REPRODUCTION IN HUMANS

Reproduction in humans is when the male gamete- sperm fuses with the female gamete - ovum/egg.

⇒ MALE REPRODUCTIVE SYSTEM:

→ TESTES - The primary male sex organ.
- Lie outside the abdominal cavity in a special sac called SCROTUM.
- Produce sperms constantly after puberty
- Produce testosterone
- In scrotum, they are kept at a slightly cooler than body temperature (37°C) which is best for sperm production.

→ EPIDIDYMIS - Secondary sex organ.
- It is a mass of coiled tube about 6 metres long that is present on the outside of each testis
- They store the sperms & the sperms mature here.

→ SPERM DUCT - Secondary male sex organ.
- It is a muscular tube that links epididymis to urethra

– SEMINAL VESICLE - It branches from each sperm duct near the urethra
- It adds fluid & nutrients to form semen.

→ PROSTATE GLANDS – Surrounds the urethra
- Secretes fluids in which sperm cells can swim
- It also secretes mucus which sperm cells use as a source of energy for their respiration.

* SEMEN – Sperm cells + secretion from prostate gland & seminal vesicle

→ URETHRA – Allows semen & urine from the bladder at different times
- A ring of muscle around urethra contracts to prevent the loss of any urine from bladder during intercourse.

→ PENIS – Allows the transfer of sperms into vagina during sexual intercourse

⇒ FEMALE REPRODUCTIVE SYSTEM:

→ Ovaries – Primary sex organs.
- Whitish oval bodies which lie in the lower half of the abdomen one of each side of the uterus
- It contains follicle in which eggs are produced.
- It also produces female sex hormones – oestrogen & progesterone

→ OVIDUCT OR
FALLOPIAN TUBE – It carries ovum to the uterus
- site of fertilization

→ UTERUS – Present lower down in the abdomen.
It is the site of fetus development

→ CERVIX – Ring of muscles at the lower end of uterus.
- Sepelates uterus from vagina

→ VAGINA – Receives the penis during intercourse & sperms are deposited here.
- It is also the part of birth canal.

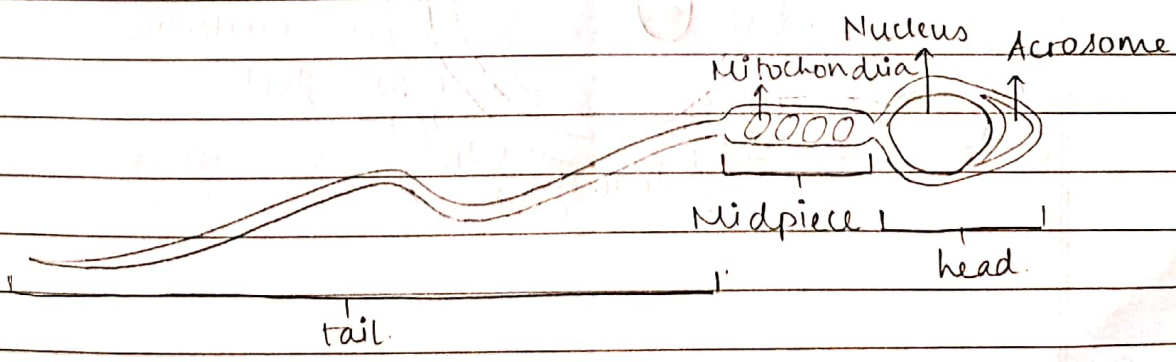
→ URETHRA – Carries urine from the urinary bladder.

→ VULVA – Outer opening of the vagina

⇒ COMPARING MALE & FEMALE GAMETES:

	MALE GAMETE (SPERM)	FEMALE GAMETE (EGG)
SIZE	Very small	Much larger than sperm cells.
MOVEMENT	Swims using tail that lashes from side to side.	Does not move itself - is moved along the oviduct by cilia & peristalsis
FOOD STORE	Very little - uses sugar in semen for respiration	Protein & fat in cytoplasm - enough to last until implantation in uterus
NO. OF CHROMOSOMES	23 (Haploid number)	23 (Haploid number)
NO. PRODUCED	Millions constantly produced after puberty throughout life	One a month after puberty until menopause except when pregnant or taking contraceptive pill.

⇒ MALE GAMETE - SPERM:



→ ACROSOME contains enzymes that are released during fertilisation. These enzymes digest a pathway through the jelly coat surrounding the egg

→ MITOCHONDRIA releases energy for the sperm to swim. They are present in the midpiece

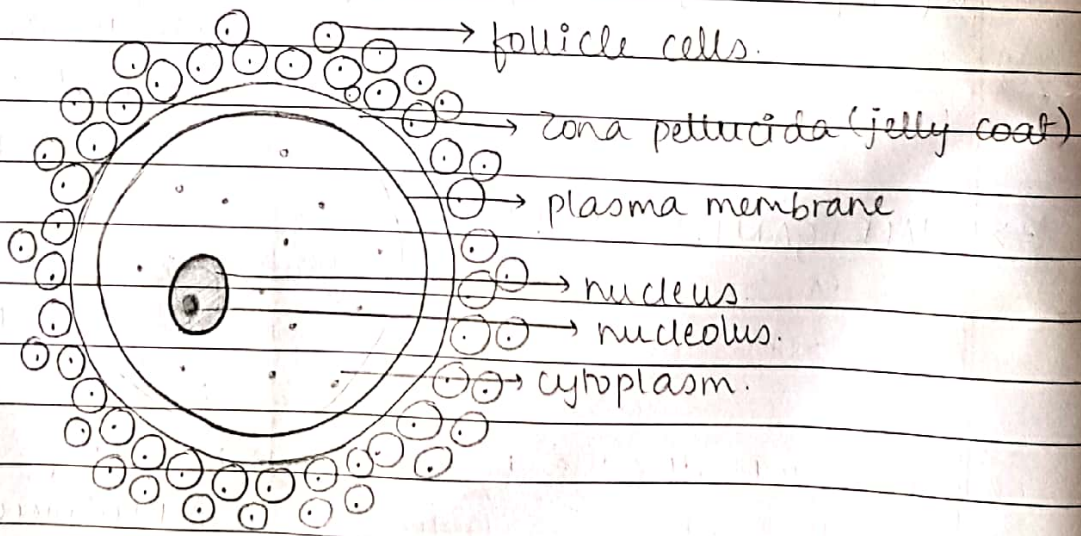
→ The NUCLEUS contains (father's) chromosomes

→ The sperms are produced in tubules in testis

→ The sperms & the nutritive fluid form the semen.
SEMEN – Protects & activates the sperm.
– Facilitates their movement (swimming)
– Provides energy from sperm movement.
– Neutralizes the urethra & vagina due to its high pH

* 2-5 cm^3 of semen contains about 500 million sperms.

⇒ FEMALE GAMETE – OVA :



→ The egg cells (ova) are present in the ovary since the time of birth.
No more are formed during the lifetime but between the age of 10-14, some of the egg cells start to mature & are released, one at a time about every 4 weeks. from alternate ovaries

→ When the ovary releases a mature ova into the funnel of oviduct, it is called OVULATION.

→ From here, the ovum is wafted down the oviduct by the action of cilia in the lining of the tube

→ If the ovum meets sperm cells here, it may be fertilised.

→ The released ovum is enclosed in a jelly-like coat called the zona pellucida
It is also surrounded by a layer of follicle cells

→ An egg is much bigger than a sperm because it provides food store that supports the embryo after fertilisation

⇒ SEXUAL INTERCOURSE:

→ During sexual intercourse, male & female stimulate each other.

→ Arousal in male results in erection. The penis becomes firm & erect as a result of blood flowing into the erectile tissue.

→ Arousal in females stimulates the lining of the vagina to produce mucus. This lubricates vagina & makes it easy for the erect penis to enter.

→ The male inserts the penis into female's vagina.

→ The sensory stimulus that this produces causes a reflex (in male) which results in ejaculation by contractions of urethra

→ EJACULATION is the act of ejecting semen through penis into the top of vagina.

⇒ FERTILISATION:

→ After intercourse, sperm cells swim through the mucus in the cervix into the uterus & then to oviduct by wriggling movements of their tails.

→ A huge number of sperms is produced to increase the chance of some of them reaching the oviduct.

→ If there is an egg in the oviduct, a sperm cell might succeed in penetrating it.

→ Enzymes released by the acrosome on the head of sperm digest a pathway through the jelly coat.

→ After the sperm membrane has fused with the egg membrane the nucleus enters the egg cytoplasm & the tail is left outside.

→ Sperm nucleus fuses with egg nucleus to form zygote nucleus which contains 2 sets of chromosomes – one from mother & one from father

→ Cell division starts shortly after fertilisation

→ A membrane immediately forms around the fertilised egg or zygote to stop other cells from entering

→ The released ovum is thought to survive for about 24 hrs, the sperms might be able to fertilise an ovum for about 2-3 days.

⇒ IMPLANTATION :

→ Fertilisation takes place in the oviduct.

→ The fertilised egg or zygote first divides into two, then 4 & 8 & so on.

→ After a while, this cycle of division becomes less regular. Some cells continue to divide while the others stop or slow down the rate of division

→ After a while, the EMBRYO is a hollow ball of cells.

→ This early embryo travels down the oviduct by peristaltic contractions of the oviduct & beating of the ciliated epithelial cells lining the oviduct

→ The embryo reaches the uterus.

→ Here it sinks into the soft lining of the uterus. This is called IMPLANTATION.

→ The embryo continues to grow & produces new cells which form tissues & organs.

→ After 8 weeks, when all the organs are formed, the embryo is called a FETUS.

→ As the embryo grows, the uterus enlarges (& the uterus lining has already thickened) to contain it.

⇒ AMNION:

→ As the embryo grows, it becomes enclosed in a fluid (AMNIOTIC FLUID) filled sac called the AMNION or AMNIOTIC SAC. It
- Protects the fetus from mechanical damage.
- Prevents unequal pressures acting on it.
- Prevents it from drying out
- Protects it from temperature fluctuations.

⇒ PLACENTA:

→ Soon after the zygote reaches the uterus, some of the cells, instead of forming the organs of the embryo, grow into finger-like projections or villi that penetrate the lining of the uterus.

→ The UMBILICAL CORD joins the fetus to the placenta. The cord contains an artery & a vein, that carry the fetal blood to the placenta & back again

→ In the placenta, the blood of the fetus flows very close to the blood of the mother (due to the umbilical cord) but they don't meet
There is a very thin lining of cells between the fetal blood & the maternal blood.

→ This allows diffusion of materials between them easy.
Also the villi provides large surface area for diffusion
(this way the fetus gets its nutrients & other essentials)

→ Oxygen, Glucouse, Amino acids,
Salts, Fats, Minerals, Water, Vitamins

Maternal Blood ⟶ DIFFUSION ⟶ Fetal Blood

Fetal Blood ⟵ DIFFUSION ⟵ Maternal Blood

Carbon dioxide, urea
(this way the fetus gets rid of its excretory products)

→ ADVANTAGES of the disconnection between circulations:

- The mother's blood flows under high pressure & this could damage the delicate blood vessels of the fetus if they did mix

- If the mother & the fetus have different blood groups, then the fetal blood would clot.

- Only selective materials are allowed to pass from the mother's blood.

- The fetus is protected from mother's immune system.

→ HOWEVER:

- Only large molecules like bacteria are prevented from entering fetus's circulatory system. Smaller particles like viruses & molecules of alcohol & smoke can enter & damage fetus's body.

* UMBILICAL ARTERY - carries deoxygenated blood containing wastes such as urea away from fetus to placenta.

UMBILICAL VEIN carries oxygenated blood cleared of wastes from placenta to fetus. It contains a high concentration of soluble foods such as glucose, amino acids & iron.

⇒ ANTENATAL CARE:

→ PREGNANCY (or gestation) is the period of time between fertilisation & birth, which in humans is 9 months.

→ ANTENATAL refers to the period before birth.

→ A pregnant woman will need to make sure that she gets adequate quantities of:

- CALCIUM - as bones of the fetus are growing

- IRON so that her body can make the extra RBCs s needed to carry oxygen to the fetus
Her growing fetus also is making RBCs & needs proper haemoglobin.

- CARBOHYDRATES for enough energy to move her heavier body around.

- PROTEIN to provide AA that they both need to make new tissues.

→ The mother shouldn't smoke since nicotine & carbon monoxide can result in premature or underweight babies
Smoking also makes miscarriage more likely

→ Drinking(heavy) damages the developing brain of the fetus. resulting in its mental retardation.

→ Drugs such as heroin cross the placenta so some babies are born with an addiction to herion

⇒ BIRTH:

→ A few weeks before the birth, the fetus turns over inside the uterus.
This positions its head above the cervix

→ STAGES:

- Oxytocin released from the pituitary gland stimulates the muscles of the uterus to contract.

- Small contractions of the uterus wall are felt. This is the beginning of LABOUR

* RELAXIN relaxes the cervix & pelvic ligaments for easy birth.

- The rythmic contractions become more stronger & frequent
- Contractions slowly stretch the opening of the cervix & the amnion breaks, allowing fluid to escape
- They push the baby towards the cervix
- The cervix dilates(widens) to let baby's head pass through. (This part of the birth takes place very quickly).
- The vagina too stretches for the passage of the baby
- The umbilical cord is tied & cut just above the point where it attaches to the baby.
The remains of the cord heal to form the baby's navel.
- After a few minutes, the placenta sheds off the uterus wall. It is pushed out of the vagina as afterbirth.

⇒ FEEDING & PARETAL CARE:

→ During pregnancy, the size of mammary glands increases.

→ The hormones that stimulate the birth process also stimulates the release of milk. There is no milk secreted during pregnancy.

→ Milk secretion begins usually within 24 hrs under the influence of prolactin.

BREAST FEEDING.	BOTTLE FEEDING.
ADVANTAGES	DISADVANTAGES
→ Breast milk contains antibodies which pass to the baby & give it passive immunity to the diseases the mother has had recently. This also helps because the baby's own immune responses aren't fully developed.	No antibodies present to help the baby against diseases. Baby is at a greater risk of childhood diseases like cancers & diabetes.
→ Contains essential nutrients like proteins, fats, vitamins & mineral salts in easily digestible form.	Formula milk contains nutrients in harder digestible form.
→ Breastfeeding enables a close bond to form between mother & baby that is beneficial to both.	-
→ There is no cost involved	Cost is involved.
→ No risk of allergic reactions.	
→ No additive of preservatives	
→ Doesn't need any preparation.	

DISADVANTAGES	ADVANTAGES
→ There could be problems in producing enough milk	Enough milk could be provided
→ Nipples could become painful	
→ Cannot delegate to male partner	More convinient as either parent can bottle feed.
→ Mother needs to make sure that she eats proper diet & food that is appropriate for the baby	Parent doesn't need to worry about what to eat.
→ Harmful effects of drugs, nicotine & virus like HIV could be transmitted.	No need to feed the baby so often.

⇒ THE MENSTRUAL CYCLE:

→ Girls are born with a very large number of potential eggs in their ovaries.

→ Each potential egg is surrounded by a small group of cells & together they form a FOLLICLE.

→ There are thousands of these follicles in each ovary. At puberty, some of these follicles start to develop.

→ This development involves the egg dividing by meiosis which reduces the no. of chromosomes in the nucleus by half

→ STAGE 1 : Follicular Phase (Day 6 - 13)
- A pituitary hormone called FSH (follicle stimulating hormone) starts the cycle by stimulating a follicle to develop.
- This includes formation & maturation of Graafian follicle
- Cells in the maturing follicle secretes oestrogen into bloodstream.
- Oestrogen passes to the pituitary gland in the blood & stops it from making any more FSH
- This results in prevention of any other follicles maturing
- Oestrogen also causes the lining of the uterus to thicken (in preparation to recieve fertilised egg)
- Oestrogen also stimulates production of another pituitary hormone called LH (luteinising hormone) just before ovulation

→ STAGE 2 : Ovulatory Phase (Day 14).
- LH travels to the ovary in the blood
- It stimulates ovulation which is release of the egg cell from the mature graafian follicle.
- The egg is drawn into the Fallopian Tube.

→ STAGE 3 (Day 15 - 26) :
- The remaining follicle cells from the 'empty' Graafian follicle form a yellow body known as CORPUS LUTEUM.
- Corpus luteum produces progesterone, which affects the uterus lining in the same way as oestrogen, making it grow thicker & produce more blood vessels & preventing it from breaking down

* Both oestrogen & progesterone are needed to prepare the lining of the uterus for implantation of fertilised egg.
- If the ovum is not fertilised, the corpus luteum stops producing progesterone & disintigrates.

→ STAGE 4 (Day 26 to 28).
- The degeneration of the corpus luteum causes the levels of oestrogen & progesterone to decline rapidly.
- The degenerated corpus luteum becomes a small scar in the ovary.

→ STAGE 5: Mensuation Phase (Day 1-5).
- Due to the decline in progesterone & oestrogen, there is breakdown & discharge of the thickened uterus lining which escapes through cervix & vagina
- This is the menstrual period which begins day 1
- Low oestrogen & progesterone levels permit the secretion of FSH by pituitary gland.

⇒ PUBERTY & ADOLESCECE:

→ Sex organs become active only in later life - between the ages of 10 & 14

→ PUBERTY is the stage of development during which sexual maturity is reached & secondary sexual characteristics develop. A person becomes an adolescent when puberty starts.

→ The changes that take place are controlled by hormones

→ Puberty in BOYS - Testosterone produced by testis stimulates
- Growth of male sex organs - penis
- The testes start to produce sperm cells.
- Growth of hair on the face, chest, underarms & pubic area
- Deepening of voice
- Development of muscles in the body.

→ Puberty in GIRLS - Oestrogen produced by ovaries stimulates
- Growth of female sex organs - uterus & vagina
- Menstruation begins.
- Widening of hips (as uterus becomes larger)
- Growth of hair under arms & in pubic area
- Breasts grow & nipples enlarge

* Hormones that stimulate ovaries & testes are produced by Pituitary Gland.

* Between the age of 45 to 55 years a woman's menstruation cycles stop. This is MENOPAUSE

→ BIRTH CONTROL:

→ NATURAL METHODS:

– RHYTHM METHOD:
- Intercourse is avoided during ovulation period / when fertilisation is most likely to occur.
- Not very reliable as it cannot be exactly predicted.

– WITHDRAWL:
- Withdrawl of penis before ejaculation
- Not very reliable

– ABSTINENCE:
- No sexual intercourse
- Most reliable method.

→ CHEMICAL METHODS:

– CONTRACEPTIVE PILL:
- Contains oestrogen & progesterone which prevent ovary from releasing eggs. by preventing production of FSH
- The intake should be regular
- Side effects include – sore breasts
  - weight gain
  - painful menstruation
  - heart & circulation problems (in very few)
  - risk of cancers (breast & cervical)

— SPERMICIDE:
- Kills sperm in vagina but is harmless to the tissues
- Could be foam, cream or jelly
- Should only be used with condom.

→ MECHANICAL METHODS:

— SHEATH or CONDOM:
- Placed on the penis before the intercourse.
- Stops sperms from entering woman's body
- Prevent transmission of STD
- Reliable if used with spermicide

— FEMIDOM:
- Plastic sheath placed in the vagina before intercourse
- Prevents entry of sperm
- Prevents transmission of STD

— DIAPHRAGM or CAP:
- A dome or disc shaped rubber barrier that fits in the vagina at the cervix
- Needs to be of correct size
- Should be used with spermicide.

— IUD (INTRA-UTERINE DEVICE)
- A small plastic device wrapped in copper or containing hormones is surgically fitted in woman's uterus
- It prevents implantation of a fertilised ovum
- Reliable

→ SURGICAL METHODS:

— VASECTOMY:

- Male's sperm ducts are cut & ends are sealed.
- Operation isn't usually reversible
- The man can ejaculate but there is no sperm in semen.
- Desire, erection, copulation & masculinity remain unaffected because of testosterone
- The sperms are removed by white cells as they form.

— TUBECTOMY/LAPAROTOMY:

- Oviducts are tied, cut or blocked
- Ovaries are unaffected.
- Desire & menstruation are unaffected. but sperms can no longer reach ova
- Released ova breakdown in the upper part of oviduct.
- Operation cannot be reversed.

⇒ HIV:

→ HIV (Human immunodeficiency virus (fragile)) is a human pathogen which attacks & destroys an important type of lymphocyte that co-ordinates the immune system.

→ These lymphocytes are responsible for stimulating other lympocytes to produce antibodies.

→ During its infection, fewer antibodies are produced everytime there is another infection.

→ This means HIV+ people develop diseases & cancers as immune system doesn't recognise & destroy them

→ HIV causes AIDS (Acquired Immune Deficiency Syndrome)

→ SYMPTOMS of AIDS (not all HIV+ people develop AIDS).
- Flu.
- Swollen glands
- High temperature
- Weight loss
- Various types of cancer
- Decrease in brain function

→ METHODS OF TRANSMISSION:
- Unprotected sexual intercourse with infected person.
- Drug use involving sharing needle used by infected person
- Transfusion of infected blood
- Infected mother to fetus
- Feeding a baby with milk from an infected mother.
- Unsterilised surgical instruments

→ PREVENTION METHODS: (There is no cure for AIDS).
- Use of condoms during sexual intercourse.
- Refusal to intercourse
- Screen blood (for transfusion)
- Using sterilised needles
- Feeding baby with formula/bottled milk
- Using sterilised surgical instruments

→ GONORRHOEA (A STD):

→ Only transmitted during sexual intercourse

→ Caused by Neisseria Gonorrhoe - small, spherical bacterium which can only survive in the moist lining of the male & female reproductive tracts.

→ SYMPTOMS:

– In Males: (btwn 2-7 days)

• Unpleasant discharge & pain during urination
• Sores on penis & discharge of pus from penis

– In Females: (can remain unnoticed)

• Pain when urinating.
• Discharge of pus from vagina (not so obvious)

→ EFFECTS

• Damage to urinary & reproductive organs
• Sterility
• Blindness in baby born to a mother with the disease

→ PREVENTION & CURES:

• Use of condoms
• Treatment with antibiotics
•