REPRODUCTION NOTES

Function of reproductive organs

MALE

(successful fertilization)

Penis: Erectile tissue with large spaces that when filled with blood → penis becomes rigid and erect → penetration during sexual intercourse

Sperms: Millions of sperm released during ejaculation → increased chance of fertilization

Seminal Vesicles: Secrete fluid containing fructose → provide energy for sperms to move towards ovum

Prostate gland: contributes additional prostate fluid to ejaculate → nourish sperm

Cowper's gland: secrete clear, slippery fluid → lubricate urethra and neutralize acidity of the semen

(sperm development)

Scrotum: special muscles in the wall of scrotum that contract and relax → moe testicles closer to the body (warmth), further away (cool) → keeping testes at optimum temperature slightly cooler than body temperature → normal sperm development

Testes: seminiferous tubules within testes responsible for producing sperm cells through spermatogenesis + testes make testosterone

Epididymis: transport and storage of sperm cells produced in testes + bring sperm to maturity for **fertilization** + during sexual arousal, contractions force sperm into vas deferens

(ejaculation)

Vas deferens: long muscular tube → transports mature sperm to urethra in preparation for ejaculation

Urethra: when penis is erect during intercourse, urethra blocks flow of urine → only semen ejaculated at orgasm

FEMALE

Vagina: aka birth canal, joins cervix to outside of body → allow sperm to pass through

Uterus: hollow, pear-shaped organ → easily expand to hold developing fetus after implantation of blastocyst + allow sperm to enter and menstrual blood to exit

Fallopian tubes: narrow tubes for ova to travel to uterus + fertilization site

Ovaries: small, oval-shaped glands → produce ovum and hormones

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Function of organs post-fertilisation

Amniotic fluid:
Temperature higher than rest of body → keeps baby cozy
Incompressible → protect fetus from mechanical injury
Supports and cushions fetus → shock absorber
Contains fetal cells from fetus → extract fetal cells for Down syndrome test without harming fetus

Placenta:
Contain villi → increase SA → rapid diffusion of substances
Maternal and fetal blood vessels allow exchange of materials through diffusion
Produces HCG to sustain corpus luteum to produce estrogen and progesterone until placenta large enough to sustain production

Menstrual cycle

DAY 0:
Release GnRH from hypothalamus
Stimulates anterior pituitary gland to secrete small amounts of FSH and lh
DAYS 0-5:
Start of menstrual cycle, endometrium wall breaks down
FSH aided by LH stimulates maturation of follicles that will in turn
Secrete estrogen for
Repairing of endometrium after menstruation
DAYS 0-8:
Low levels of estrogen → exert negative feedback inhibiting secretion of FSH and LH → prevent new follicles from developing

DAY 11:
High level of estrogen (__units) bring about positive feedback on LH and FSH
LH and FSH increase (from __ units to __units) stimulating follicles to mature
DAY 12-13:
Sudden peak of LH and FSH (from ___ to ___ units)
Surge in LH caused ovulation → rupture of mature follicles to release ovum
Remaining follicle cells develop into corpus luteum that secretes progesterone and estrogen

DAYS 14-24:
Increase in estrogen and progesterone levels (from ___ to __ units) further thickens and maintains endometrium for implantation

DAYS 18-24:
HIGH LEVELS of estrogen and progesterone (___units) exerts negative feedback on hypothalamus inhibiting secretion on LH and FSH → levels of these two hormones remain low (__units)

DAY 28:
In the absence of fertilization, corpus luteum will degenerate
Fall in both progesterone and estrogen levels (___ units)
Alleviating repression on FSH and LH

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DNA REPLICATION NOTES

Semi-conservative replication

- ___ replicates its DNA by semi-conservative replication
- After **1st round** of replication, **CsCl density gradient** shows formation of **hybrid DNA molecules**
- That contain **one original (N15) radioactive** strand and one **newly-synthesised (N14) non-radioactive daughter strand**
- During semi-conservative DNA replication, **two strands of DNA separate**
- Each stand is used as a **template** to synthesise **new daughter strand**

DNA REPLICATION

- Helicase unwinds double-stranded DNA
- Single-stranded binding protein stabilizes the separated DNA strands
- Each parent strand acts as a **template** to synthesise **new daughter strand**
- RNA primase binds to initiation site, synthesizes RNA primer
- DNA polymerase III binds to both template strands
- To the 3' to 5' parent strand, DNA polymerase III adds DNA nucleotides to the 3'OH end of RNA primer
- Forming the daughter strand (leading strand) continuously
- To the 5' to 3' parent strand, DNA polymerase III adds DNA nucleotides in Okazaki fragments
- Forming the daughter strand (lagging strand) discontinuously
- RNA primer removed by DNA Polymerase I
- Nicks between Okazaki fragments filled in by DNA ligase, by forming phosphodiester bond between Okazaki fragments
- Both parental strand and daughter strands recoils
- Form 2 identical double helix DNA molecules

Answering Genetics Questions

How did you determine the genotype?

Case 1

Father's genotype is eebb, has recessive alleles e and b

But he is **phentoypically normal**, hence he also has **dominant alleles E and B**

Hence he is double heterozygous EeBb

Case 2

Person A Blood group A, Person Blood group B

As they have a child who is of blood group A, so person Q must be a **heterozygous** blood group B.

Co-dominance vs incomplete dominance?

Co-dominance: two alleles **not identical** but **expressions of both** are observed in the **heterozygous individual**

Incomplete: two alleles **interact**, creating **intermediate phenotype**

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Why are none of the daughters colour-blind?
For her to be colour-blind, **BOTH her X-chromosomes** must carry **recessive alleles** (X^nX^n) and she would need to **inherit X^n** from her **father and mother**. (However, her father is unaffected, so his genotype has to be X^NY, hence this cannot be a sex-linked disease

Why woman with hemophilia will always pass condition to son?
A woman with hemophilia has **recessive allele** on **BOTH** the **X**-chromosomes. The recessive allele **ON THE X-chromosome** inherited from his mother would be **expressed**.

Why eventually have 4 children with normal sight, none night-blind?
1. The size of the **progeny** is **SMALL**
2. The **expected ratio** of 1 night blind:1 normal can only be **observed** when the **SAMPLE SIZE** of the offspring is **LARGER**

<u>Cancer and stem cells</u>
What is a cancer stem cell?
A **smaller subset** of cancer cells within a particular type of cancer that can **maintain cell growth indefinitely**

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