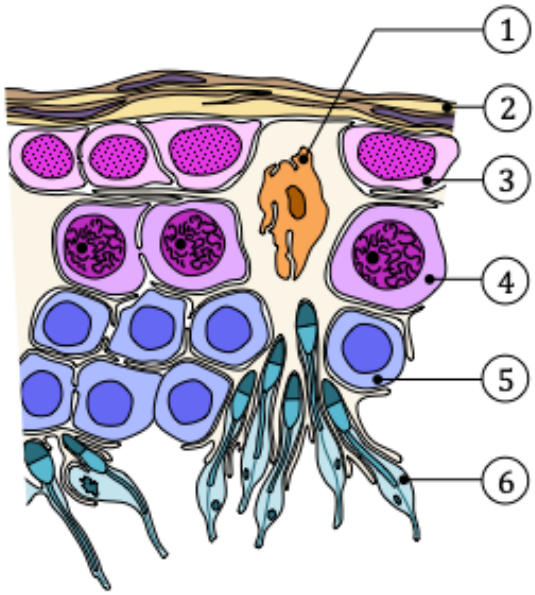
11.4 Sexual Reproduction

Male Reproduction

Annotate a diagram of the testis tissue



1. Sertoli cell
2. Basement membrane
3. Spermatogonia
4. Primary spermatocyte
5. Secondary spermatocyte
6. Spermatid

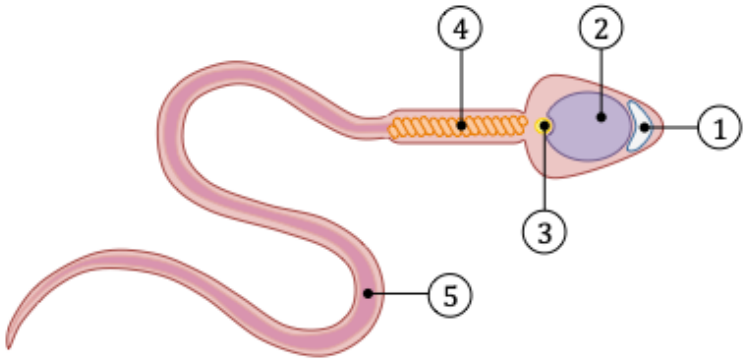
Outline the process of spermatogenesis

Spermatogenesis involves mitosis followed by cell growth followed by meiosis (two divisions) and differentiation

Occurs in seminiferous tubules (testes) and produces four gametes per germ cell

Gametes differentiate into spermatozoa via a process that occurs continuously from puberty

Annotate a diagram of a mature sperm



1. Acrosome
2. Nucleus
3. Centriole
4. Mitochondria
5. Axoneme (within flagellum)

Outline the role of the following in the production of semen

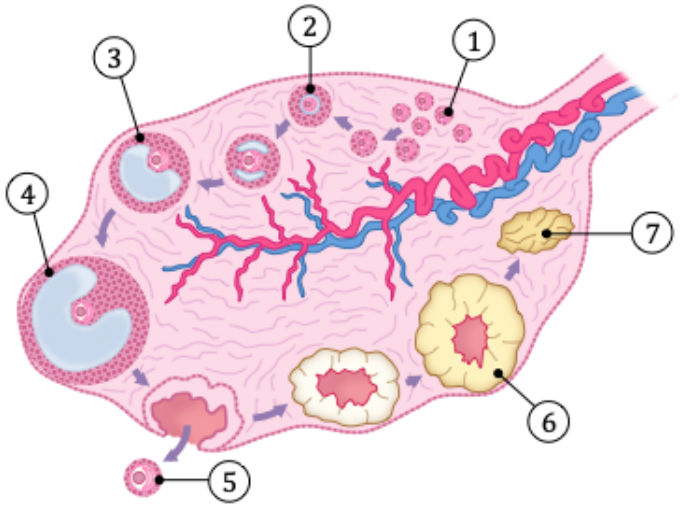
Epididymus: Where sperm matures and develops capacity to 'swim'

Seminal Vesicle: Adds nutrients (provides energy for the sperm) and secretes prostaglandins

Prostate Gland: Secretes alkaline fluids which help to neutralise vaginal acids

Female Reproduction

Annotate a diagram of ovarian tissue



1. Primordial follicle
2. Primary follicle
3. Secondary follicle
4. Graafian follicle (mature)
5. Oocyte
6. Corpus luteum
7. Corpus albicans

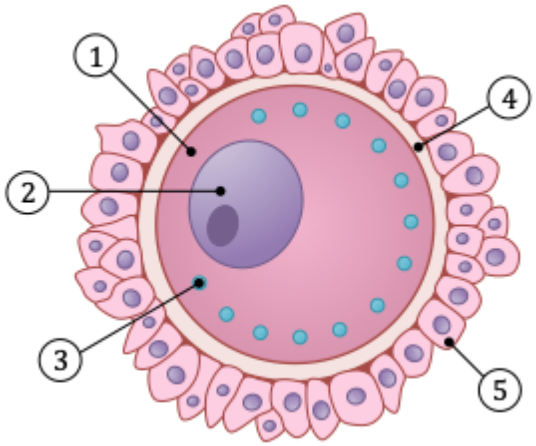
Outline the process of oogenesis

Occurs in ovaries (completed in oviduct), with only one gamete produced per germ cell

There is unequal division of cytoplasm (forms one egg and up to three polar bodies)

Occurs in staggered stages (foetal development ⇒ puberty ⇒ fertilisation)

Annotate a diagram of a mature egg



1. Cytoplasm
2. Nucleus (not technically present, but usually included)
3. Cortical granule
4. Zona pellucida (jelly coat)
5. Corona radiata (follicular cells)

Outline the events that precede the meiotic divisions of a developing egg cell

The process begins during foetal development, when a large number of primordial cells are formed by mitosis

The primary oocytes remain arrested in prophase I until puberty, when a girl begins her menstrual cycle

Each month, hormones unlock some oocytes to begin the second meiotic division (but are arrested in metaphase II)

If the oocyte is fertilised by a sperm, meiosis II is completed and the mature egg forms a ovum

Fertilisation

Compare the processes of spermatogenesis and oogenesis

Feature	Spermatogenesis	Oogenesis
Number of gametes produced	Four	One (+ polar bodies)
Cytoplasmic division	Equal	Unequal
Duration of process	Continuous	In staggered stages
Timing of gamete release	Lifelong (from puberty)	Finite (menarche to menopause)

Describe the conditions required for fertilisation

Capacitation

Biochemical changes occur when sperm enters the female reproductive tract

Uterine chemicals dissolve the sperm's cholesterol coat, improving its motility

Acrosome Reaction

To enter the egg, sperm must penetrate the protective jelly coat (zona pellucida)

Acrosome vesicles release enzymes which soften the glycoprotein matrix

Egg and sperm membranes fuse and the sperm nucleus (+ centriole) enters the egg

Cortical Reaction

Cortical granules release enzymes that destroy sperm-binding proteins on the jelly coat

(after fertilisation has occurred)

This prevents other sperm penetrating the fertilised egg (polyspermy)

Embryo Development

Outline the role of hCG in early pregnancy

When a blastocyst is implanted into the endometrium it begins to secrete hCG (human chorionic gonadotropin)

hCG sustains the corpus luteum and prevents its degeneration (continues to make oestrogen and progesterone)

Oestrogen inhibits FSH & LH, preventing further egg release, while progesterone maintains the endometrium

When a placenta develops and begins to produce progesterone, hCG levels drop and the corpus luteum degenerates

Outline, with the aid of the diagram, the early development of an embryo

Zygote **Morula** **Blastocyst**

A zygote undergoes several divisions to form a morula, and subsequent unequal divisions results in a blastocyst

Blastocyst contains an inner cell mass (forms embryo), outer layer (trophoblast: forms placenta) and a cavity

This occur in the oviduct and when the blastocyst reaches the uterus, it embeds into the endometrium

Explain how the structure of the placenta relates to its function

The placenta is a disc-shaped structure that nourishes the developing embryo

It is formed from the trophoblast of a developing embryo (i.e. the outer layer)

An umbilical cord connects a fetus to the placenta and maternal blood pools via open ended arterioles into lacunae

Fetal chorionic villi extend into these lacunae and facilitate materal exchange

List the materials that are exchanged between maternal blood and foetal blood within the placenta

Maternal → Foetal: Nutrients, oxygen and maternal antibodies will be taken up by the fetus

Foetal → Maternal: Carbon dioxide and toxic waste products (e.g. urea) will be removed by the mother

Outline the hormonal role of the placenta

Placenta takes over hormonal role as corpus luteum degenerates ; Estrogen stimulates growth of the uterine

myometrium and mammary glands ; Progesterone maintains the endometrial lining and reduces uterine contractions

Outline the role of hormones and positive feedback in the process of birth

The fetus begins to stretch the uterine walls, which triggers the release of two hormones – oxytocin and estrogen

Estrogen inhibits progesterone (which was preventing contractions) and oxytocin stimulates uterine contractions

As the uterus contracts, stretch receptors are further stimulated (positive feedback)

Contractions will stop when the baby is birthed (no more stretching of the uterus)