

Obstetrics

Edition 8.5

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Instructions

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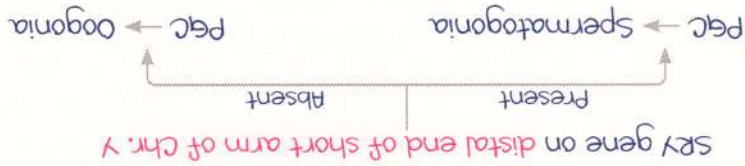
GAMETOGENESIS

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Primordial Germ Cells :

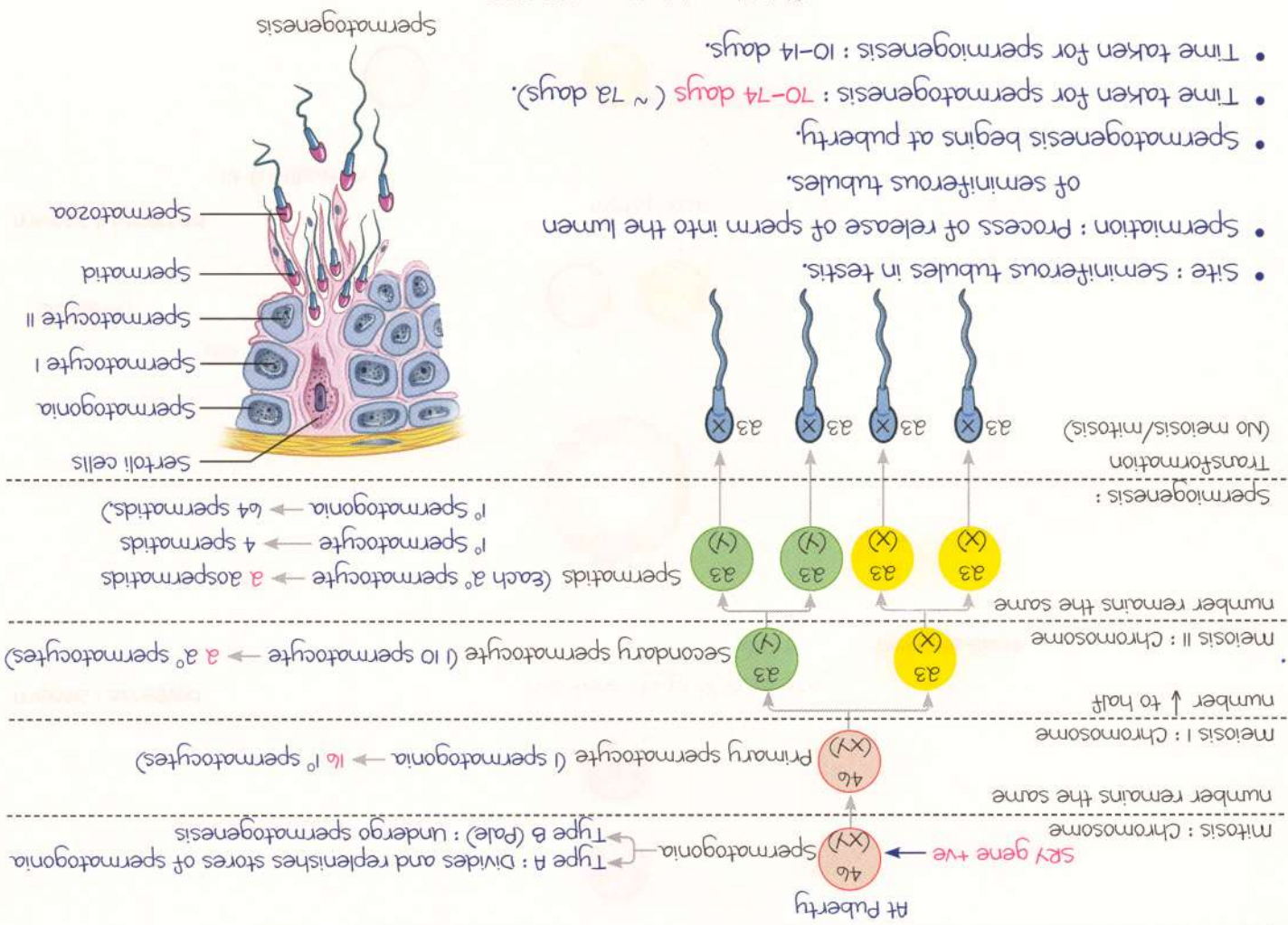
- gametogenesis begins with the primordial germ cell (PGC).
- Derived from :
 - epiblast.
 - ectoderm.
- bipotent cells : They can form spermatogonia/oogonia.

Differentiation : Determined by the SRY gene (Sex related gene on chromosome Y).



Spermatogenesis

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!! Adluminal compartment : a^o spermatocyte + spermatid + sperms.

spermatid to sperm.

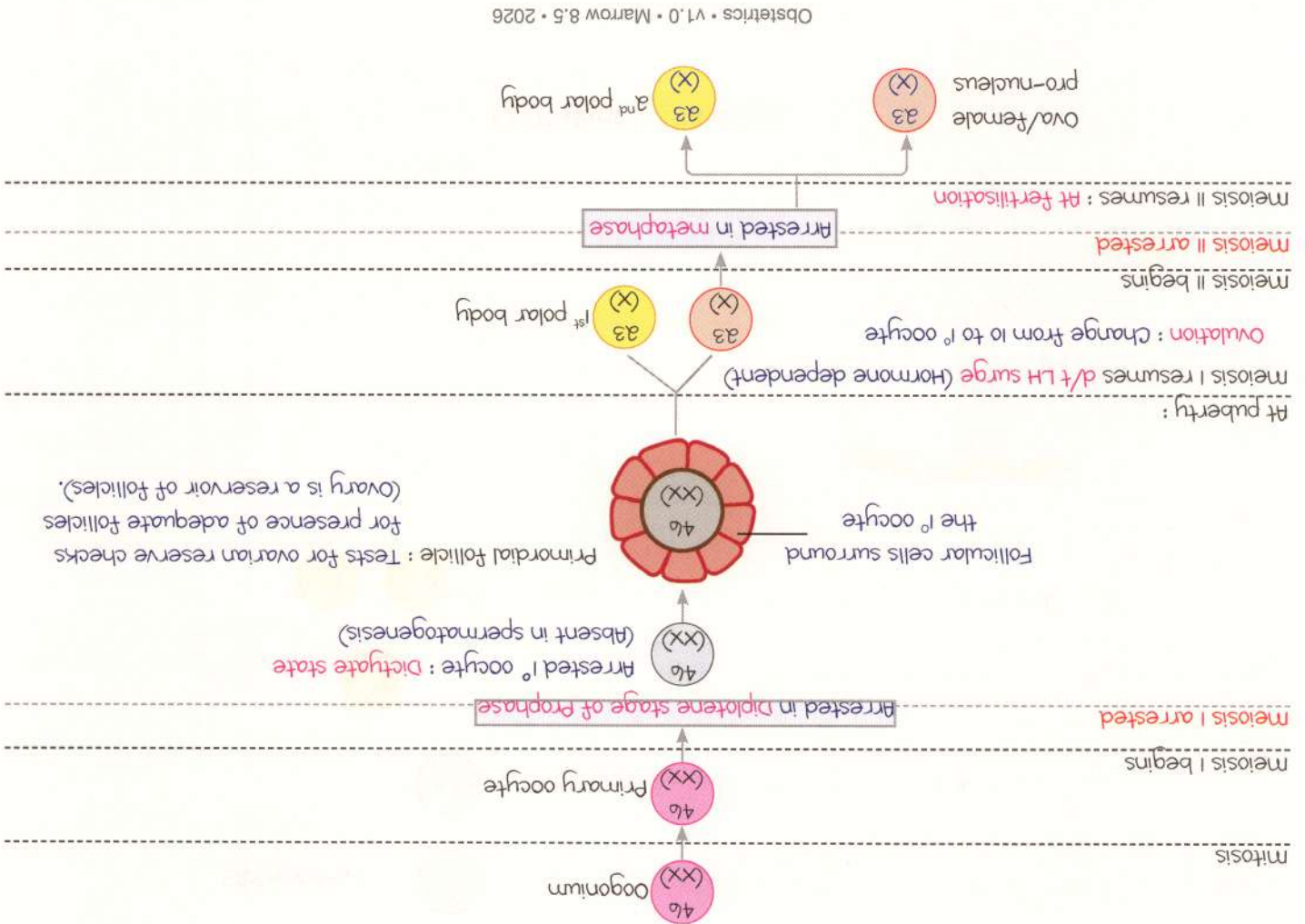
Structural analogues:

Sperm	Spermatid
Head	Nucleus
Middle piece (Powerhouse of the sperm)	Mitochondria
Acrosomal Cap	Golgi Apparatus
Axial filament/Tail	Centriole

- Time taken for epididymal maturation: 12-14 days.

Oogenesis

00:15:04



- germ cells : Pluripotent (Ability to form all 3 germ layers).
- Zygote upto/untill 8 cell stage, : Totipotent (Ability to form embryonic + extraembryonic tissue).
- germ cells migrate
 - Yolk sac → genital ridge → gonads formed.
 - Failure of migration (Aberrant location) → Form teratomas.

Note :

Age	No. of follicles
5m of life	6 - 7 million (max)
At birth	1 - 2 million
At puberty	4 - 5 lakh
Every month	1000 follicles undergo atresia
At menopause	No follicles in ovary

No. of follicles in ovary based on age :

- Oogenesis begins in intrauterine (IU) life.
- Size of ovum : 100µm.
- Fertilisable life span of ova : 12-24 hrs.
- Size of follicle just before ovulation : 18-20mm.
- Follicle formation begins at : 14 weeks.
- Follicle formation is complete by : 22-24 weeks.
- Each oogonia gives rise to : 1 ova/female pronucleus.

Salient points :

FERTILIZATION & IMPLANTATION

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Events Prior to Fertilization

00:01:30

Capacitation :

- Process by which sperms become capable of fertilizing the ova.
- Site : Female reproductive tract.
- Begins at : Cervix.
- main site : Fallopian tube (FT).
- In vitro capacitation : 2 hours.
- Time taken : 6 - 8 hours.

Sequence of events :

Step 1 : Capacitation - Sperms become hypermotile (in FT).

Step 2 : Sperms bind to zona pellucida.

Step 3 : Acrosomal reaction : Release enzyme → Digest zona pellucida.

(Hyaluronidase)

Step 4 : Head of single sperm (male pronucleus) fuses with oolemma.

Step 5 :

- 2nd meiotic division complete → Female pronucleus + 2nd polar body.

- Cortical reaction : Cortical granules (Cytoplasm of 2^o oocyte)

Release

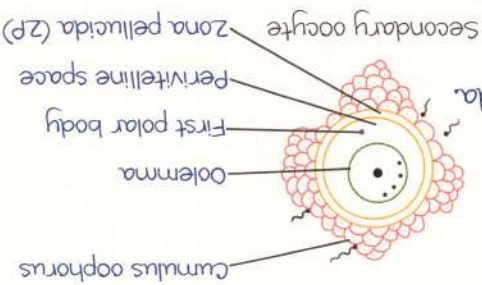
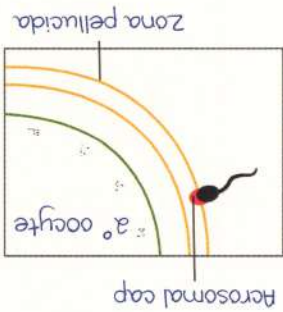
Ca²⁺ + other substances

Step 6 : Substances released by cortical granules

Zona reactions : Hardening of zona pellucida (Doesn't allow entry of any other sperm)

Note :

- Polyspermy is prevented by : Cortical reaction, Zona reaction.
- Time taken by sperms to reach the site of fertilization : 30 mins.
- male sperm attain mobility in epididymis (distal part).
- sperm attain hypermotility in female reproductive tract.
- Zona pellucida :
- Acellular membrane.
- made of glycoprotein.
- Receptors for sperm head : ZP₃ receptor.
- Function : To prevent polyspermy.



Process of Fertilization

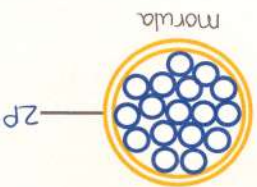
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Fertilization & Implantation

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- male pronucleus (a3) + Female pronucleus (a3) → Zygote (46 : Diploid)
- Occurs in : Ampulla of fallopian tube.
- Day of fertilization = Day of ovulation = Day 14 (in a 28 day cycle) :
- Fertilisable span of a° oocyte : 24 hours.
- In IVF : Day of ovulation = Day of oocyte retrieval = Day of fertilization.
- Zygote formation
 - After 30 hours
 - a cell → 4 cell → 8 cell → 16 cell
- 16 cell morula enters the uterine cavity.



Note :

- ectopic pregnancy :
 - ↑ peristalsis of FT.
 - cilia absent.
 - blockage in tube

morula implanted in FT

(D/t adhesion formation).

- High chances of ectopic pregnancy :
 - Immotile cilia syndrome (Kartagener syndrome).
 - Adhesion inside tube (e.g. PID, salpingitis).
 - Failure of contraceptive (with progesterone containing pills).
 - (Smooth muscle relaxant action → ↑ peristalsis).

morula :

- moves towards uterine cavity.
- morula is pushed towards uterine cavity due to :
 - Peristalsis in tube.
 - movement of cilia (FT lined by ciliated columnar epithelium).
- Till 3 days after fertilization : Stays in FT (Nutrition by secretory cells).
- 4th day after fertilization : enters uterine cavity (16 celled).
- (Day 18 of cycle)
- 5th day after fertilization :
 - zona hatching : ZP is lost.
 - Fluid enter morula → converted to blastocyst.

Implantation

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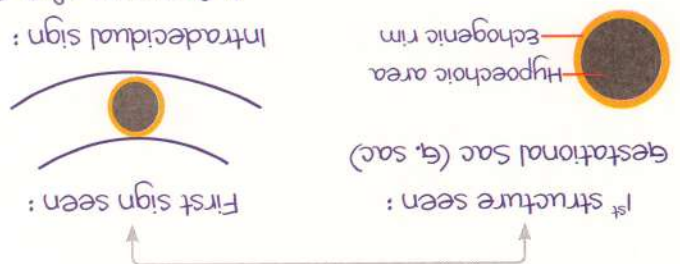


Interstitial implantation

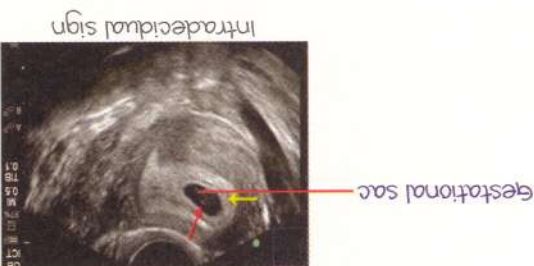
• Salient features :

- Attachment of blastocyst to endometrium.
- On day 6 after fertilization (Day 20 of cycle).
- Implantation window : Time period (Day 20 - Day 24) when endometrium/uterus is most receptive for blastocyst.
- Type of implantation : Interstitial implantation deep inside endometrium.
- Placental/Hartmann sign : Few experience bleeding at the time of implantation.

• Applied aspect : USG in pregnancy :



- Presence of G. sac deep inside endometrium.



Stages of implantation :

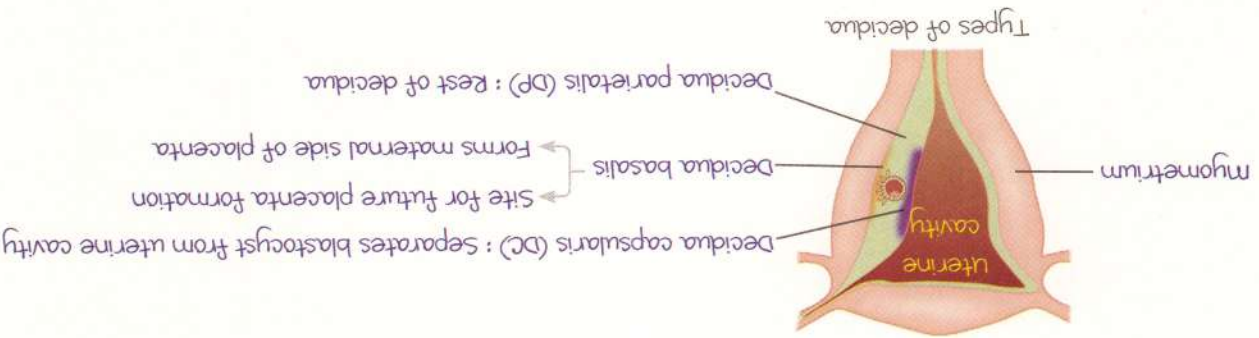
Stage	Factor responsible
1. Stage of Apposition	Selectin
a. Stage of Adhesion	Integrin (most important)
3. Stage of Penetration	matrix metalloproteinases

Implantation is eccentric :

- Piskacek sign : growth of uterus in early pregnancy is asymmetrical.
- True gestational sac (Of intrauterine pregnancy) : Always eccentric.

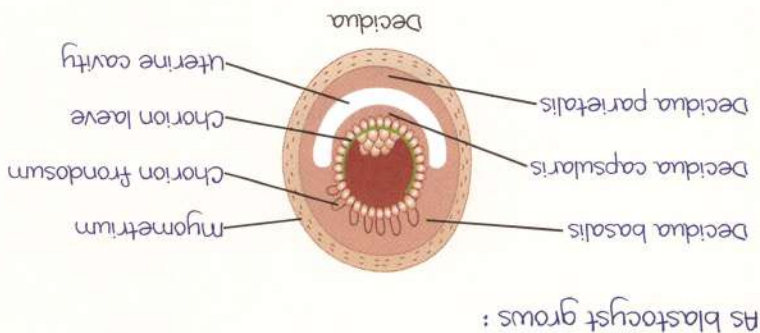
Decidualisation :

After implantation, endometrium is called decida.



Fertilization & Implantation

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As blastocyst grows :

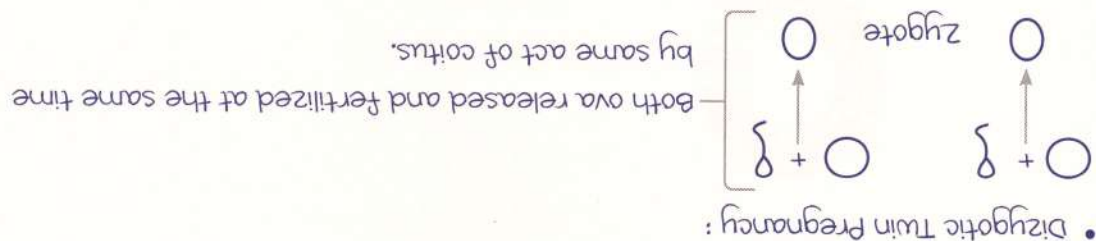


On USG :

- As blastocyst grows :
 - DC comes closer to DP → DC fuses with DP

(14-16 weeks of pregnancy)
 Leads to
 Obliteration of uterine cavity
 (14-16 weeks of pregnancy)

Obliteration of uterine cavity :



• Superfetation :

- Not seen in humans.
- a ova released in a different cycles & fertilized by a different acts of coitus.
- in humans : Superfetation possible till 14-16 weeks of pregnancy (Only theoretical).

Changes in decidualization :

Hormone responsible : Progesterone

1. Secretory changes in endometrium.

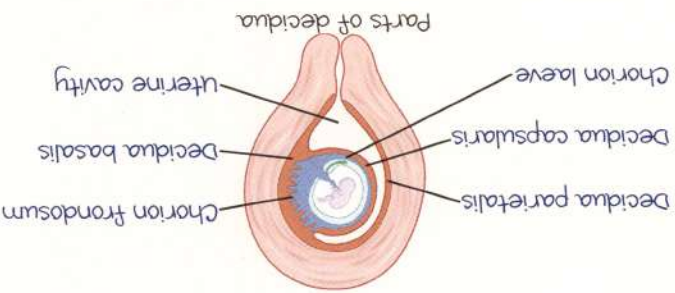
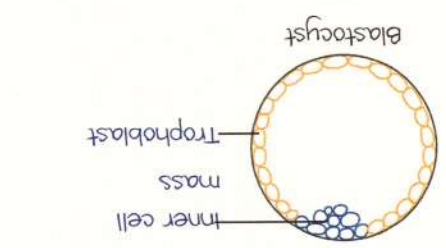
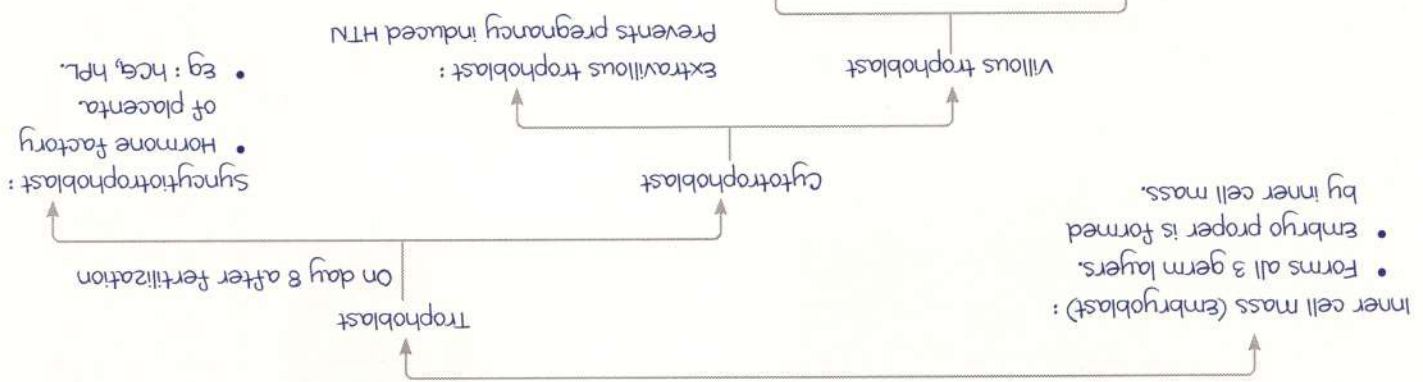
a. ↓ thickness of endometrium (10-11mm) d/t **stromal edema** (most important histological finding).

- in non-pregnant female during secretory phase (6mm).

Blastocyst

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Fate of blastocyst:



Fetal Membranes

01:06:10

- Chorion:
- Formed by chorion laeve (cytotrophoblast).
 - Outermost fetal membrane.
 - Formed earlier than amnion (day 8 after fertilization).
- Amnion:
- Formed by ectoderm.
 - Innermost fetal membrane.
 - Day 10 after fertilization.
 - gives tensile strength.
- Yolk Sac:
- First site for fetal hematopoiesis.
 - Source of α fetoprotein.