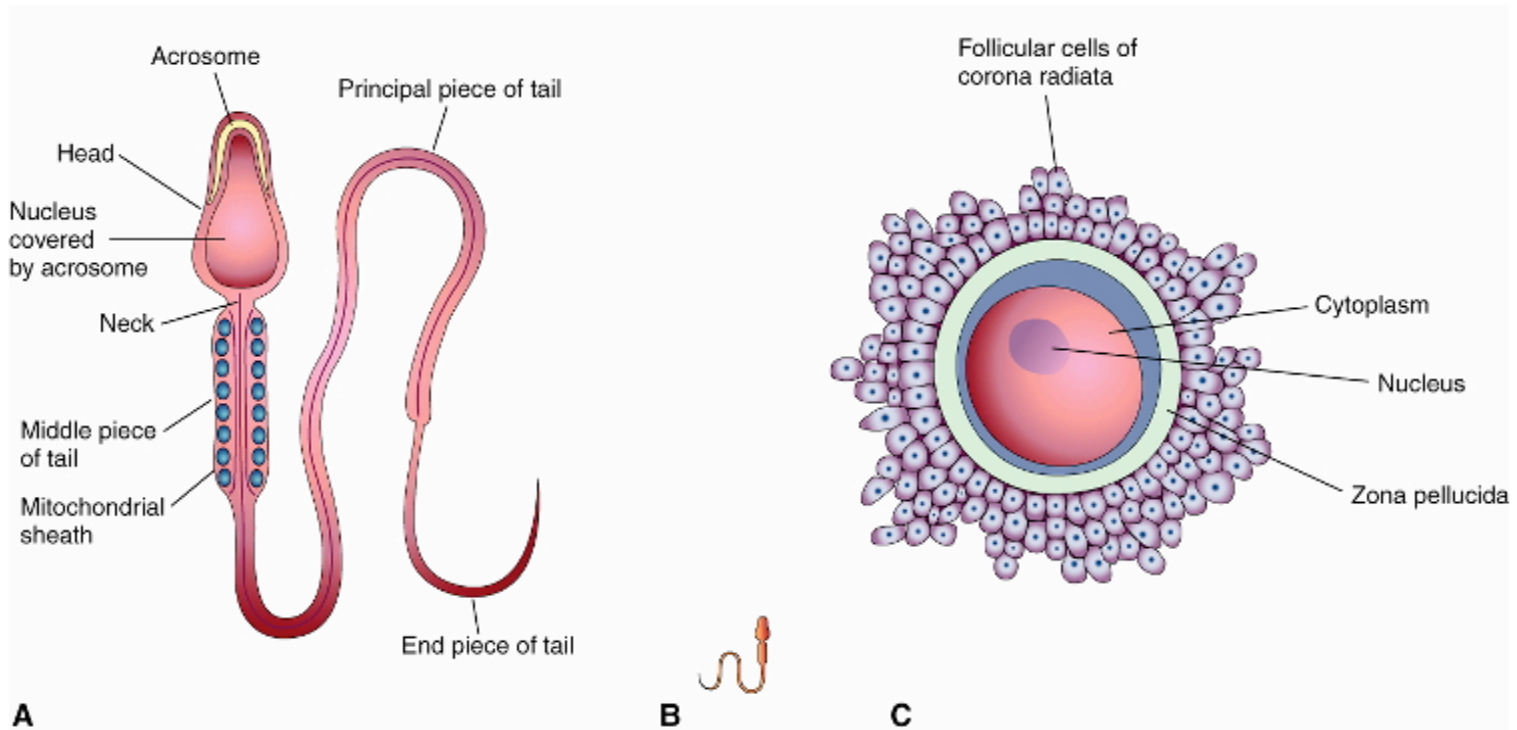


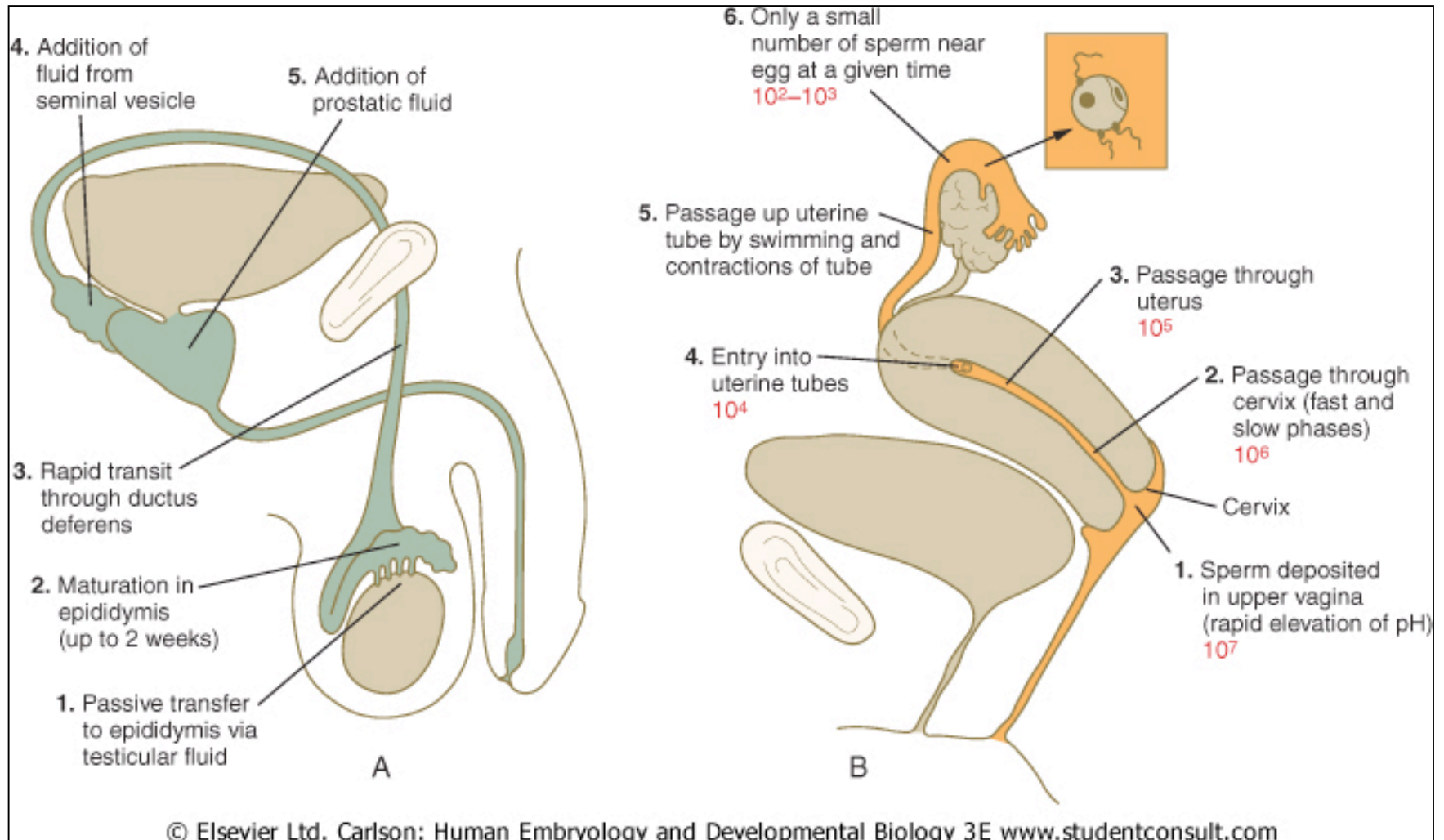
Fertilization, Placenta and Fetus

Male and Female gametes



Copyright © 2003, Elsevier Science (USA). All Rights Reserved.

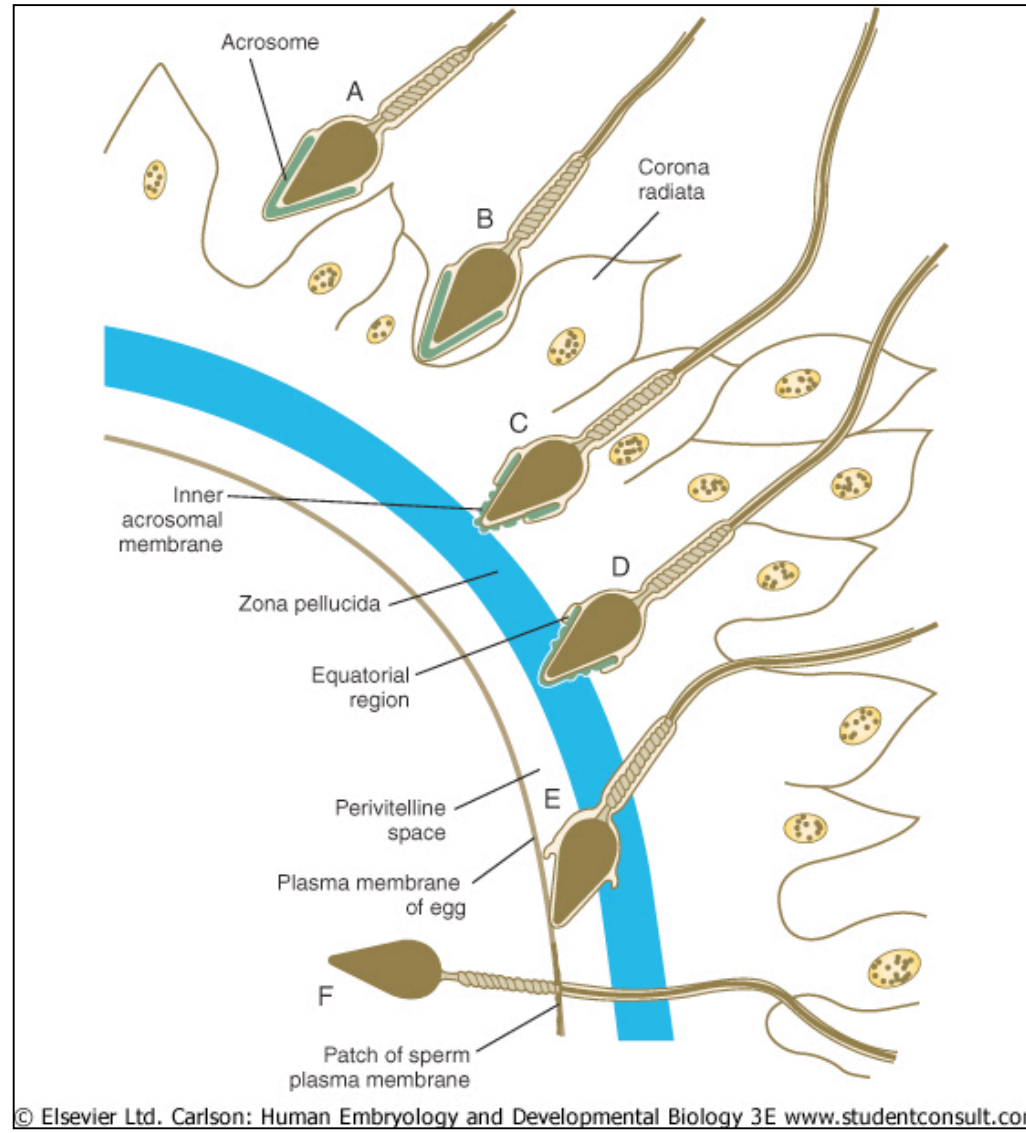
JOURNEY OF THE SPERM



SEQUENCE OF EVENTS

- 3: Spermatogenesis, spermiogenesis and spermiation in testis.**
- 2: Biochemical maturation in epididymis.**
- 1: Addition of prostatic and seminal vesicle fluids (fructose, buffers, ions).**
- 0: Ejaculation and deposition into vagina (optimum pH 6.0-6.5).**
- 1: Penetration of cervical mucus (most hospitable on days 9-16).**
- 2: Capacitation in tubes (required for later acrosomal reaction).**

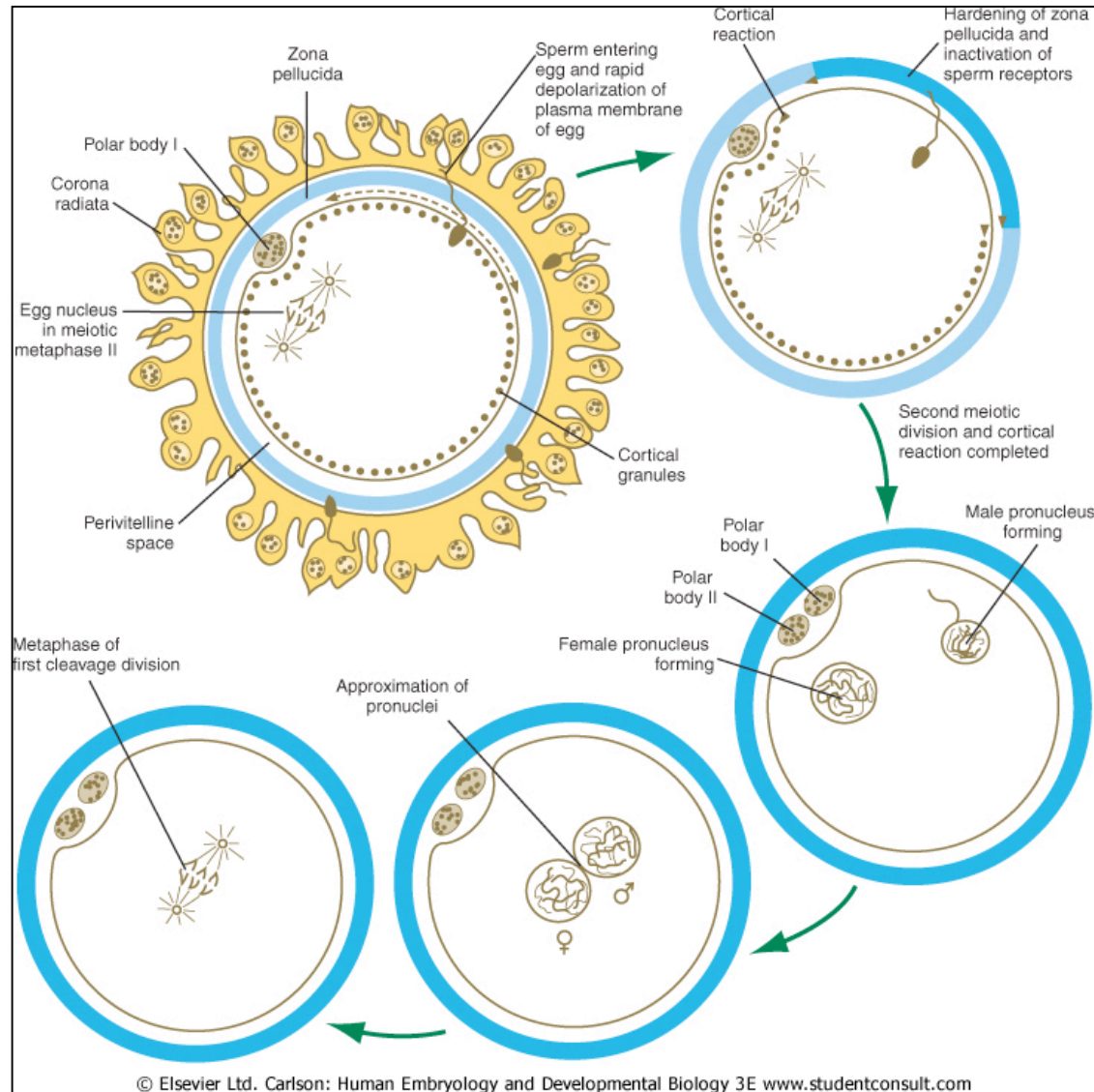
PENETRATION OF OOCYTE



SEQUENCE OF EVENTS

- 3: Penetration of corona radiata (hyaluronidase from sperm).**
- 4: Binding (species specific): zona pellucida (ZP3 gp.) & sperm receptor.**
- 5: Acrosomal reaction with release of acrosin and other enzymes.**
- 6: Penetration of zona pellucida, entry into perivitelline space.**
- 7: Binding: $\alpha 6\beta 1$ integrin of egg with fertilin on sperm plasma membranes.**
- 8: Fusion: of egg and sperm plasma membranes.**
- 9: Entry of sperm head, midpiece and tail into egg cytosol.**

COMPLETION OF FERTILIZATION



SEQUENCE OF EVENTS

- 10: Fast block to polyspermy- depolarization of egg plasma membrane.**
 - membrane potential goes from -70 mV to +10mV in 2-3 seconds.
 - lasts for 5 minutes.

- 11: Slow block to polyspermy- Calcium influx into egg and cortical reaction.**
 - polysaccharides in perivitelline space cause hydration and swelling.
 - hydrolytic enzymes enter zona and hydrolyze ZP3: zona reaction.

- 12: Metabolic activation of egg- probably related to Calcium release.**

- 13: Decondensation of sperm nucleus- formation of male pronucleus.**
 - Sulfhydryl reduction of sperm protamines by egg.

- 14: Completion of oocyte meiosis II, formation of female pronucleus.**

- 15: Fusion of pronuclei and formation of first mitotic spindle: ZYGOTE.**

IMPORTANCE OF ZONA PELLUCIDA

Allows only sperm of the same species to access the egg.

Initiates the acrosomal reaction.

Participates in the polyspermy block.

Acts as a porous filter through which certain substances can reach the embryo.

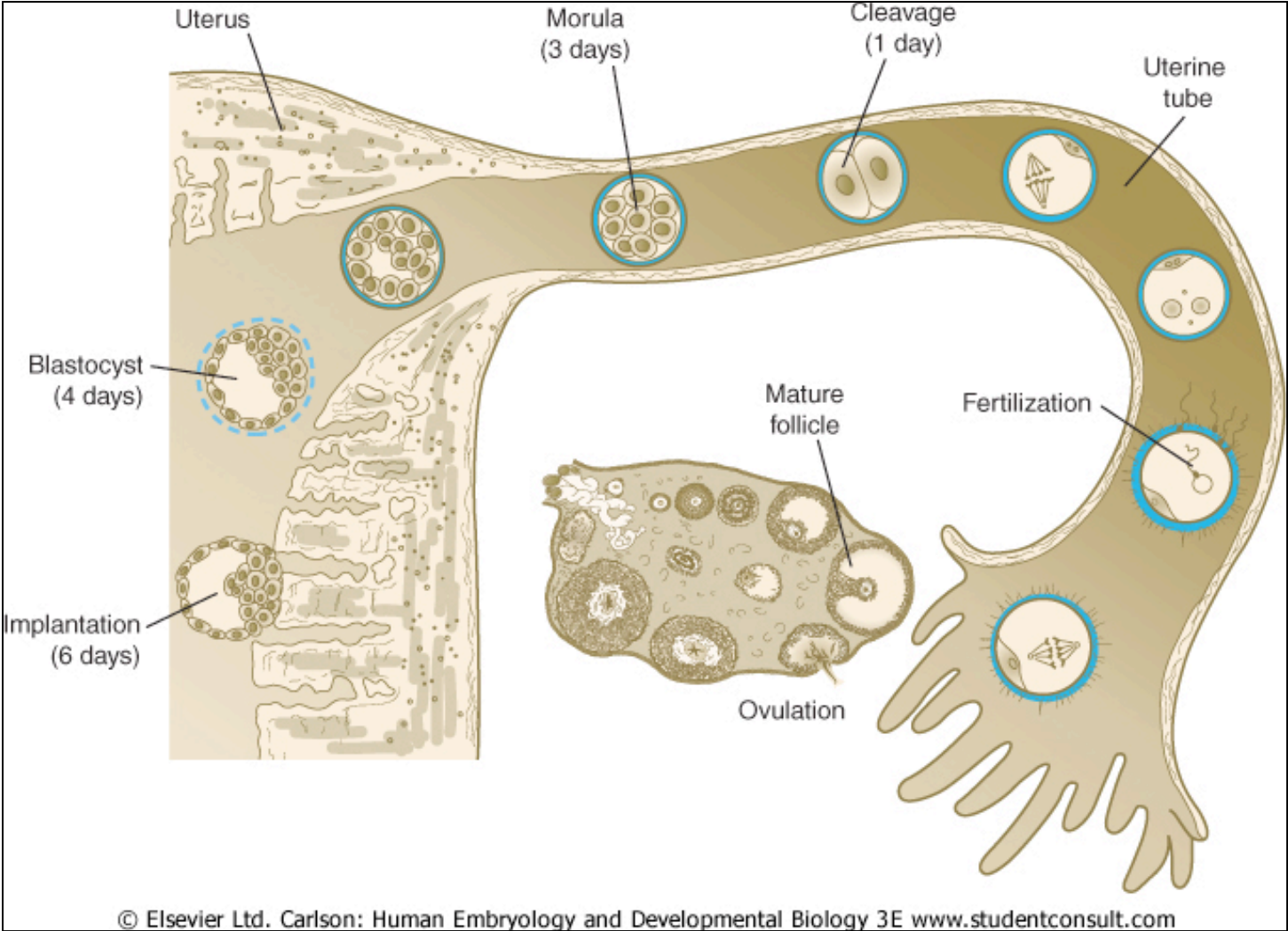
Serves as an immunological barrier between the mother and the embryo.

Prevents the blastomeres of the early cleaving embryo from dissociating.

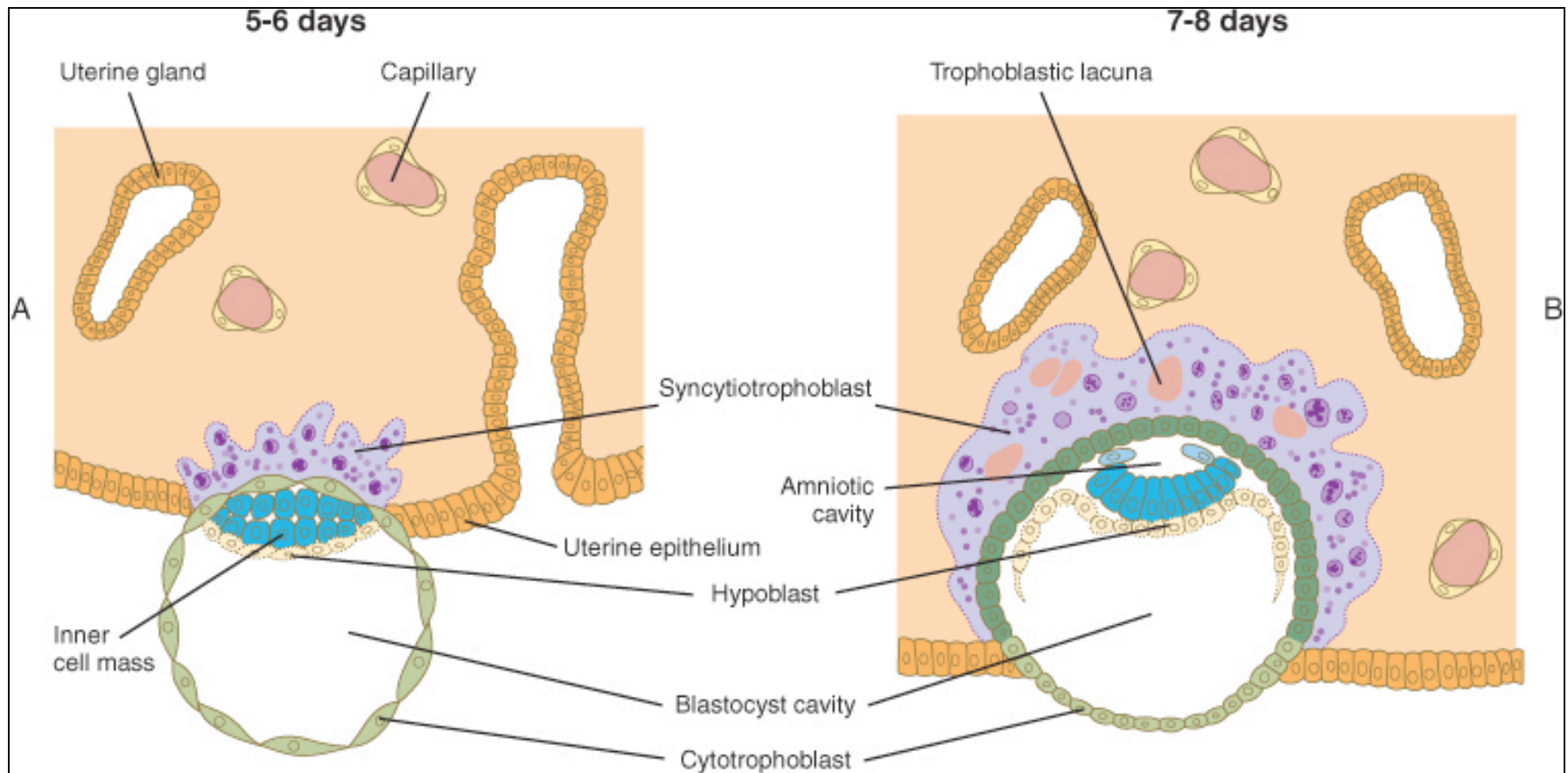
Prevents premature implantation of the cleaving embryo.

PLACENTA

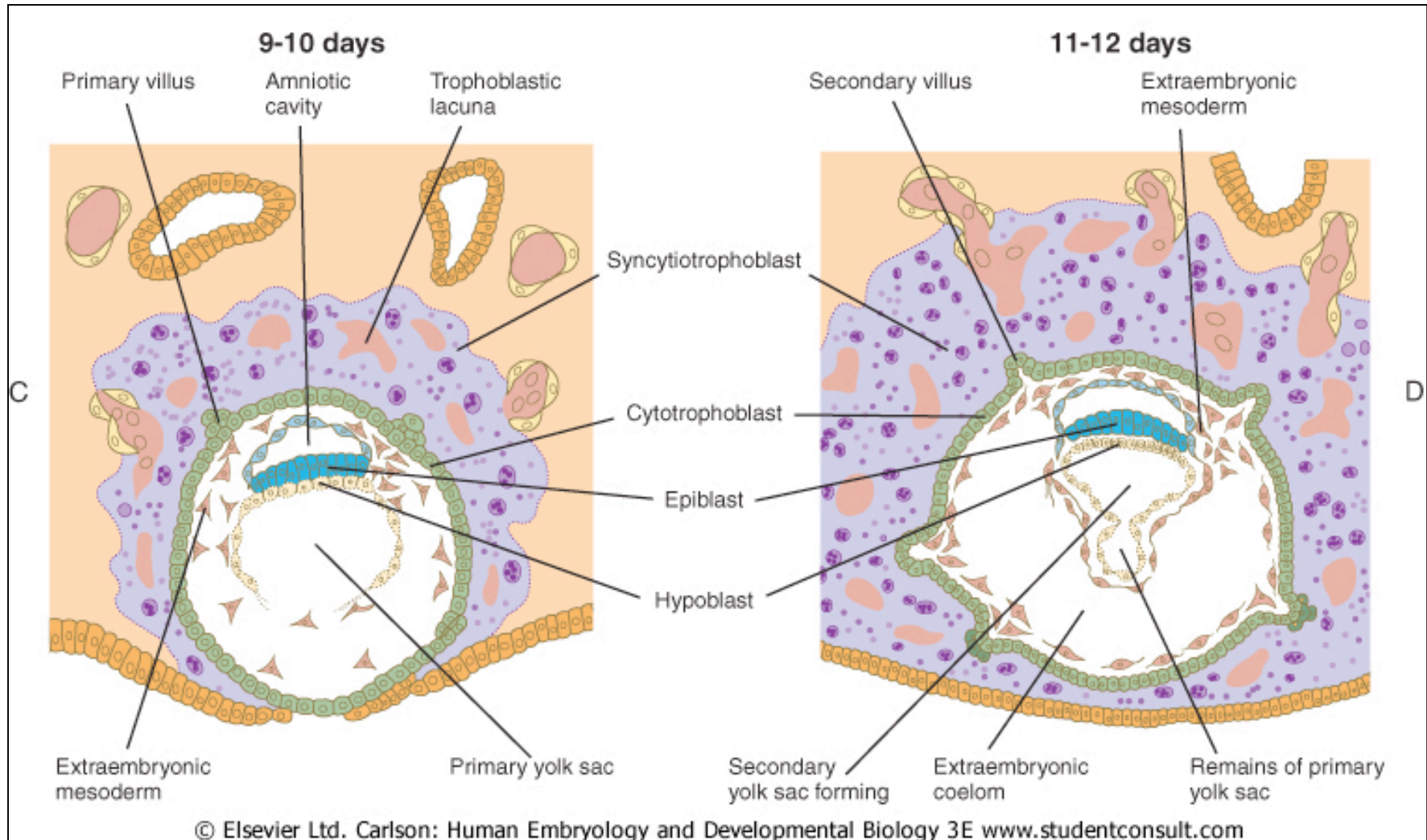
JOURNEY OF THE ZYGOTE



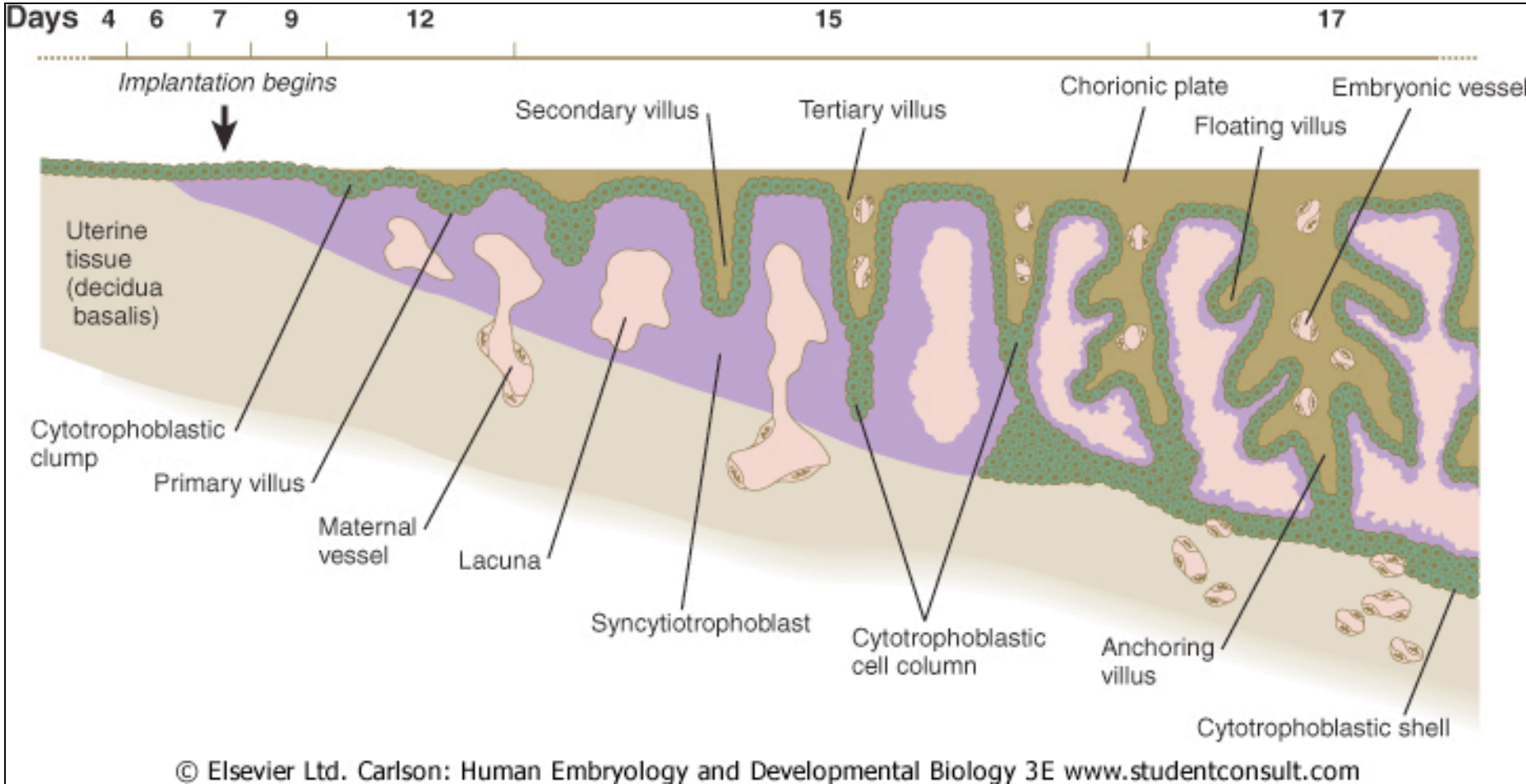
IMPLANTATION



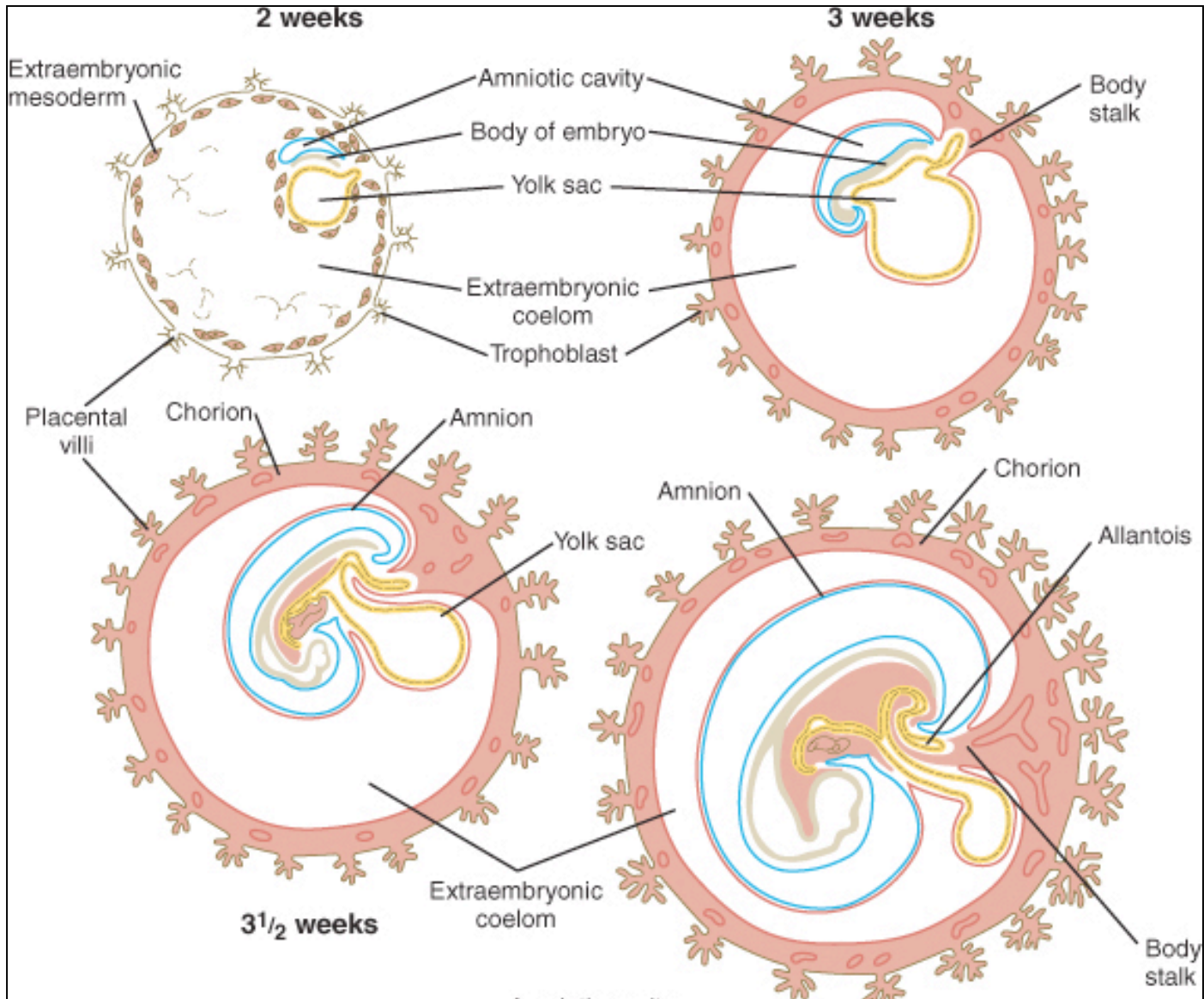
IMPLANTATION



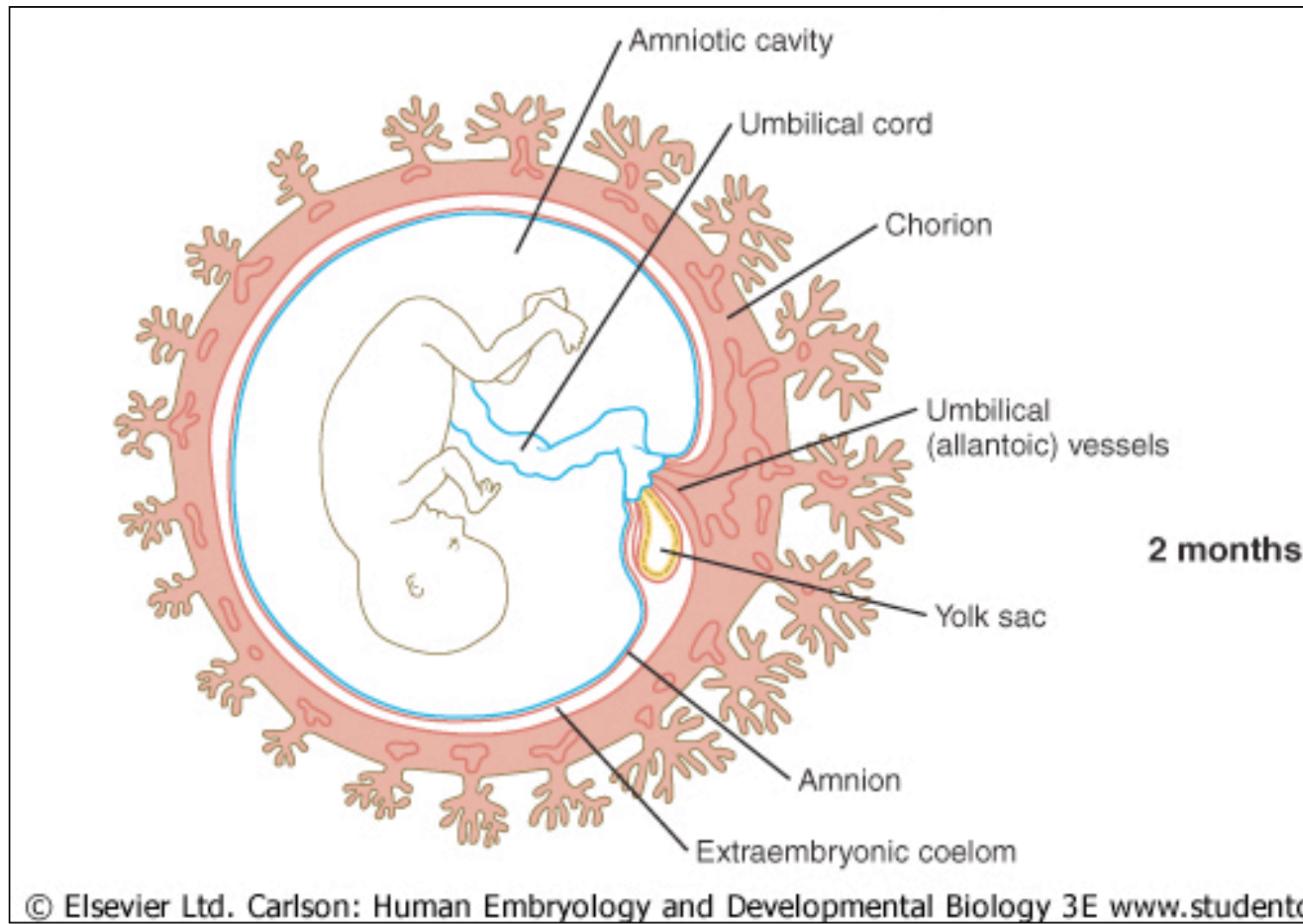
TROPHOBLAST AND VILLI



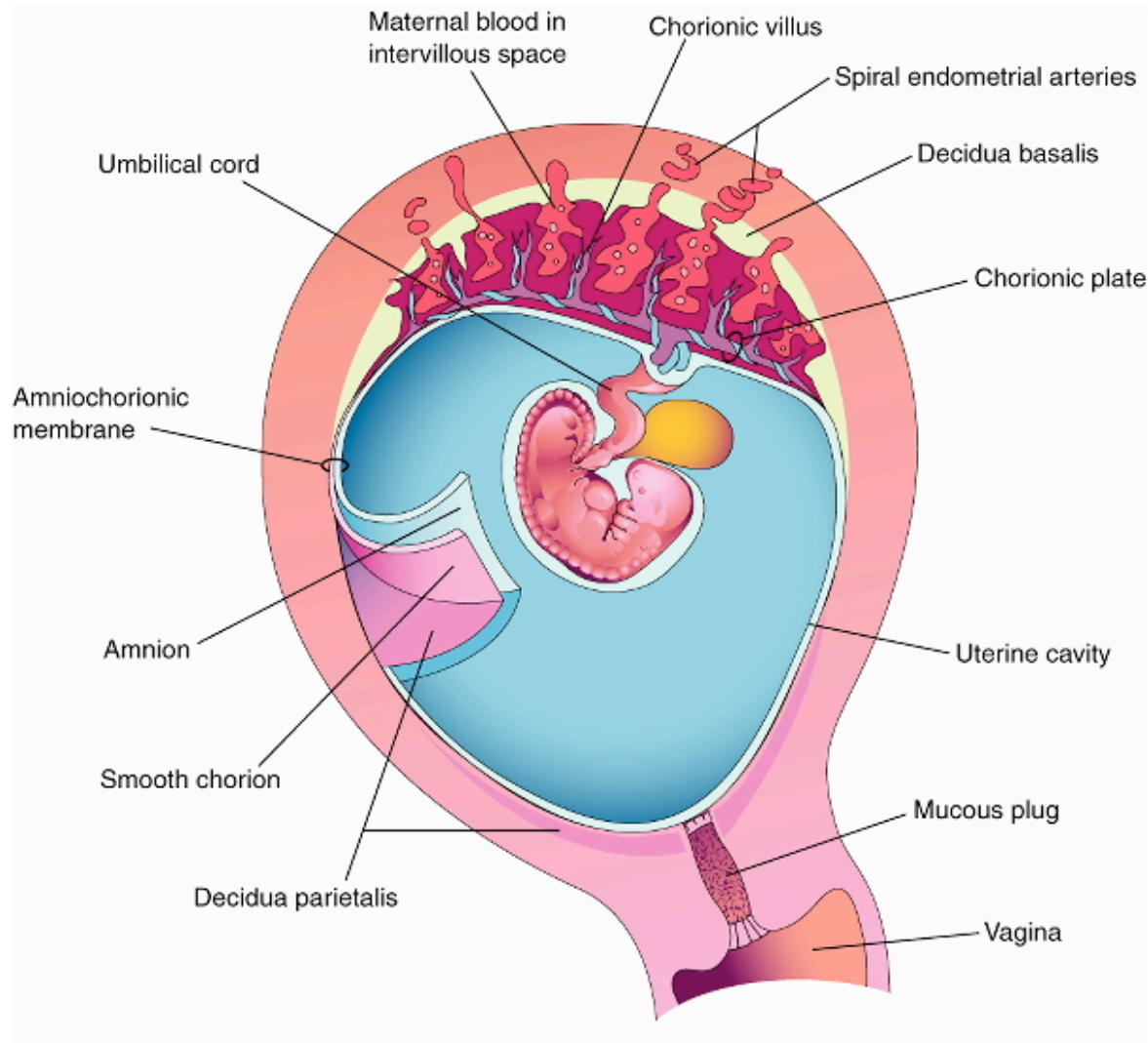
FETAL MEMBRANES



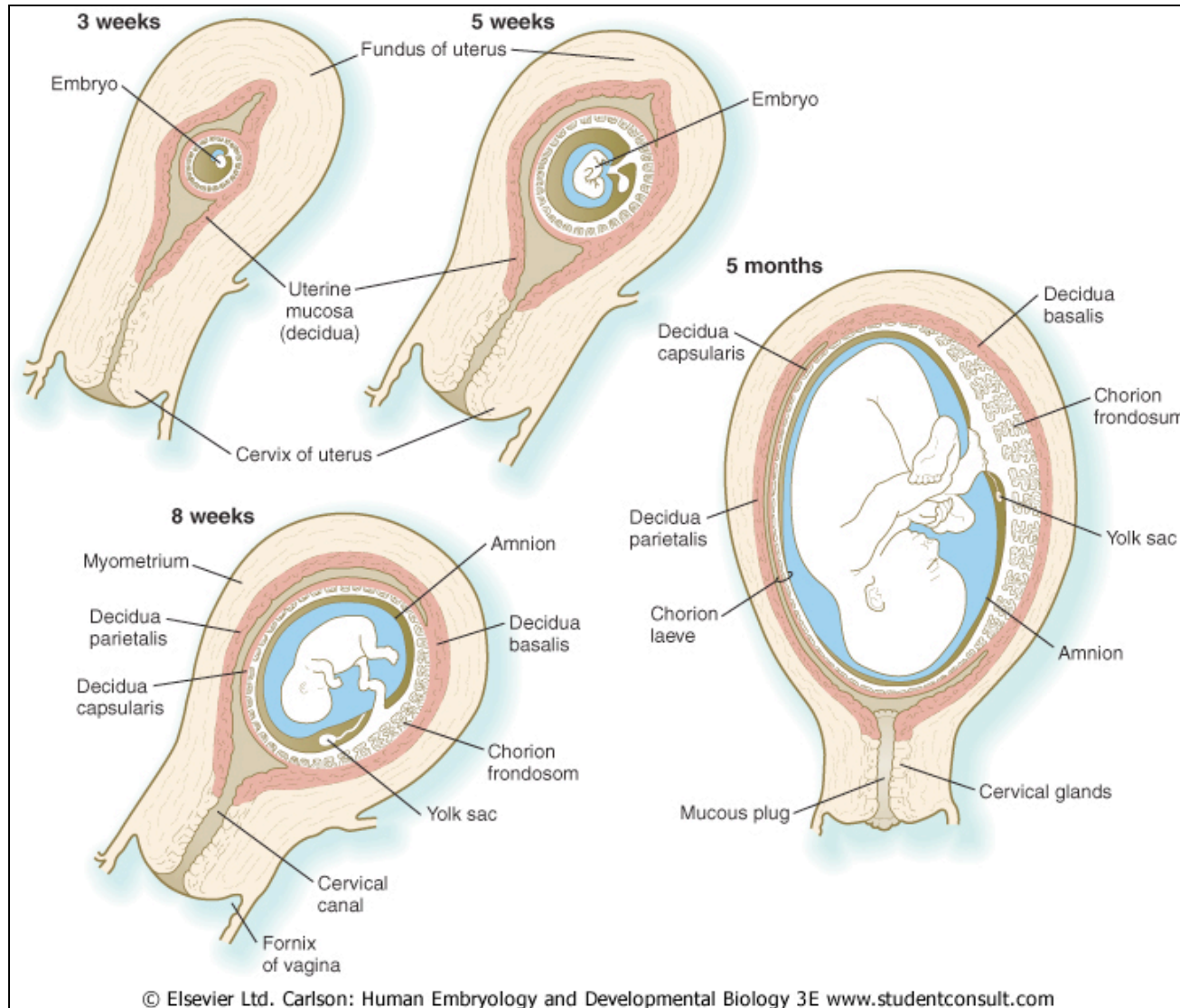
FETAL MEMBRANES



FETAL MEMBRANES



DECIDUA



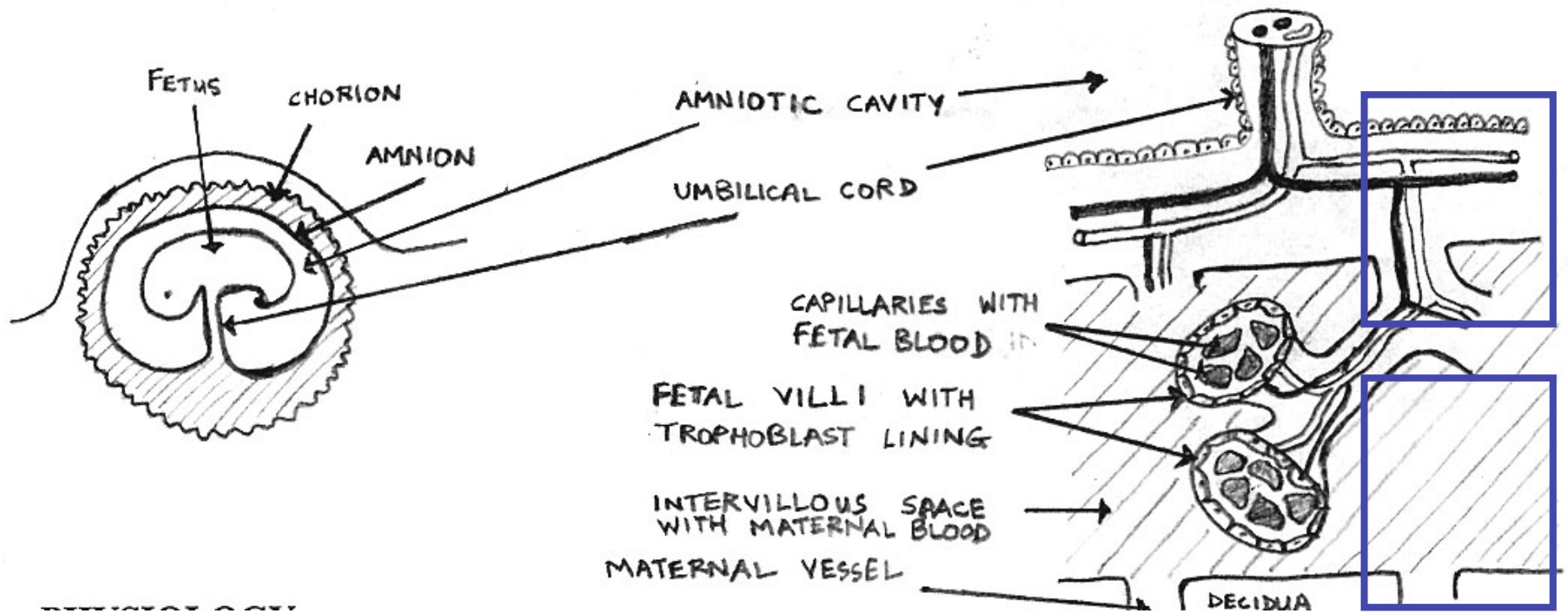
PLACENTA: FETAL SURFACE



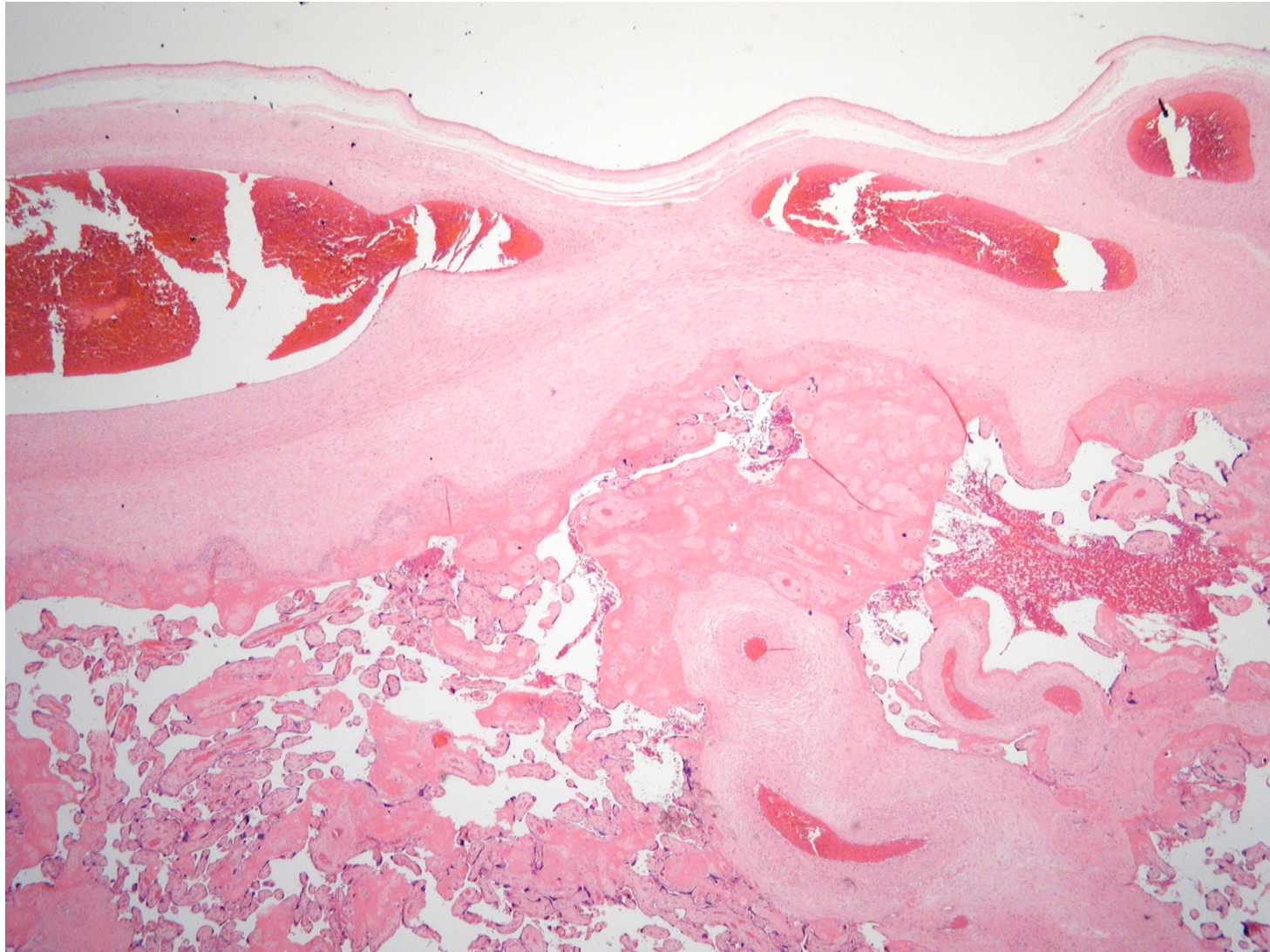
PLACENTA: MATERNAL SURFACE

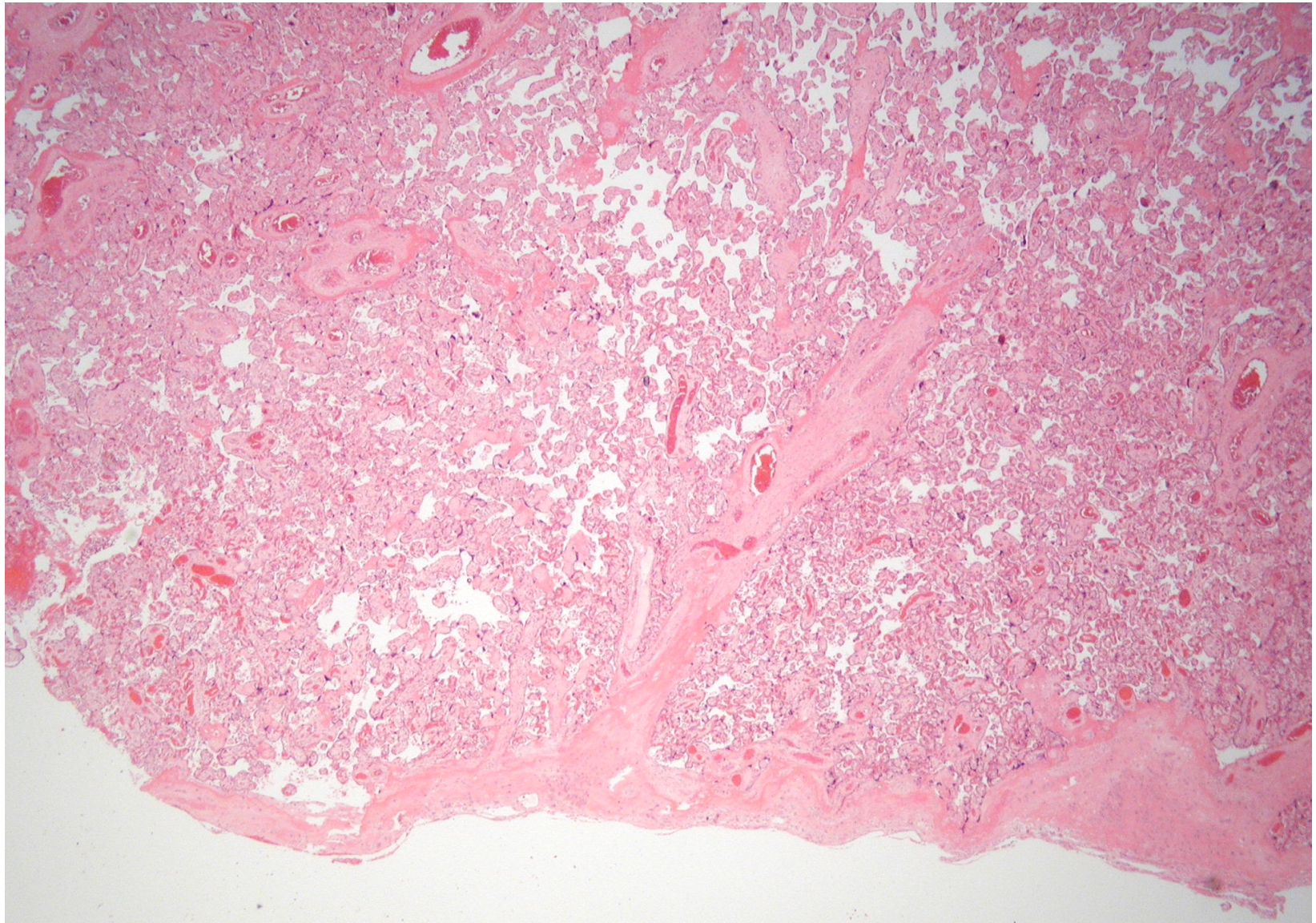


HISTOLOGY: PLACENTAL DISC



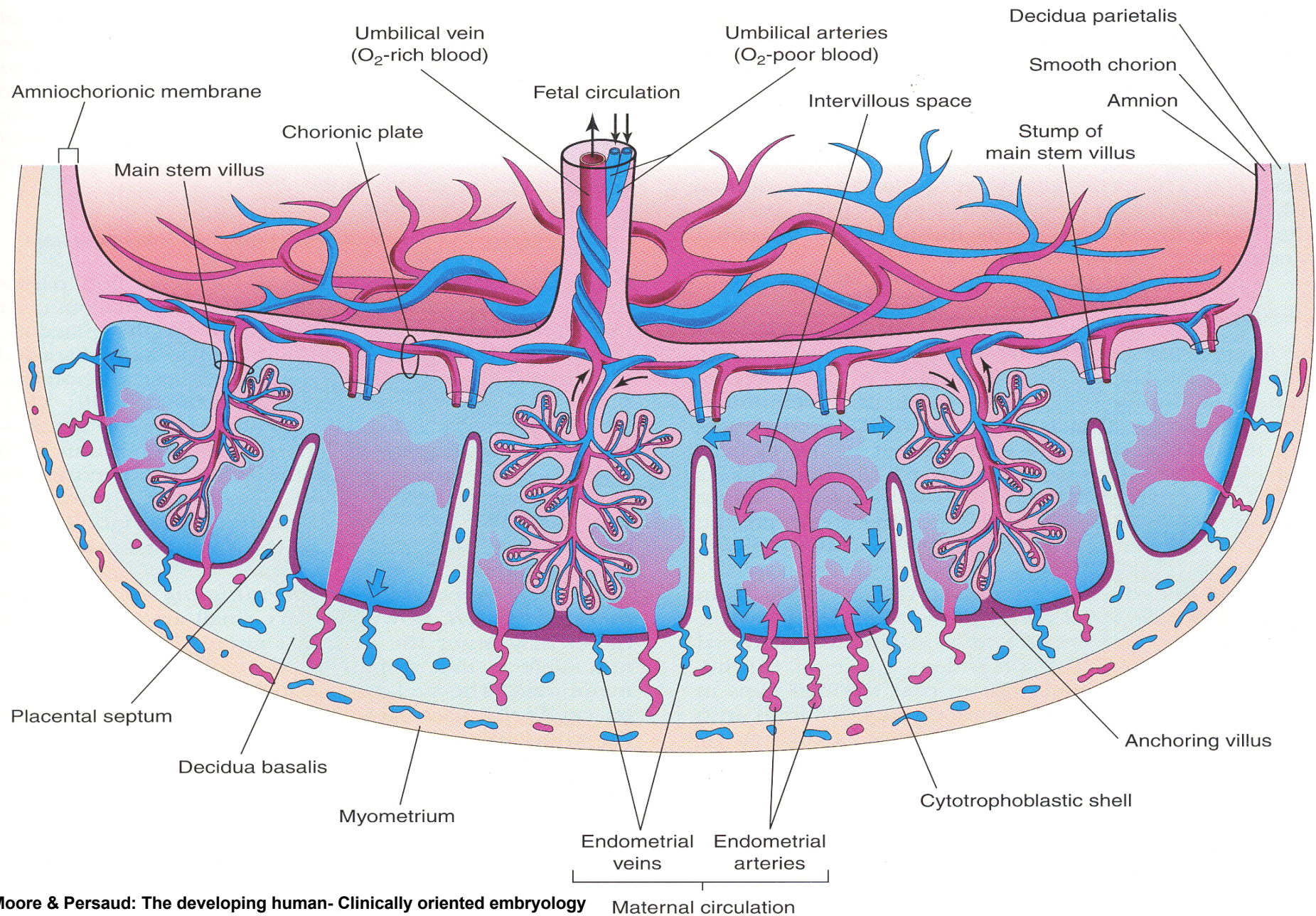
HISTOLOGY: PLACENTAL DISC-FETAL SURFACE



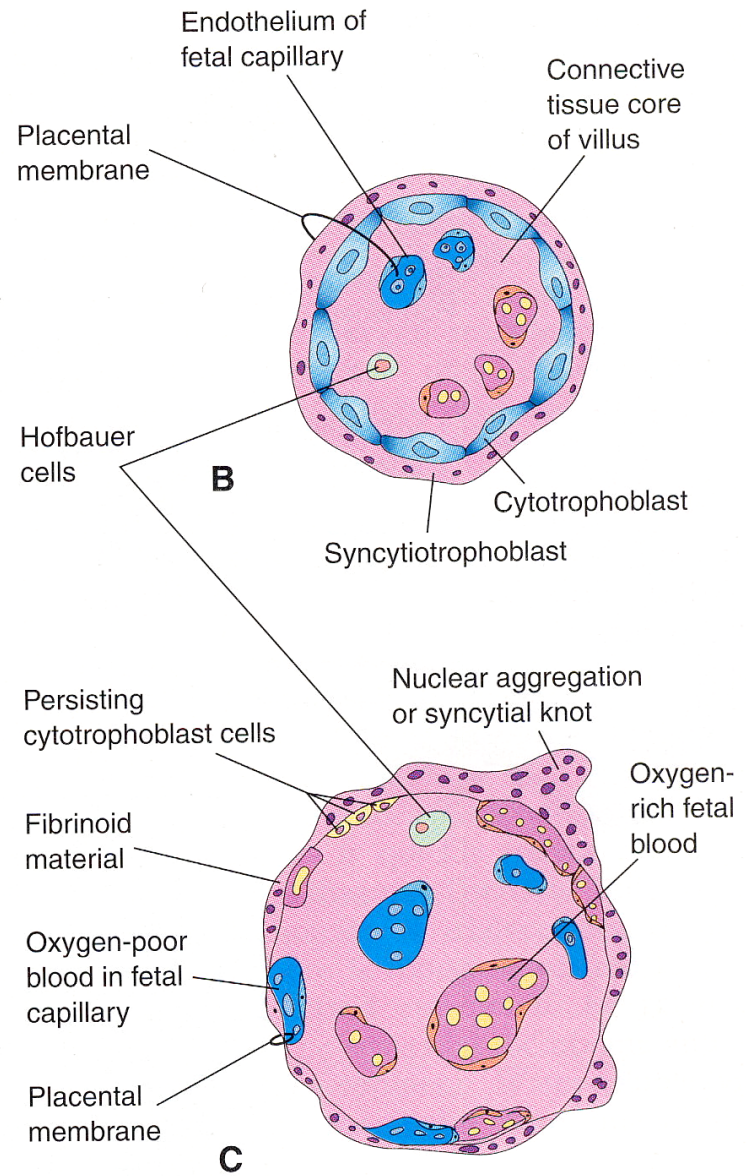
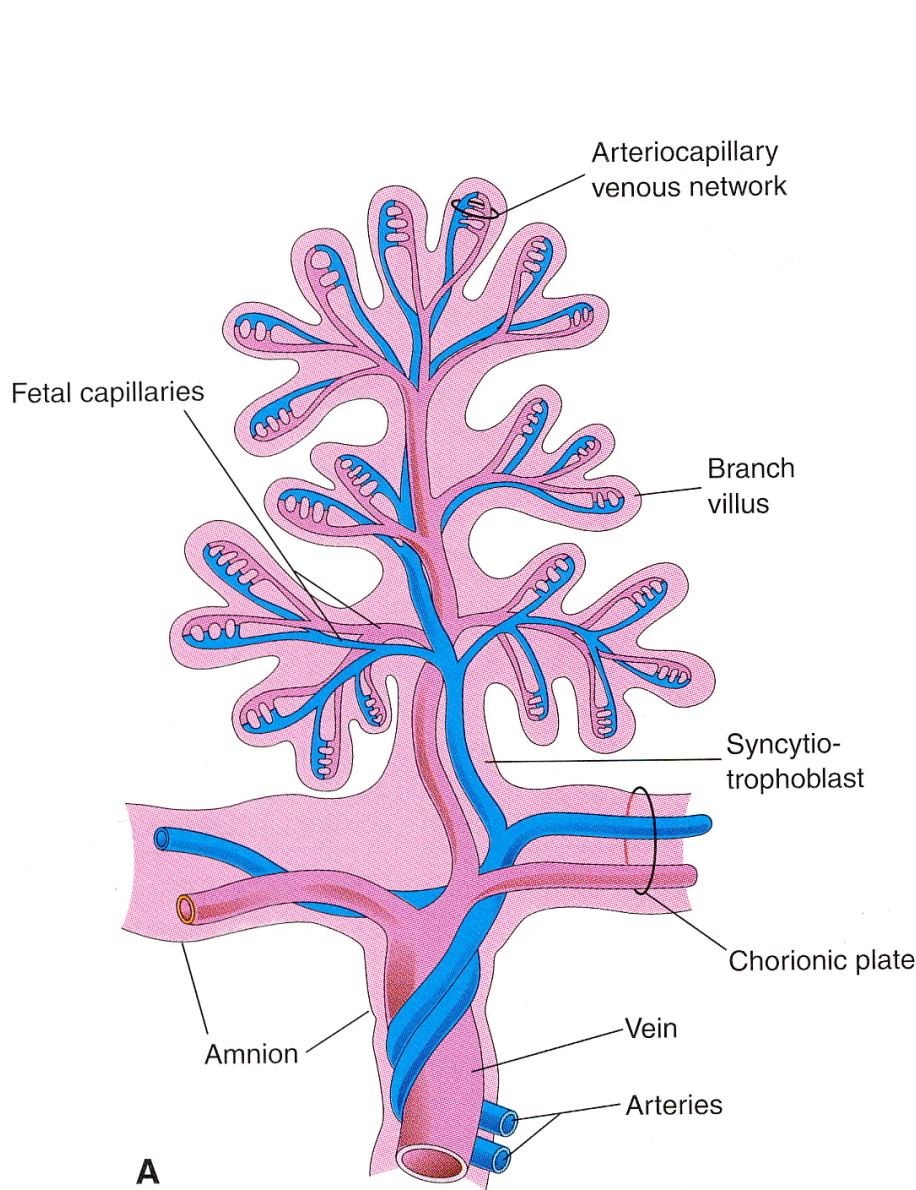


HISTOLOGY: PLACENTAL DISC- MATERNAL SURFACE

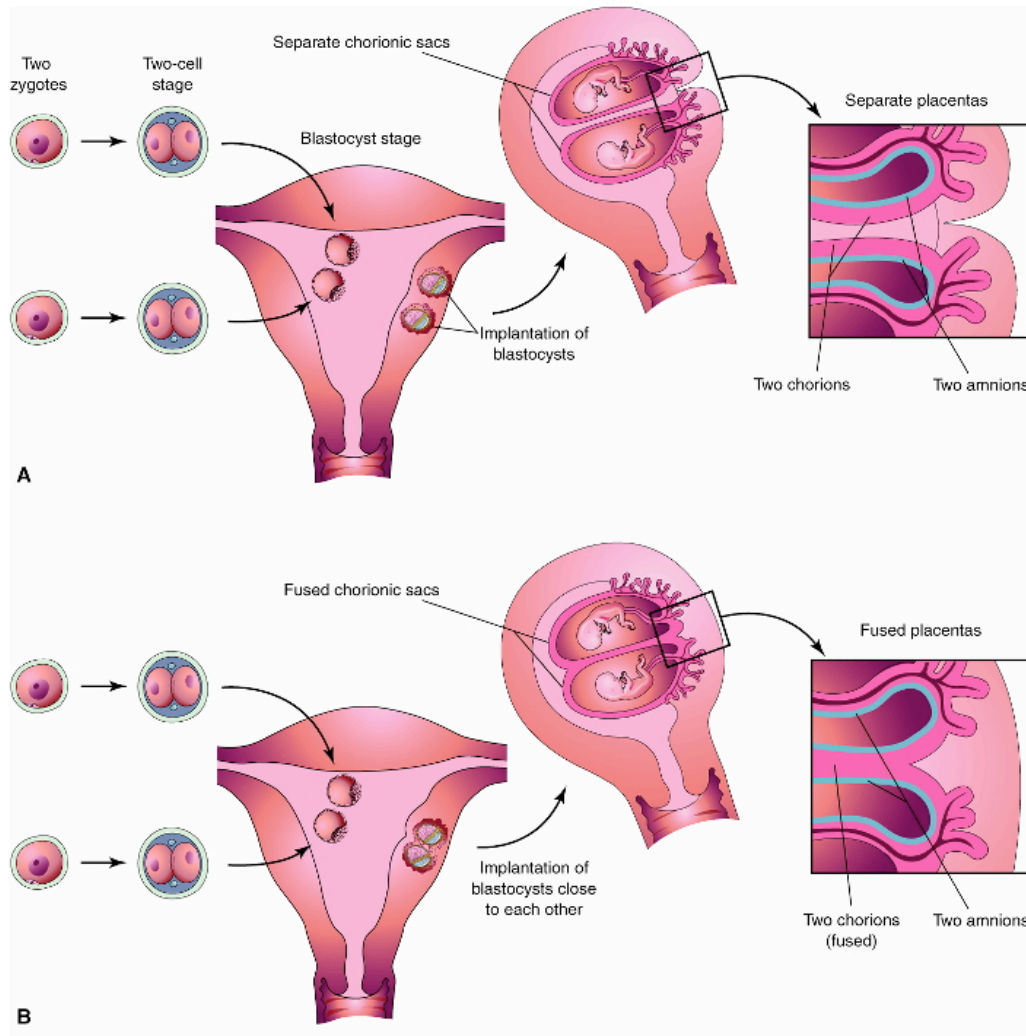
PLACENTAL VASCULAR ANATOMY:



HISTOLOGY: VILLOUS ARCHITECTURE

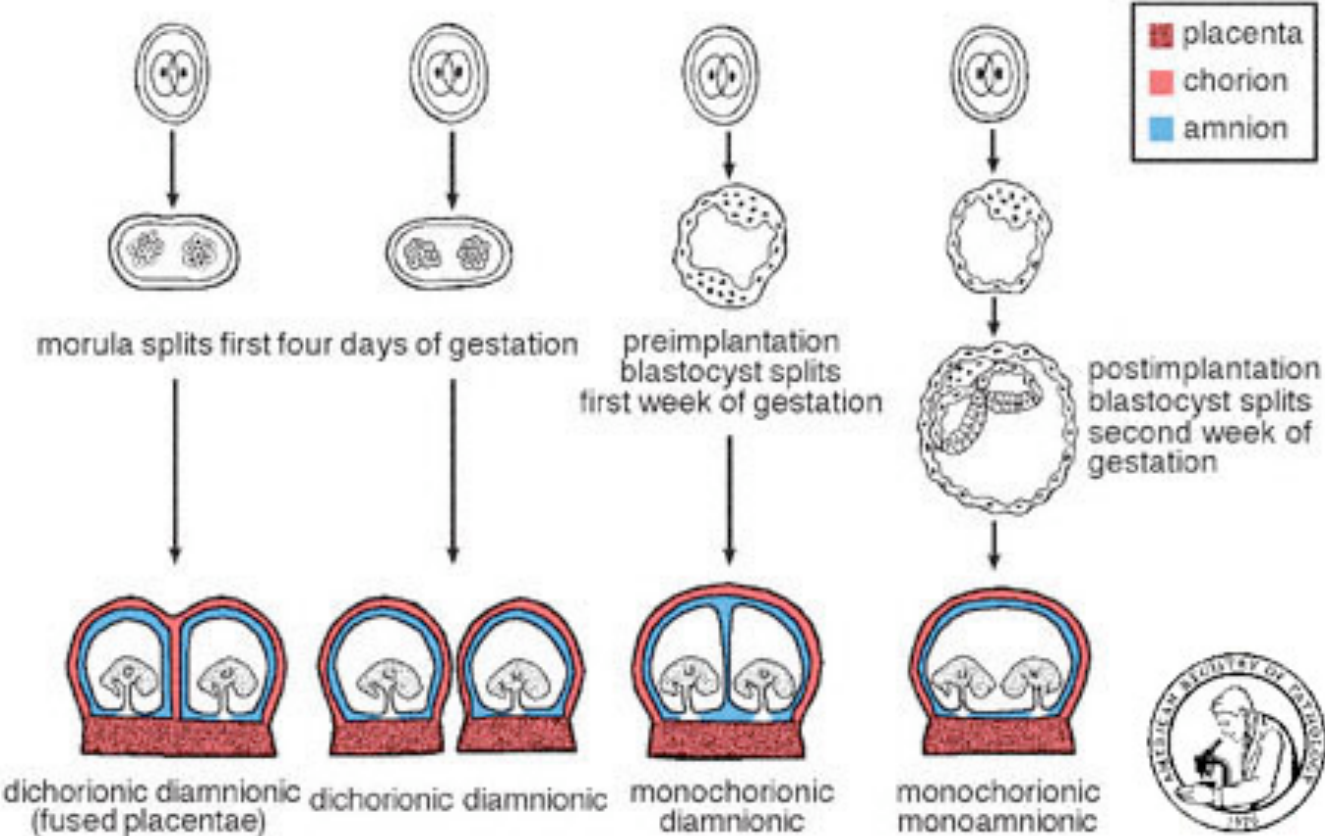


TWINS- Dizygotic twins



**TWO AMNIONS
TWO CHORIONS
(fused or separate)**

TWINS- Monozygotic twins



TWO AMNIONS

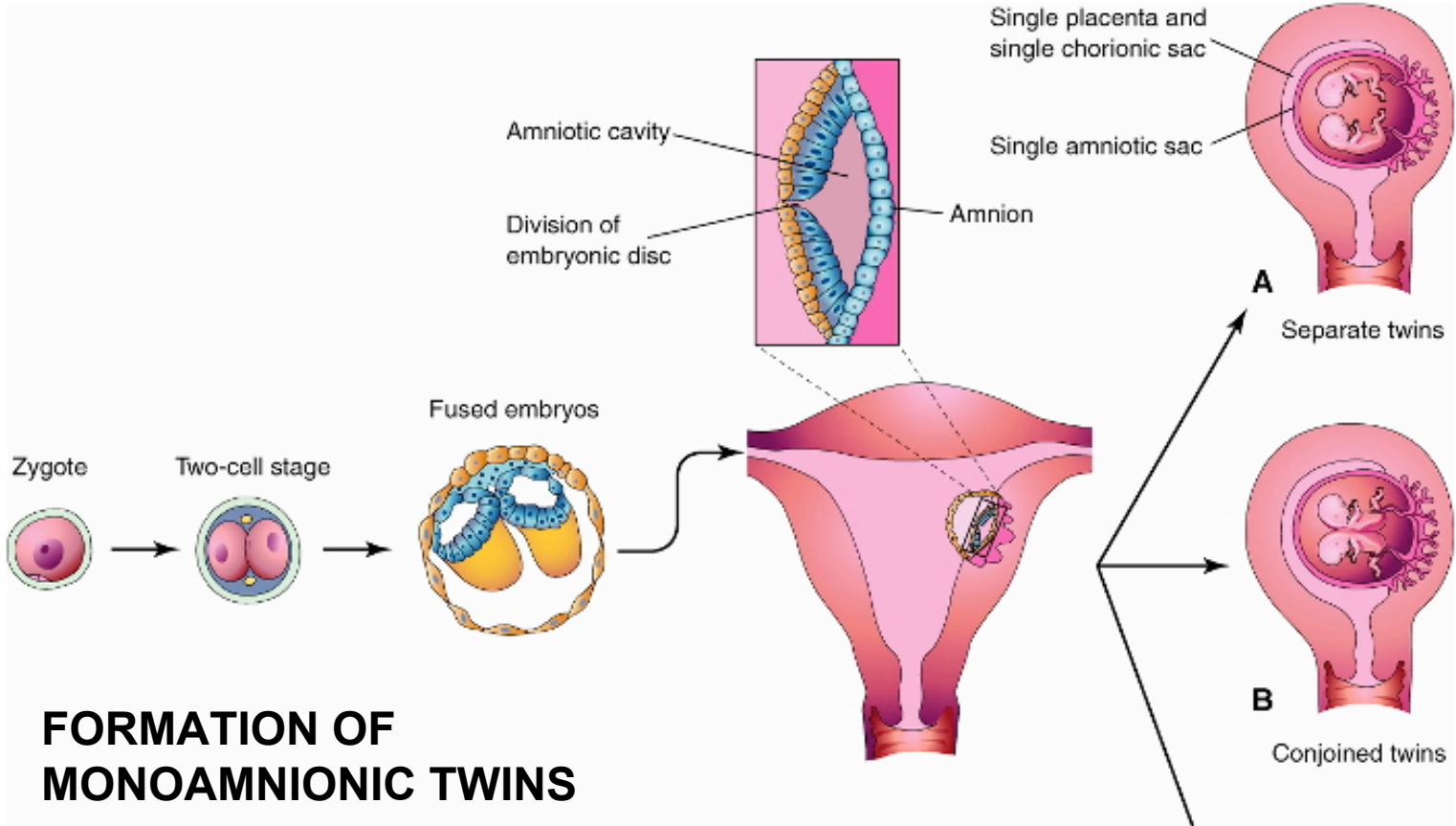
TWO CHORIONS

(fused or separate)

ONE CHORION

ONE OR TWO AMNIONS

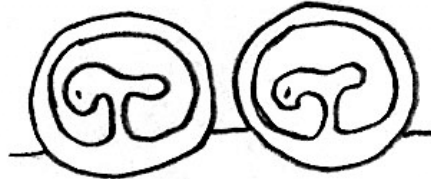
TWINS- Monozygotic twins



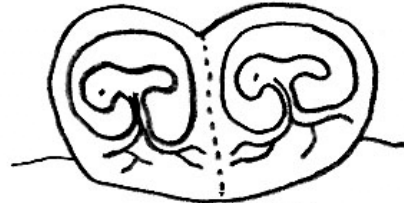
FORMATION OF MONOAMNIONIC TWINS

(including conjoined twins)

MULTIPLE GESTATIONS



DICHORIONIC
DIAMNIONIC
SEPARATE



DICHORIONIC
DIAMNIONIC
FUSED

MAY BE
MONOZYGOTIC
OR
DIZYGOTIC



MONOCHORIONIC
DIAMNIONIC



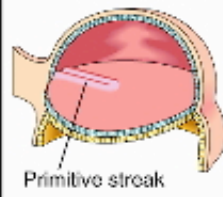
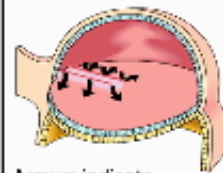
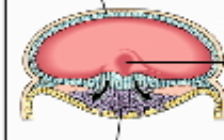
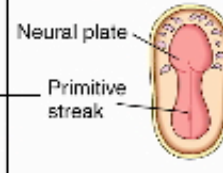
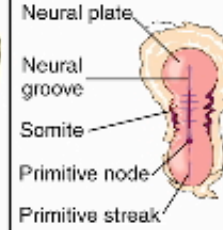
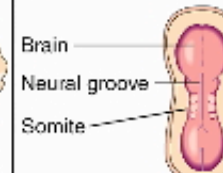
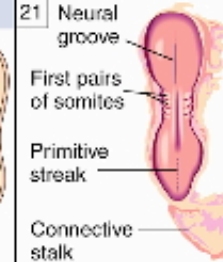
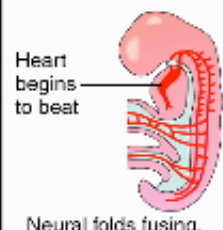
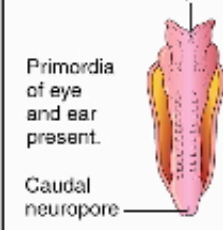
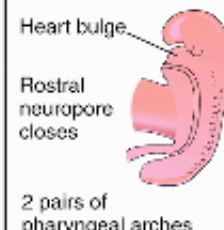
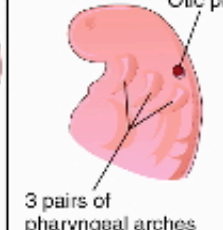
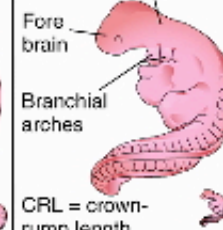
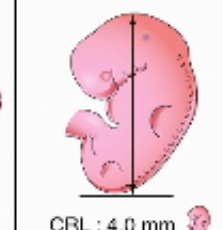

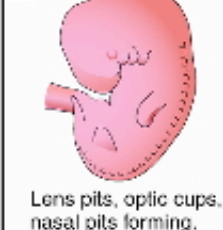
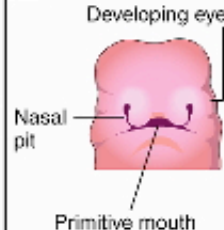
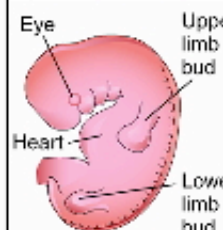
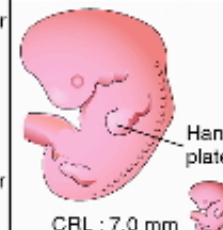
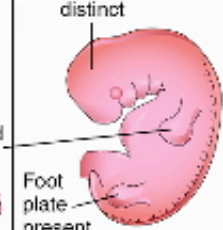
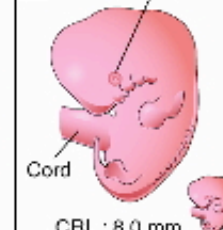

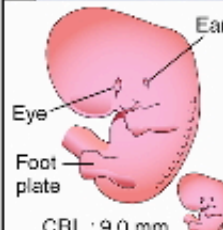
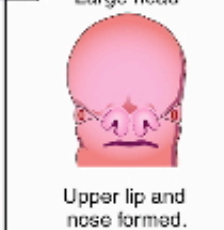
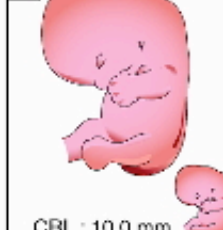
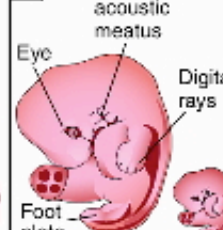
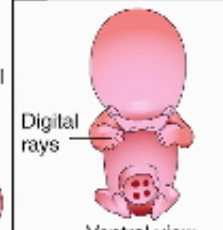
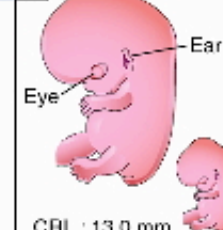
MONOCHORIONIC
MONOAMNIONIC

ALWAYS
MONOZYGOTIC



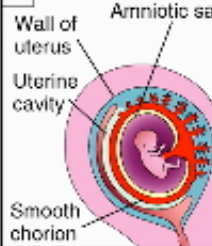

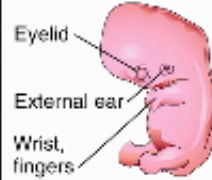

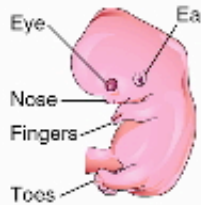

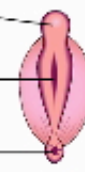
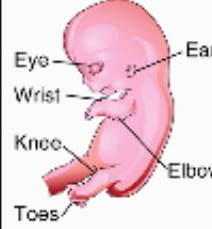

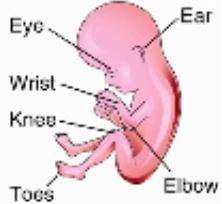
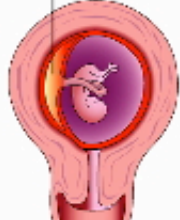
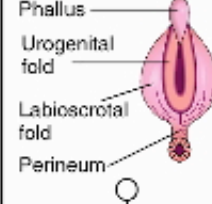

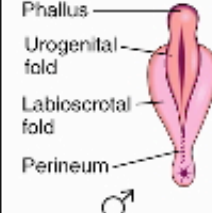



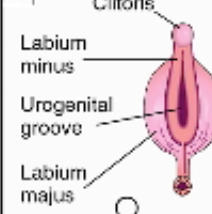
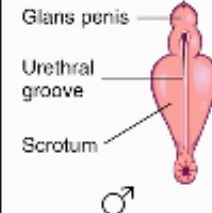



CONJOINED

FETUS

3	15	First missed menstrual period	16	Stage 7 begins	17	Trilaminar embryo	18	Stage 8 begins	19	Stage 9 begins	21	Neural groove		
		Primitive streak		Arrows indicate migration of mesenchymal cells.		Amnion Migration of cells from primitive streak.		Neural plate Primitive streak Length: 1.5 mm		Neural plate Neural groove Somite Primitive node Primitive streak		Brain Neural groove Somite Thyroid gland begins to develop.		Neural groove First pairs of somites Primitive streak Connective stalk
	22	Stage 10 begins	23	Rostral neuropore	24	Stage 11 begins	25	Stage 12 begins	27	Stage 13 begins	28	Stage 13 begins		
		Heart begins to beat Neural folds fusing.		Rostral neuropore Primordia of eye and ear present. Caudal neuropore		Heart bulge Rostral neuropore closes 2 pairs of pharyngeal arches		Otic pit 3 pairs of pharyngeal arches		Site of otic (ear) pit Fore brain Branchial arches CRL = crown-rump length.		CRL : 4.0 mm		
29	Stage 14 begins	30	Stage 15 begins	31	Stage 16 begins	32	Stage 17 begins	33	Stage 17 begins	34	Stage 17 begins	35	Stage 17 begins	
	CRL : 5.0 mm		Lens pits, optic cups, nasal pits forming.		Developing eye Nasal pit Primitive mouth		Eye Upper limb bud Heart Lower limb bud		Hand plate Foot plate present CRL : 7.0 mm		Cerebral vesicles distinct Foot plate present CRL : 8.0 mm		Eye Cord CRL : 8.0 mm	
36	Stage 17 begins	37	Stage 17 begins	38	Stage 17 begins	39	Stage 17 begins	40	Stage 17 begins	41	Stage 17 begins	42	Stage 17 begins	
	Oral and nasal cavities confluent.		Ear Eye Foot plate CRL : 9.0 mm		Large head Upper lip and nose formed.		External acoustic meatus Eye Digital rays Foot plate CRL : 10.0 mm		External acoustic meatus Eye Digital rays Foot plate		Digital rays Digital rays Ventral view		Ear Eye CRL : 13.0 mm	
4	5	6												

TIMETABLE OF HUMAN PRENATAL DEVELOPMENT
7 to 39 weeks

AGE (weeks)	43	44	45	46	47	48	49
7	<p>Actual size</p>  <p>CRL: 16 mm</p>	<p>Stage 18 begins</p>  <p>Eyelids beginning</p>	<p>Head large but chin poorly formed. Grooves between digital rays indicate fingers.</p>	 <p>Wall of uterus Amniotic sac Uterine cavity Smooth chorion</p>	 <p>Genital tubercle Urogenital membrane Anal membrane</p> <p>♀ or ♂</p>	<p>Stage 19 begins</p>  <p>Eyelid External ear Wrist, fingers fused</p>	<p>Actual size</p>  <p>CRL: 18 mm</p>
8	<p>Upper limbs longer and bent at elbows.</p> <p>Fingers distinct but webbed.</p>	 <p>Eye Ear Nose Fingers Toes</p>	<p>Stage 21 begins</p>  <p>Large forehead</p>	<p>Stage 21</p> <p>External genitalia still in sexless state but have begun to differentiate.</p>	 <p>Genital tubercle Urethral groove Anus</p> <p>♀ or ♂</p>	 <p>Eye Ear Wrist Knee Elbow Toes</p>	<p>Stage 23</p>  <p>CRL: 30 mm</p>
9	<p>Beginning of fetal period.</p>	 <p>Eye Ear Wrist Knee Elbow Toes</p>	<p>Placenta</p> 	<p>Genitalia</p>  <p>Phallus Urogenital fold Labioscrotal fold Perineum</p> <p>♀</p>	 <p>CRL: 45 mm</p>	<p>Genitalia</p>  <p>Phallus Urogenital fold Labioscrotal fold Perineum</p> <p>♂</p>	 <p>CRL: 50 mm</p>
10	<p>Face has human profile.</p> <p>Note growth of chin compared to day 44.</p>		 <p>Ears still lower than normal.</p>	<p>Clitoris</p>  <p>Labium minus Urogenital groove Labium majus</p> <p>♀</p>	<p>Genitalia have ♀ or ♂ characteristics but still not fully formed.</p>	 <p>Glans penis Urethral groove Scrotum</p> <p>♂</p>	 <p>CRL: 61 mm</p>

MILESTONES IN FIRST TRIMESTER

(in completed post-conception weeks, a.k.a. fertilization age)

1wk- Implantation.

2wk- Formation of chorionic villi.

3wk- Gastrulation, formation of somites, beginning of neural folds.

4wk- Heart beats. Closed neural canal. Limb buds and lens placodes appear.

5wk- Face taking form. Hand plate and foot plate form.

6wk- Fingers and toes form. Face better defined with eyes and ear.

7wk- Genital tubercle forming.

8wk- Tail disappears. Midgut herniation begins.

EMBRYONIC STAGE ENDS, FETAL STAGE BEGINS

9wk- Early muscular movements begin to occur (imperceptible to mother).

10wk- External genitalia become gender specific. Gut returns to abdomen.

11wk- Urine excretion begins (into amniotic cavity).

12wk- Fetus has well-formed neck. Fetus swallows amniotic fluid (urine and all).

MILESTONES IN SECOND TRIMESTER

4 months: Fine downy fetal hair “lanugo” on fetal head.

Thumb sucking movements.

Fetal “brown fat” develops (involved in heat production).

Active ossification of bones.

5 months: Lanugo hair covers most of body.

“Vernix caseosa” begins to be deposited on the skin.

Eyelids and eyebrows visible.

Mother starts to feel fetal movements “quickenings” around 18-19wks.

6 months: **SURFACTANT SECRETION** starts around 24 wks.

Skin is wrinkled, translucent.

Late second trimester newborn baby



MILESTONES IN THIRD TRIMESTER

7 months: Eyes open.

Subcutaneous fat (not brown fat) forms, smoothing out wrinkles.

Testes descending into scrotum.

Sulci and gyri appear in brain.

8 months: Skin becomes pink and smooth.

Fat deposition continues, fetus has a 'chubby' appearance.

Pupillary light reflex develops.

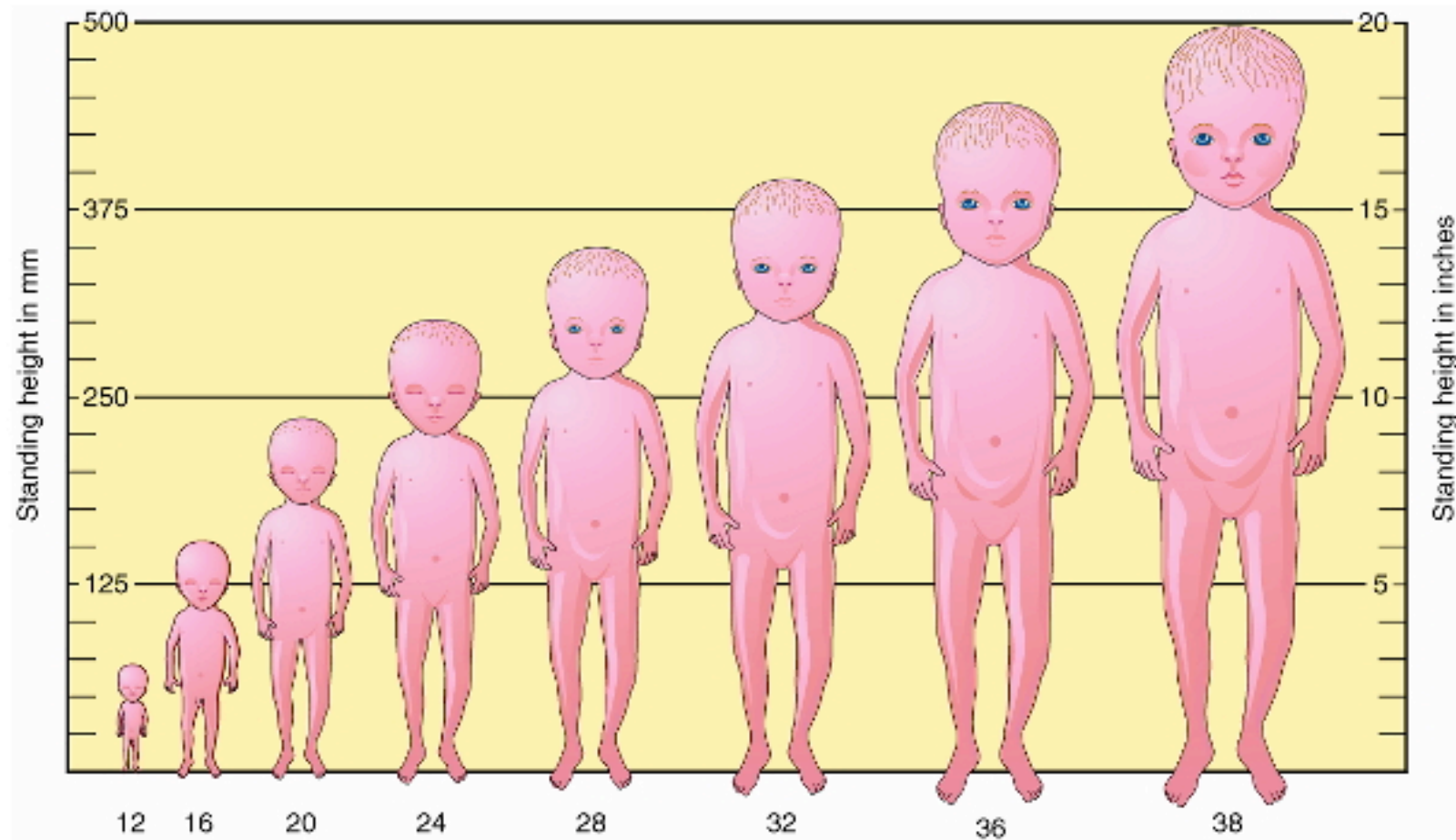
9 months: Lanugo hairs are lost.

Skin covered all over with vernix caeseosa.

Testes completely descended by 38 wks.

Myelination of brain BEGINS.

FETAL GROWTH



Copyright © 2003, Elsevier Science (USA). All Rights Reserved.

MOVIE!

