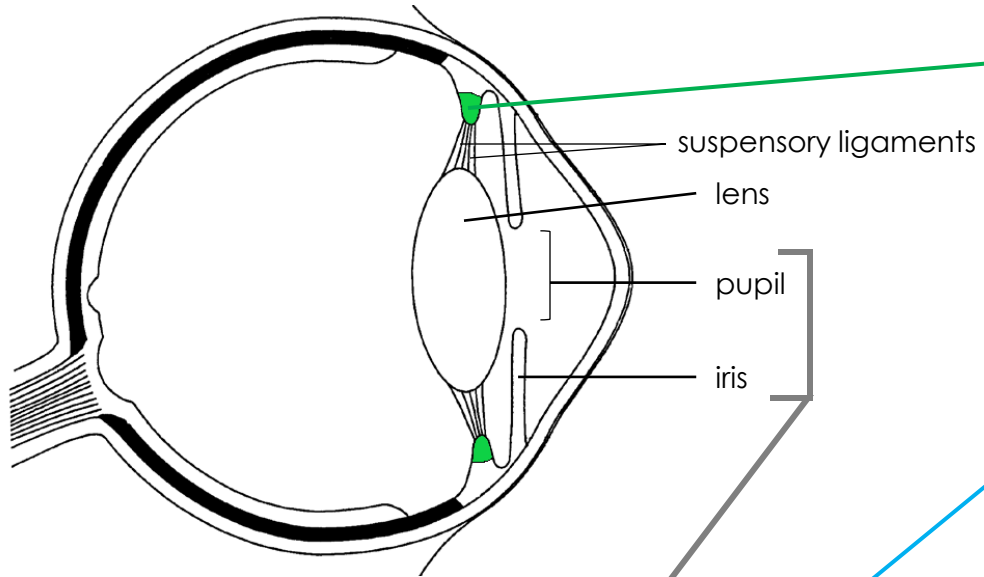
Axon

- ✓ A **type of outgrowth/process** that extends **from a neuron's cell body**.
- ✓ Axons **conduct** nerve **impulses away** from the cell body.



CLOSELY RELATED STRUCTURES – ciliary vs circular muscles

Extract from *The Answer Series*
Grade 12 Life Sciences P1 (2025 ed.)
p. 55 & 58

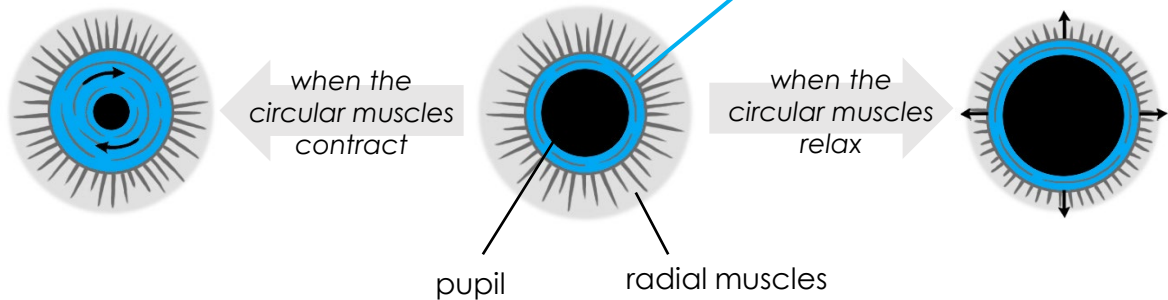


Ciliary muscles

- ✓ **Attached to the lens** via the suspensory ligaments.
- ✓ Plays a role in **eye accommodation** – contracts and relaxes to change the shape of the lens.

Circular muscles

- ✓ **Located in the iris** along with the radial muscles.
- ✓ Play a role in the **pupillary mechanism** – contract and relax to change the size of the pupil.



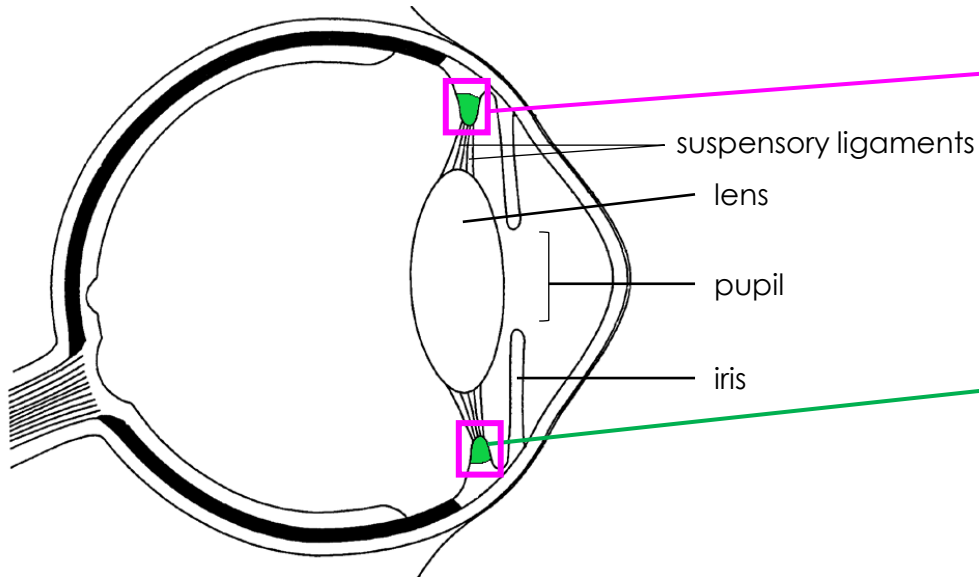
'Circular' means 'round' ○
They contract in a circle like a hooded sweatshirt.



Continue learning – ciliary body vs ciliary muscle

CLOSELY RELATED STRUCTURES – ciliary body vs ciliary muscle

Extract from *The Answer Series*
Grade 12 Life Sciences P1 (2025 ed.) p. 55



Ciliary body

- ✓ A **thickening** of the **front part** of the **choroid**.
- ✓ It **consists of**, i.e. contains, involuntary muscles called the **ciliary muscles**.

Ciliary muscle

- ✓ **Attached to** the **lens** via the suspensory ligaments.
- ✓ Plays a role in **eye accommodation** – contracts and relaxes to change the shape of the lens.



Ciliary muscles:	contract		relax
bring the ciliary body:	closer to		further away from lens
make suspensory ligaments:	slack		taut



NEGATIVE FEEDBACK VS HOMEOSTASIS

Negative feedback is the **mechanism** by which **homeostasis** is **maintained**.

MECHANISM

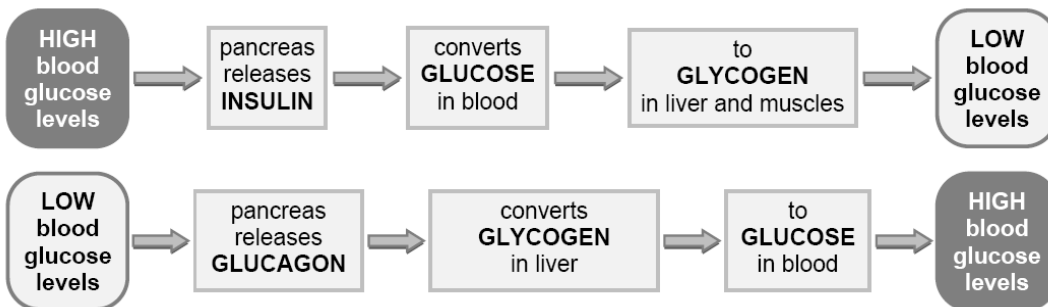
GOAL

to achieve the

A **negative feedback mechanism** is when the detection of a deviation from the normal triggers a reaction that counteracts the change and returns it to normal. The return to normal is detected and the corrective action is switched off.

Homeostasis is the maintenance of a constant internal environment in the body.

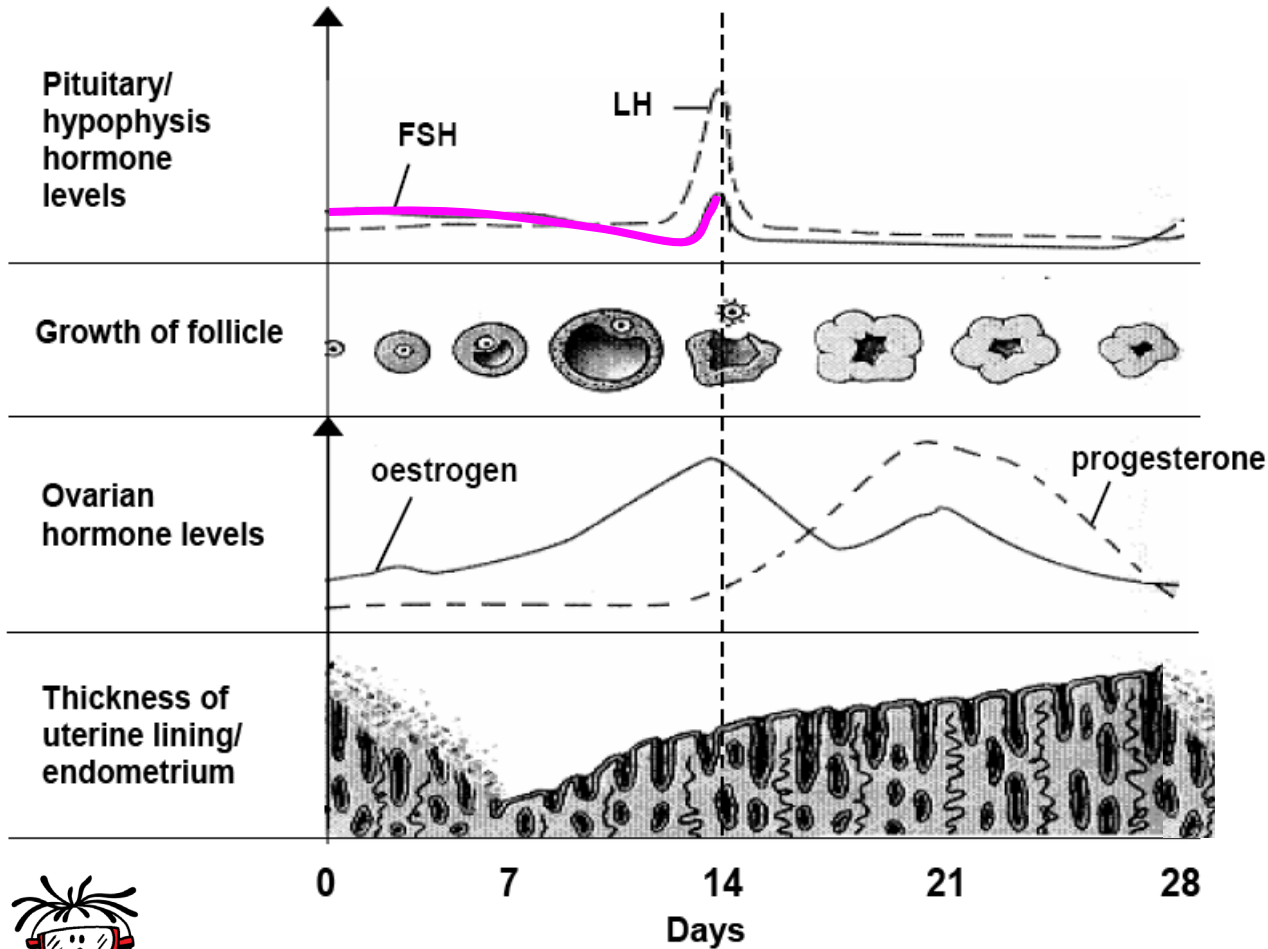
Blood glucose remains constant (homeostasis).



achieves



HORMONAL CONTROL OF THE MENSTRUAL CYCLE



- Increase in FSH causes primary (ovarian) follicles to develop and mature into a Graafian follicle.

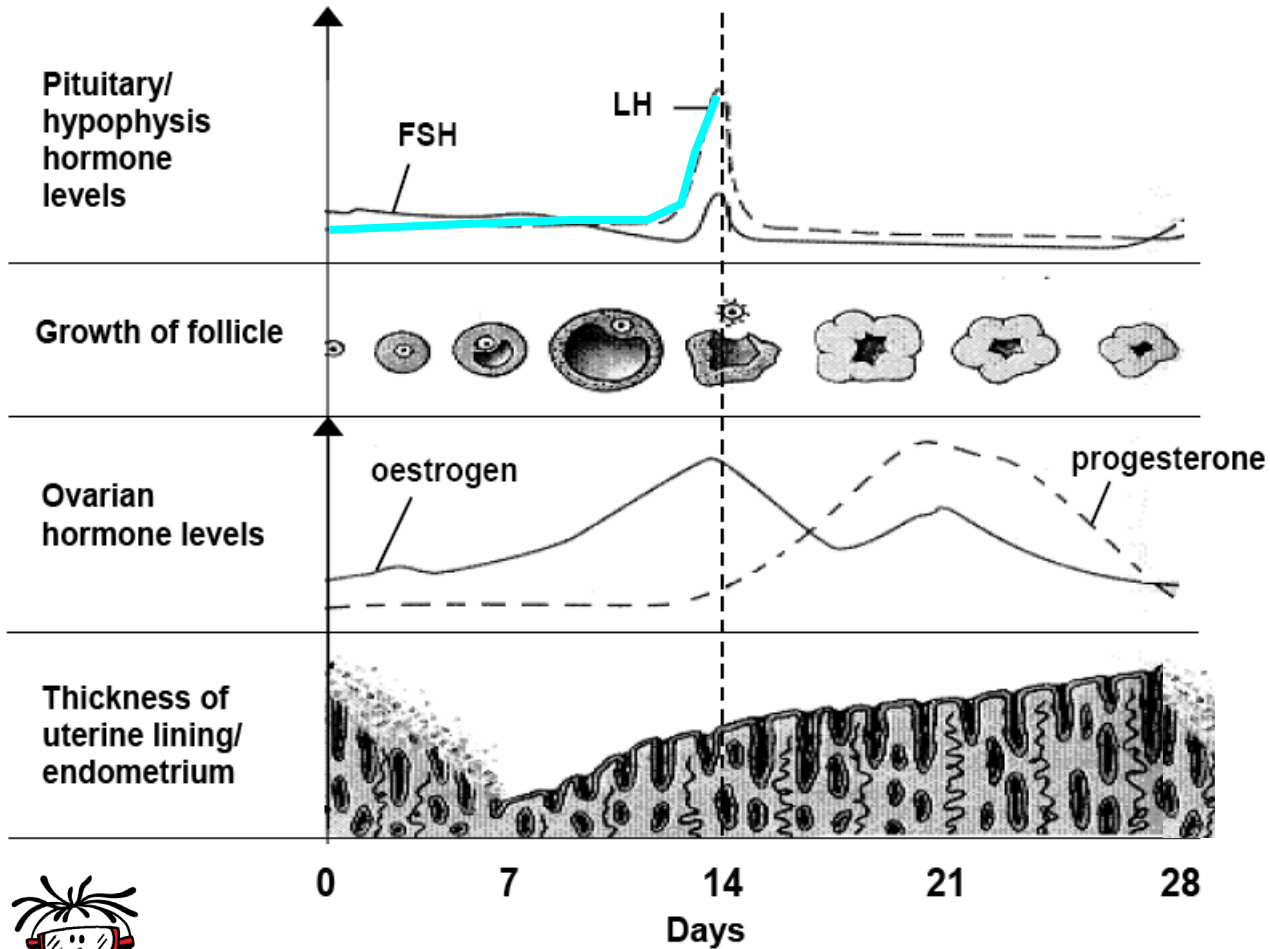


This is only a summary, and not all events of the menstrual cycle have been included.



Continue learning

HORMONAL CONTROL OF THE MENSTRUAL CYCLE



- Increase in FSH causes primary (ovarian) follicles to develop and mature into a Graafian follicle.
- Increase in LH brings about ovulation.

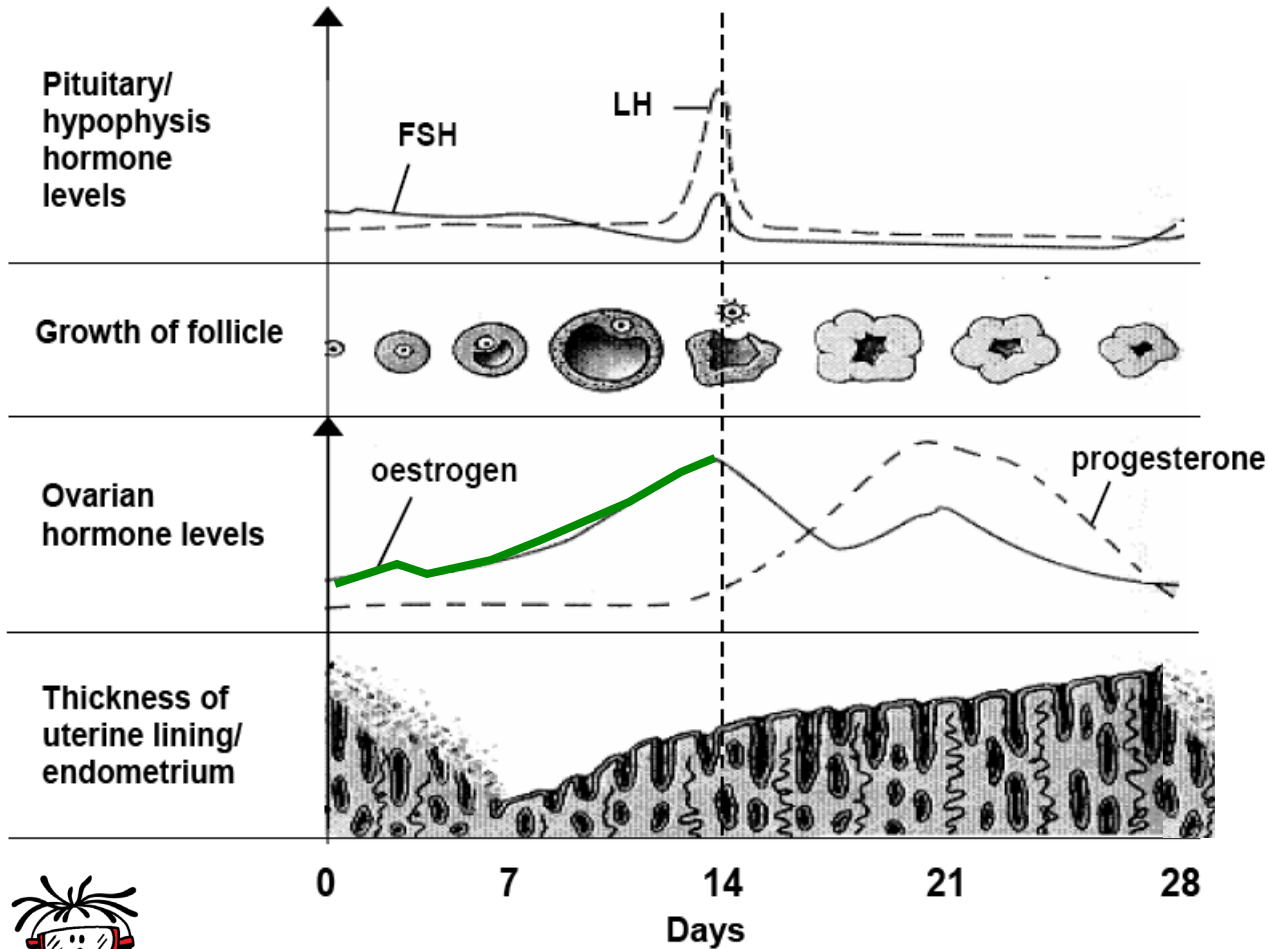


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Continue learning

HORMONAL CONTROL OF THE MENSTRUAL CYCLE



- Increase in **FSH** causes **primary (ovarian) follicles** to **develop** and mature into a **Graafian follicle**.
- Increase in **LH** brings about **ovulation**.

- Developing **follicle** **secretes oestrogen**.

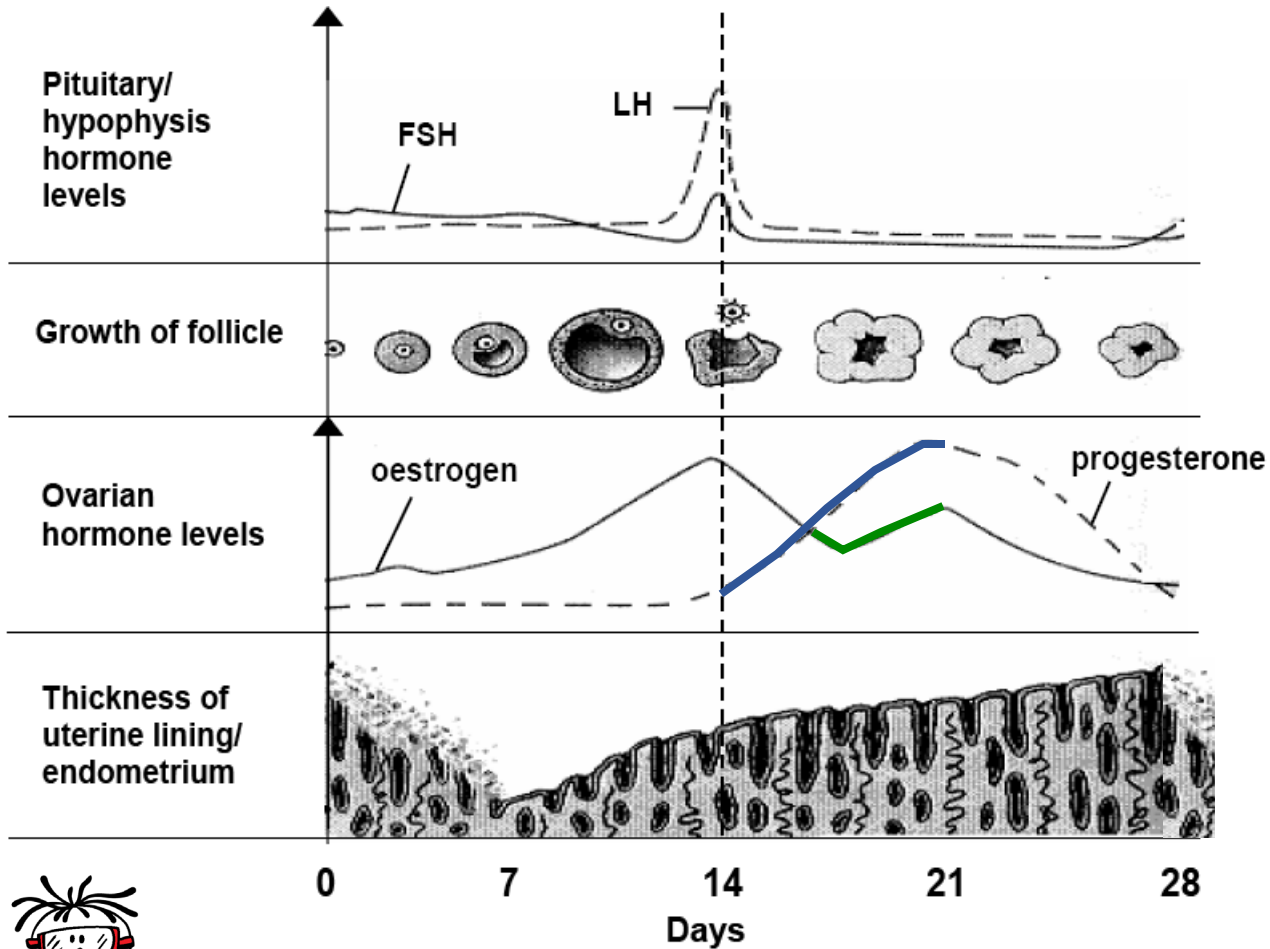


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[Continue learning](#)

HORMONAL CONTROL OF THE MENSTRUAL CYCLE



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- **Corpus luteum** secretes **progesterone** (and **oestrogen**).

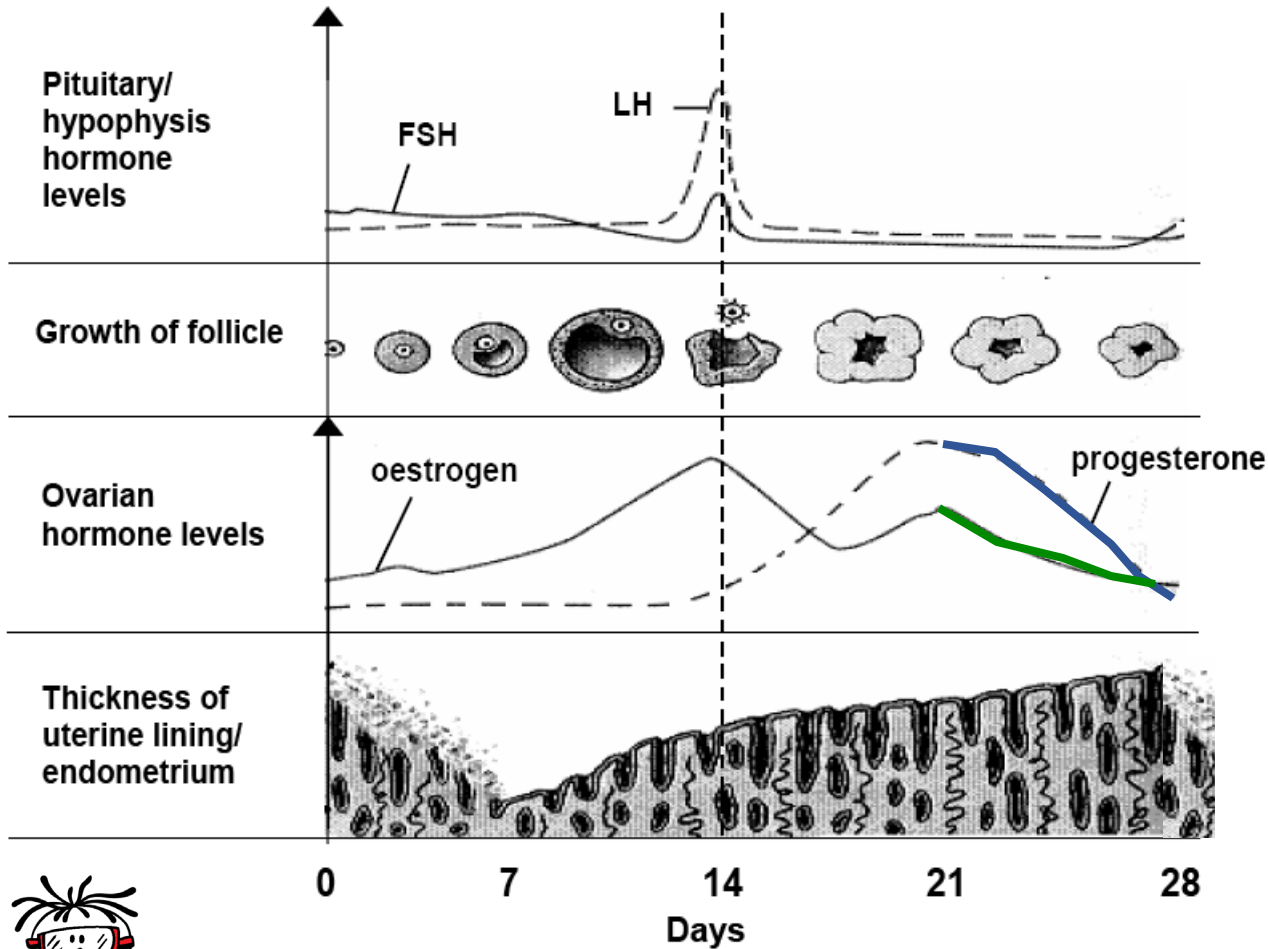


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Continue learning

HORMONAL CONTROL OF THE MENSTRUAL CYCLE



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- If **no fertilization** occurs → **Corpus luteum degenerates**.

Progesterone
and Oestrogen
levels drop

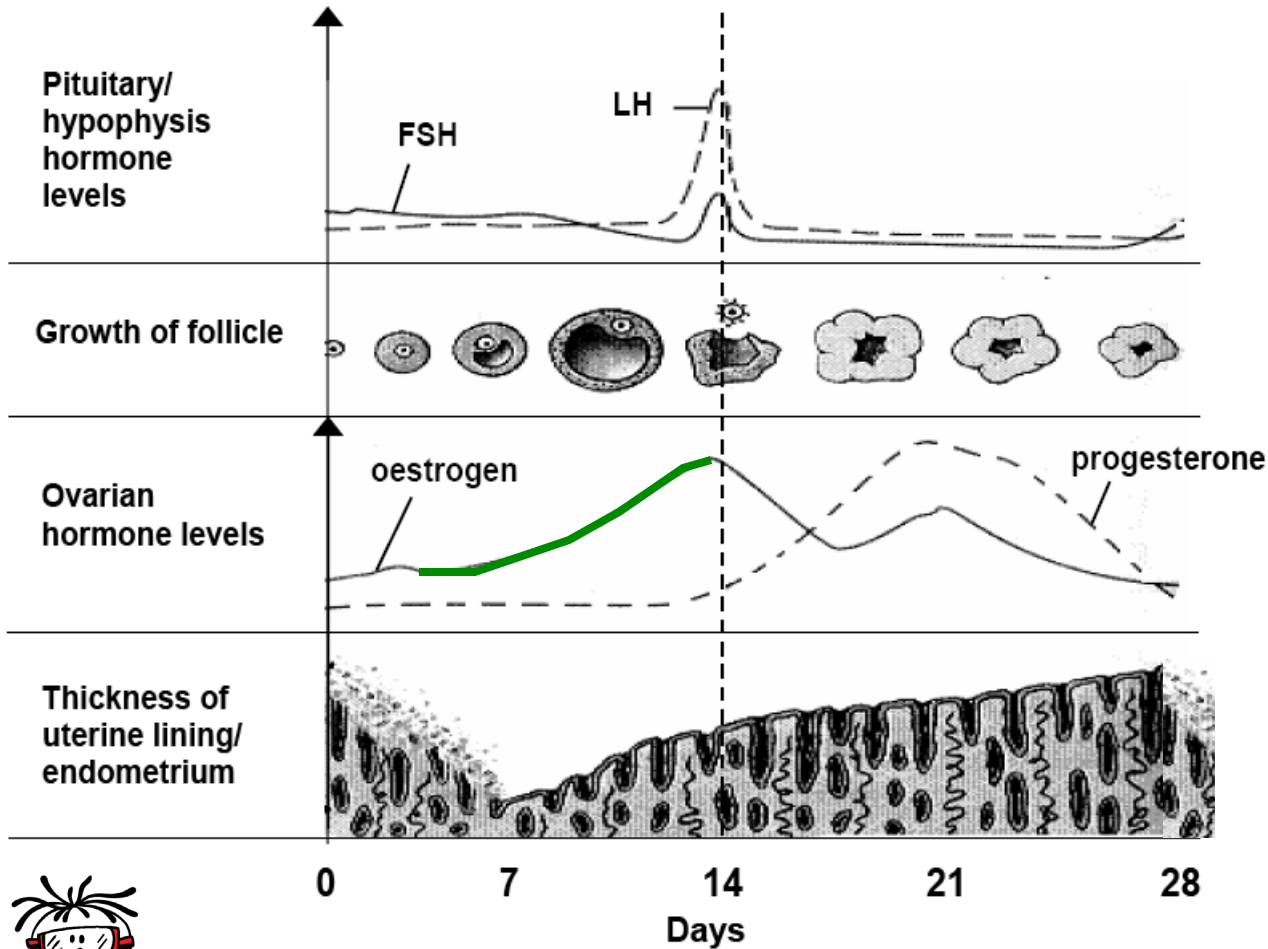


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Continue learning

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- **Increased oestrogen** causes **initial thickening** of the **endometrium**.

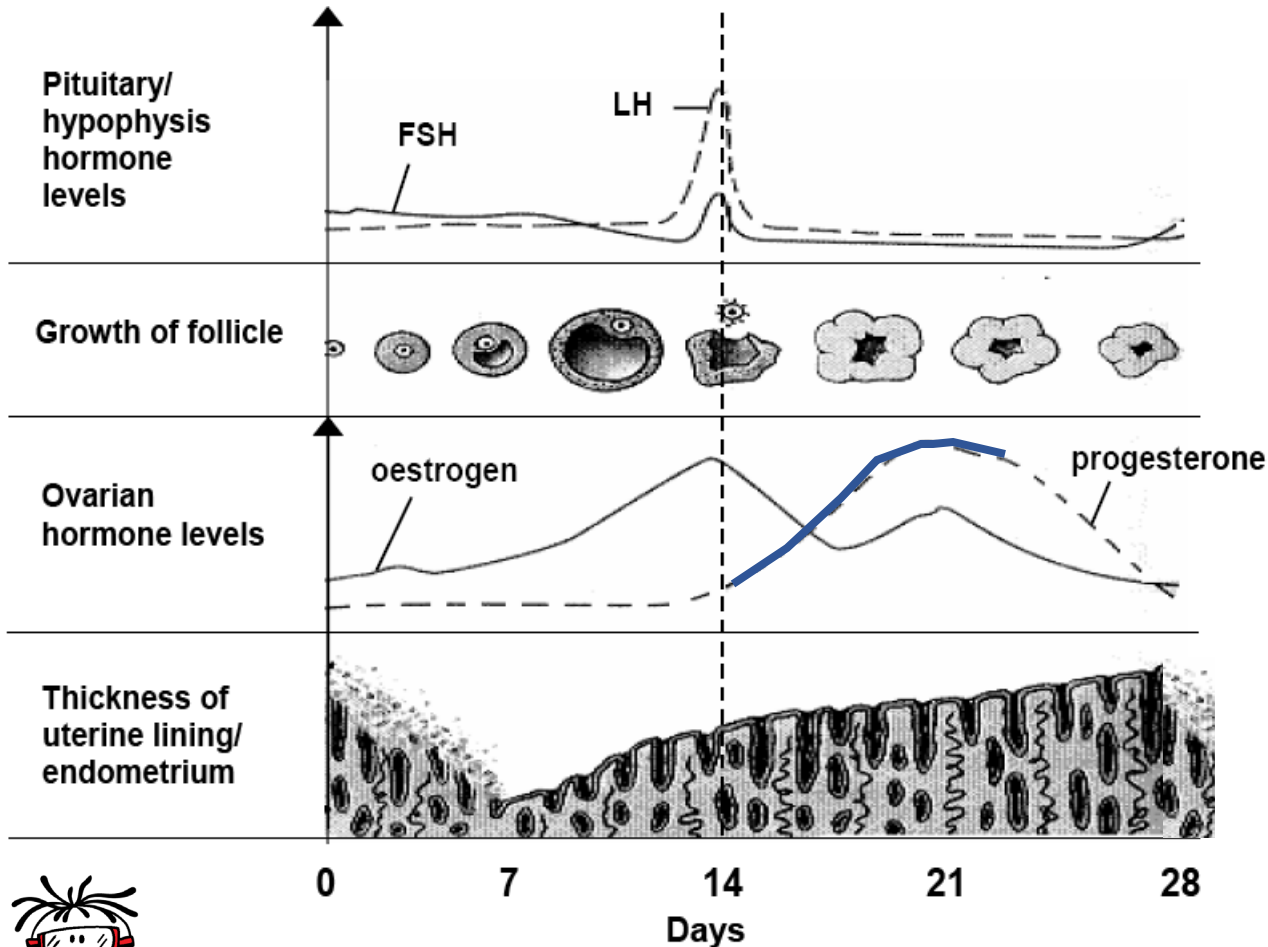


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Continue learning

HORMONAL CONTROL OF THE MENSTRUAL CYCLE



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- Increased **oestrogen** causes **initial thickening** of the **endometrium**.
- Increased **progesterone** causes **further thickening** of the **endometrium** and **maintains** it.

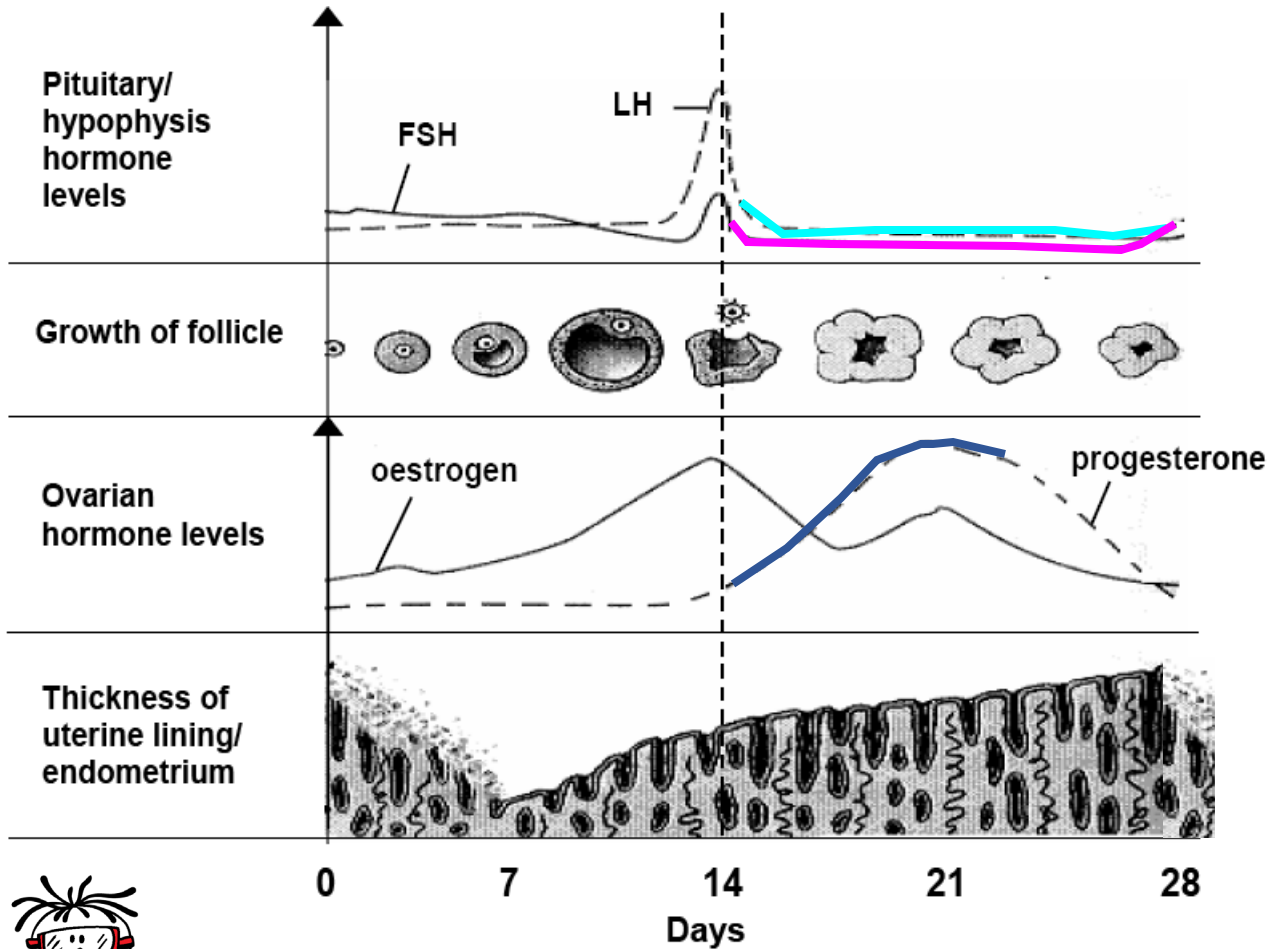


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Continue learning

HORMONAL CONTROL OF THE MENSTRUAL CYCLE



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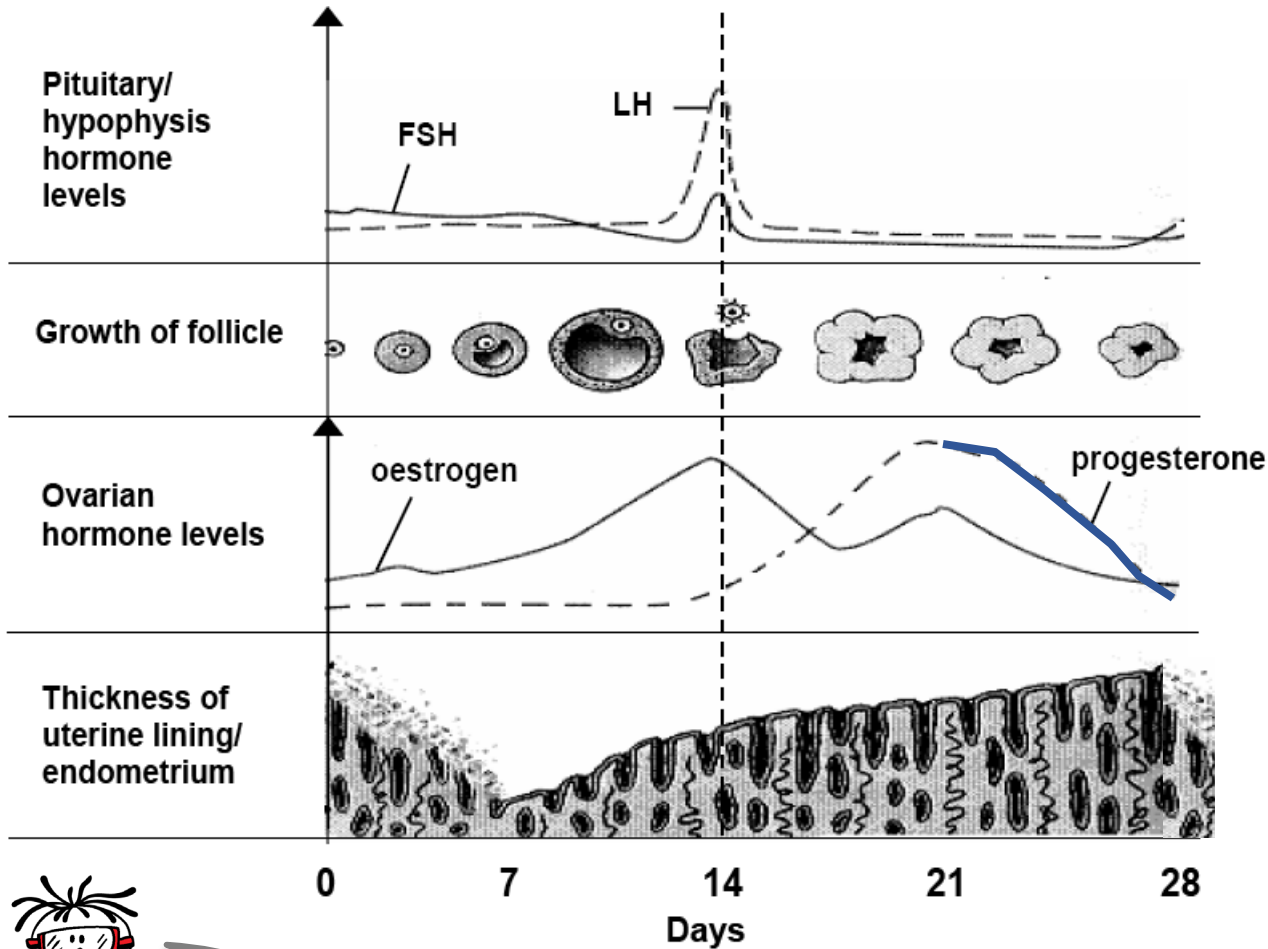


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Continue learning

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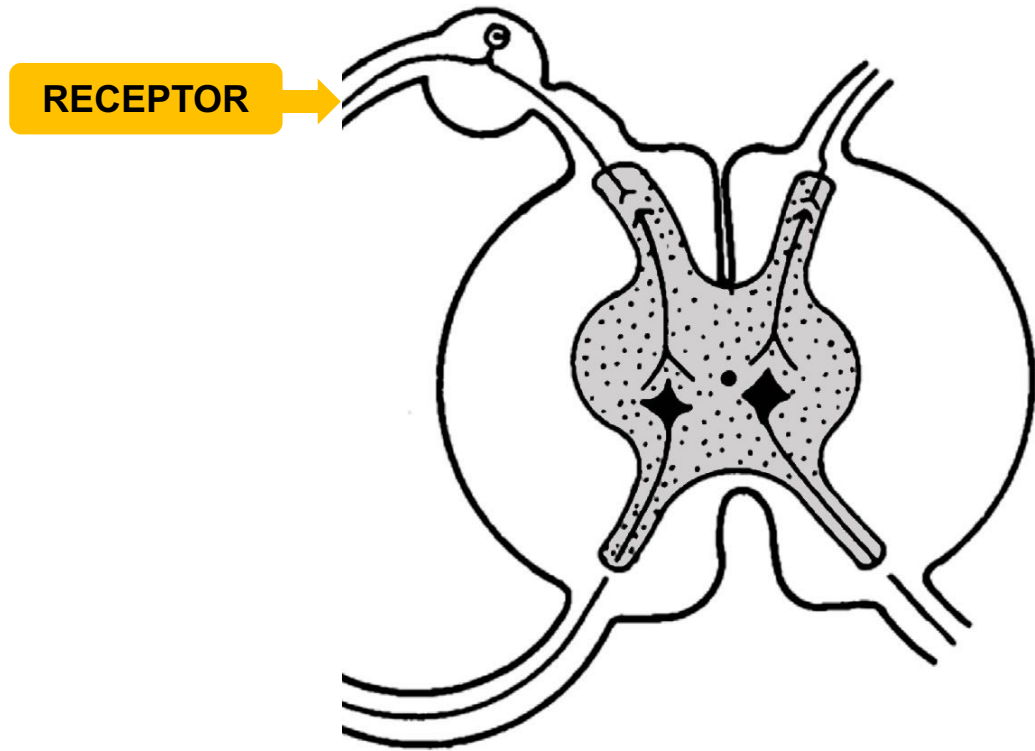
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- **Low progesterone** levels cause **endometrial shedding** (menstruation).



For more revision on the Human Reproduction system, click here:

[ENGLISH](#) | [AFRIKAANS](#)

PATHWAY FOR REFLEX ACTION

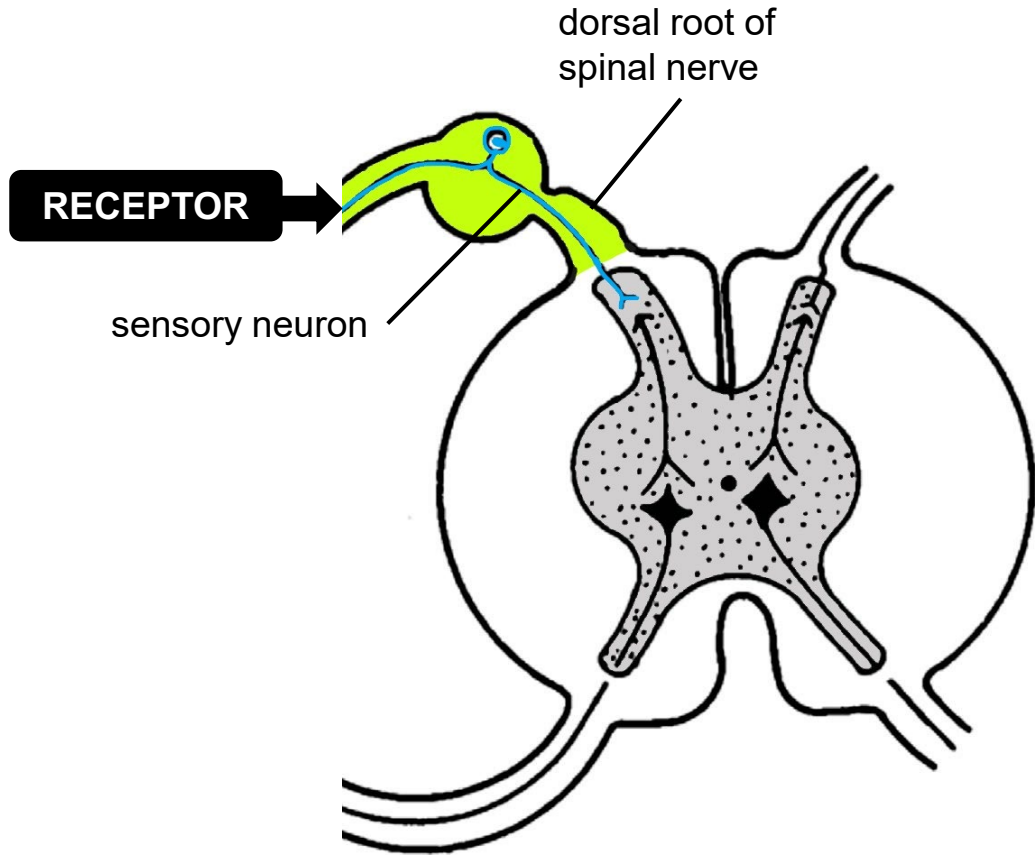


Generic sequence of a reflex arc

- ✓ The **stimulus** is detected by the **receptor** and **converted into** a nerve **impulse**.



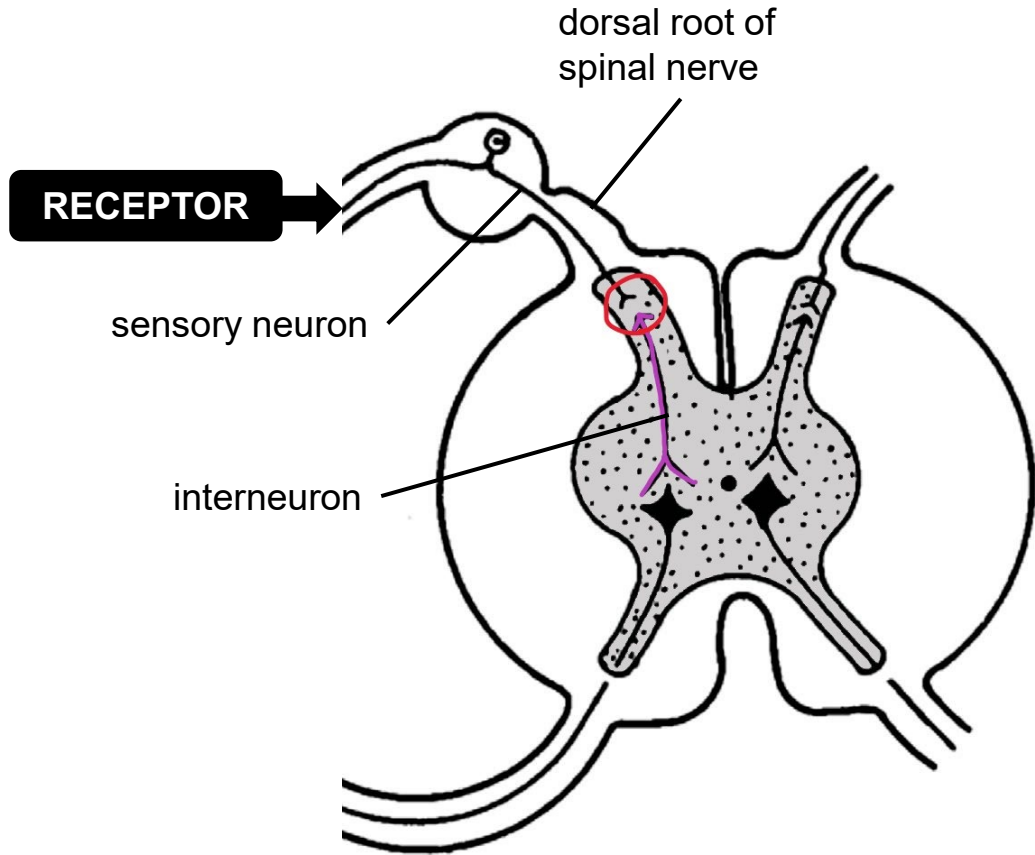
PATHWAY FOR REFLEX ACTION



Generic sequence of a reflex arc

- ✓ The **stimulus** is detected by the **receptor** and **converted** into a nerve **impulse**.
- ✓ The nerve **impulse** is **conducted along** a **sensory neuron** through the **dorsal root of the spinal nerve** to the grey matter of the **spinal cord**.

PATHWAY FOR REFLEX ACTION

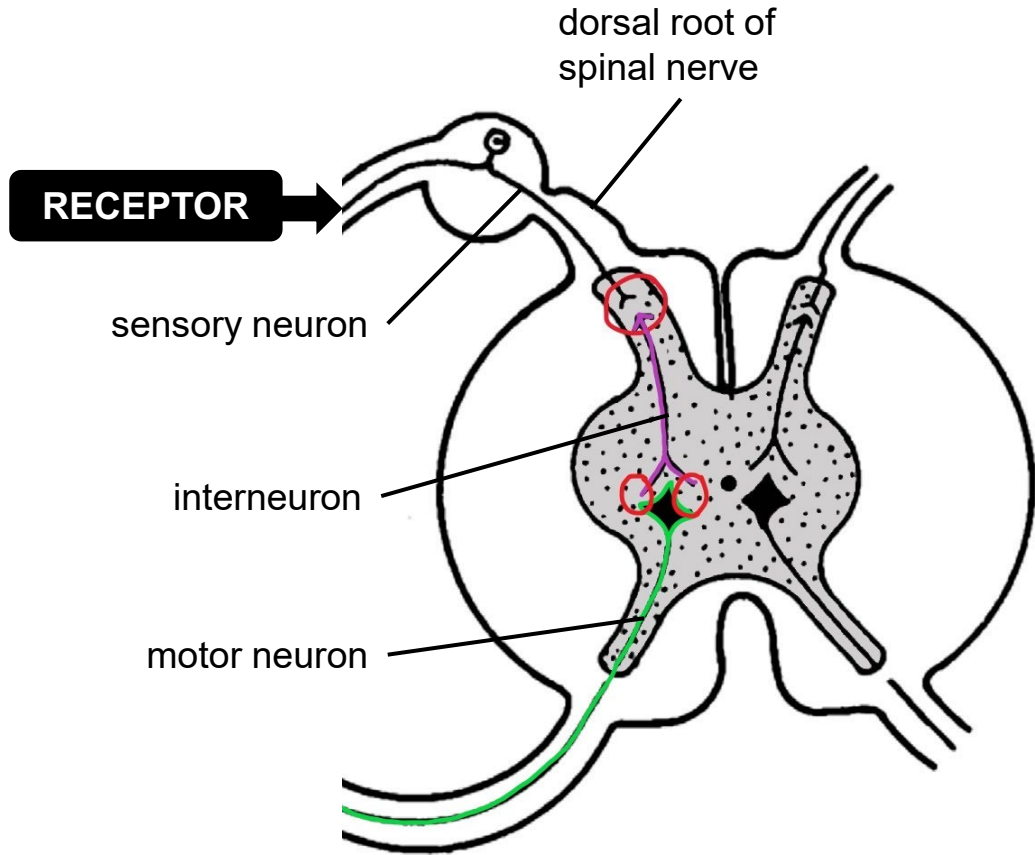


Generic sequence of a reflex arc

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- ✓ The nerve **impulse** is **conducted** across the **synapse** to the **interneuron**.



PATHWAY FOR REFLEX ACTION

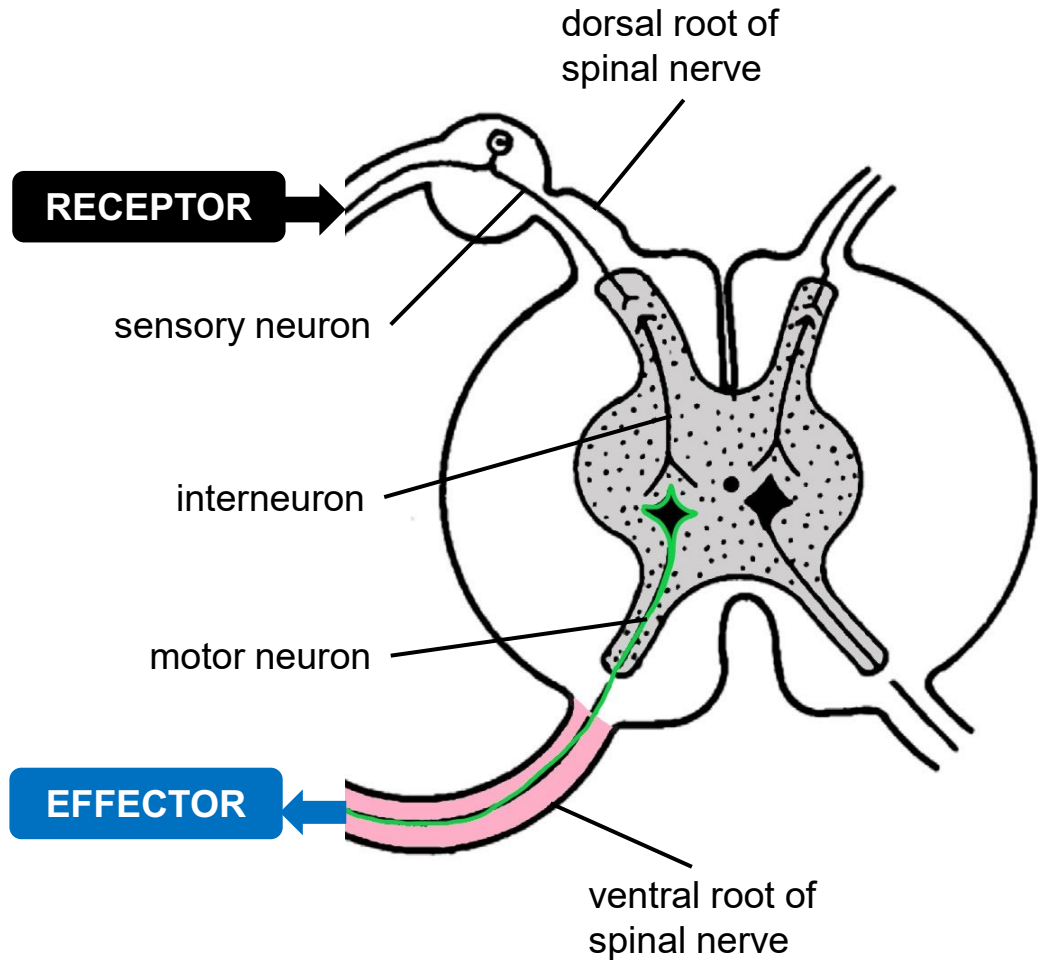


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PATHWAY FOR REFLEX ACTION

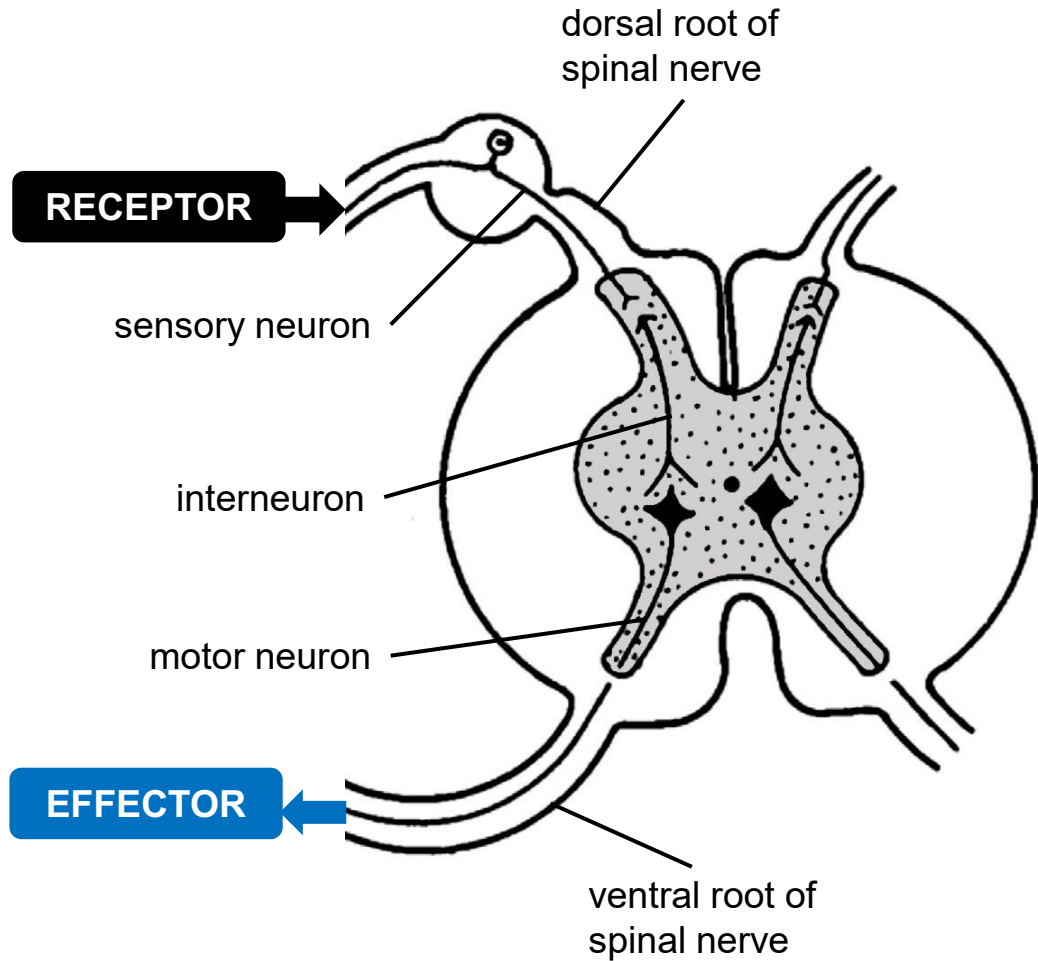


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- ✓ The nerve **impulse** is **conducted** across the **synapse** to the **interneuron**.
- ✓ The nerve **impulse** is **conducted** across the **synapse** to the **motor neuron**.
- ✓ The nerve **impulse** **exits** the **spinal cord** through the **ventral root of the spinal nerve** and is conducted **along** the axon of the **motor neuron** to the **effector**.



PATHWAY FOR REFLEX ACTION



Generic sequence of a reflex arc

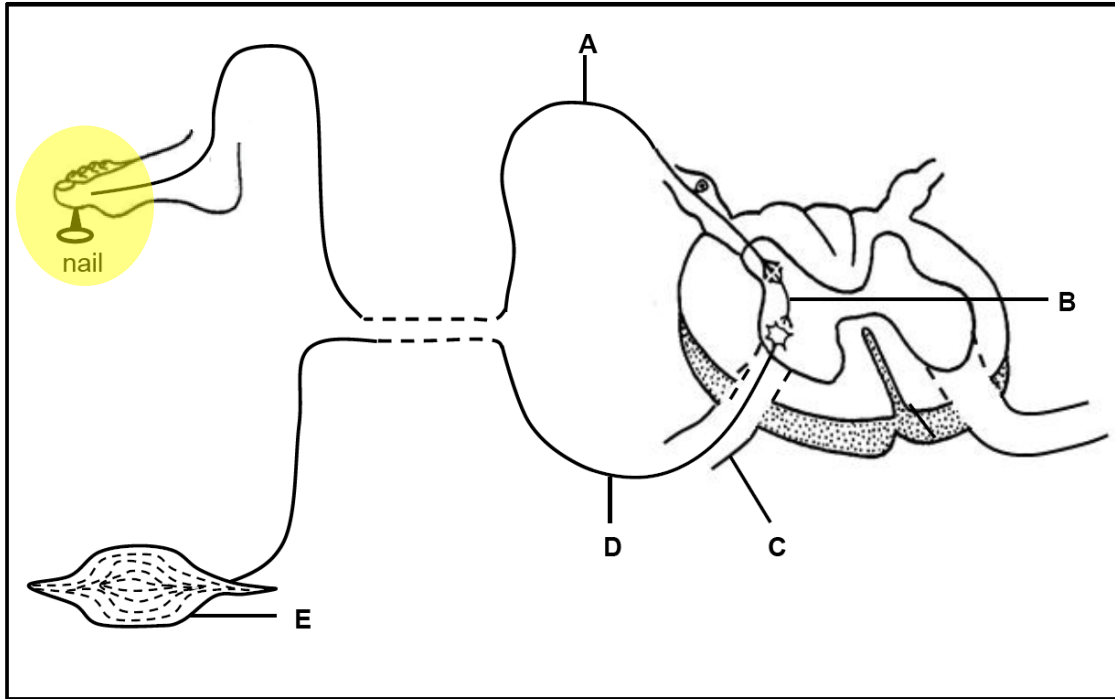
- ✓ The **stimulus** is detected by the **receptor** and **converted** into a nerve **impulse**.
- ✓ The nerve **impulse** is **conducted** along a **sensory neuron** through the **dorsal root of the spinal nerve** to the grey matter of the **spinal cord**.
- ✓ The nerve **impulse** is **conducted** across the **synapse** to the **interneuron**.
- ✓ The nerve **impulse** is **conducted** across the **synapse** to the **motor neuron**.
- ✓ The nerve **impulse** **exits** the **spinal cord** through the **ventral root of the spinal nerve** and is conducted **along** the axon of the **motor neuron** to the **effector**.
- ✓ The **effector** organ **reacts** very rapidly **to cause a response**.



Let's apply this to different scenarios



PATHWAY FOR REFLEX ACTION – Worked example 1

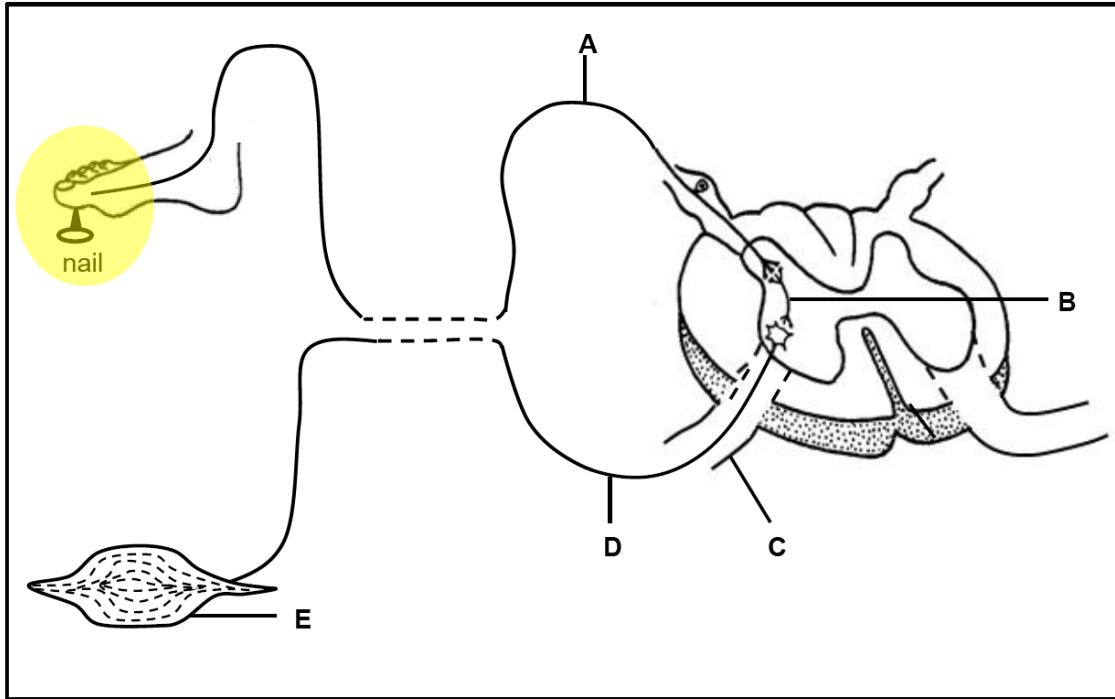


A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

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PATHWAY FOR REFLEX ACTION – Worked example 1



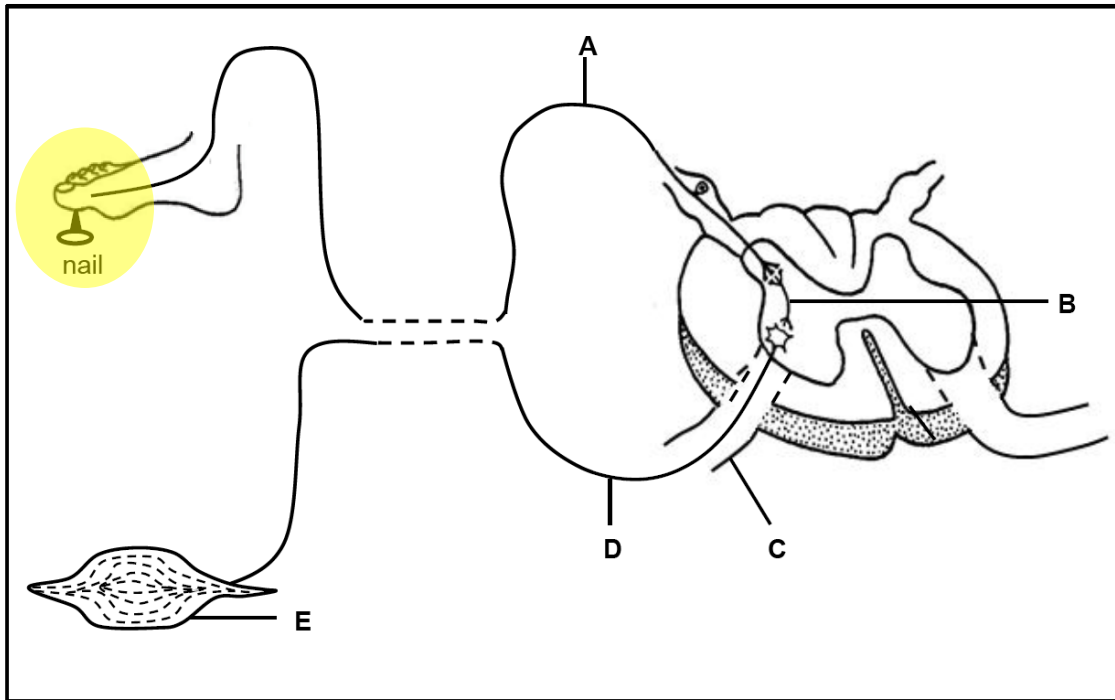
A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

- the **stimulus** ✓

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PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [the **receptor**] ✓



Be specific
to the
example!

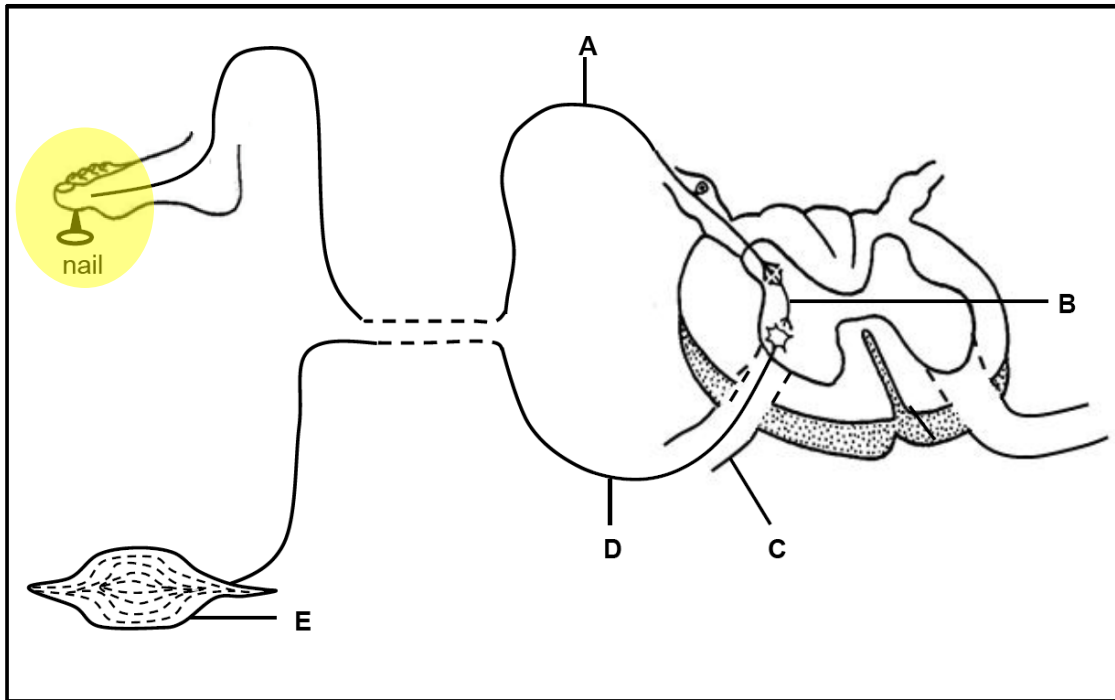
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓

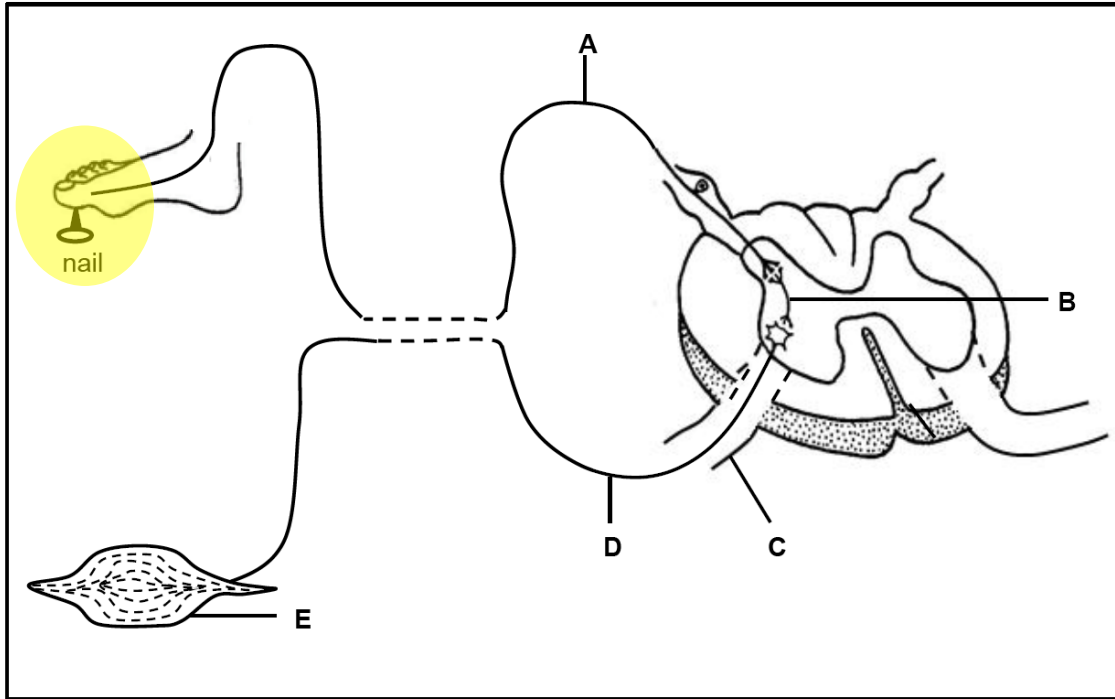
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓

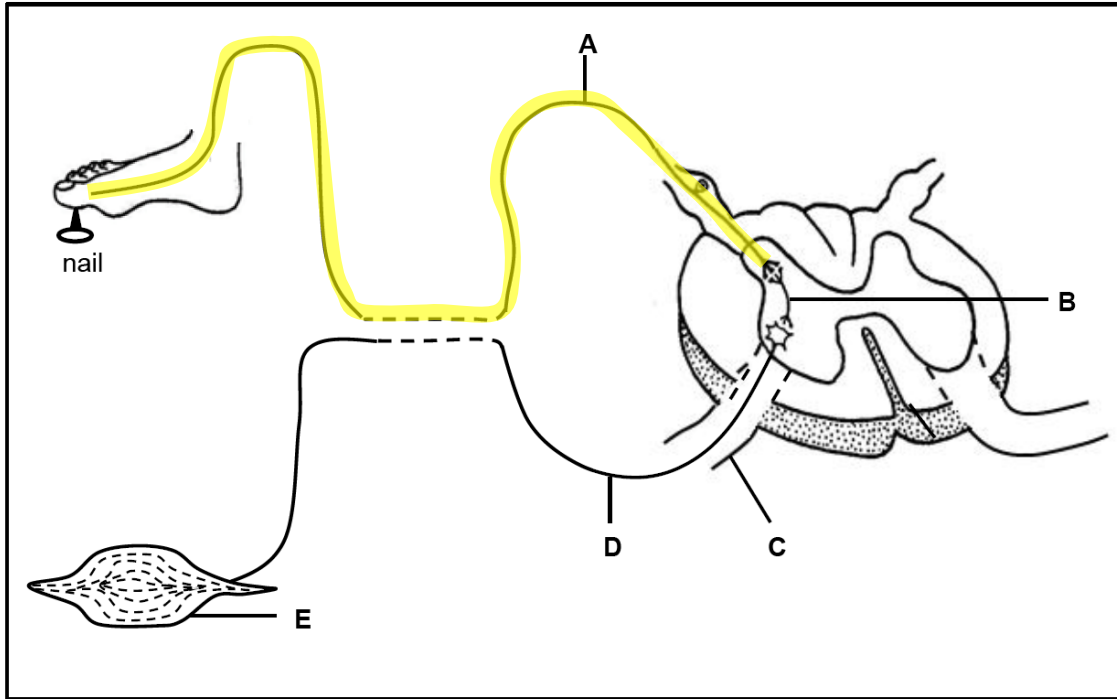
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

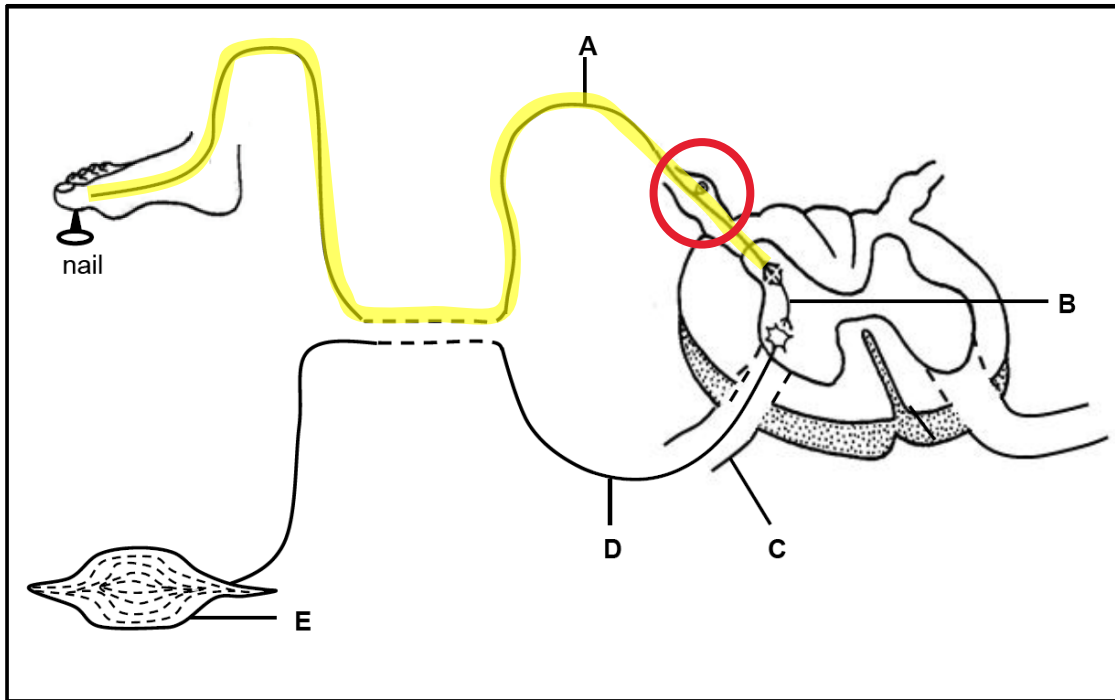
Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
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Continue the answer

PATHWAY FOR REFLEX ACTION – Worked example 1

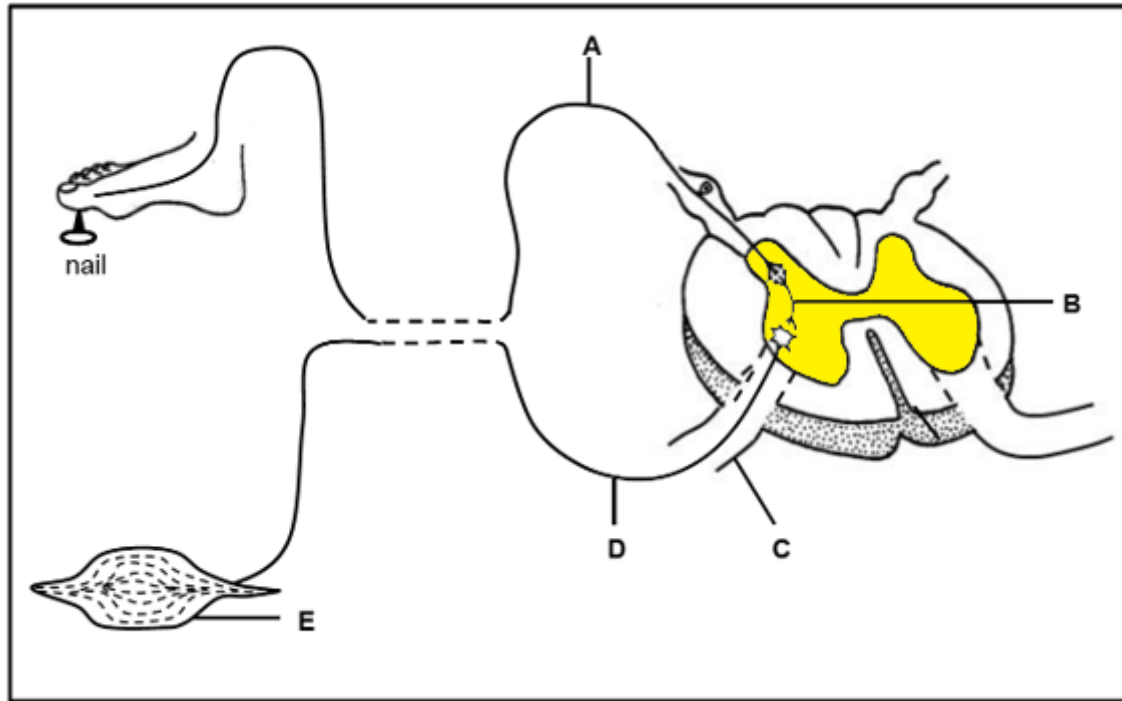


A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
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PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

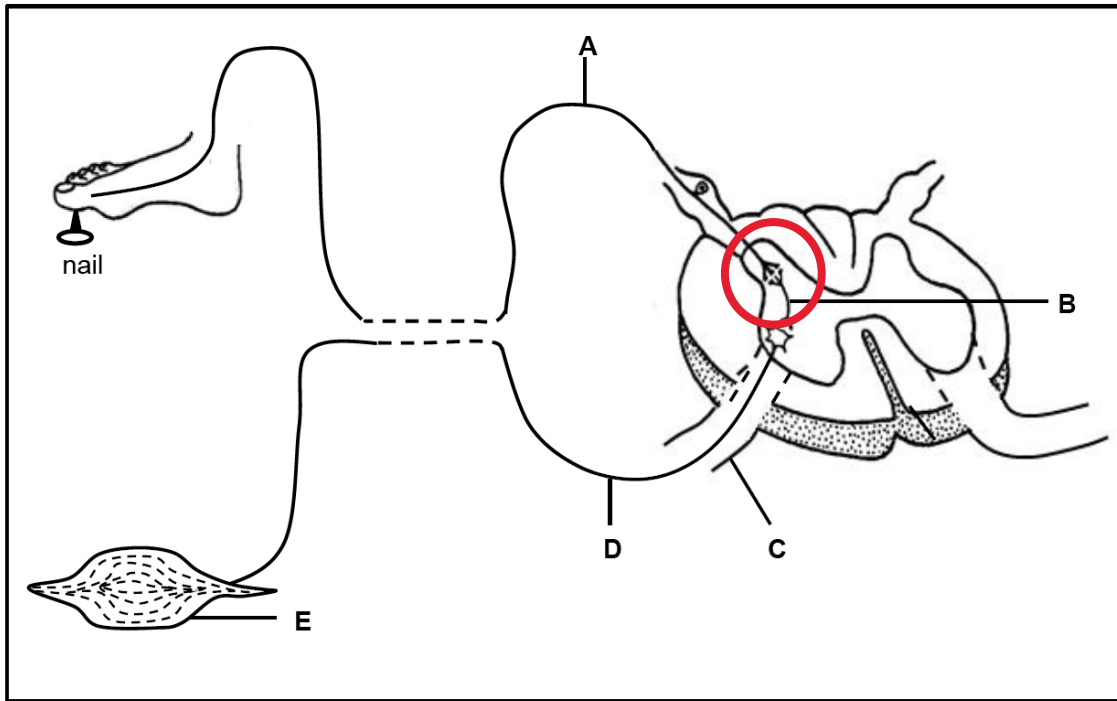
- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to the grey matter of the spinal cord** ✓
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

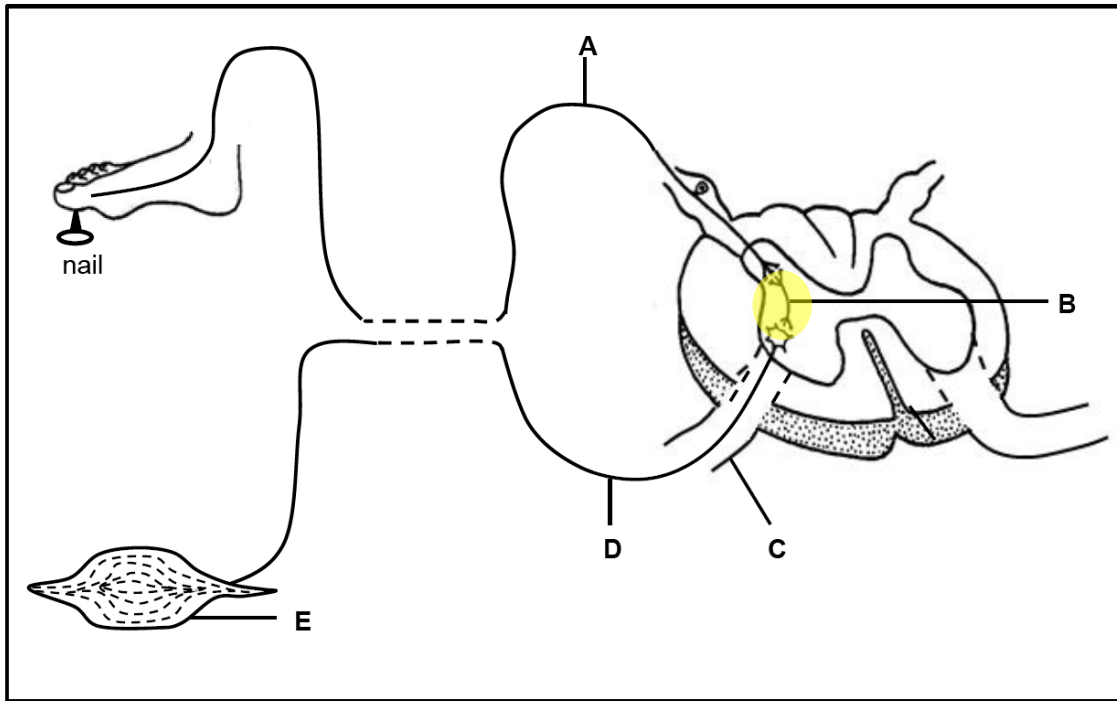
- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

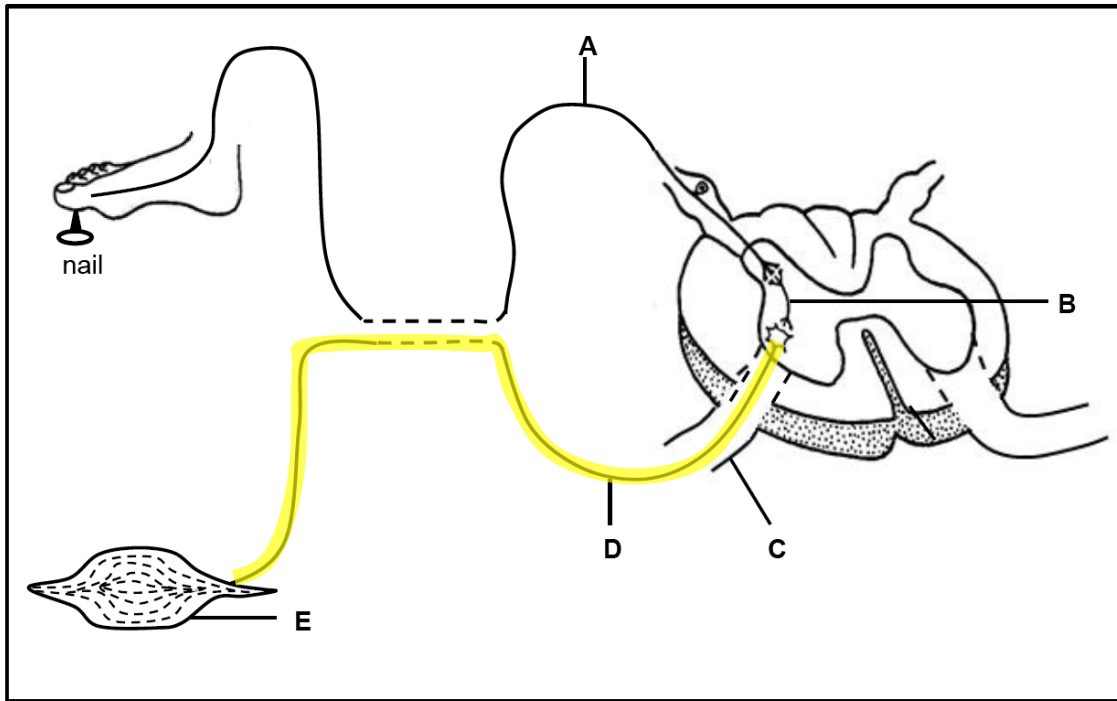
- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **interneuron** ✓
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

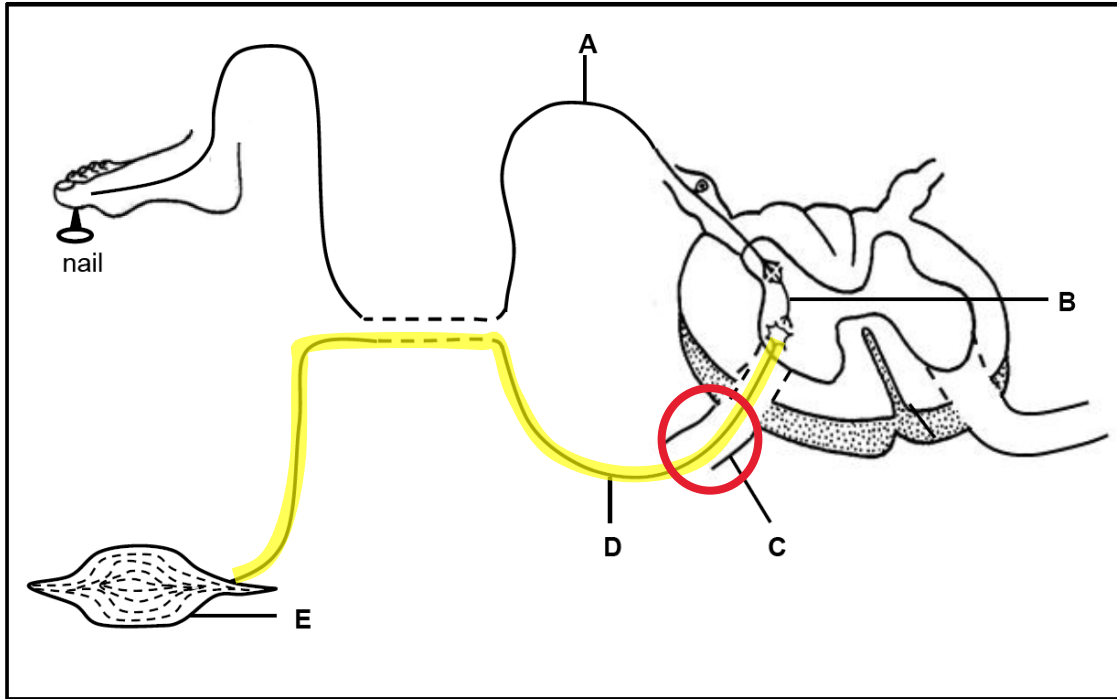
- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **interneuron** ✓
- the nerve impulse is conducted across the synapse **to** the **motor neuron** ✓
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

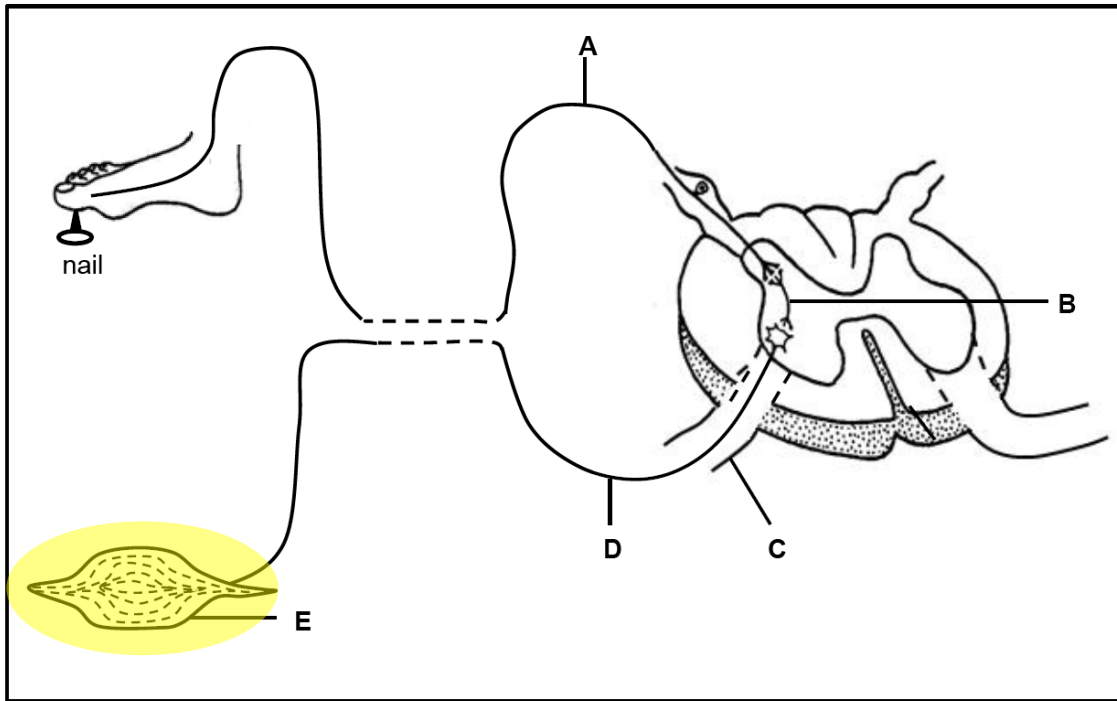
- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **interneuron** ✓
- the nerve impulse is conducted across the synapse **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 1



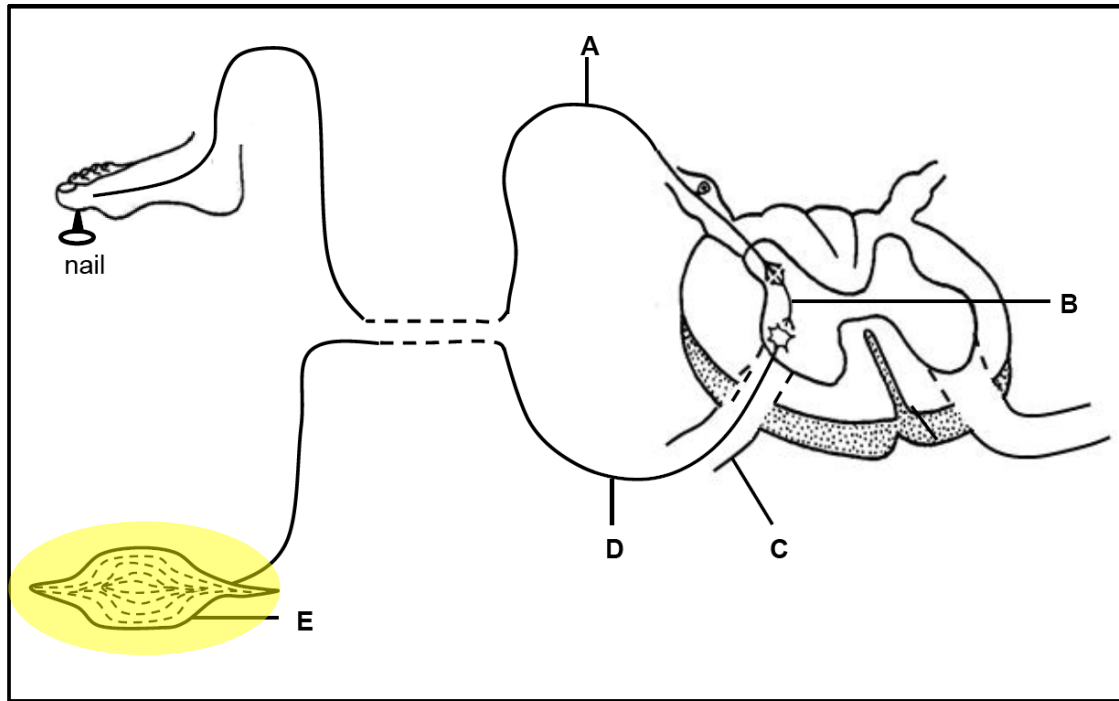
A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **interneuron** ✓
- the nerve impulse is conducted across the synapse **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
- is conducted **to** the **effector** ✓
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PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

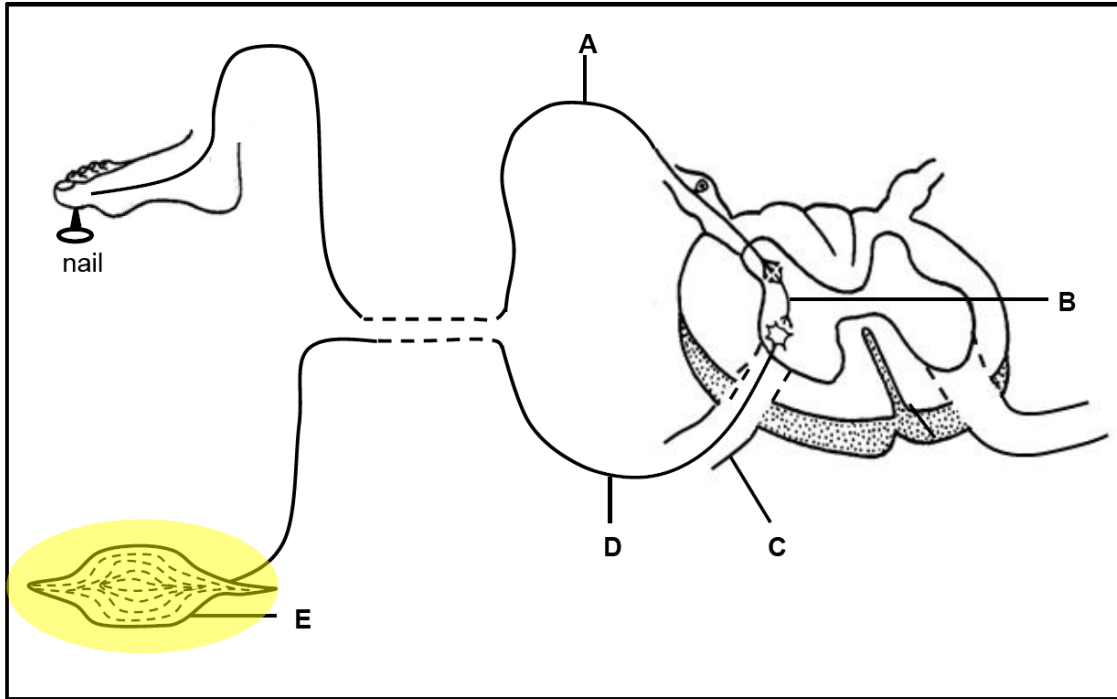
Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **interneuron** ✓
- the nerve impulse is conducted across the synapse **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
- is conducted **to** the **effector** ✓
- the [**effector organ reacts**] ✓ very rapidly



Continue the answer

PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

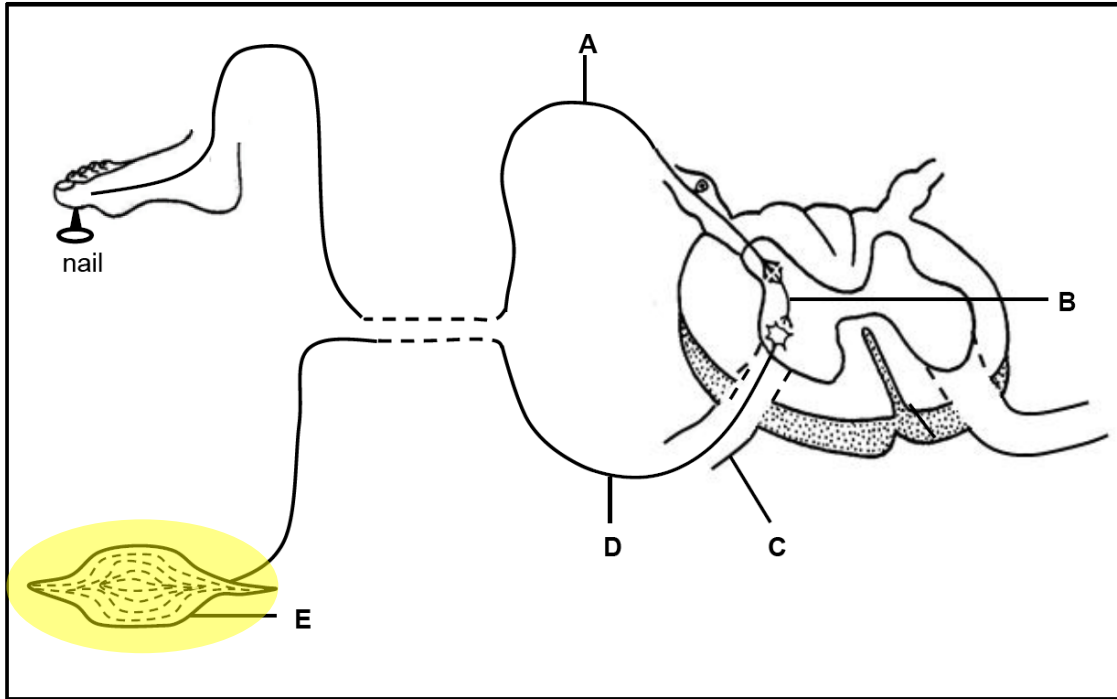
- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **interneuron** ✓
- the nerve impulse is conducted across the synapse **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
- is conducted **to** the **effector** ✓
- the [**FOOT/LEG MUSCLES**] ✓ very rapidly



Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

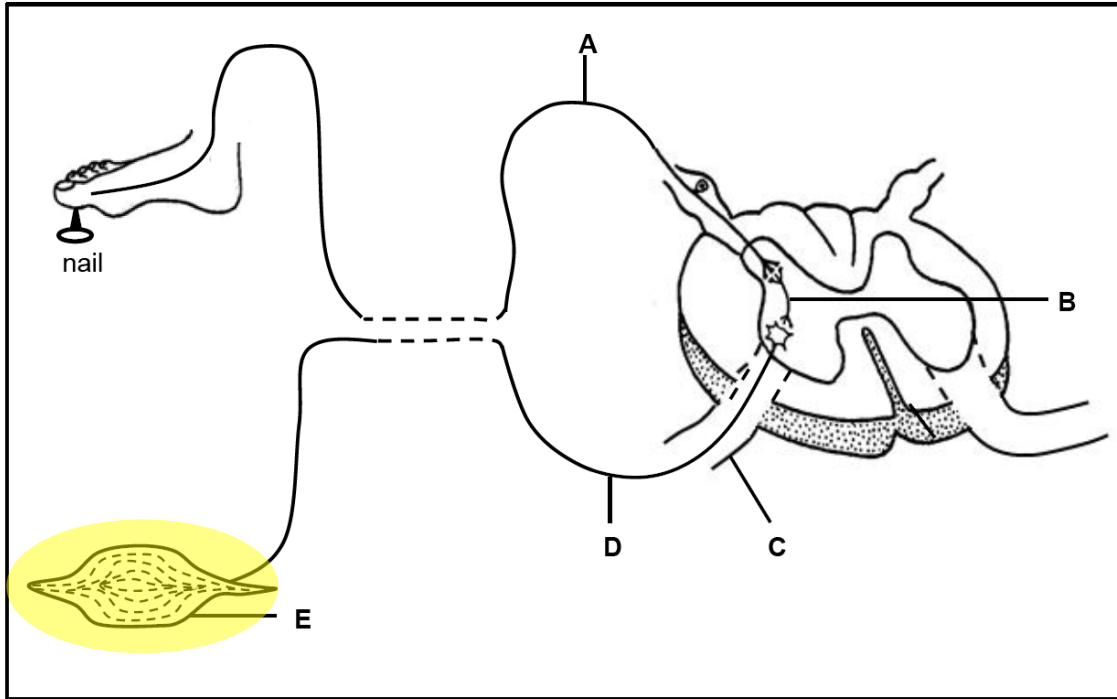
- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **interneuron** ✓
- the nerve impulse is conducted across the synapse **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
- is conducted **to** the **effector** ✓
- the [**FOOT/LEG MUSCLES**] ✓ very rapidly **to cause** [**a response**] ✓

Be specific
to the
example!



Continue the answer

PATHWAY FOR REFLEX ACTION – Worked example 1



A person steps on a sharp nail. Describe the reflex arc and response that occurs.

Generic sequence of a reflex arc

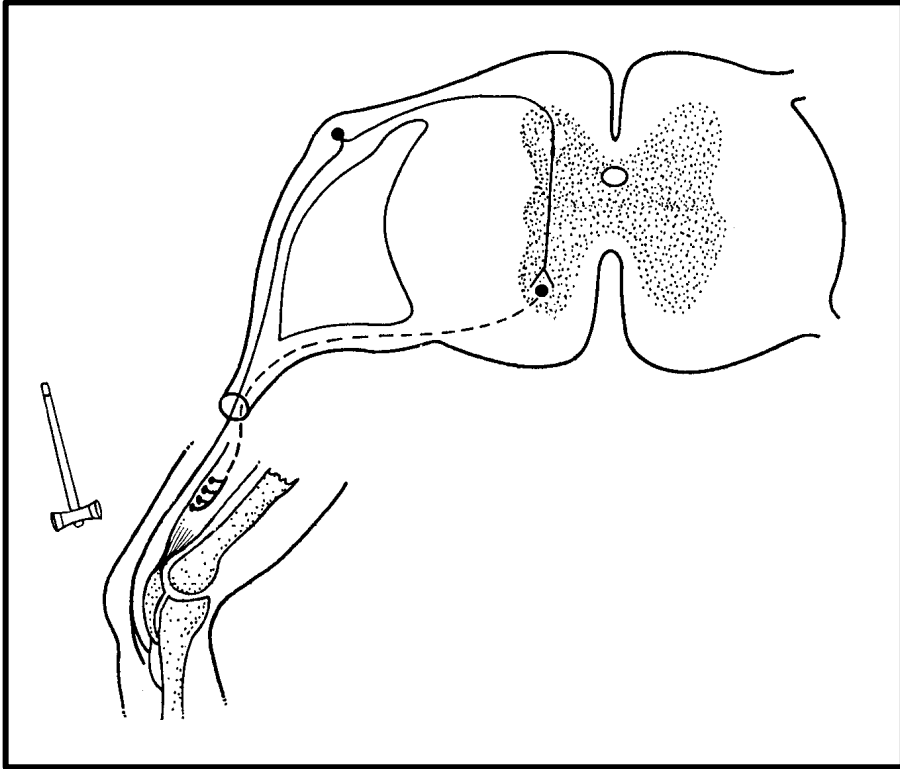
- the **stimulus** ✓ is detected by [**PAIN RECEPTORS**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **interneuron** ✓
- the nerve impulse is conducted across the synapse **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
- is conducted **to** the **effector** ✓
- the [**FOOT/LEG MUSCLES**] ✓ very rapidly **to cause** [**THE FOOT TO WITHDRAW / PULL AWAY FROM THE NAIL**] ✓



Let's apply this to another scenario



PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

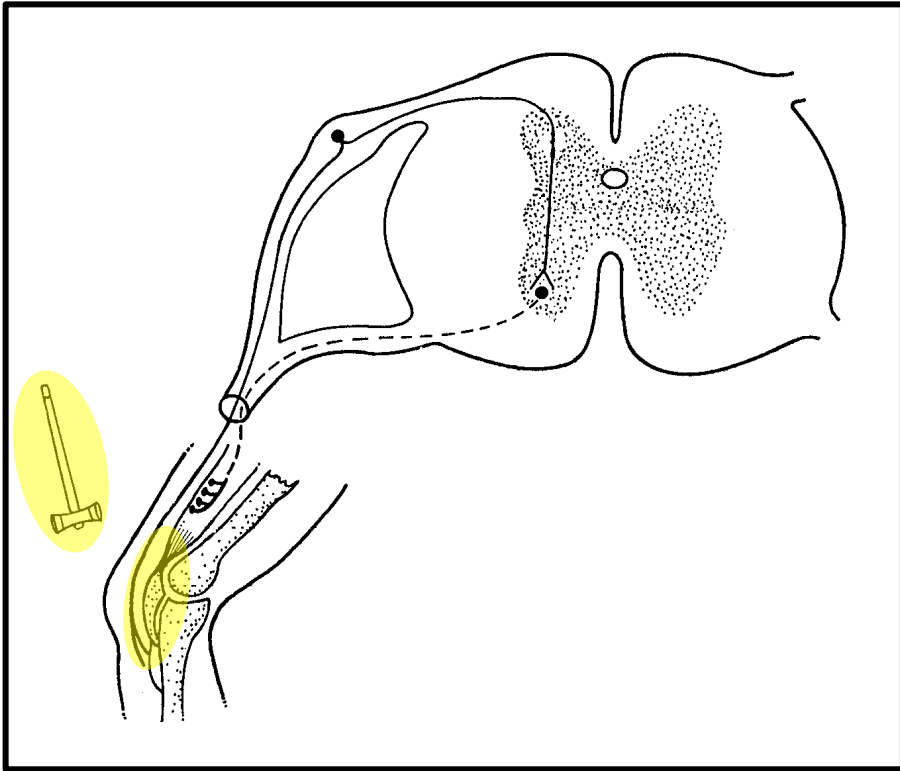
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

- the **stimulus** ✓

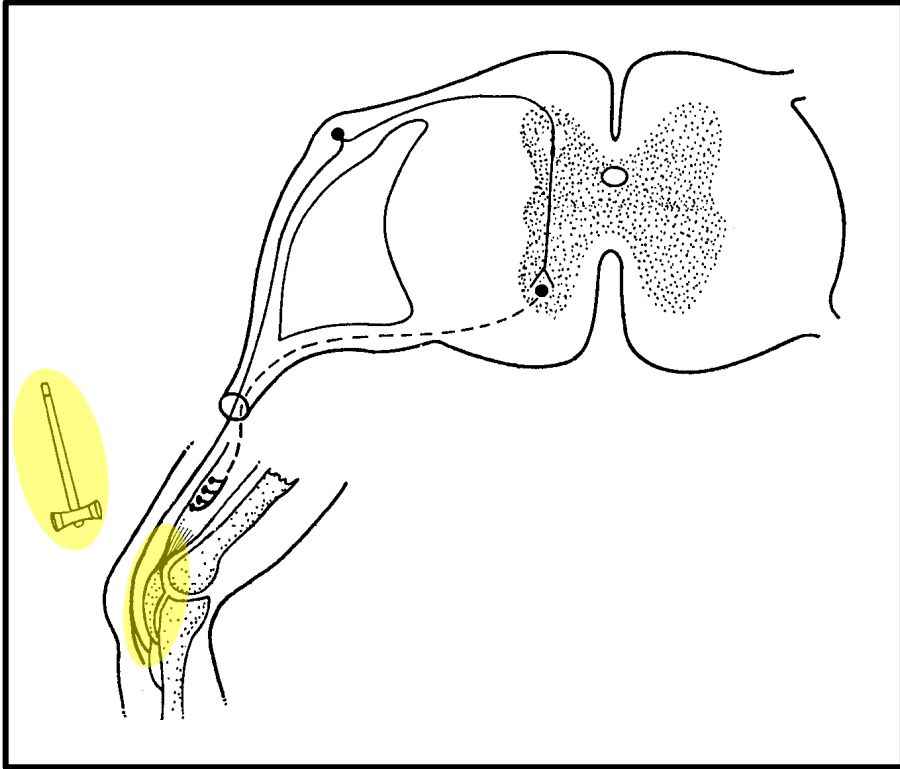
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Continue the answer



PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

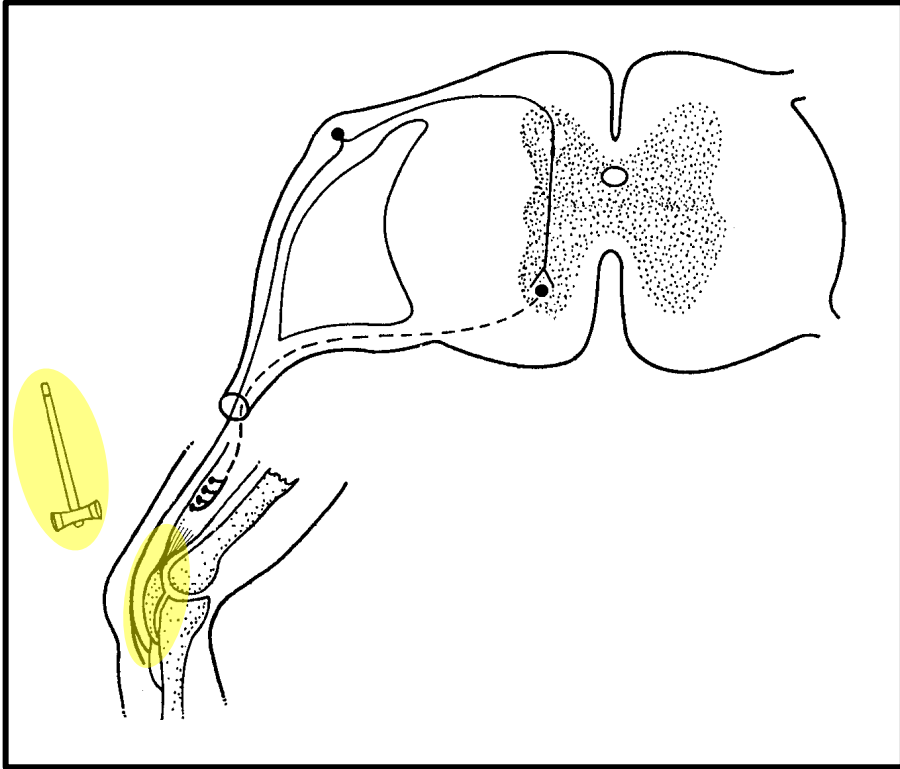
- the **stimulus** ✓ is detected by [**the receptor**] ✓



Be specific
to the
example!

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PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

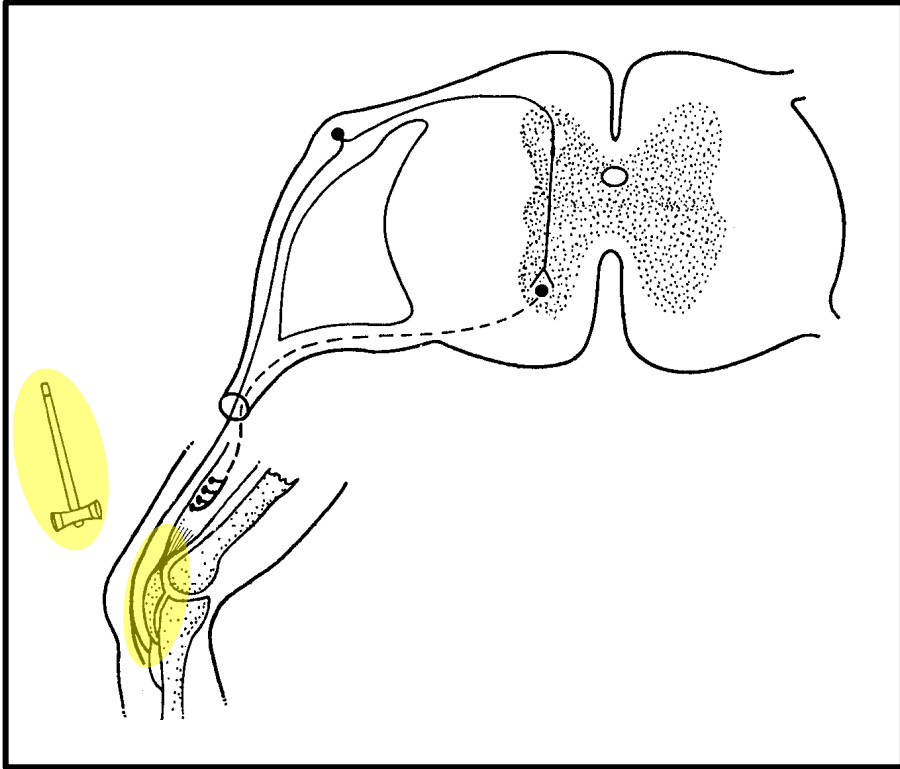
Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

- the stimulus ✓ is detected by [RECEPTORS IN THE PATELLAR TENDON] ✓

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PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

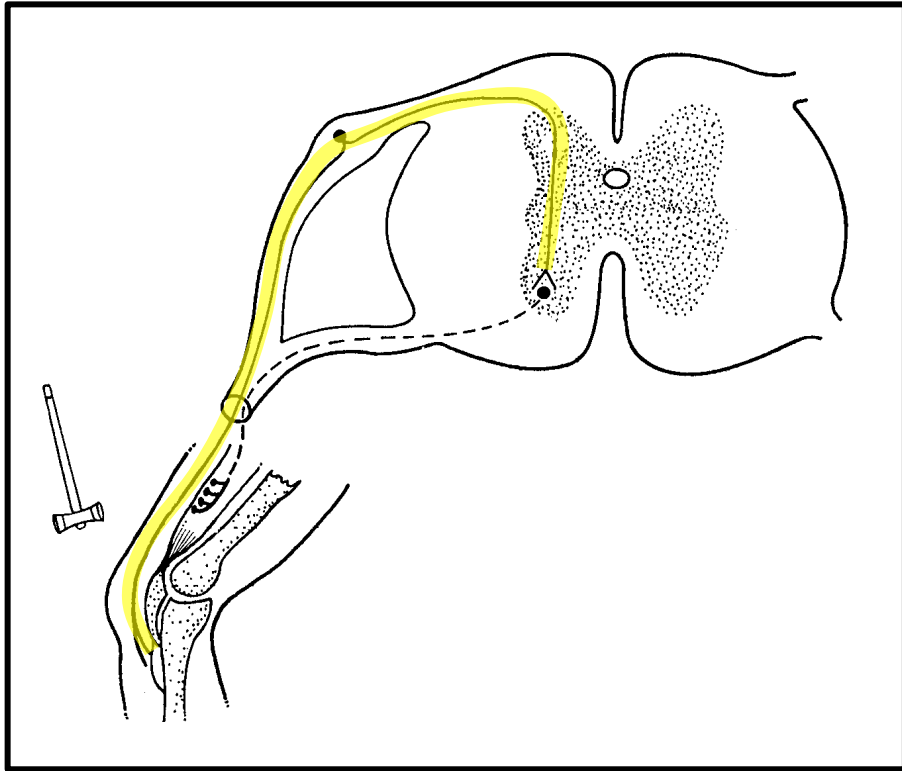
Generic sequence of a reflex arc

- the stimulus ✓ is detected by [RECEPTORS IN THE PATELLAR TENDON] ✓ and converted into a nerve impulse ✓

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PATHWAY FOR REFLEX ACTION – Worked example 2



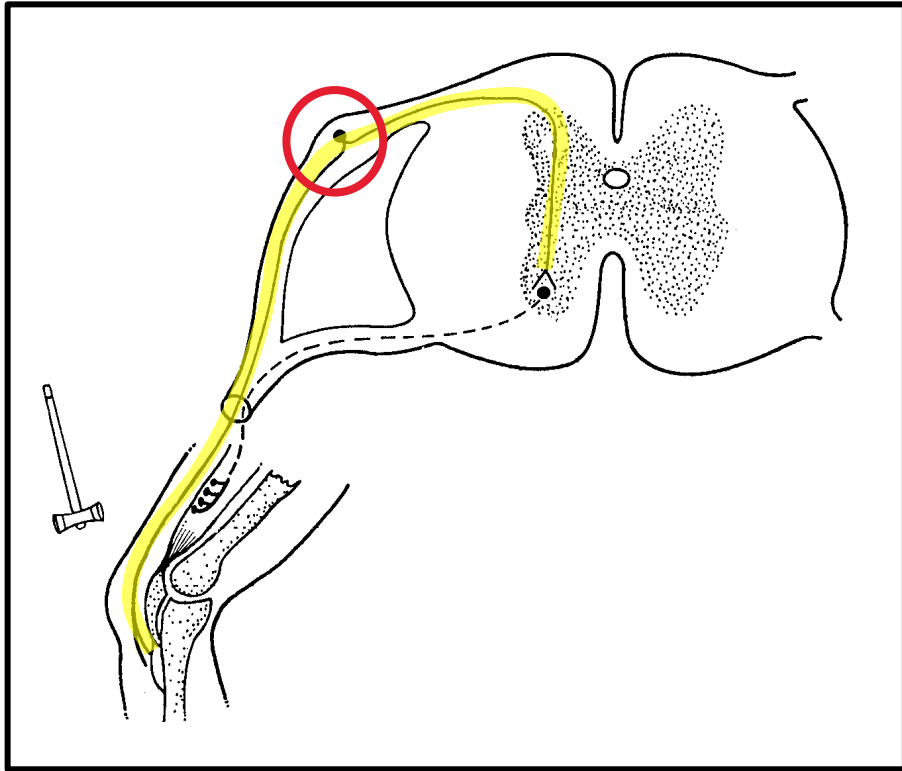
The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [**RECEPTORS IN THE PATELLAR TENDON**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
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PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

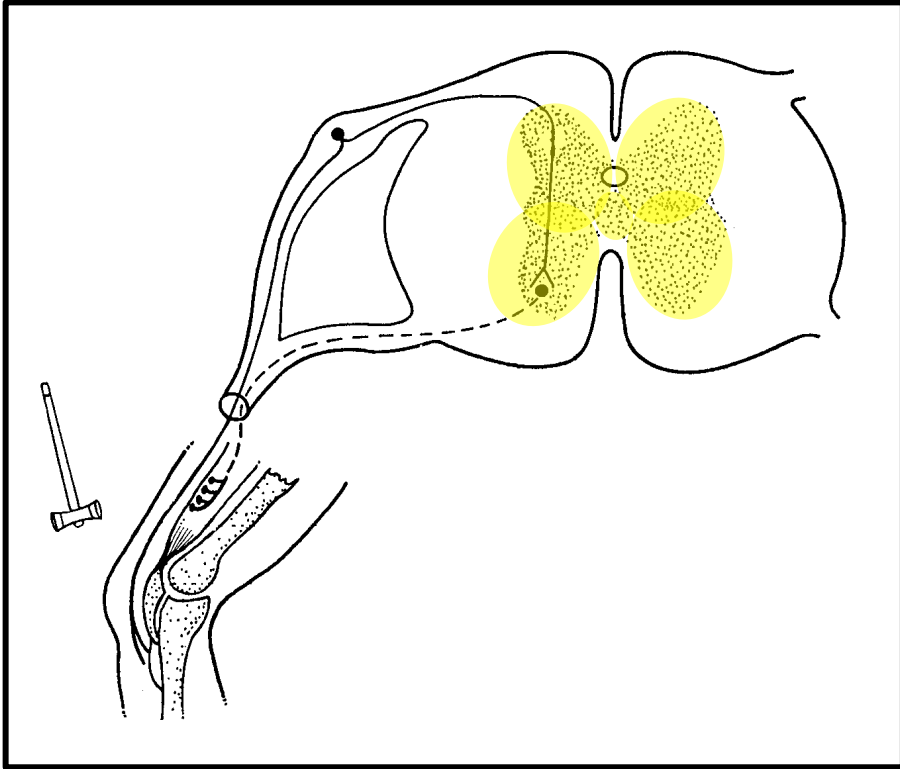
Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [RECEPTORS IN THE PATELLAR TENDON] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
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PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

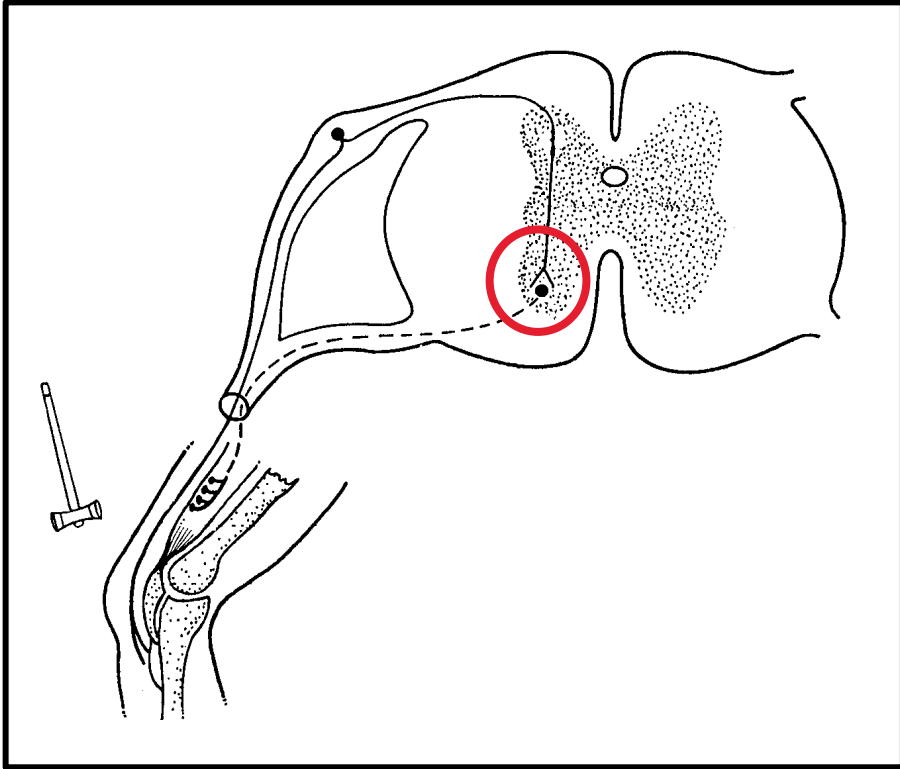
Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [RECEPTORS IN THE PATELLAR TENDON] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to the grey matter of the spinal cord** ✓
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PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

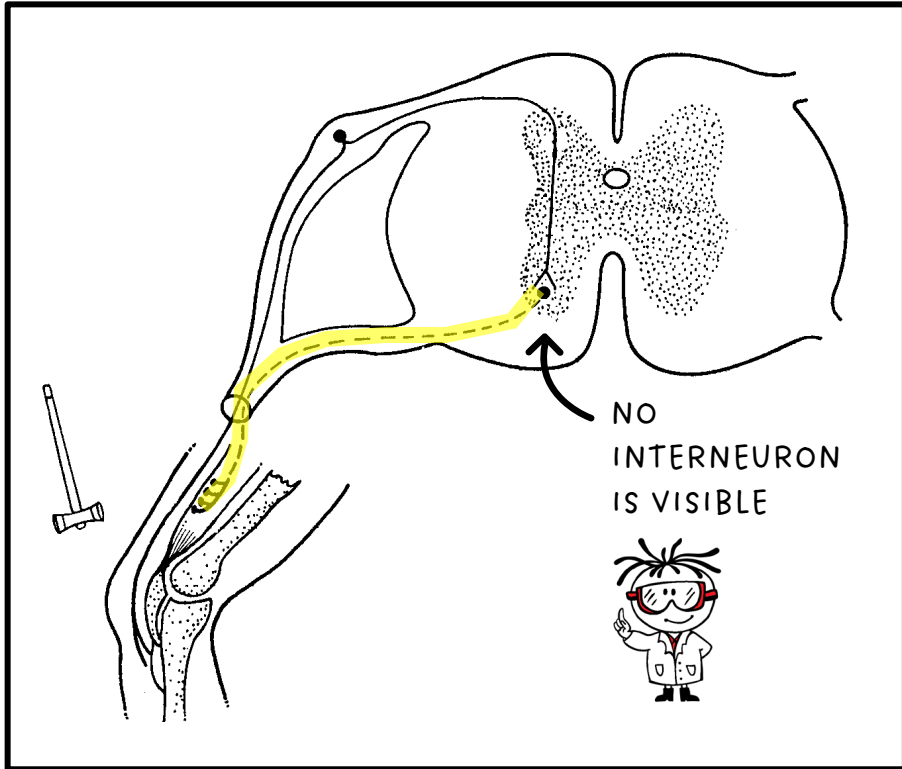
Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [RECEPTORS IN THE PATELLAR TENDON] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
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PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

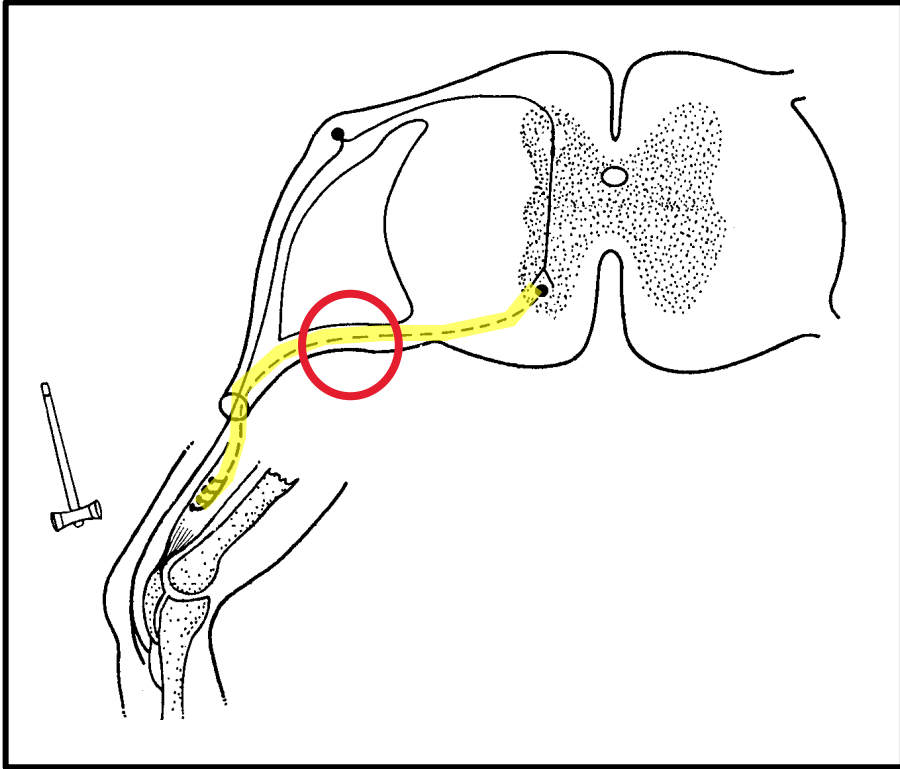
Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [RECEPTORS IN THE PATELLAR TENDON] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **motor neuron** ✓
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PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

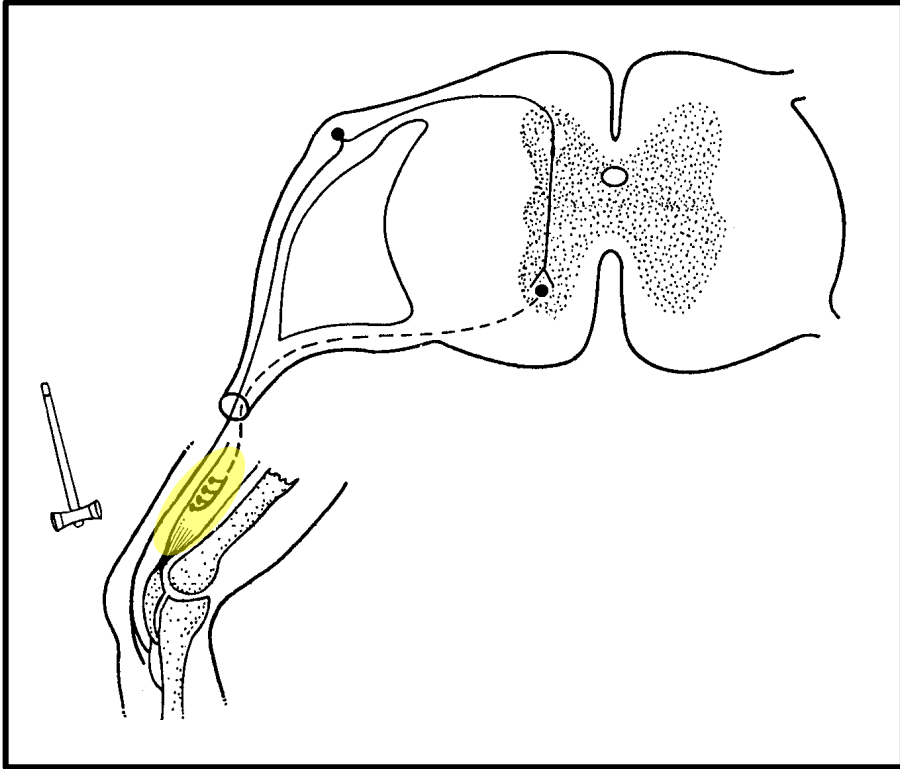
Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [RECEPTORS IN THE PATELLAR TENDON] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
-
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PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

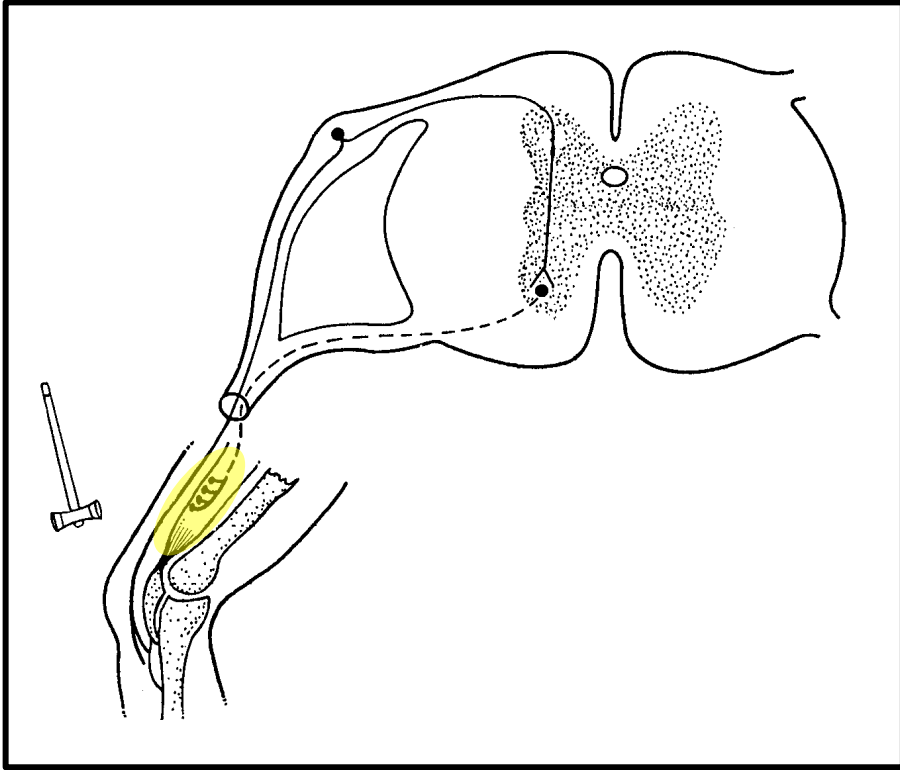
Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [RECEPTORS IN THE PATELLAR TENDON] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
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- **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
- is conducted **along** the axon of the **motor neuron** to the **effector** ✓



PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

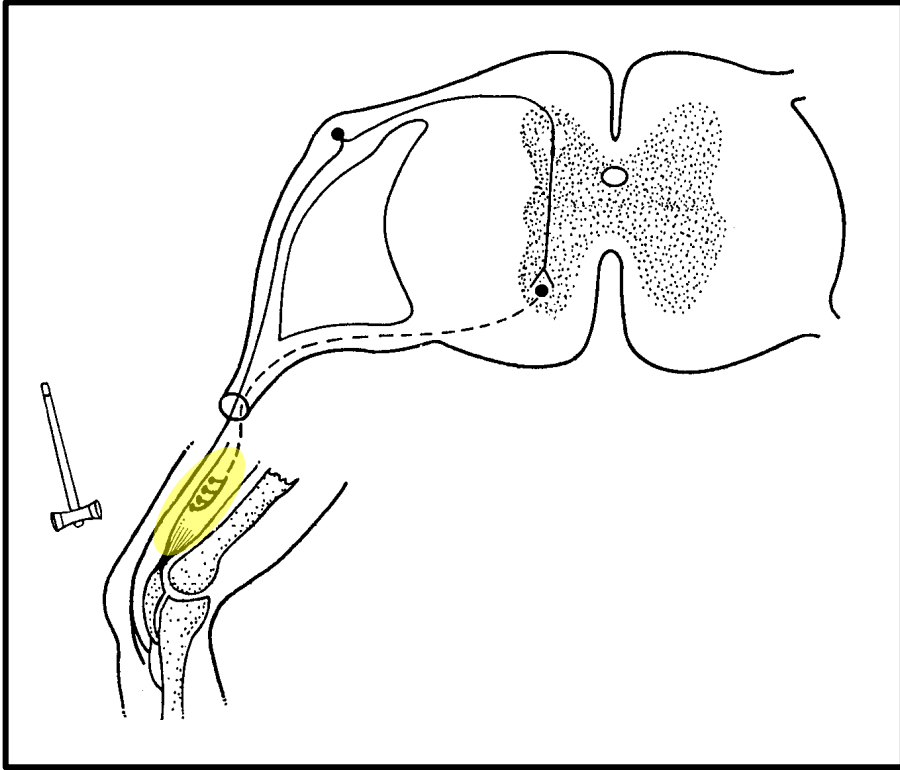
Generic sequence of a reflex arc

- the **stimulus** ✓ is detected by [RECEPTORS IN THE PATELLAR TENDON] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
- is conducted **along** the axon of the **motor neuron** to the **effector** ✓
- the [effector organ reacts] ✓ very rapidly



Be specific
to the
example!

PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the contraction and relaxation of the **quadriceps muscle** in the upper leg.

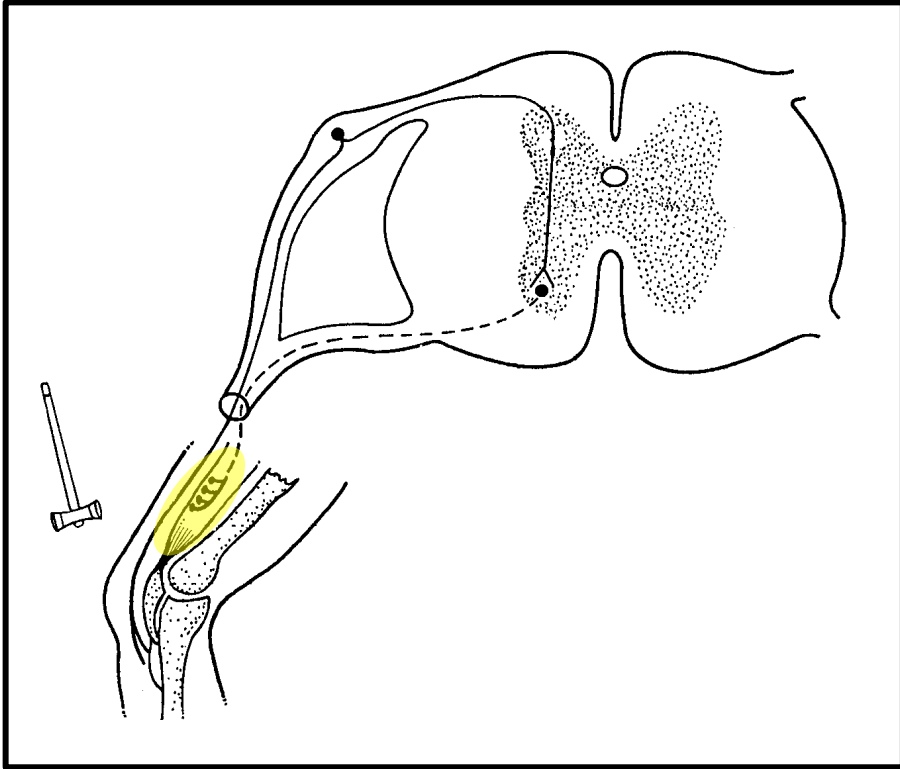
Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction.

Generic sequence of a reflex arc

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- **to** the grey matter of the **spinal cord** ✓
- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord through** the **ventral root of the spinal nerve** ✓ and
- is conducted **along** the axon of the **motor neuron to** the **effector** ✓
- the [**QUADRICEPS MUSCLE REACTS**] ✓ very rapidly



PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the **knee-jerk reaction** is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the **contraction and relaxation** of the quadriceps muscle in the upper leg.

Describe the pathway of the impulse in this reflex arc to bring about the **knee-jerk reaction**.

Generic sequence of a reflex arc

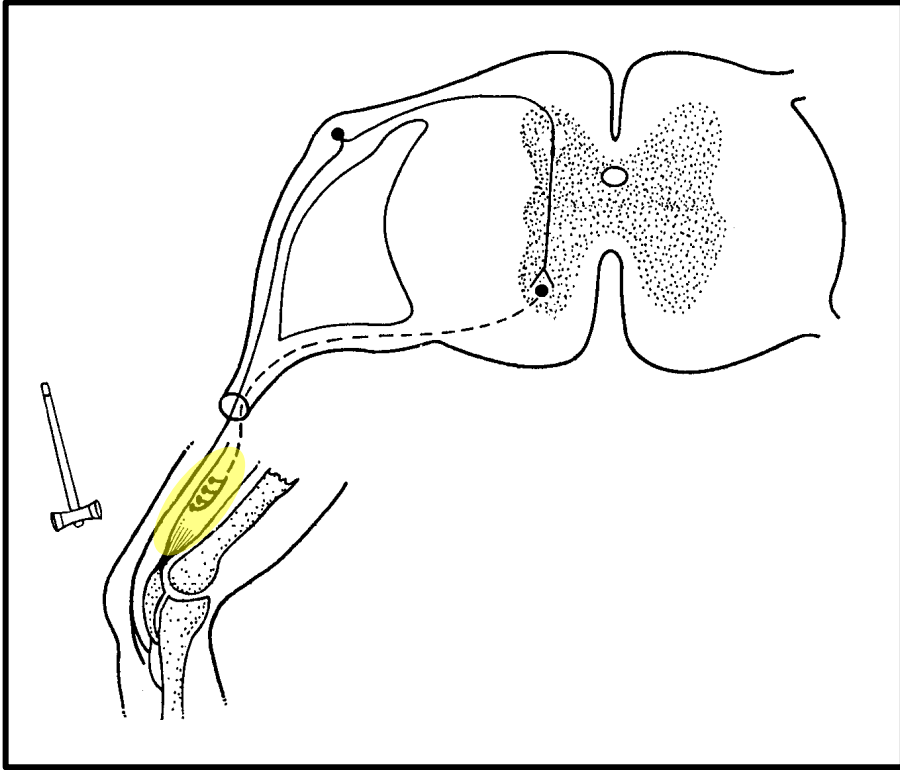
- the **stimulus** ✓ is detected by [**RECEPTORS IN THE PATELLAR TENDON**] ✓ and **converted into** a nerve **impulse** ✓
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- **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
- is conducted **along** the axon of the **motor neuron** to the **effector** ✓
- the [**QUADRICEPS MUSCLE REACTS**] ✓ very rapidly **to cause** [**a response**] ✓

Be specific
to the
example!



Continue the answer

PATHWAY FOR REFLEX ACTION – Worked example 2



The efficiency and speed of the **knee-jerk reaction** is very important for balance and movement. The stimulation of the patellar tendon, just below the kneecap (patella), causes the **contraction and relaxation** of the quadriceps muscle in the upper leg.

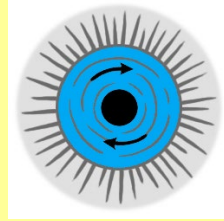
Describe the pathway of the impulse in this reflex arc to bring about the **knee-jerk reaction**.

Generic sequence of a reflex arc

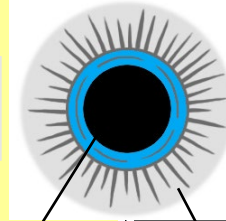
- the **stimulus** ✓ is detected by [**RECEPTORS IN THE PATELLAR TENDON**] ✓ and **converted into** a nerve **impulse** ✓
- the nerve **impulse** is **conducted along** a **sensory neuron** ✓
- through the **dorsal root of the spinal nerve** ✓
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- the nerve **impulse** is **conducted across** the **synapse** ✓
- **to** the **motor neuron** ✓
- the nerve **impulse exits** the **spinal cord** through the **ventral root of the spinal nerve** ✓ and
- is conducted **along** the axon of the **motor neuron** to the **effector** ✓
- the [**QUADRICEPS MUSCLE REACTS**] ✓ very rapidly **to cause** [**CONTRACTION AND RELAXATION / KNEE-JERK REACTION**] ✓

PUPILLARY MEHCANISM

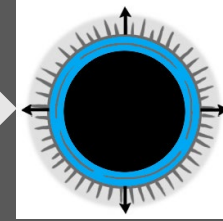
Bright light would damage the retina, so the pupil must constrict to allow less light to enter the eye.



when the circular muscles contract



when the circular muscles relax



In dim light it is difficult to see, so the pupil must dilate to allow as much light into the eye as possible for a clear, sharp image to form on the retina.



In bright light

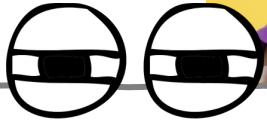
- ✓ the **radial muscles** relax
- ✓ the **circular muscles** contract
- ✓ the **pupil constricts** (becomes smaller)
- ✓ **less light** enters

In dim light

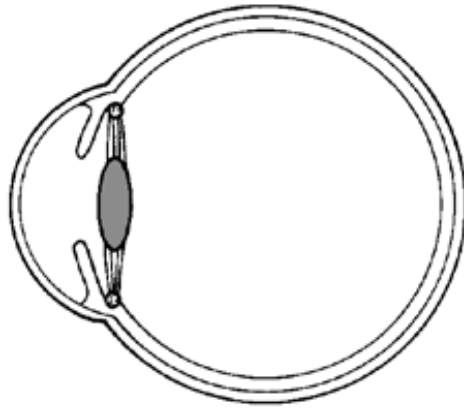
- ✓ the **radial muscles** contract
- ✓ the **circular muscles** relax
- ✓ the **pupil dilates** (becomes larger)
- ✓ **more light** enters



ACCOMMODATION

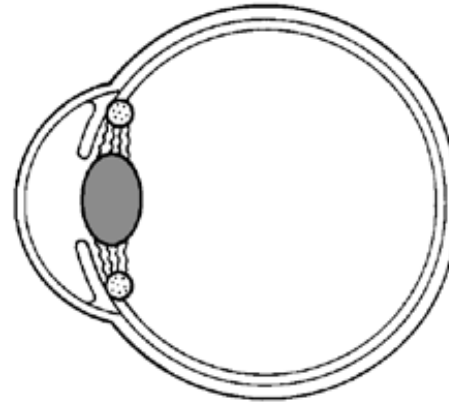


Think squinty eyes looking far away - lens is flatter and looks just like the eyes.



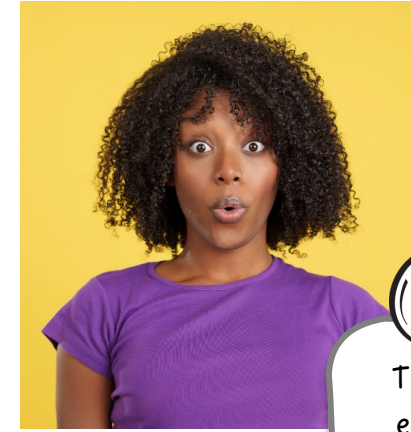
FAR VISION (further than 6 m)

- ✓ ciliary muscles relax
- ✓ ciliary body moves away from the lens
- ✓ suspensory ligaments become taut
- ✓ tension on the lens increases
- ✓ the lens becomes less convex (flatter)
- ✓ light rays are refracted less
- ✓ light rays are focused on the retina



NEAR VISION (closer than 6 m)

- ✓ ciliary muscles contract
- ✓ ciliary body moves closer to the lens
- ✓ suspensory ligaments slacken
- ✓ tension on the lens decreases
- ✓ the lens becomes more convex (rounder)
- ✓ light rays are refracted more
- ✓ light rays are focused on the retina



Think surprised eyes looking at something close to you - lens is rounder and looks just like the eyes.



PUPILLARY MECHANISM VS ACCOMMODATION



So how do these two processes compare?

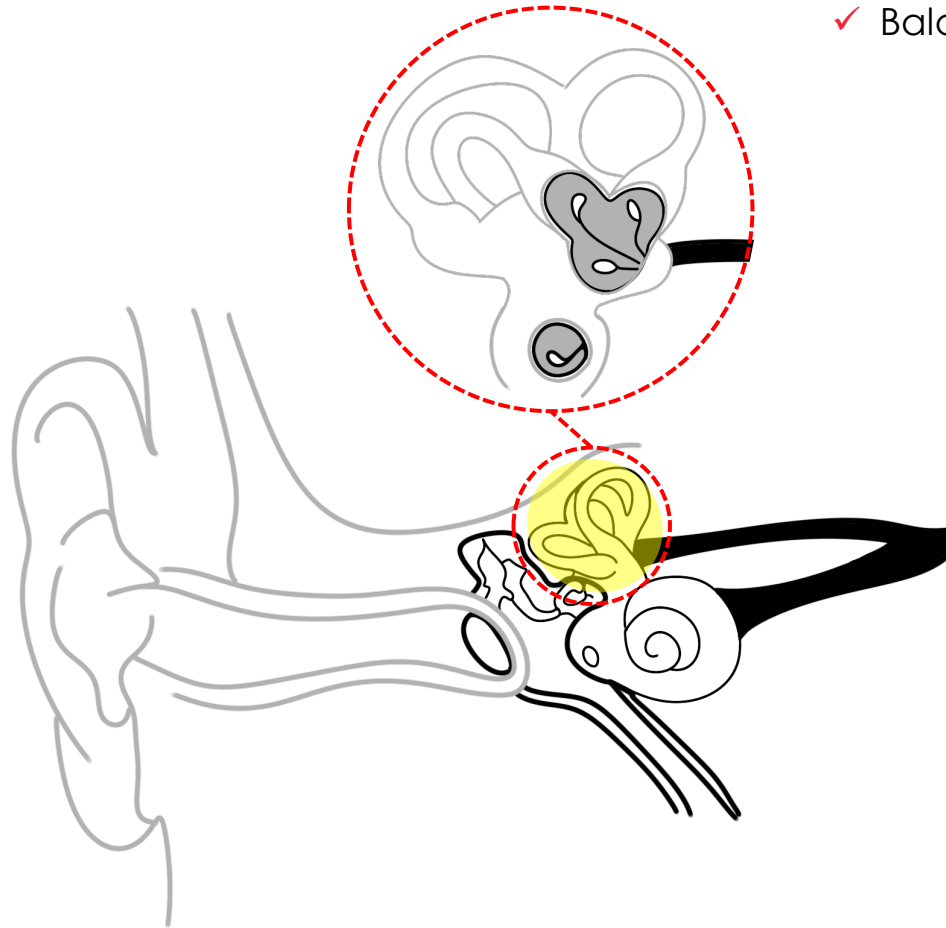
	Pupillary Mechanism	Accommodation
Response to	light intensity	distance of object
Response by	circular and radial muscles	ciliary muscles
Causes	pupil diameter to change	lens shape to change
Affects	amount of light entering the eye	light refraction
Results in	<ul style="list-style-type: none">• preventing damage to the retina in bright light• providing clear vision in low light	clear image on the retina

MAINTENANCE OF BALANCE



HOW IS BALANCE MAINTAINED?

- ✓ Balance is maintained in the **vestibular apparatus**.



Extract from *The Answer Series*
Grade 12 Life Sciences P1 (2025 ed.) p. 67 & 68

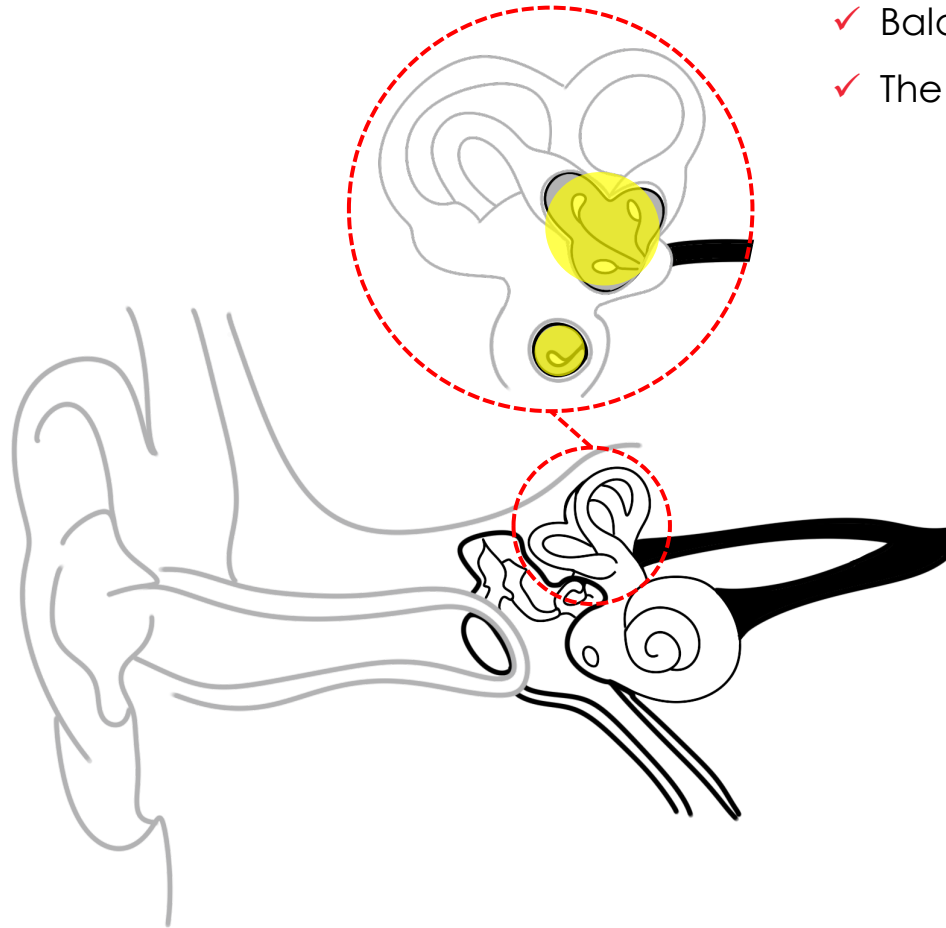


MAINTENANCE OF BALANCE



HOW IS BALANCE MAINTAINED?

- ✓ Balance is maintained in the **vestibular apparatus**.
- ✓ The vestibular apparatus has **TWO receptors** for balance.



Extract from *The Answer Series*
Grade 12 Life Sciences P1 (2025 ed.) p. 67 & 68

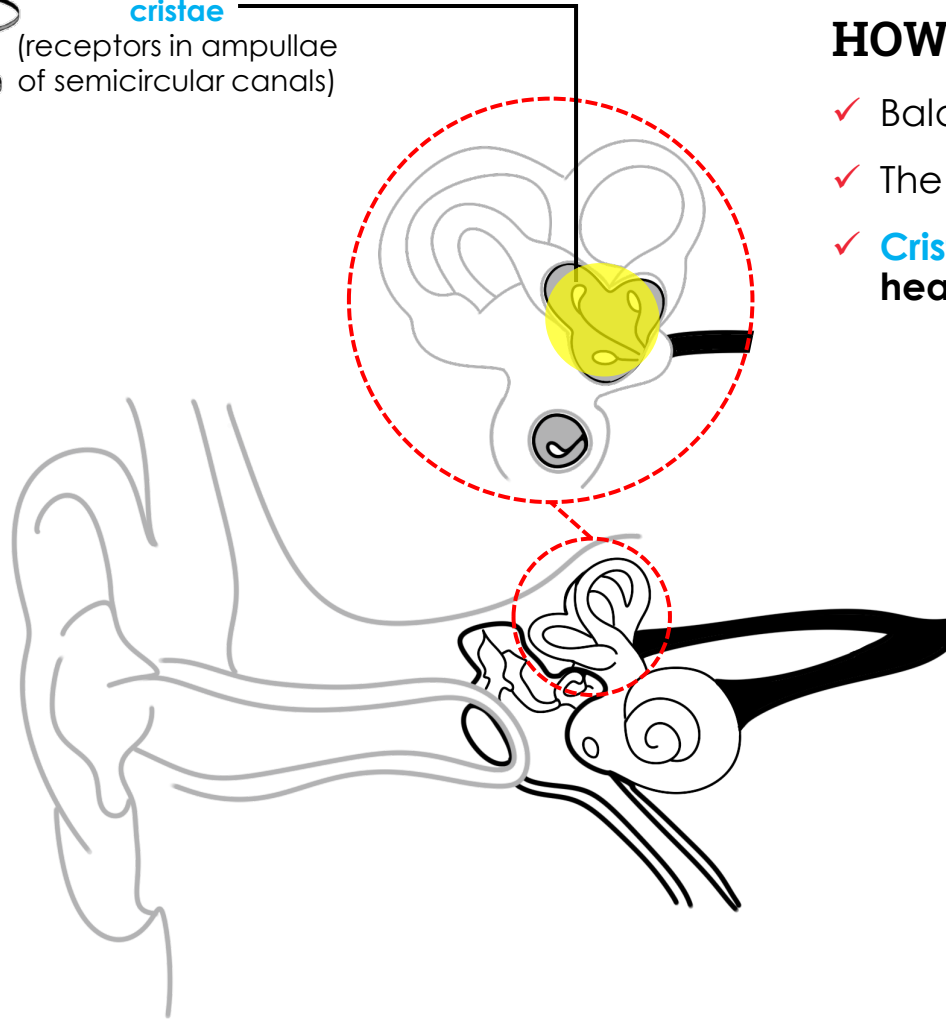


Continue learning

MAINTENANCE OF BALANCE



cristae
(receptors in ampullae
of semicircular canals)



HOW IS BALANCE MAINTAINED?

- ✓ Balance is maintained in the **vestibular apparatus**.
- ✓ The vestibular apparatus has **TWO receptors** for balance.
- ✓ **Cristae** → registers changes in the **speed/direction of movement of the head**, ie. left/right, forwards/backwards.

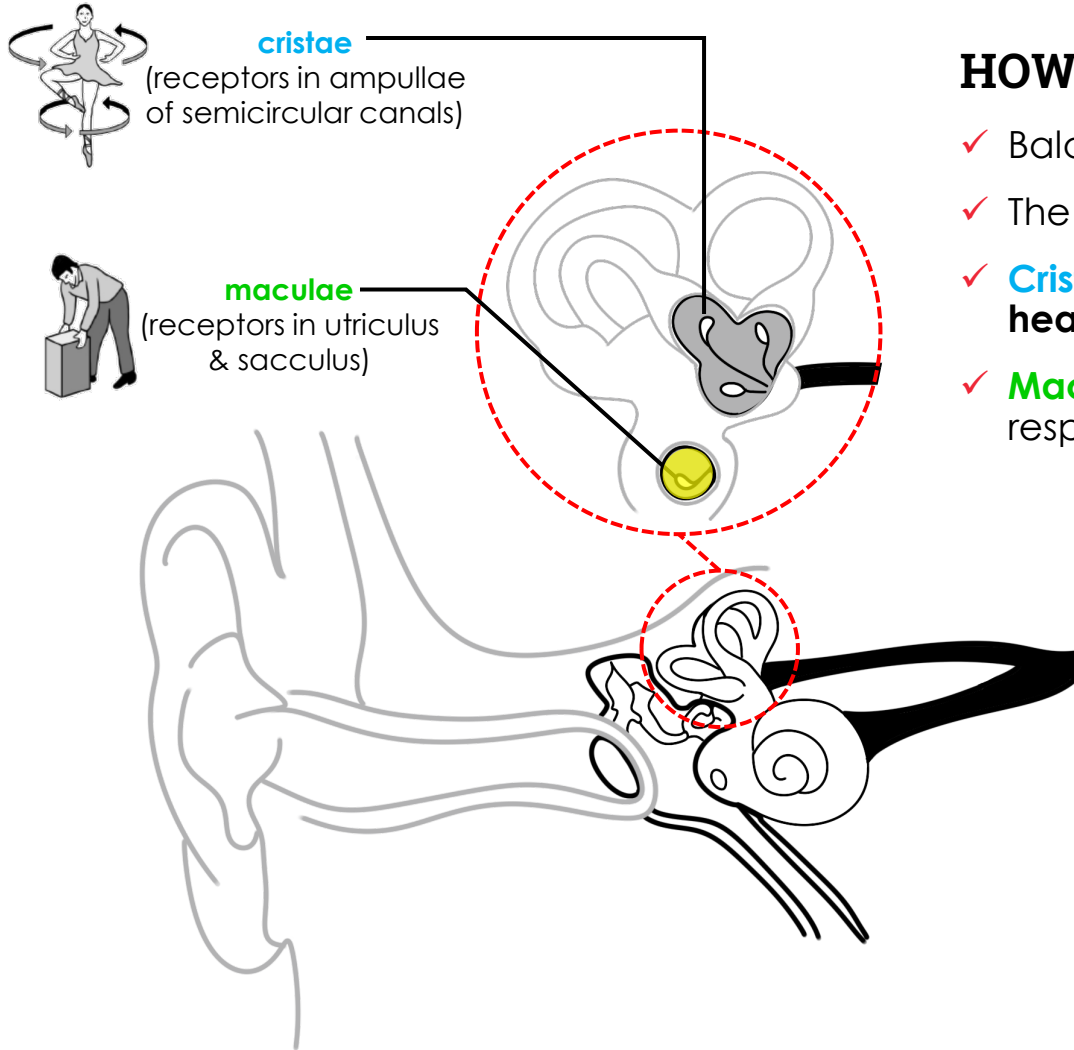


Extract from *The Answer Series*
Grade 12 Life Sciences P1 (2025 ed.) p. 67 & 68



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MAINTENANCE OF BALANCE



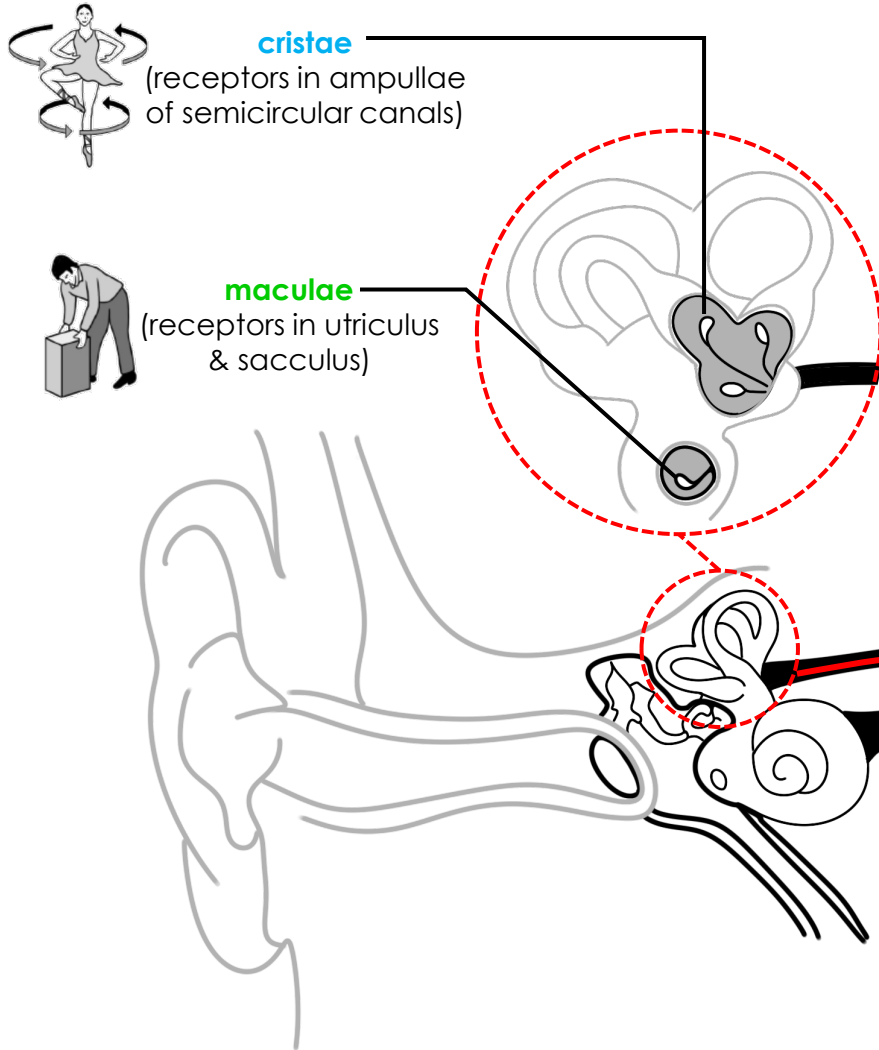
HOW IS BALANCE MAINTAINED?

- ✓ Balance is maintained in the **vestibular apparatus**.
- ✓ The vestibular apparatus has **TWO receptors** for balance.
- ✓ **Cristae** → registers changes in the **speed/direction of movement of the head**, ie. left/right, forwards/backwards.
- ✓ **Maculae** → registers changes in the **position of the head in space with respect to gravity**, i.e. up/down.

Extract from *The Answer Series*
Grade 12 Life Sciences P1 (2025 ed.) p. 67 & 68



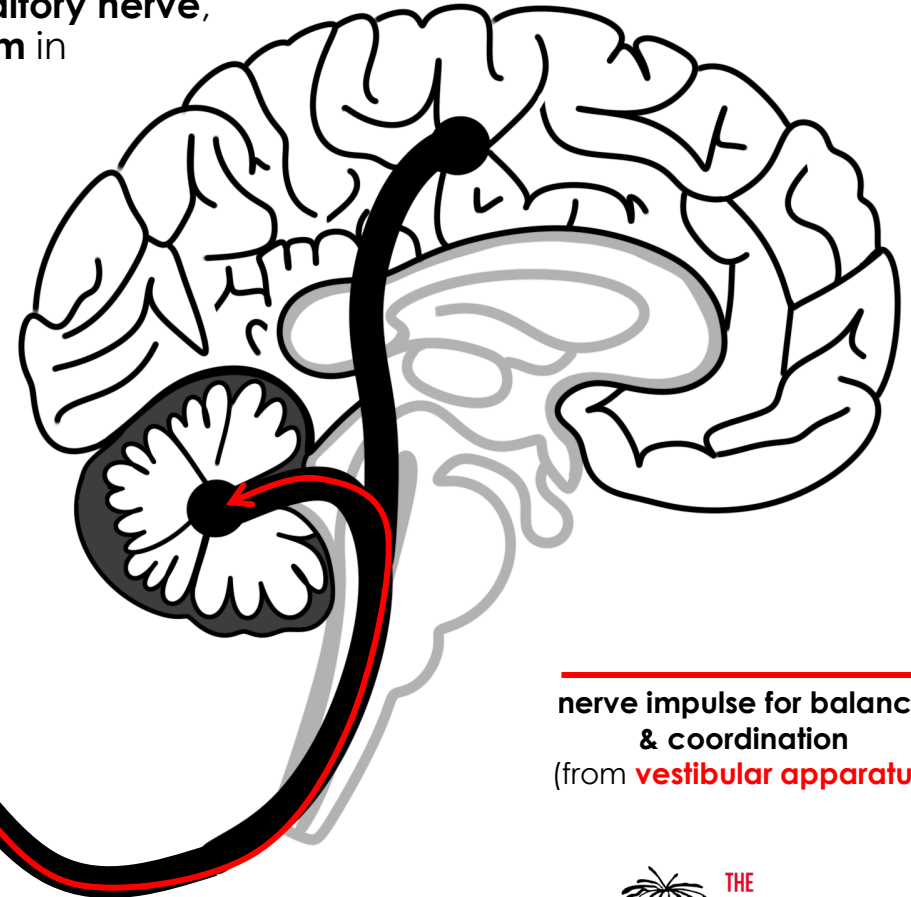
MAINTENANCE OF BALANCE



HOW IS BALANCE MAINTAINED?

- ✓ In response to a **stimulus**, both receptors will **generate** an **impulse**,
- ✓ that travels via the **auditory nerve**, towards the **cerebellum** in the brain.

auditory nerve
(vestibular & cochlear nerve combined)

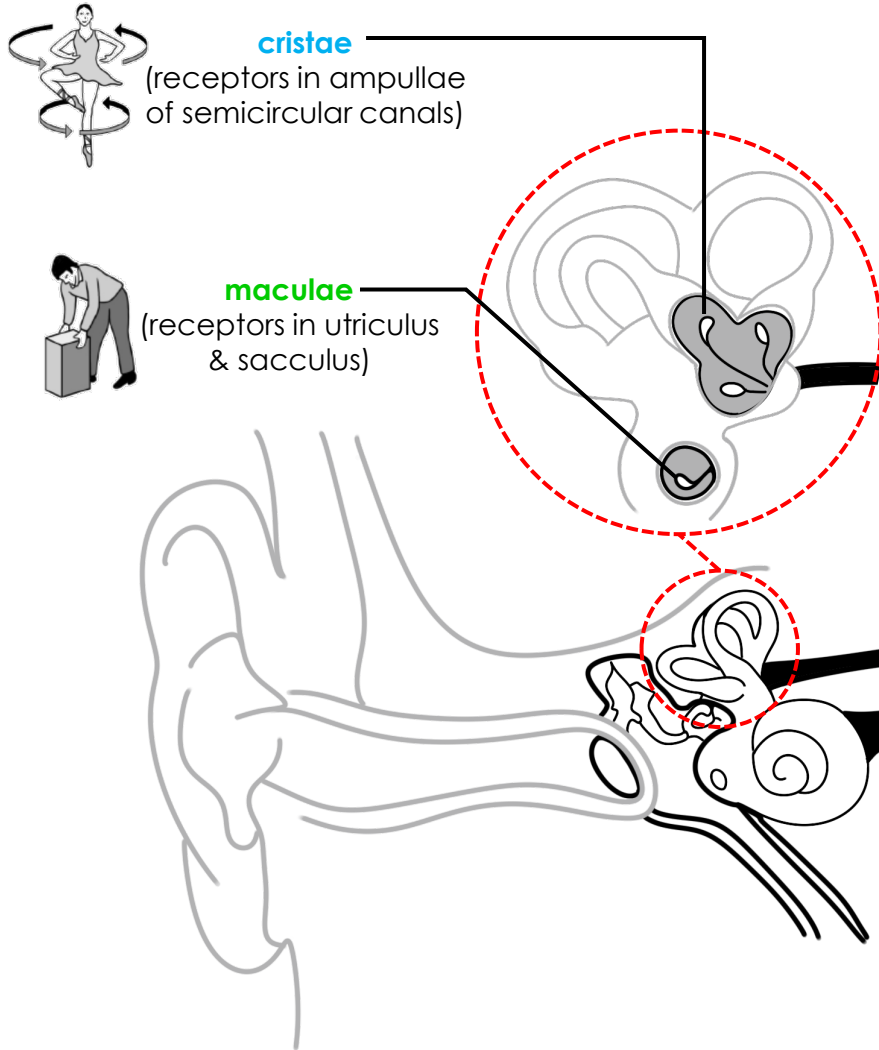


→
nerve impulse for balance & coordination
(from **vestibular apparatus**)

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Grade 12 Life Sciences P1 (2025 ed.) p. 67 & 68

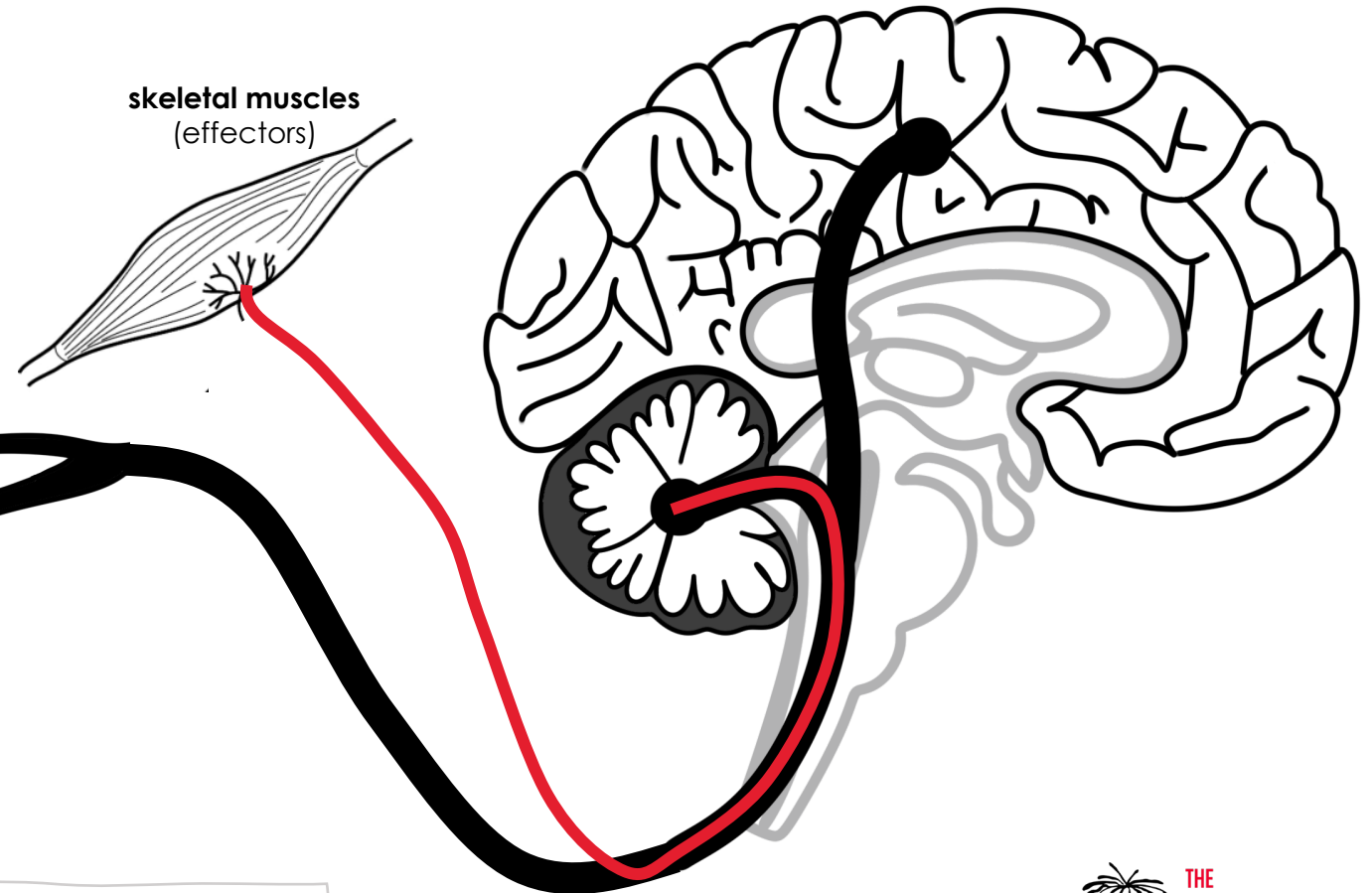
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MAINTENANCE OF BALANCE



HOW IS BALANCE MAINTAINED?

- ✓ The cerebellum then sends impulses to the **muscles** (effectors) to **restore balance**.





Extract from *The Answer Series*
Grade 12 Life Sciences P1 (2025 ed.) p. 67 & 68

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MAINTENANCE OF BALANCE



In summary...

Stimulus	Receptor	Transmits impulse	Part of brain	Effector
movement (change in speed/direction of head) 	Cristae	Auditory nerve	Cerebellum	Skeletal muscles
change in position of head (gravity) 	Maculae			

Extract from *The Answer Series*
 Grade 12 Life Sciences P1 (2025 ed.) p. 67 & 68