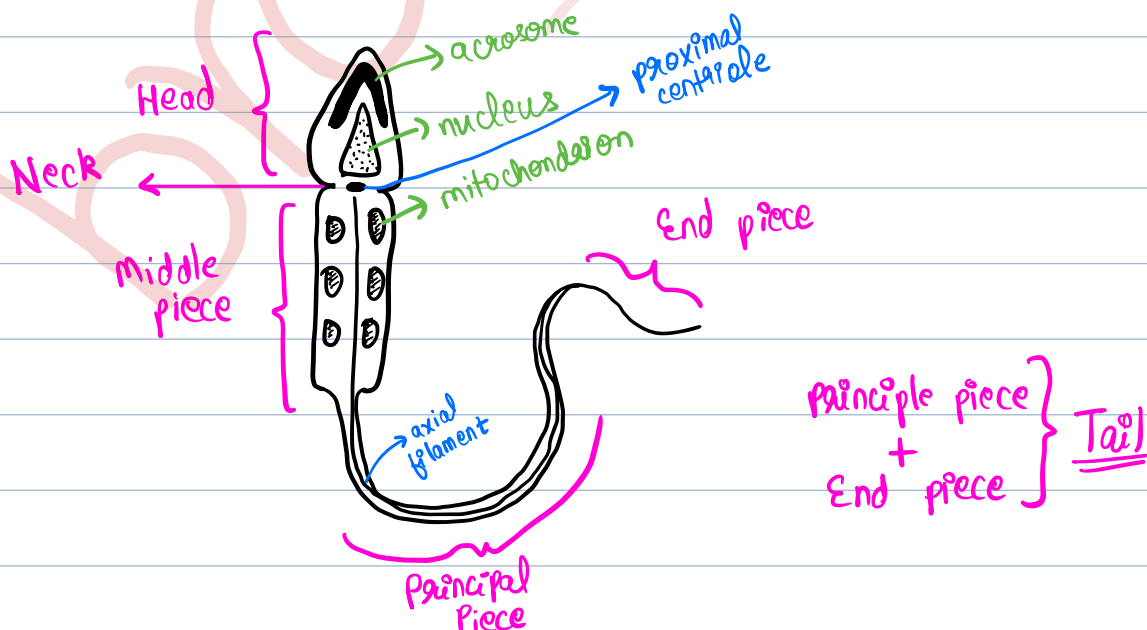
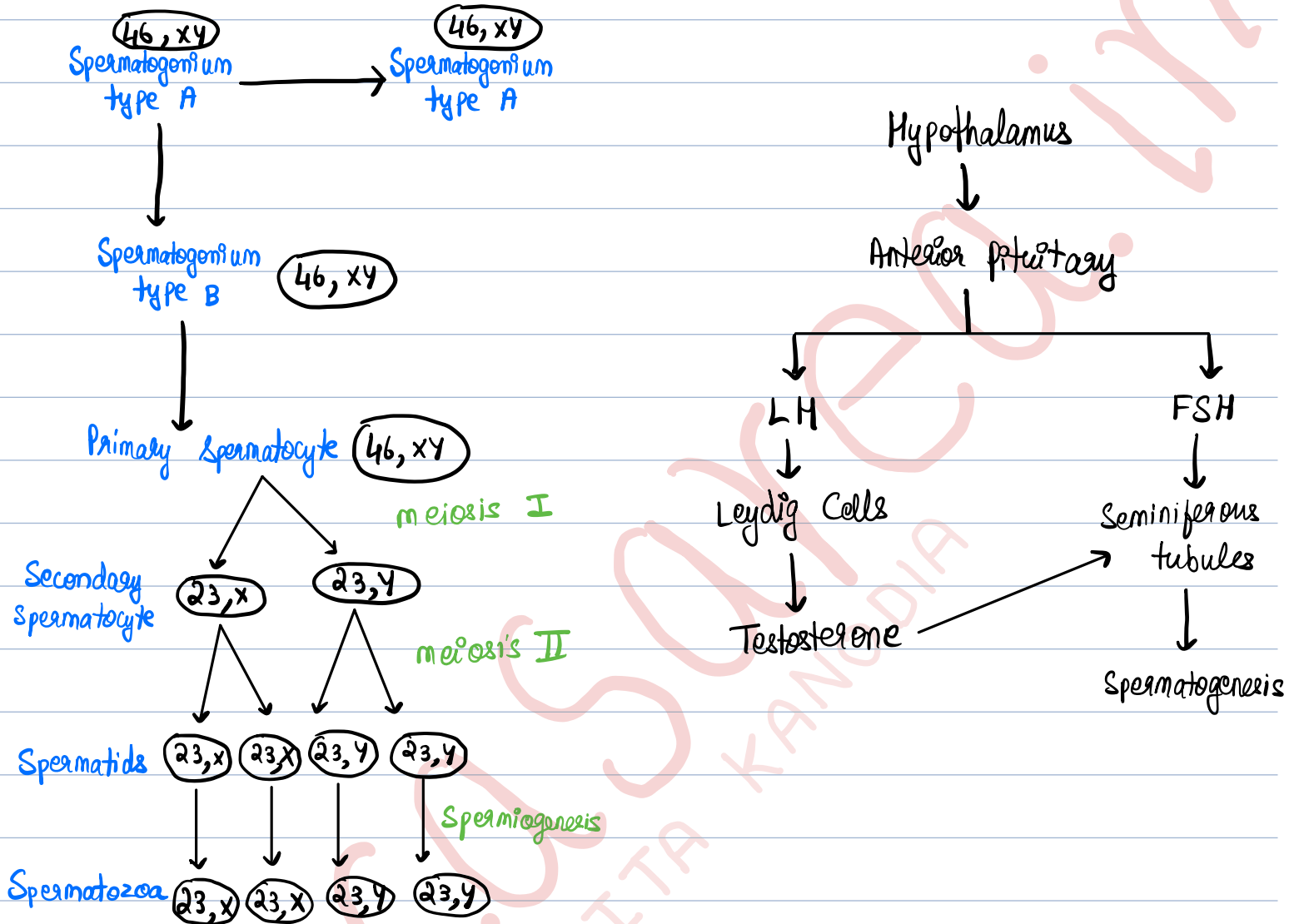
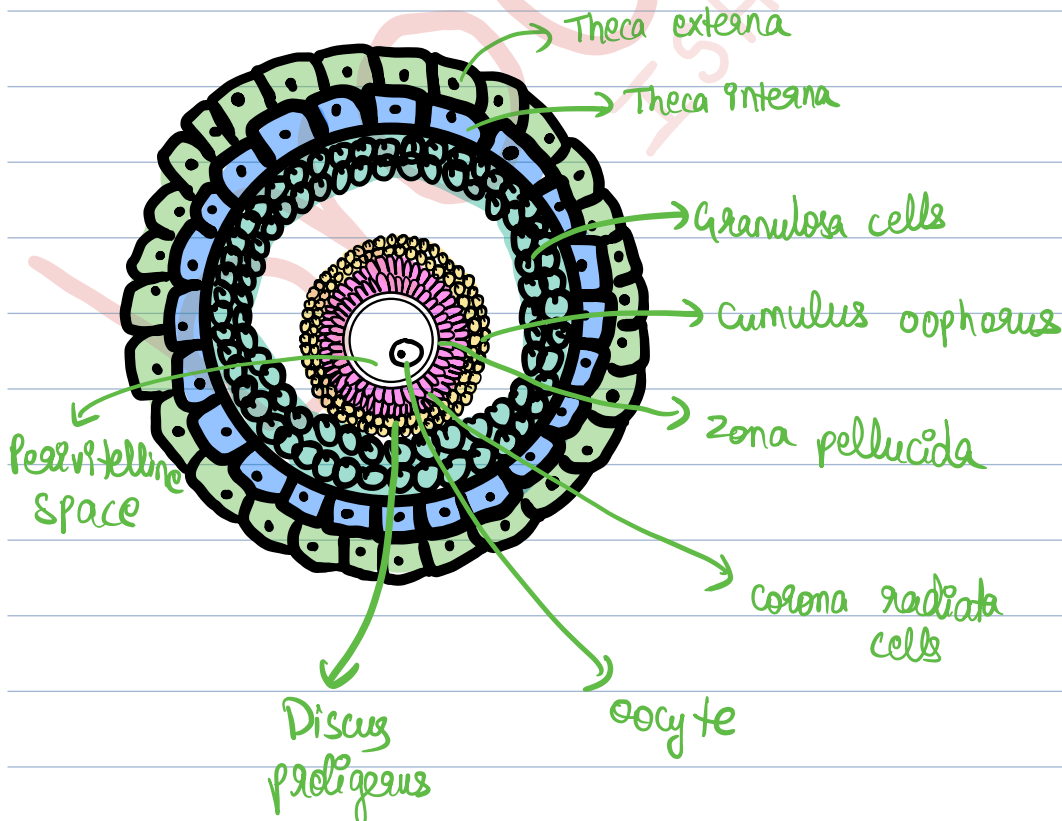
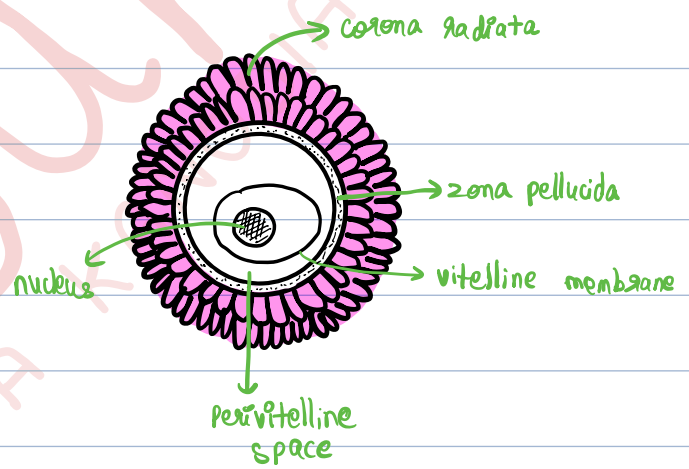
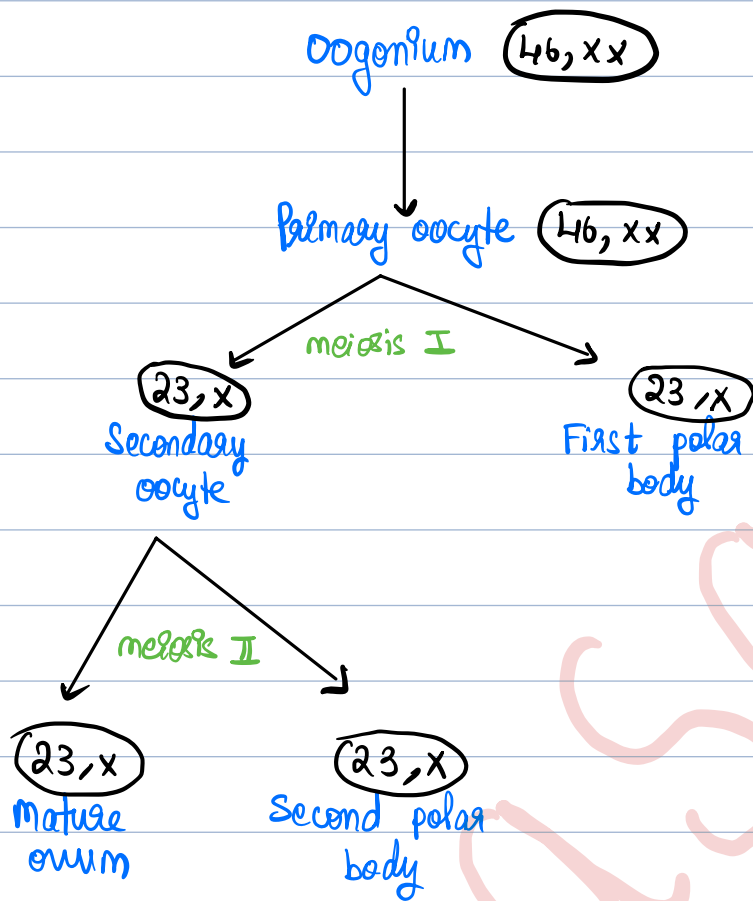


Spermatogenesis:

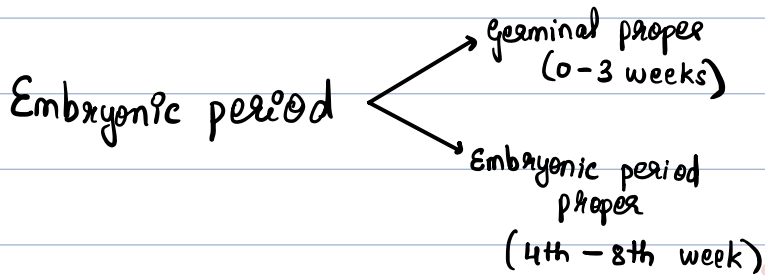
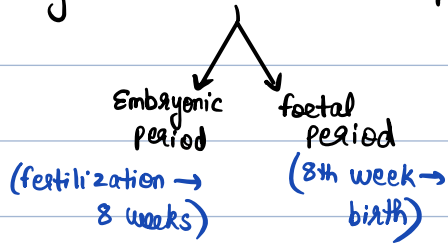


Oogenesis:



→ Fertilization $\Rightarrow$ at ampulla of fallopian tube

→ Gestation = 40 weeks / 280 days



1st Week of Development - cleavage, morula, blastocyst, implantation.

Cleavage: series of repeated mitotic divisions once the zygote reaches 2-cell stage.

→ Increase in number of cells; cells become smaller in size called blastomeres

→ 16-cell stage = **Morula**.

→ by compaction - the cells at the periphery are tightly adherent by tight junctions $\Rightarrow$ outer cell mass
- cells inside are loosely arranged $\Rightarrow$ inner cell mass.

(zona pellucida prevents implantation in uterine tube thus, preventing ectopic pregnancy)

→ once the morula reaches the uterine cavity, uterus begins secreting uterine milk which enters the morula & form small spaces inside the outer cell mass; small spaces coalesce to form a large cavity (blastocoel) so that the inner cell mass is pushed to one side

⇓
Blastocyst (32-64 cells)

→ now, outer cell mass = trophoblast

inner cell mass = embryoblast

(Trophoblast $\longrightarrow$ placenta, chorion)

→ Part of trophoblast attached to the embryoblast = polar trophoblast
rest of the trophoblast = mural trophoblast.

Changes in Uterus:

Perimetrium

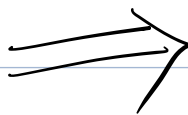
Myometrium

Endometrium

Stratum compactum

Stratum spongiosum

Stratum basale



uterine
cavity

Stratum compactum

Stratum spongiosum

Stratum basale

(i) zona pellucida disappears

(ii) penetration/invasion of stratum corneum starts at embryonic pole of blastocyst at about 7th day

→ site of **implantation** = upper part of uterine cavity.

any other site ⇒ ectopic pregnancy

- intrauterine
- extrauterine

→ Intrauterine ectopic pregnancy

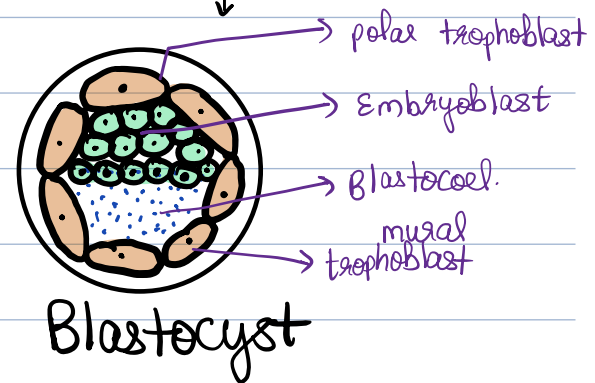
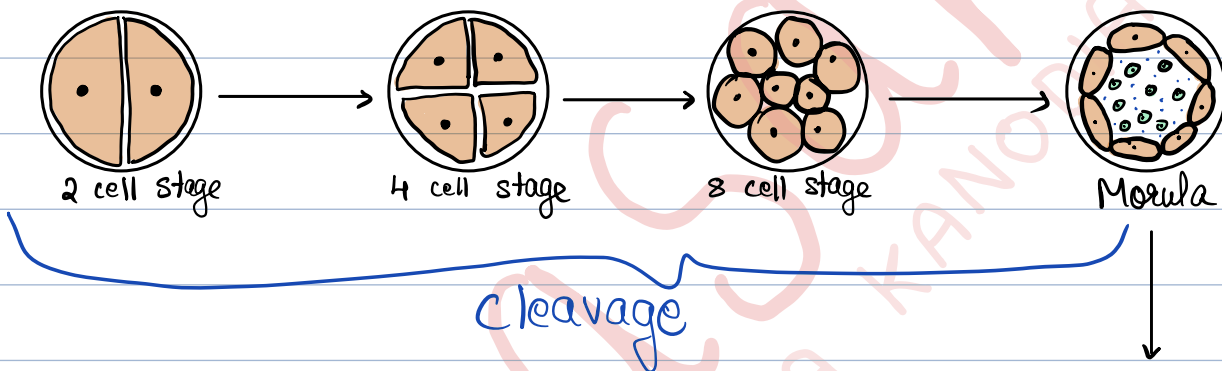
= **Placenta Praevia**

Grade I ⇒ in the lower part of uterine cavity

Grade II ⇒ blastocyst just reaches upto internal os

Grade III ⇒ blastocyst partially covers the internal os (when cervix is not dilated)

Grade IV ⇒ blastocyst completely occludes internal os (even when cervix is dilated)



2nd Week of Development

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Changes in Trophoblast: (i) inner cytotrophoblast & outer syncytiotrophoblast

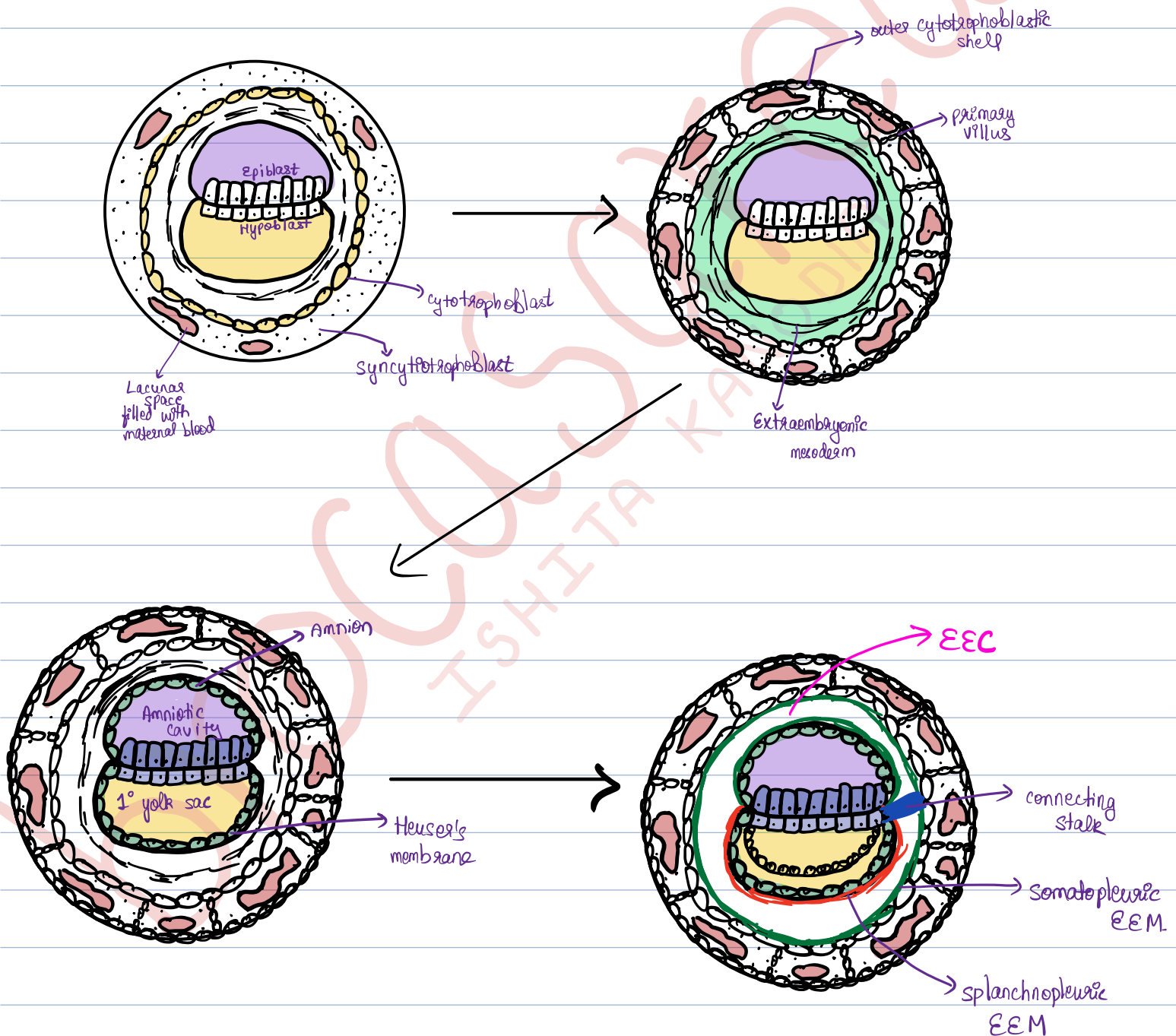
- fibrin plug formation
 - endometrium $\left\{ \begin{array}{l} \text{decidua basalis} \\ \text{decidua capsularis} \\ \text{decidua parietalis} \end{array} \right\}$ after implantation
- (basalis = part of uterus attached to embryonic pole)
(capsularis = part of uterus attached to rest of the blastocyst)
(parietalis = rest of the uterine wall)
- development of lacunar spaces in syncytiotrophoblast which are invaded by uterine spiral arteries; the spaces get filled with maternal blood
 - cytotrophoblasts start invading into trabeculae (space between adjacent lacunae)
 $\Rightarrow$ formation of primary villus; cytotrophoblasts from one trabecula communicate with those from the neighbouring trabeculae to form an outer cell coat $\Rightarrow$ outer cytotrophoblastic shell.
 - lacunar space between two villi are now called intervillous spaces.

Changes in Embryoblast: - embryoblast separates from trophoblast

- embryoblast forms upper layer of columnar cells - Epiblast / primitive ectoderm
lower layer of cuboidal cells - hypoblast / primitive endoderm
 - some cytotrophoblasts form a cell layer above the epiblast, enclosing a cavity - amniotic cavity
 $\rightarrow$ amnion
 - cytotrophoblasts form a layer below the hypoblast, enclosing a cavity - primary yolk sac.
 $\rightarrow$ Heuser's membrane
 - tissue layer between the cell layer of the two cavities & between the cytotrophoblast layer is called extraembryonic mesoderm.
 - many cavities are formed in the extraembryonic mesoderm (EEM);
these cavities coalesce to form one large cavity $\Rightarrow$ extraembryonic coelom.
 - $\therefore$ part of EEM attached to primary yolk sac = splanchnopleuric EEM.
 - rest of EEM (attached to cytotrophoblast cell layer & amniotic cavity) = somatopleuric EEM
- $\rightarrow$ At one end, the embryoblast remains connected to the layer of cytotrophoblast by connecting stalk. $\rightarrow$ umbilical cord

$\rightarrow$ Chorion = syncytiotrophoblast + cytotrophoblast + somatopleuric EEM

- Primary yolk sac gets reduced in size to form secondary yolk sac (SYS) / definitive yolk sac.
- SYS is lined by endoderm (not by Heuser's membrane which moves away due to mesodermal pull)
- attachment of connecting stalk is considered as caudal end; at the opposite (cephalic) end, some cuboidal cells of the hypoblast become columnar & this region forms the prechordal plate which establishes the cephalocaudal axis of the embryo.

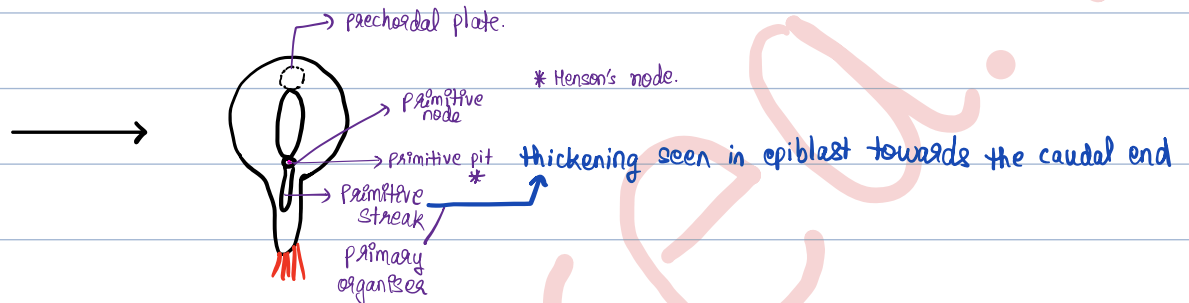
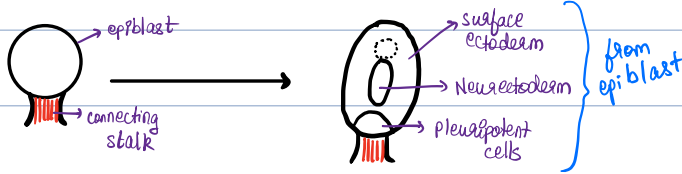


3rd Week of Development

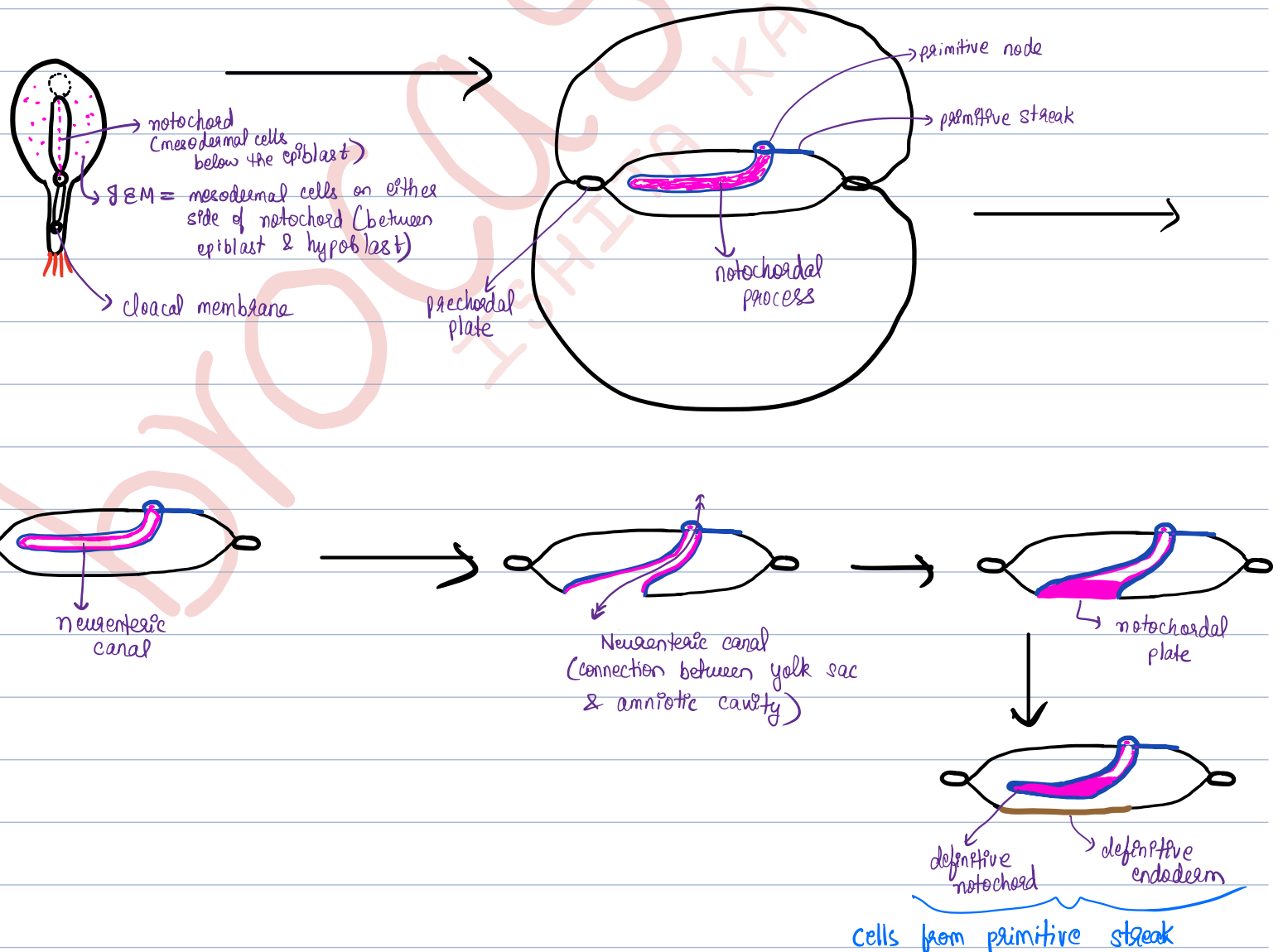
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Embryoblast:

Top view of epiblast



Gastrulation: process of conversion of bilaminar germ disc to trilaminar by (IEM) the interment of mesoderm between primitive ectoderm & primitive endoderm.



→ After formation of vertebral column, notochord degenerates

Remnants of notochord — nucleus pulposus of intervertebral disc
— apical ligament of dens

→ GEM is present around the notochord except at two places — prechordal plate
— cloacal membrane

(prechordal plate → oropharyngeal/buccopharyngeal membrane)

→ Cells of primitive ectoderm are replaced by primitive streak to form definitive ectoderm

Formation of Allantoic Diverticulum: projection from tail end of yolk sac into connecting stalk = allantois/allantoic diverticulum.

→ It vascularizes the connecting stalk

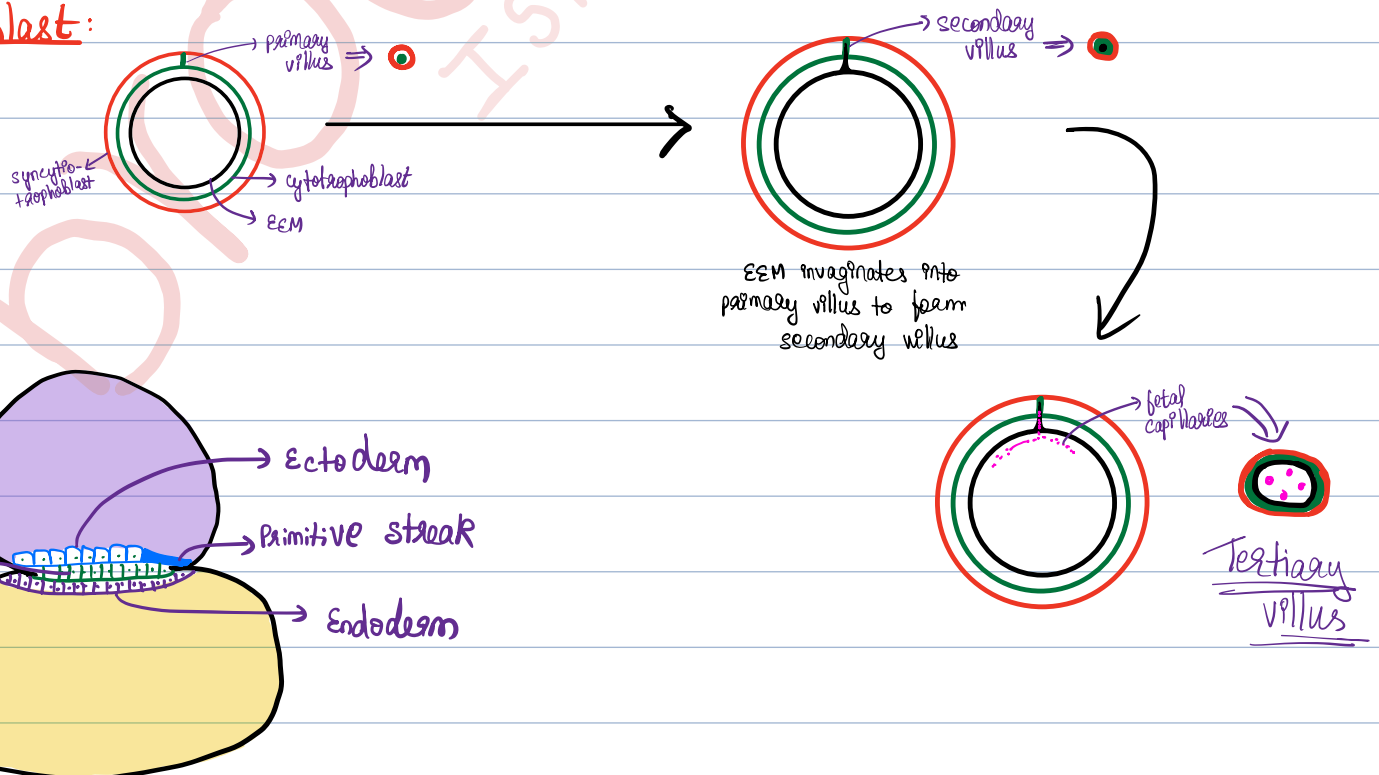
→ umbilical arteries are derived from allantois

after which allantois is called urachus → median umbilical ligament (after birth)

→ Primitive streak usually disappears by the end of 4th week.

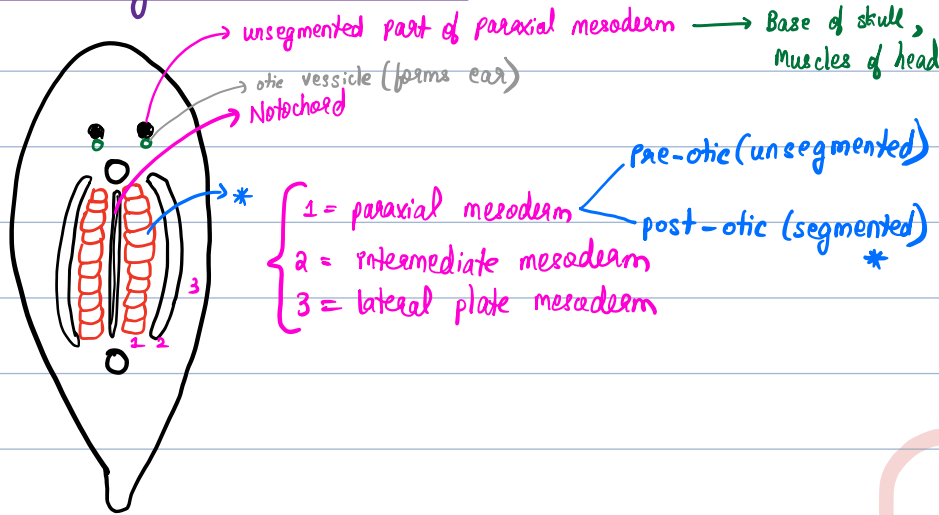
— If it persists ⇒ sacrococcygeal teratoma (benign)

Trophoblast:

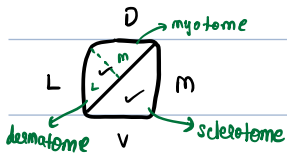
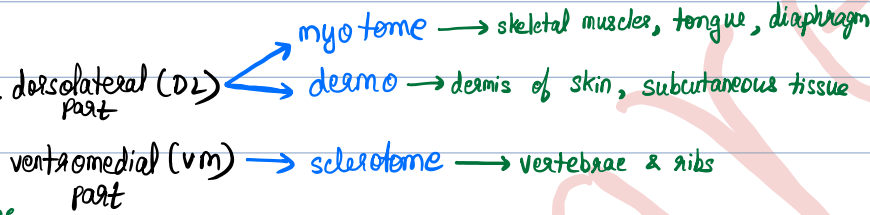


Intraembryonic Mesoderm

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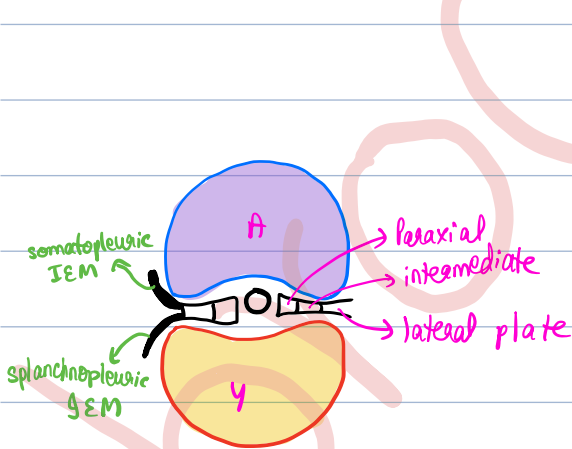


Somite

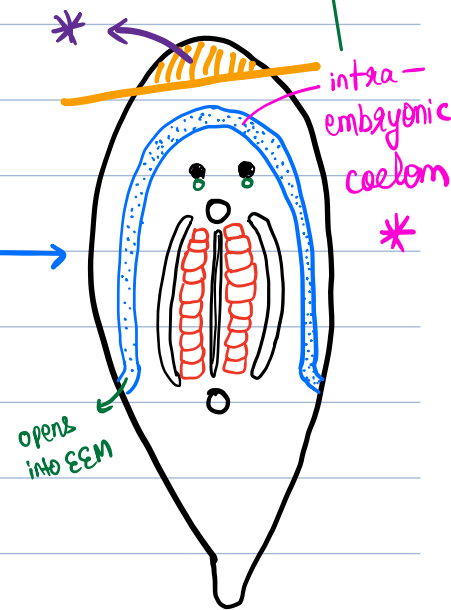
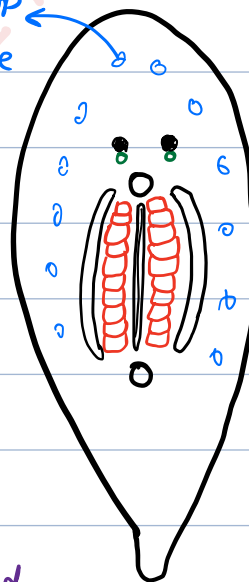


pericardial cavity
pleural cavity
peritoneal cavity

Intermediate Mesoderm → Nephrogenic Cord → kidney & gonads



Vesicles develop in lateral plate mesoderm which coalesce



* septum transversum (unseparated part of

somatopleuric & splanchnopleuric IEM)

diaphragm

* divides IEM into

somatic layer of the 3 coeloms

visceral layer of the 3 coeloms

somatopleuric IEM &

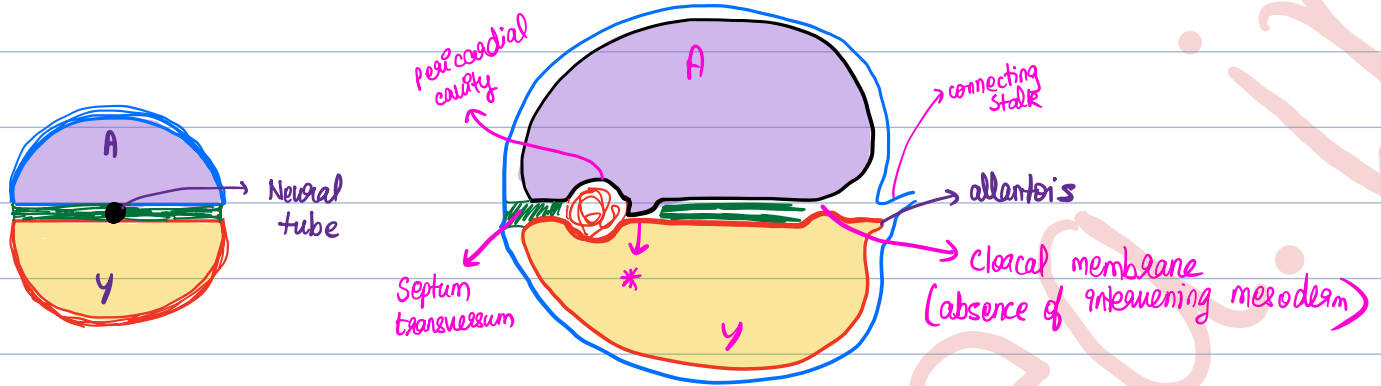
splanchnopleuric IEM

musculature of heart, lungs, GIT

Folding of Embryo:

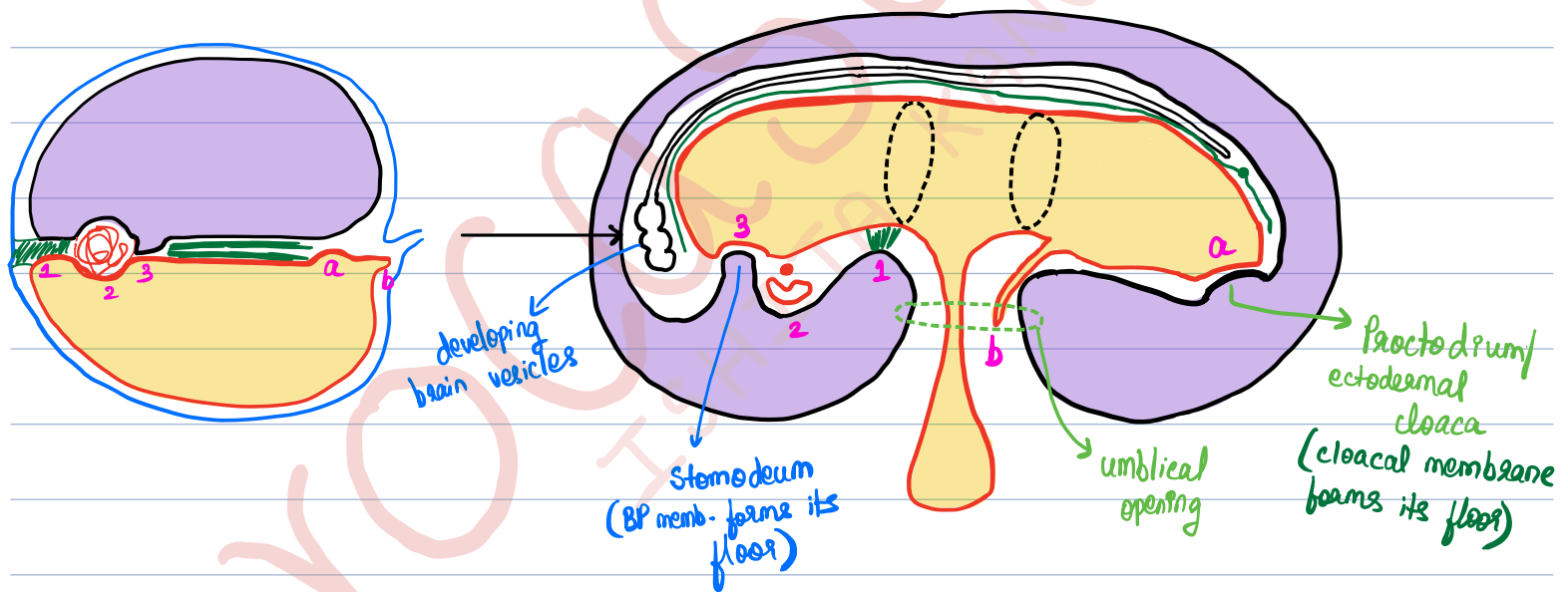
cephalocaudal folding
lateral folding

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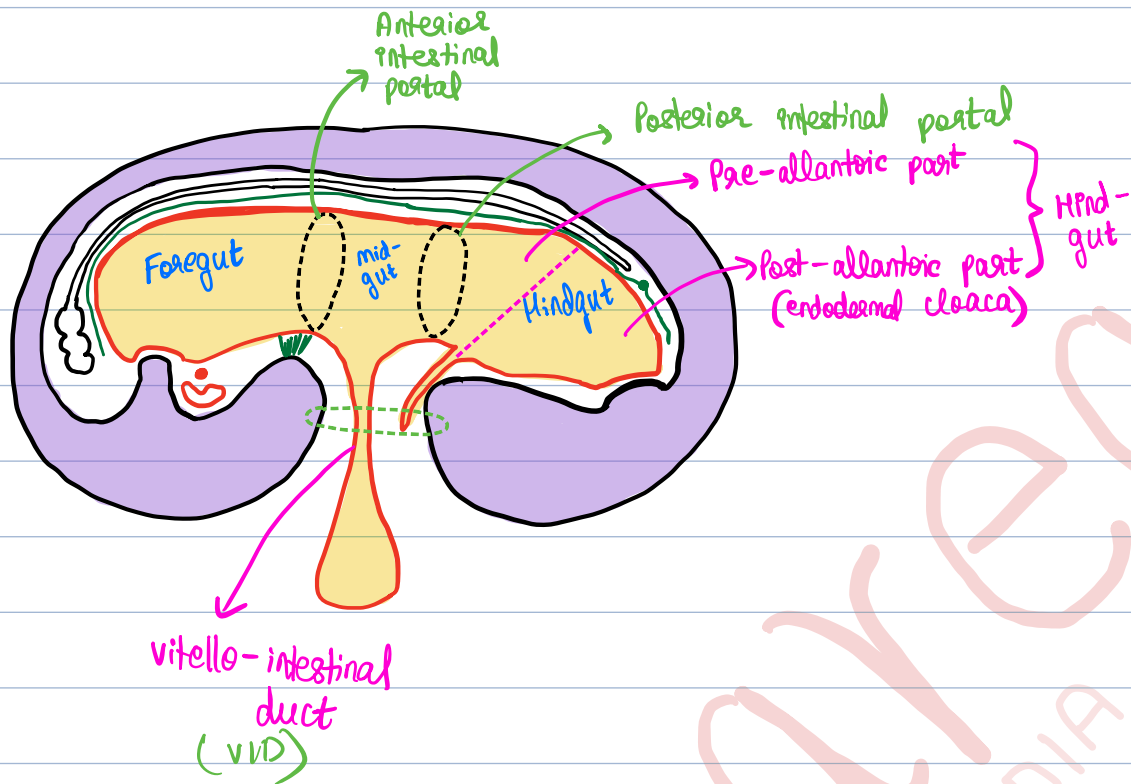
* Buccopharyngeal membrane
(absence of intervening mesoderm)

Cephalocaudal folding: due to differential growth of CNS.



→ BPM. ruptures in 4th week to form a connection b/w gut & the oral cavity

→ cloacal membrane ruptures in 5th week to form a connection b/w gut & exterior



Clinical Correlate

Sacroccygeal teratoma: a tumor that arises from remnants of the primitive streak; contains various types of tissue (bone, nerve, hair, etc)

Chordoma: a tumor that arises from remnants of the notochord, found either intracranially or in the sacral region

Hydatidiform mole: results from the partial or complete replacement of the trophoblast by dilated villi

- In a **complete mole**, there is **no embryo**; a haploid sperm fertilizes a blighted ovum and reduplicates so that the karyotype is 46,XX, with all chromosomes of paternal origin. In a **partial mole**, there is a haploid set of maternal chromosomes and usually 2 sets of paternal chromosomes so that the typical karyotype is 69,XXY.
- Molar pregnancies have high levels of hCG**, and 20% develop into a malignant trophoblastic disease, including choriocarcinoma.

Twinning: (1 in 80 pregnancies)

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Causes: Age of conception
Infertility

TWINS

(FRATERNAL) DIZYGOTIC

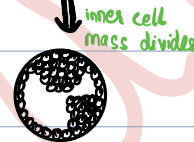
(2 oocytes released in one cycle)

- same or diff. sex
- different placenta & amniotic cavity

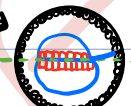
(IDENTICAL) MONOZYGOTIC

(1 zygote formed)
which divides

separation during cleavage
Bichorionic
Diamniotic



monozygotic
Diamniotic



bilaminar germ
disc is formed

division along
bilaminar germ
disc
(before formation
of primitive streak)

monozygotic
Monoamniotic

CONJOINED TWINS

→ incomplete separation
of bilaminar germ
disc

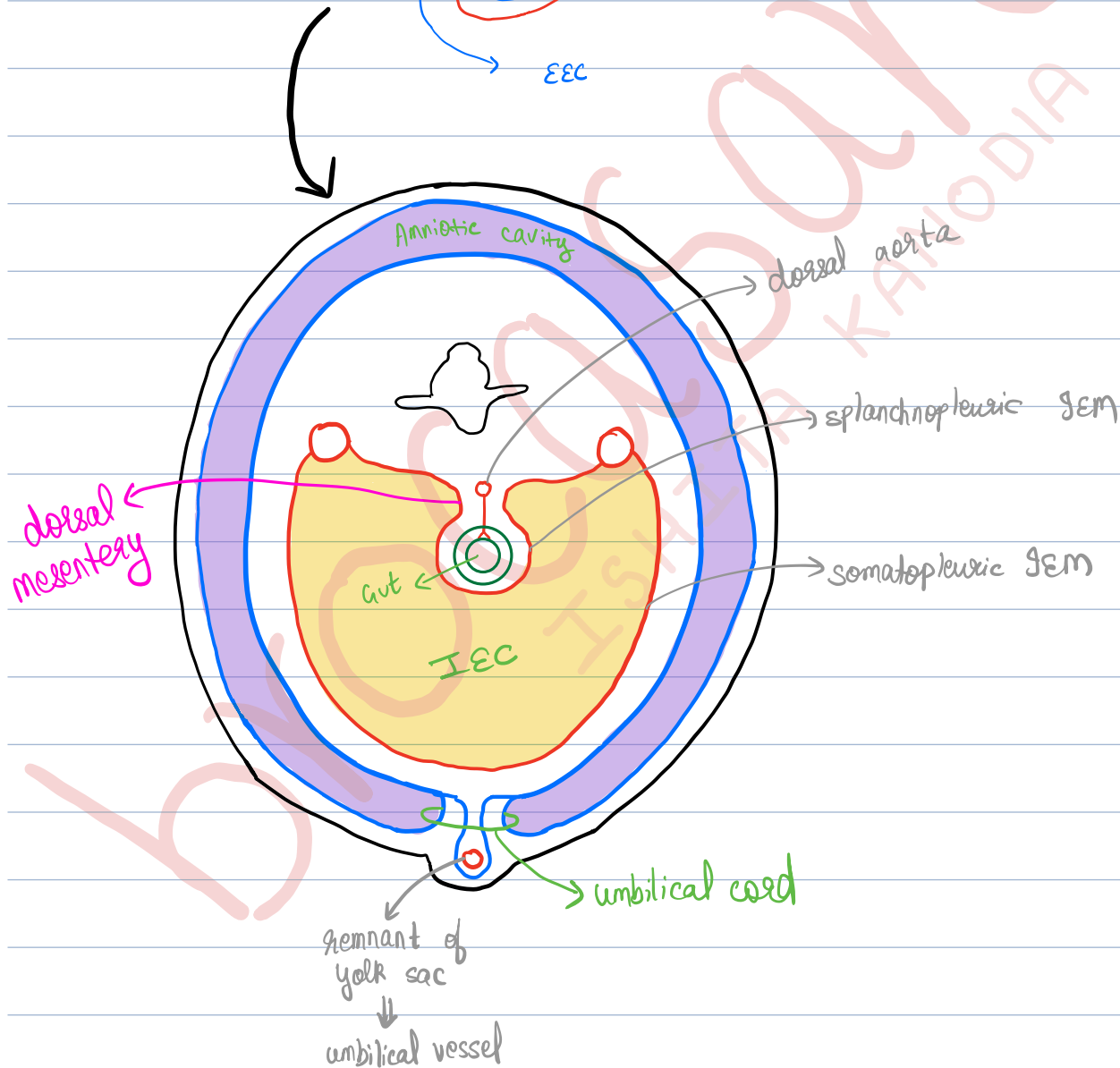
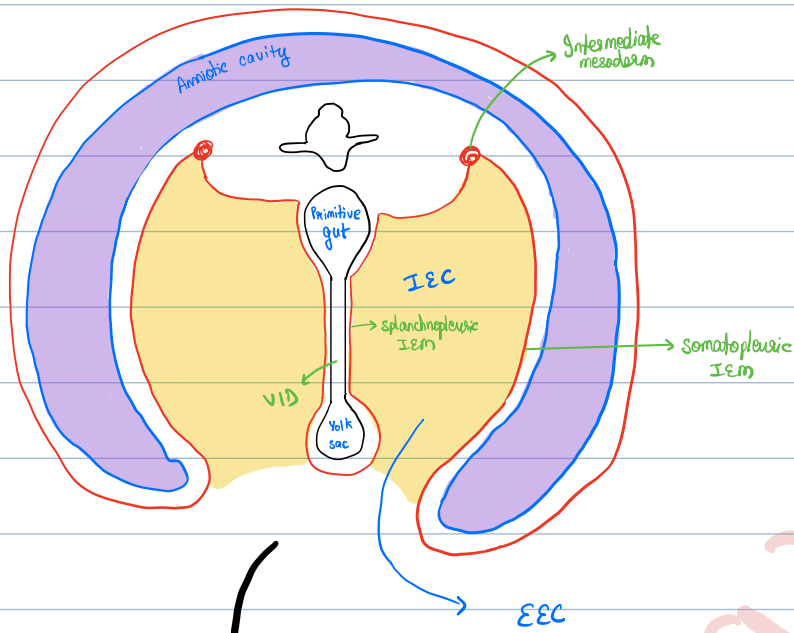
(Thoracopagus, Craniopagus,
Craniothoracopagus, pygopagus)

PARASITIC TWINS

→ one twin will be rudimentary
due to diminished
blood supply

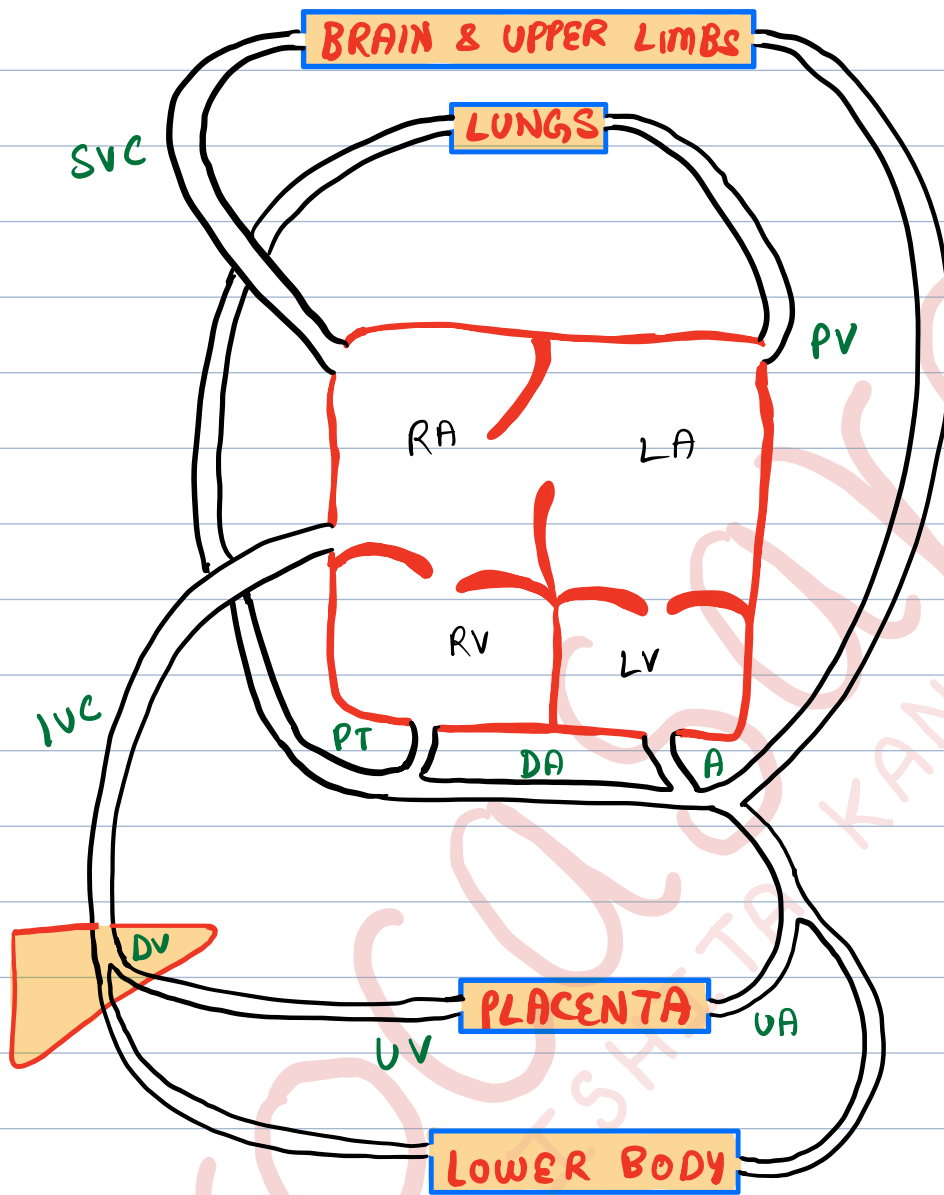
- Dichorionic diamniotic ⇒ Cleavage on days 1-3
- Monochorionic diamniotic ⇒ Cleavage on days 4-8
- monochorionic monoamniotic ⇒ Days 8-13
- Conjoined ⇒ Days 13-15

Lateral Folding:



Fetal Circulation:

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Placenta Praevia:

↳ implantation of placenta in lower uterine segment

Incidence: 1:200

Clinical Features: - Painless haemorrhage in last trimester (particularly in 8th month) is a common diagnostic feature of placenta praevia (3rd, 4th degree)

Types:

1st degree: attachment of placenta extends into lower uterine segment, but does not reach internal os.

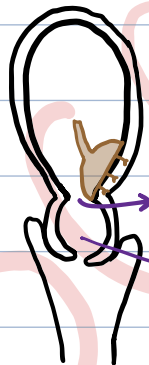
2nd degree: margin of placenta reaches internal os but does not cover it.

3rd degree: edge of placenta covers internal os, but it is not fully occluded.

4th degree: placenta completely covers internal os & occludes it even after it has dilated.



1°



2°



3°



4°

