

Reproduction in Vertebrates

The role of the following reproductive strategies in animals in maximising reproductive success in different environments (using relevant examples):

- ❑ **External fertilisation and internal fertilisation**
- ❑ **Ovipary, ovovivipary and vivipary**
- ❑ **Amniotic egg**
- ❑ **Precocial and altricial development**
- ❑ **Parental care**

External fertilisation:

- A. Sperm **fertilize the egg cell OUTSIDE** the female body.
- B. **Water is always required**, physical contact not required.
- C. Disadvantages: **Chance of fertilisation is reduced** and **large amounts of sperm** needed.
- D. Zygote **not well protected from predators**.

Internal fertilisation:

- A. The male deposits sperm **inside female bod** where **fertilisation** occurs
- B. Advantages: **Chances of fertilisation increased** and **small amounts of sperm** need to be produced
- C. Zygote is **well protected inside the female body**.

	Ovipary	Ovovivipary	Vivipary
fertilisation	external or internal	internal	internal
development of embryo	external to the body of the female	inside the body of the female	inside the female's body
nutrition	Yolk is the only form of nutrition for the developing embryo and is usually present in small quantities	Yolk present in the egg. Young are independent of the mother's body	Young receive nutrition from the mother's body through the placenta
type of egg	jelly-like or calcareous	calcareous or leathery	None

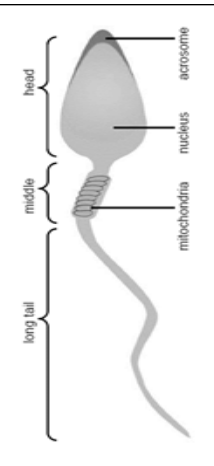
AMNIOTIC EGG Extra embryonic membranes:

- A. **Chorion:**
 - allows **oxygen to enter and CO₂** to leave through to the shell and out
- B. **Amnion:**
 - membrane enclosing the amniotic cavity which contains **amniotic fluid** which **protects** the embryo against **mechanical damage, temperature change and dehydration**.
- C. **Allantois:**
 - stores **waste produced** by the embryo;
 - also functions in **gaseous exchange**
- D. **Yolk sac:**
 - provides **nourishment** to the embryo
- E. **Shell:**
 - **prevents dehydration** and
 - gives **protection**

	Precocial development	Altricial development
Development of the body	well developed	under developed
Eyes after birth	open	closed
Presence of fur / feathers	have fur / feathers	usually naked
Parental care required	low degree of parental care required	high degree of parental care required
Mobility	young can move soon after birth	young have limited ability to move freely
Yolk amount in egg	greater quantity	lower quantity

PROCESS OF SPERMATOGENESIS AND FORMATION OF SEMEN

1. **Spermatogenesis** takes place under influence of **testosterone**
2. In **seminiferous tubules** in **testes**
3. **Diploid** germinal **epithelial cells undergo meiosis**
4. to form **haploid sperm cells**



Human reproductive system

- **Scrotum** – **Protection** and **temperature** control.
- **Testis** – produce **sperm cells**. Sertoli cells gives nutrients, cells of Leydig secretes **Testosterone**
- **Epididymis** – store sperm for **maturation**.
- **Vas deferens** – **transport sperm** from testis to urethra.
- **Seminal vesicle** – **nutrients**
- **Prostate** – **alkaline fluid**
- **Coper's glad** – **movement** of sperm
- **Urethra** – **transport urine and semen**
- **Penis** – **Copulation and ejaculation**.

OOGENESIS

- Under the influence of **FSH**
- diploid** (germinal epithelium) **cells** in the **ovary**
- undergo **mitosis** to form **numerous follicles**
- One** of these follicles enlarges and
- undergoes meiosis**
- Of the four cells produced, only **one survives** to form the **haploid ovum**

STRUCTURE AND FUNCTION OF OVUM

- Haploid nucleus**
- fuses with sperm's nucleus** to form
- diploid zygote**
- jelly layer protects** ovum
- and makes the ovum **impenetrable after fertilisation**

HORMONAL CONTROL OF MENSTRUAL CYCLE (OVARIAN AND UTERINE cycles)

Pituitary gland FSH

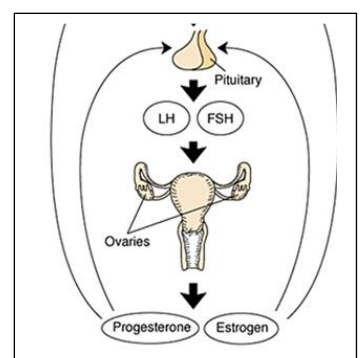
Developing follicle
Oestrogen

Pituitary gland LH

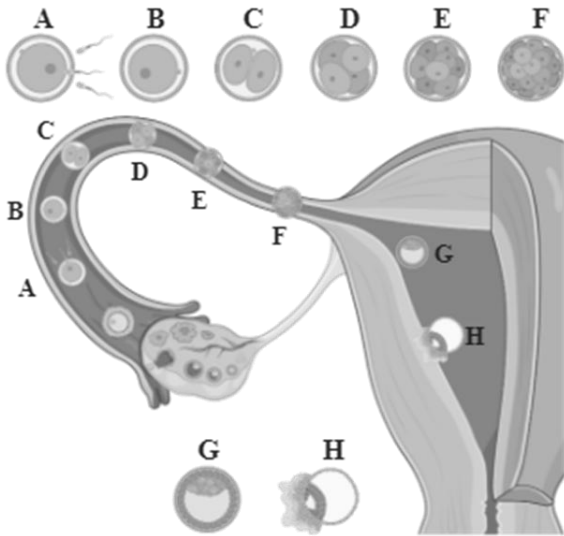
Corpus luteum
Progesterone

- FSH** is secreted by the **pituitary gland**
- FSH stimulates the **development of a primary follicle** into a **Graafian follicle**.
- As the **Graafian follicle develops**, it **secretes Oestrogen**
- Which causes the lining of the uterus - **endometrium** to become **thicker/more vascular**. In preparation for a possible implantation.
- The **pituitary gland secretes LH**
- Which causes the **Graafian follicle to rupture**, releasing the ovum – **Ovulation**.
- Graafian follicle** becomes the **corpus luteum** – which **secrete progesterone**.
- Which causes **further thickening of the endometrium**.

- High** levels of **progesterone inhibit** the **secretion of FSH**
- Which **prevents the development** of a **new follicle** in the ovary.
- If there is **no fertilisation, the corpus luteum degenerates**.
- Which leads to a **drop** in the **progesterone levels**
- The **endometrium disintegrates** and is shed during **menstruation**
- If **fertilisation occurs**, the **corpus luteum remains intact**
- Which leads to **high levels of progesterone**



- ❑ To maintain the pregnancy
- ❑ The secretion of progesterone is eventually taken over by the placenta



FERTILISATION

- A. In the fallopian tubes
- B. The nucleus of the sperm fuses with the nucleus of the ovum
- C. to form a diploid zygote
- D. The zygote divides by mitosis
- E. to form a ball of cells
- F. called the morula
- G. The morula then develops into a hollow ball of cells
- H. called the blastula

EVENTS AFTER IMPLANTATION

- ❖ The embryo continue to divide to to form a foetus
- ❖ Enclosed in membrane called the amnion filled with amniotic fluid
 1. which protects the fetus against temperature fluctuations
 2. dehydration and
 3. mechanical injuries/acts as a shock absorber.
 4. The chorionic villi and the endometrium form the placenta – secretes progesterone.
- ❖ Umbilical cord
 1. Umbilical vein carries absorbed nutrients and oxygen from mother to foetus
 2. Umbilical artery carries the waste and carbondioxide away from the fetus to the mother.

Central nervous system

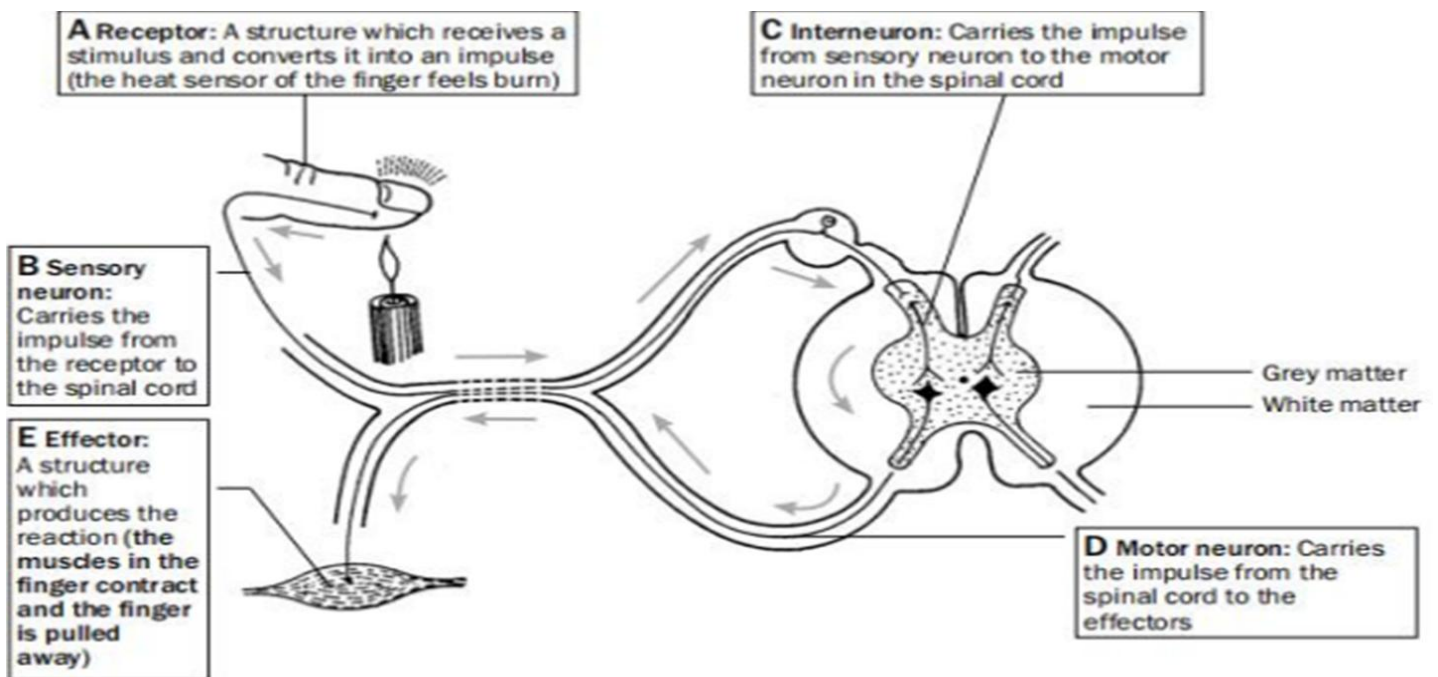
- ❑ Brain and spinal cord - protected by meninges
 - A. Medulla oblongata – heartrate and breathing
 - B. Cerebrum – cognitive abilities
 - C. Corpus callosum – connection.
 - D. Cerebellum – balance
 - E. Spinal cord - reflex

AUTONOMIC NERVOUS SYSTEM

- ❑ Every organ/gland is controlled by two sets of nerves/double innervation
- ❑ that act antagonistically to control involuntary events
- ❑ Sympathetic nerves stimulates
- ❑ Parasympathetic nerves inhibit a response

PHERIPHERAL NERVOUS SYSTEM

Sensory neuron → inter neuron → Motor neuron



REFLEX ACTION AS A RESULT OF A REFLEX ARC

- **Receptor** convert **stimulus into an impulse**
- which is transmitted to the **spinal cord**
- via **sensory neuron**
- **Connector neuron transmits the impulse** via the **motor neuron** to the **effector/muscles**

Causes and symptoms of:

- Alzheimer's disease
- Multiple sclerosis

Note : Any disorder can be asked if the condition is explain in the extract(Learners have to read the extract)

The Eye

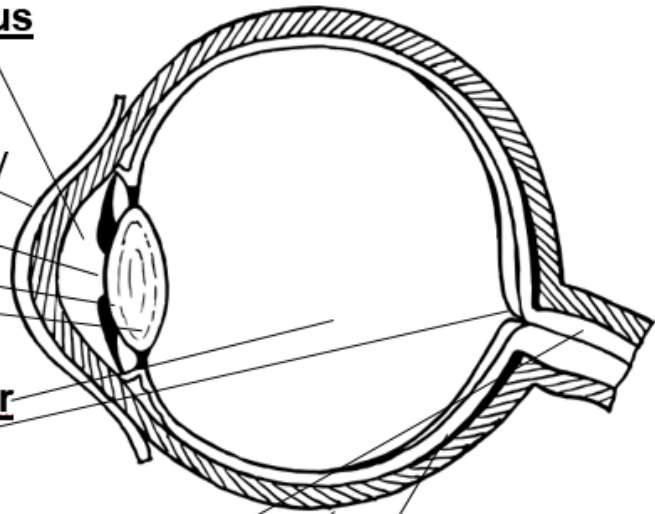
STRUCTURAL SUITABILITY OF LENS

1. **Elastic**, change shape - **accommodation**
2. **Transparent** to allow light **rays to pass through**
3. **Biconvex** to **refract light** rays

Light is bright		Light is dim	
1. Radial muscles of the iris relax		1. Radial muscles of the iris contract	
2. Circular muscles of the iris contract		2. Circular muscles of the iris relax	
3. Pupil constricts (gets smaller)		3. Pupil widens (gets bigger)	
4. Less light enters the eye		4. More light enters the eye	
Sclera Pupil constricts (becomes smaller)		Sclera Pupil widens	
	Radial muscles of iris relax Circular muscles of iris contract		Radial muscles of iris contract Circular muscles of iris relax

THE EYE

- ☞ Light enters the eye through the **cornea** which refracts light
- ☞ It then passes through the **aqueous humour**
- ☞ and the **pupil**
- ☞ The size of the pupil is adjusted by the **iris** that **regulate the amount of light.**
- ☞ The light passes through the **lens** which further **refracts the light**
- ☞ then through the **vitreous humour** and
- ☞ reaches the **retina's yellow spot**
- ☞ which has **photoreceptors/** rods and cones which convert the light into **nerve impulse**
- ☞ The impulse is sent via the **optic nerve** to the **cerebrum**
- ☞ where the **image is interpreted**



Sclera is white inelastic for protection around eye.
Choroid have blood with nutrients and gasses.

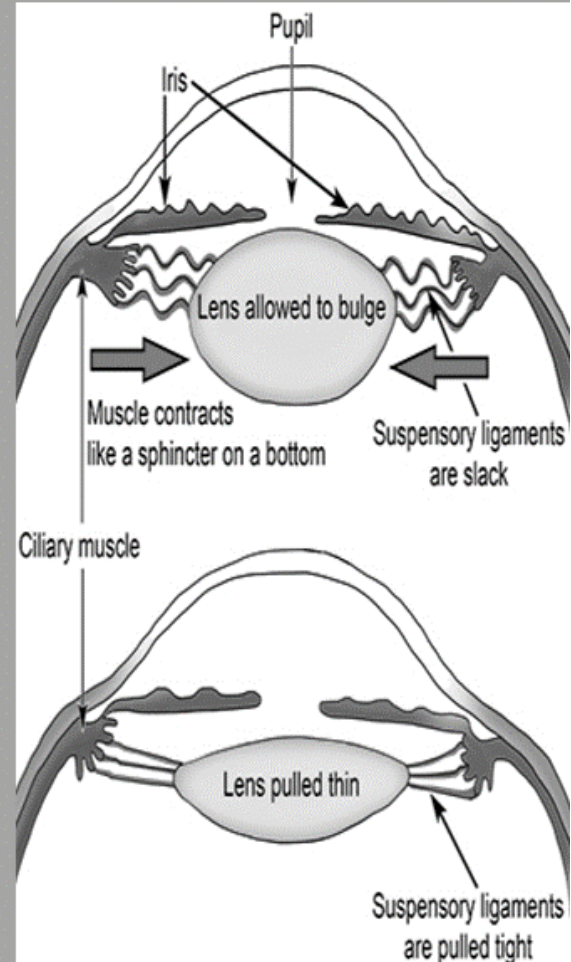
ACCOMODATION

(objects **closer than 6m**)

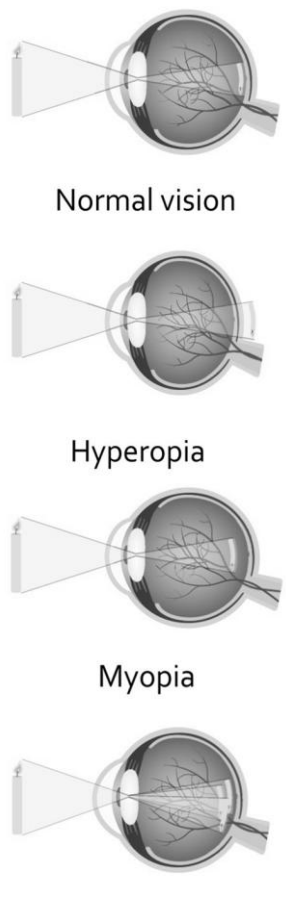
- ☞ **Ciliary muscles contract**
- ☞ **Suspensory ligaments slacken**
- ☞ **Tension** on the **lens decreases**
- ☞ **Lens** becomes **more convex**
- ☞ **Refractive power** of **lens increases**
- ☞ A **clear image falls on the retina**

(objects **further than 6m**)

- ☞ **Ciliary muscles relax**
- ☞ **Suspensory ligaments** become **taut**
- ☞ **Tension** on the **lens increases**
- ☞ **Lens** becomes **less convex**
- ☞ **Refractive power** of **lens decreases**
- ☞ A **clear image falls on the retina**



Visual defect	Nature of the defect	Corrective measures
Short-sightedness Near objects can be seen clearly (myopia)	<ul style="list-style-type: none"> Inability of lens to become more flat/eyeball is longer than normal Lens bends the light rays too much As a result it falls in front of the retina causing the image to be blurred Cannot see distant objects clearly 	Wearing glasses with converging (biconcave) lens Figure 6.12 A
Long-sightedness Objects far away can be seen clearly (hyperopia)	<ul style="list-style-type: none"> Inability of lens to become more convex/eyeball is shorter than normal Lens does not bend light rays enough As a result it falls behind the retina causing the image to be blurred Cannot see near objects clearly 	Wearing glasses with converging (biconvex) lens Figure 6.12 B
Astigmatism	<ul style="list-style-type: none"> The curvature of the lens or cornea is uneven resulting in distorted images 	Glasses with lenses shaped to correct the distortion
Cataracts	<ul style="list-style-type: none"> Lens becomes cloudy and opaque 	Surgery to replace the lens with a synthetic lens



Normal vision

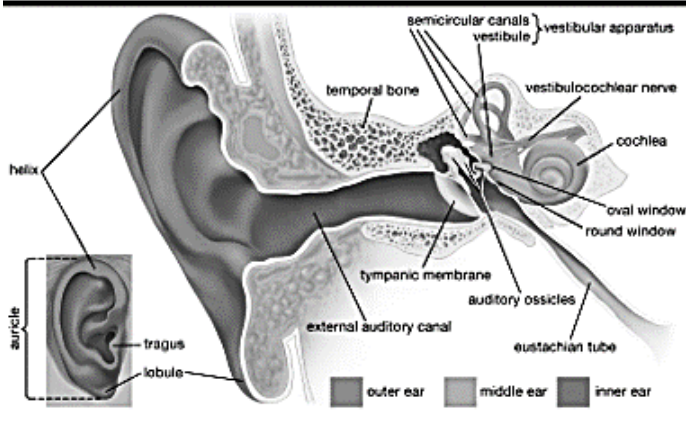
Hyperopia

Myopia

Astigmatism

HEARING

- 👂 Sound waves are directed by the pinna
- 👂 through the auditory canal
- 👂 to the tympanic membrane causing it to vibrate
- 👂 Vibrations are transferred to the ossicles, which enhance and transfer vibrations
- 👂 which causes the oval window to vibrate
- 👂 This sets up pressure waves in the perilymph
- 👂 Pressure waves are transferred to the endolymph in the cochlea
- 👂 Organ of Corti is stimulated to convert the stimulus into an impulse
- 👂 which is then transported along the auditory nerve
- 👂 to the cerebrum where the sound is interpreted



BLOCKED EUSTACHIAN TUBE

- Air will not equalise pressure
- on both sides of tympanic membrane
- Tympanic membrane/ossicles may not vibrate freely
- or lead to the tympanic membrane bursting and lead to hearing loss

BALANCE

Changes in the direction and speed of movement of the head

- causes the **endolymph** to move in the **semi-circular canals**
- The **cristae** in the **ampulla are stimulated** and
- convert the **stimulus into an impulse**
- which is transmitted via the **auditory nerve**
- to the **cerebellum** from which
- impulses are transmitted via motor neurons**
- to the **skeletal muscles**/effector to **restore balance** to the body

Changes to the position of the head.

- causes the endolymph to move in the semi-circular canals
- which stimulates the **macula**
- found in the **utricle and saccule** to
- convert the **stimulus into an impulse**
- which is transmitted via the **auditory nerve**
- to the **cerebellum** from which
- impulses are transmitted via **motor neurons**
- To the **skeletal muscle**/ effector to **restore balance** to the body

DIFFERENCES BETWEEN AN ENDOCRINE AND EXOCRINE GLAND

- Exocrine glands release their **secretions into ducts** (glands with ducts)
- Endocrine glands release their secretions directly **into the blood** stream (ductless glands)

DEFINITION OF A HORMONE

- It is a **chemical messenger**
- that is **protein** in nature
- **Secreted by glands**, but
- act on **target organs** (far from the glands)

Position of the cristae and macula

The role of the macula, cristae and auditory nerve and the cerebellum.

Macula is stimulated by the position of the head

Cristae is stimulated by the speed and movement of the head (the head must be in the answer to receive the mark, as well as the fact that the movement or gravity stimulates the macula and cristae)

