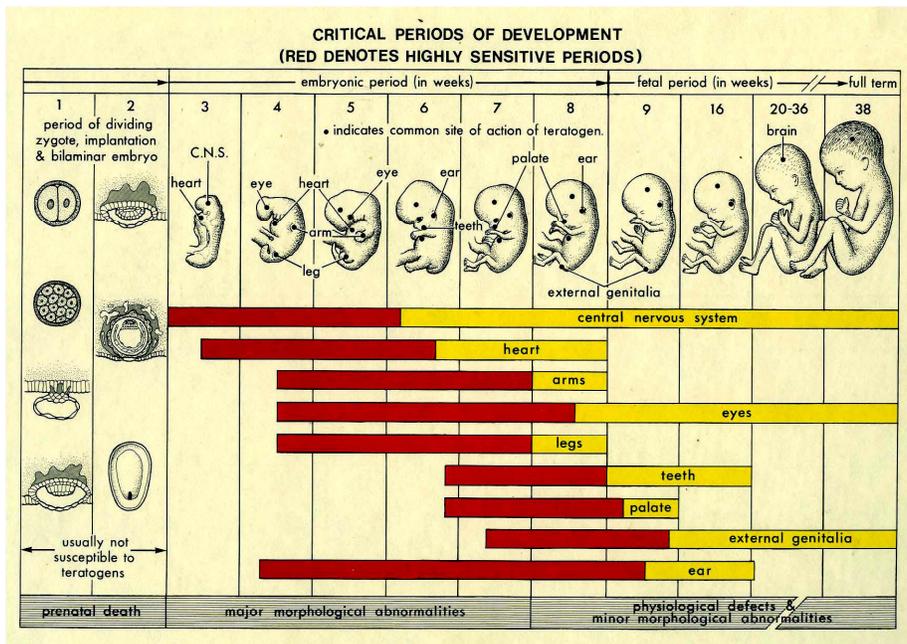
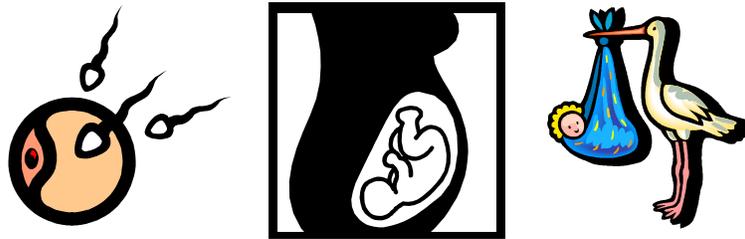
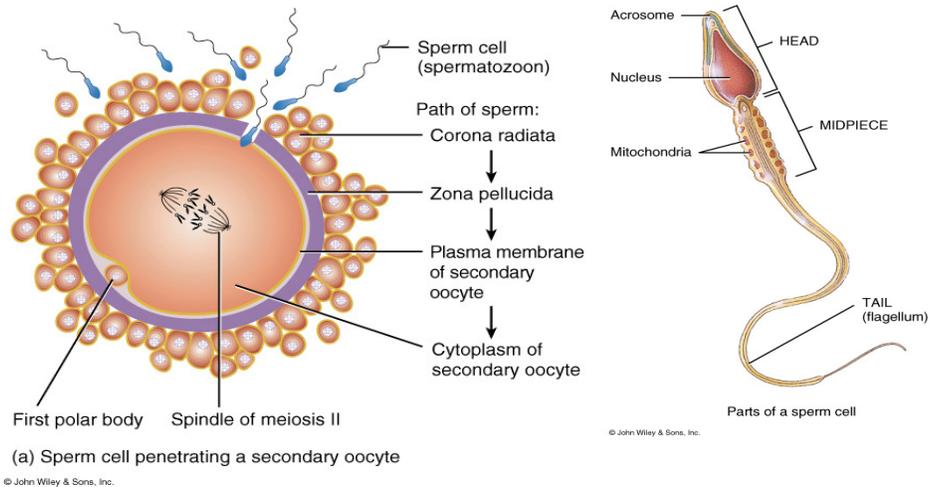


Bio& 242 A&P

Unit 4 / Lecture 5



Sperm Penetration and Meiosis II



Activation of Sperm.

Capacitation: Changes undergone by spermatozoa in the female genital tract that enables them to penetrate and fertilize an egg.

- ❖ Facilitated by the removal of sterols (e.g. cholesterol) and non-covalently bound epididymal/seminal glycoproteins. The result is a more fluid membrane with an increased permeability to Ca^{2+} .
- ❖ An influx of Ca^{2+} produces increased intracellular [cAMP](#) levels and thus, an increase in motility.
- ❖ The tripeptide FPP (fertilization promoting factor) produced by the male is essential for capacitation. It has a synergistic stimulatory effect with adenosine that increases adenylyl cyclase activity in the sperm.
- ❖ FPP is found in the seminal fluid, and comes into contact with the spermatozoa upon ejaculation.

"Polyspermy" means fertilization by more than one sperm.

"Fast block" to polyspermy:

- ❖ *Uses a propagated change in electrical voltage across the plasma membrane of the oocyte.*
- ❖ *This depolarization is closely equivalent to nerve action potentials!*
- ❖ *Before being sperm contact, the oocyte membrane is at a resting voltage of -70 millivolts, same as most cells.*
- ❖ *At sperm contact ion channels open in the plasma membrane that let sodium ions leak in (& also calcium ions).*
- ❖ *The oocyte membrane (somehow!) won't fuse with the sperm membrane after it has depolarized*

"Polyspermy"

"Slow blocks" to polyspermy

- ❖ *Just under the plasma membrane of oocytes are thousands of Cortical vesicles.*
- ❖ *The increased calcium concentration causes these cortical vesicles to fuse with the plasma membrane and release their content.*
- ❖ *Enzymes in the cortical vesicles digest away adhesion molecules on the oocyte surface that are needed for sperm to stick to oocyte membrane*
- ❖ *In some animals these Cortical vesicles form a "fertilization membrane" by lifting the Zona pellucida away from the plasma membrane.*

Problems Associated with Polyspermy

Partial molar pregnancy

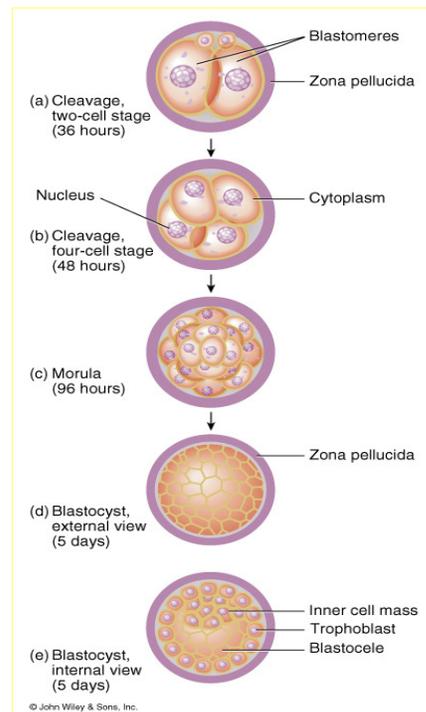
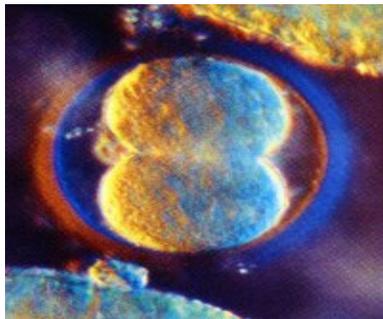
- ❖ *The placenta grows abnormally into tissue called a “mole.” Any fetal tissue that develops is likely to have severe defects.*
- ❖ *Caused when A normal egg is fertilized by two sperm, “polyspermy.”*

Complete molar pregnancy.

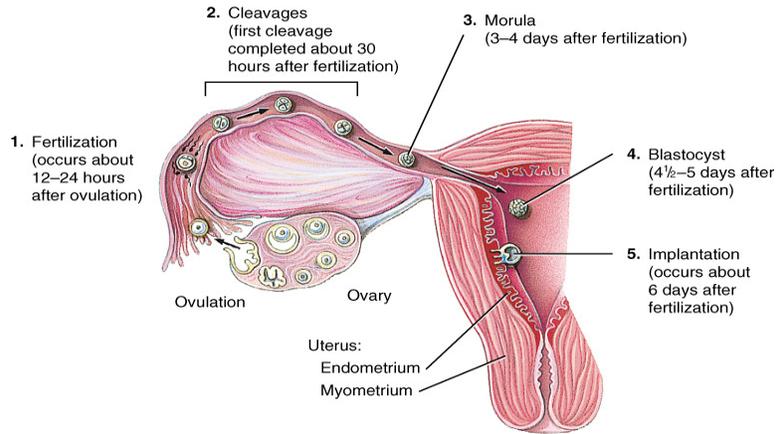
- ❖ *In place of a normal placenta and embryo, a mole of abnormal placental tissue grows into a grapelike cluster that can fill the uterus.*
- ❖ *An abnormal egg with no genetic information is fertilized by a sperm. The sperm's chromosomes duplicate and develop into a complete mole.*
- ❖ *Some molar pregnancies lead to abnormal cell growth called gestational trophoblastic disease. . A small percentage of these may become invasive cancer.*

Early Mitotic cell division are called “Cleavage”

Cleavage results in smaller cells and increase cell numbers but the size of the zygote remains the same size as the egg.



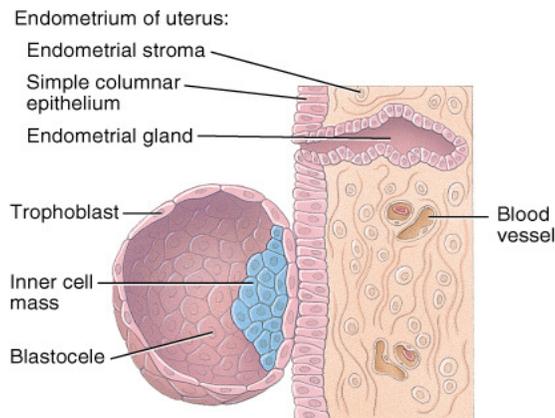
Cleavage results in a solid ball of cells
 “Morula” and finally a hollow ball of cells
 “Blastrula or Blastocyst”



Frontal section through uterus, uterine tube, and ovary

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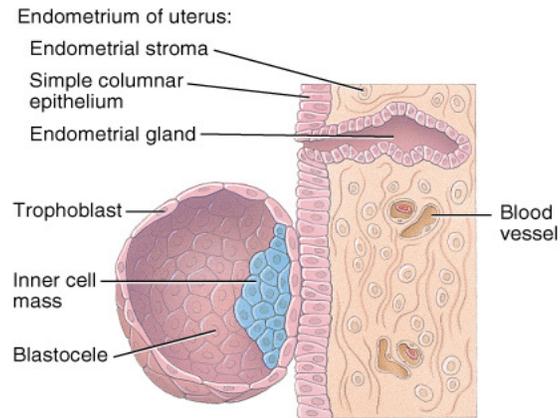
Blastrula or Blastocyst arrives in the uterus
 after about 6 days and implants in the
 endometrium



(b) Internal view, about 6 days after fertilization

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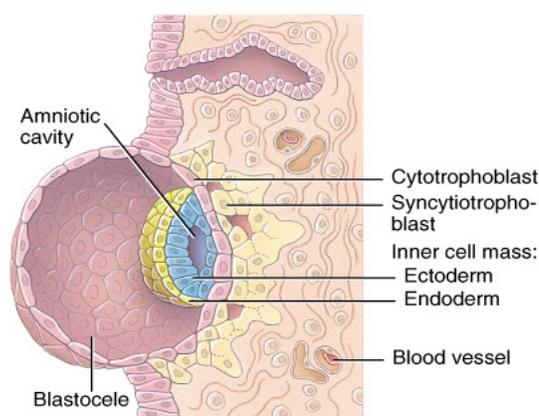
The Human Fetus develops from a group of cells called the Inner Cell Mass



(b) Internal view, about 6 days after fertilization

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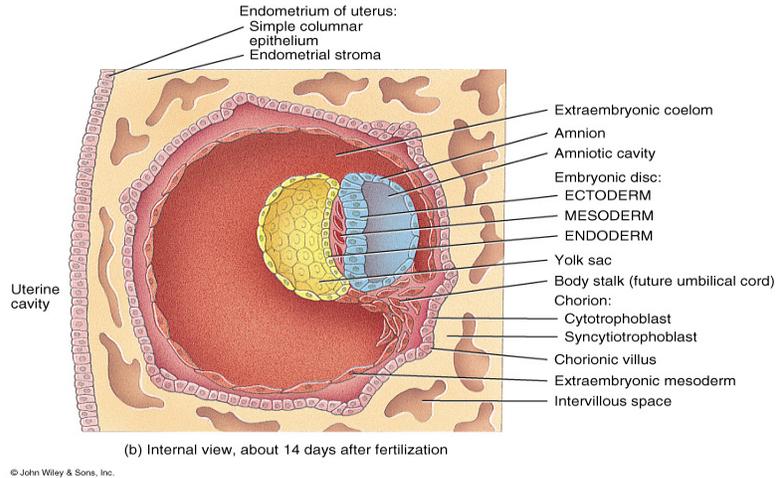
The Inner Cell Mass develops into two embryonic tissues



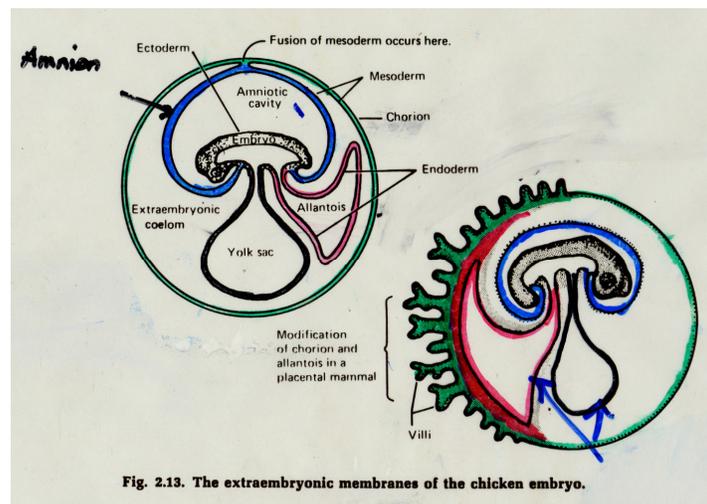
(c) Internal view, about 7 days after fertilization

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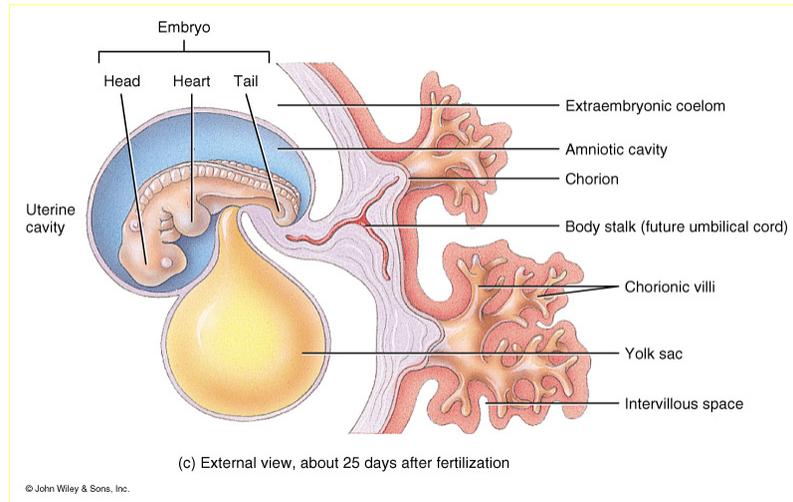
Embryo develops the third embryonic tissue and extra-embryonic membranes



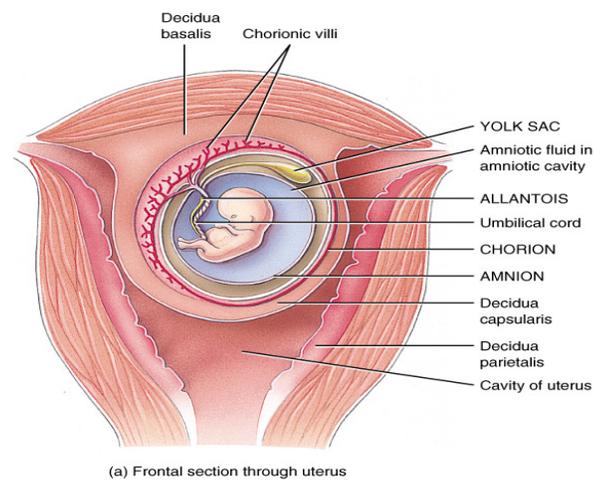
Extra-embryonic membranes and the modification to form the placenta and the umbilical cord



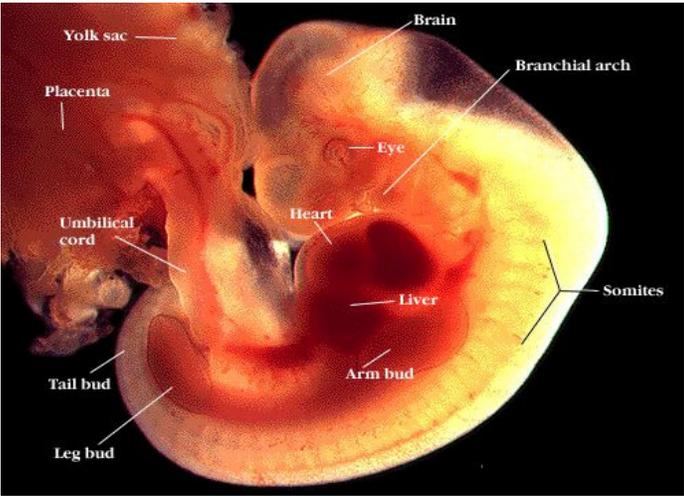
Formation of the placenta and umbilical cord



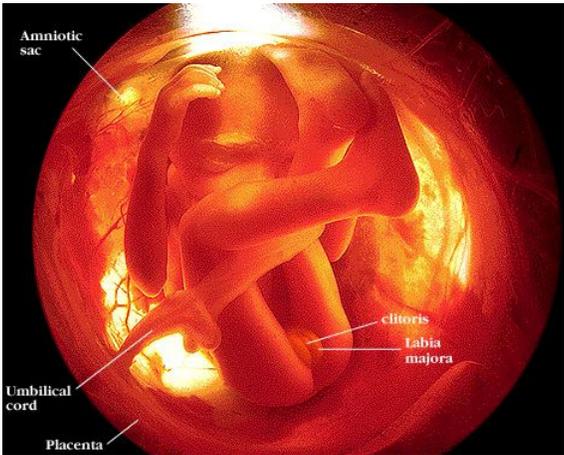
Implanted fetus showing the extra-embryonic membranes and layers of the endometrium



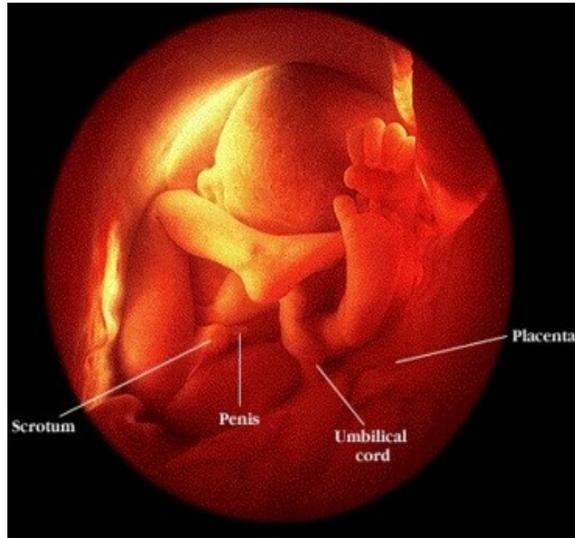
First Trimester, about 5 weeks



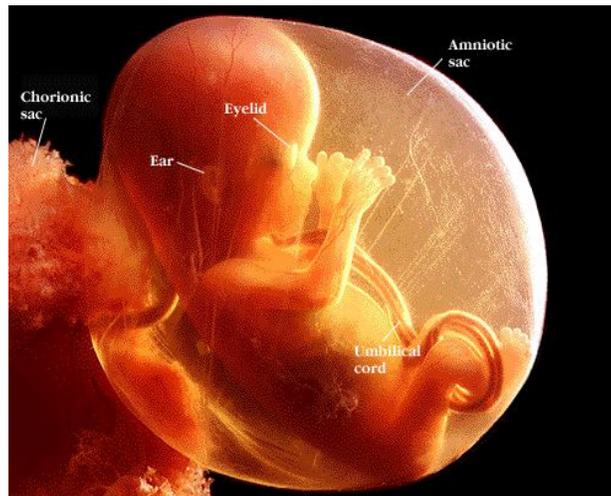
**Second Trimester, about twenty weeks,
late second trimester premature baby**



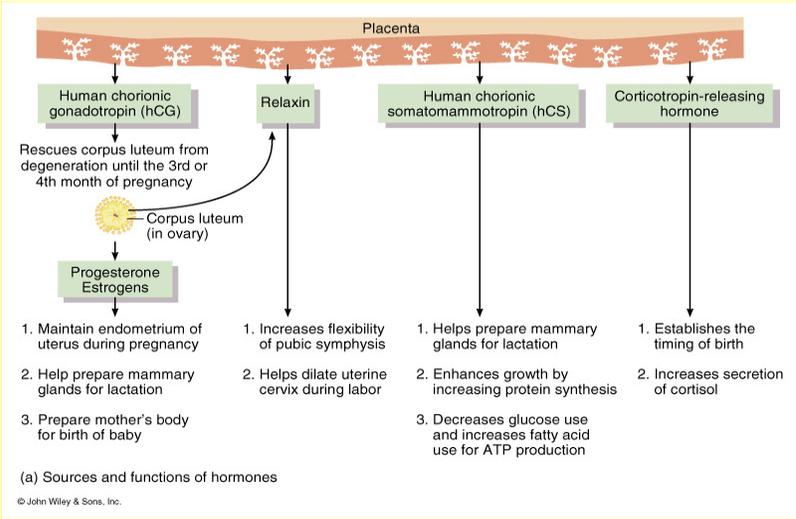
Third Trimester, about 30 weeks



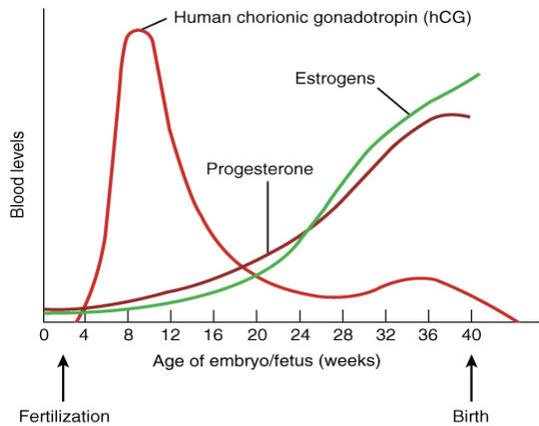
Third Trimester, about 30 weeks



Hormonal Control of Development and Childbirth



Cyclic hormone levels during pregnancy

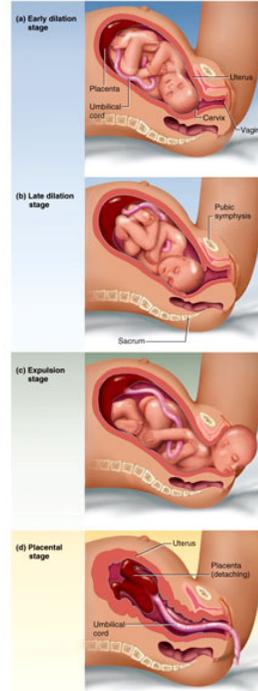


(b) Blood levels of hormones during pregnancy
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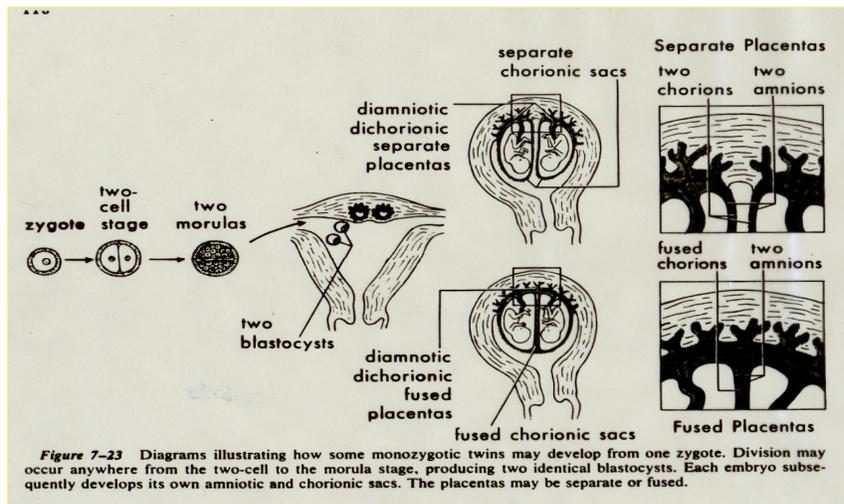
Childbirth



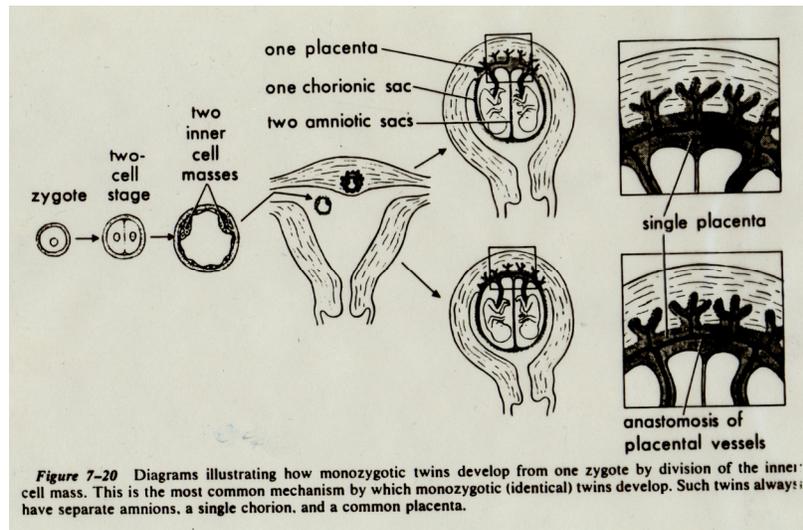
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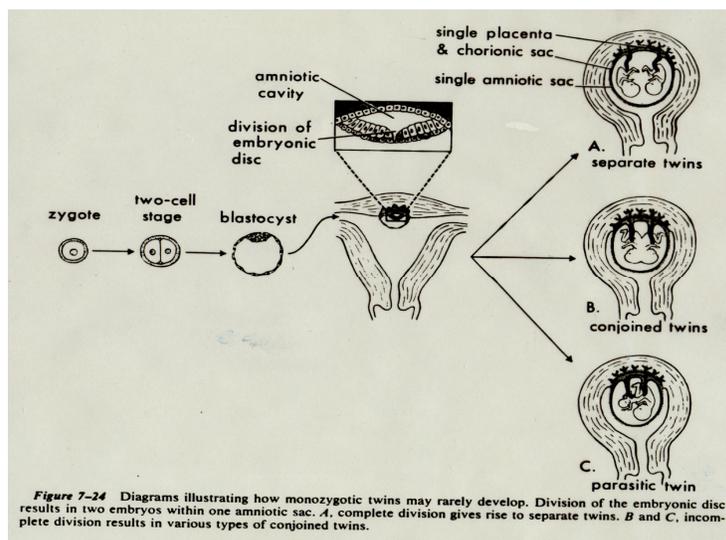
Formation of Monozygotic Twins



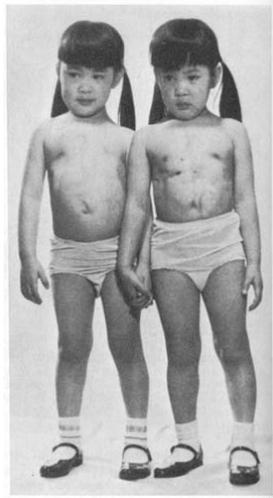
Formation of Monozygotic Twins



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