Derivatives of Germ Layers

ECTODREM

1. Lining Epithelia of
    i. Skin
    ii. Lips, cheeks, gums, part of floor of mouth
    iii. Parts of palate, nasal cavities and paranasal sinuses
    iv. Lower part of anal canal
    v. Terminal part of male urethera
    vi. Labia majora and outer surface of labia minora
    vii. Epithelium of cornea, conjuctiva, ciliary body, iris
    viii. Outer layer of tympanic membrane and membranous labyrinth

ECTODERM (contd.):

2. Glands
   - Exocrine – Sweet glands, sebaceous glands
     Parotid, Mammary and lacrimal
3. Other derivatives
   i. Hair
   ii. Nails
   iii. Enamel of teeth
   iv. Lens of eye; musculature of iris
   v. **Nervous system**

MESODERM:

- All connective tissue including loose areolar tissue, superficial and deep fascia, ligaments, tendons, aponeuroses and the dermis of the skin.
- Specialised connective tissue like adipose tissue, reticular tissue, cartilage and bone
- All muscles – smooth, striated and cardiac – except the musculature of iris.
- Heart, all blood vessels and lymphatics, blood cells.
- Kidneys, ureters, trigone of bladder, parts of male and female urethera, inner prostatic glands.
- Ovary, uterus, uterine tubes, upper part of vagina.
- Testis, epidydimis, ductus deferens, seminal vesicle ejaculatory duct.
- Lining mesothelium of pleural, pericardial and peritoneal cavities; and of tunica vaginalis.
- Living mesothelium of bursae and joints.
- Substance of cornea, sclera, choroid, ciliary body and iris.

ENDODERM:

1. Lining Epithelia of
   i. Part of mouth, palate, tongue, tonsil, pharynx.
   ii. Oesophagus, stomach, small and large intestines, anal canal (upper part)
   iii. Pharyngo – tympanic tube, middle ear, inner layer of tympanic membrane, mastoid antrum, air cells.
   iv. Respiratory tract
   v. Gall bladder, extrahepatic duct system, pancreatic ducts
   vi. Urinary bladder except trigone
   vii. Female urethera except part of its posterior wall
   viii. Male urethera except part of posterior wall of prostatic part
   ix. Greater part of vagina, vestibule and inner surface of labia minora

ENDODERM (contd.)

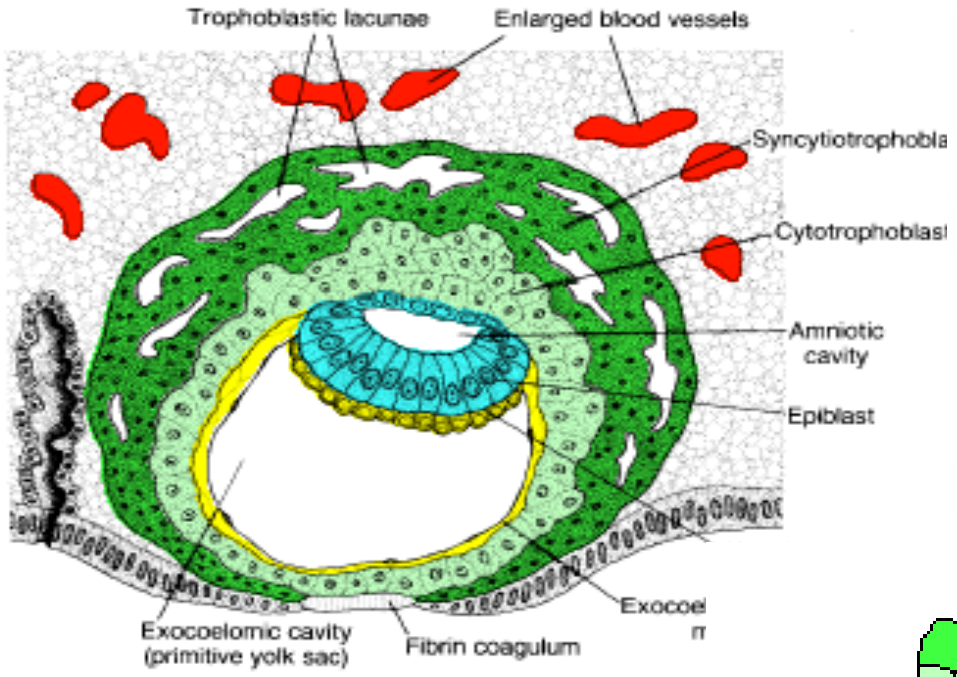
2. Glands

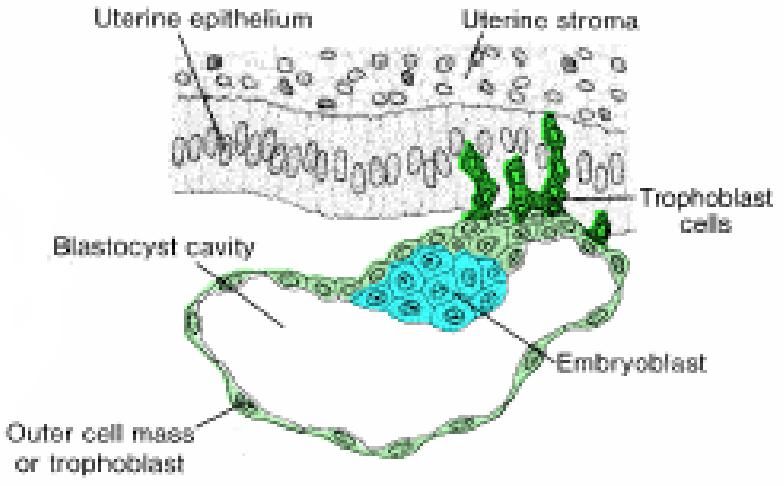
i. Endocrine: Thyroid, parathyroid, thymus, islets of Langerhans

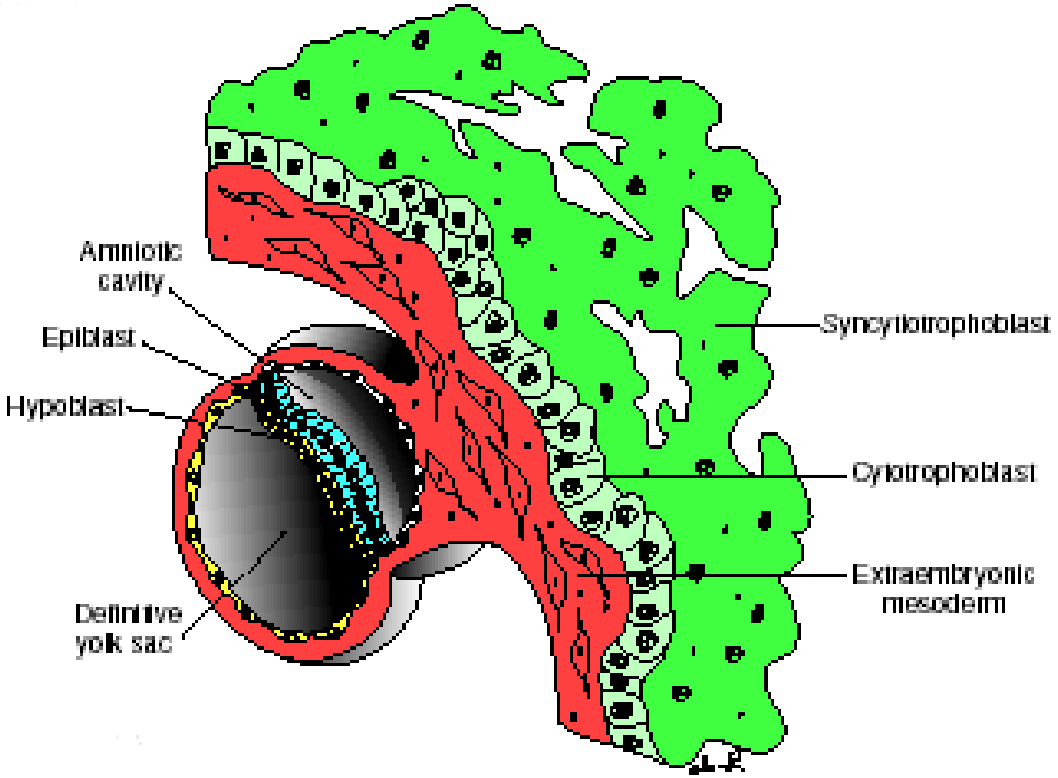
ii. Exocrine : Live, pancreas, glands in G.I.T., prostatic glands and its female homologues

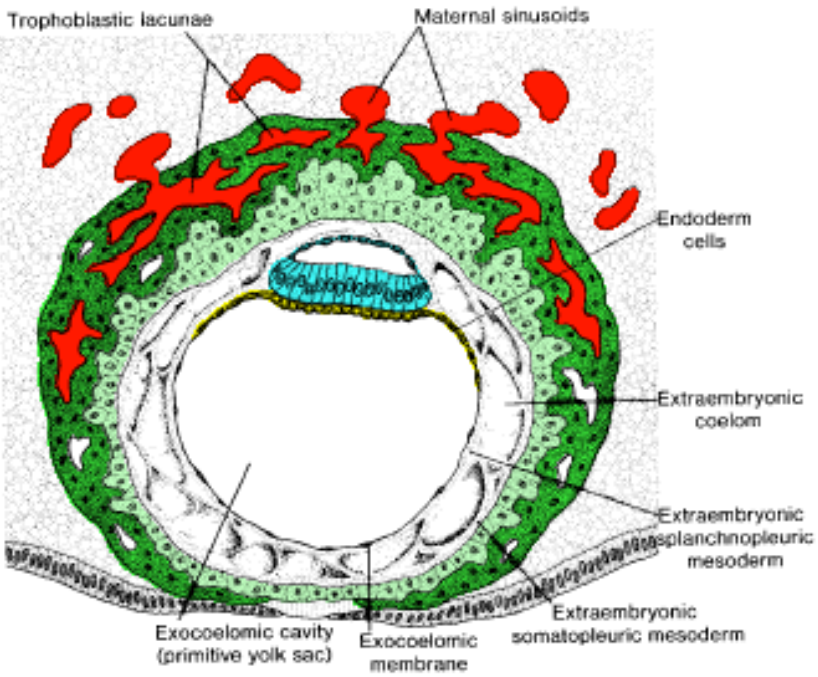
Placenta

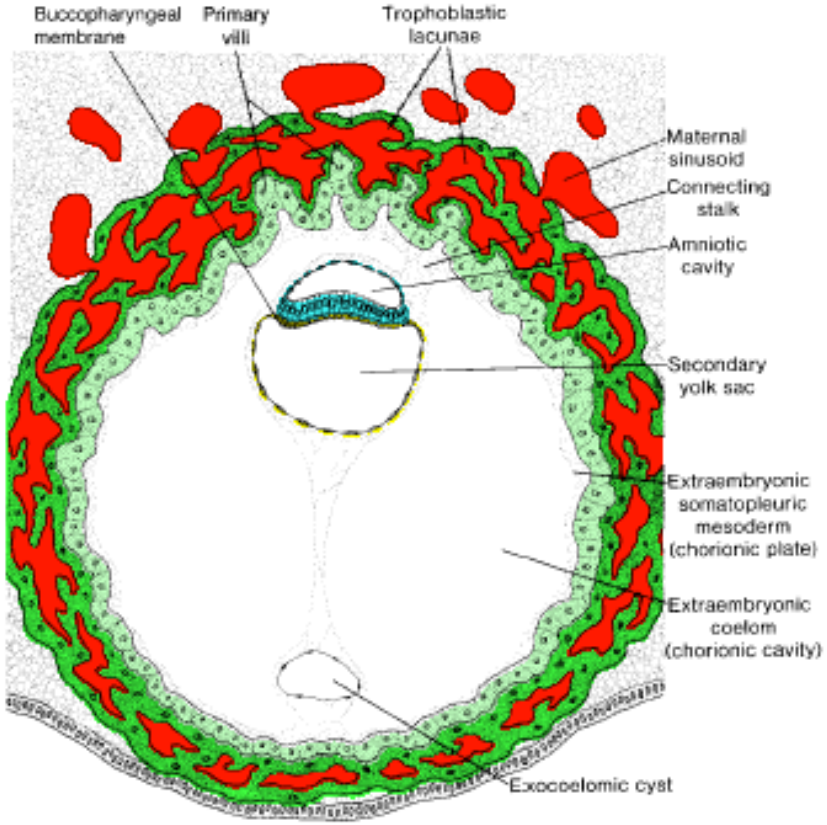
- Primary site of nutrient and gas exchange between mother and foetus
- feto-maternal organ

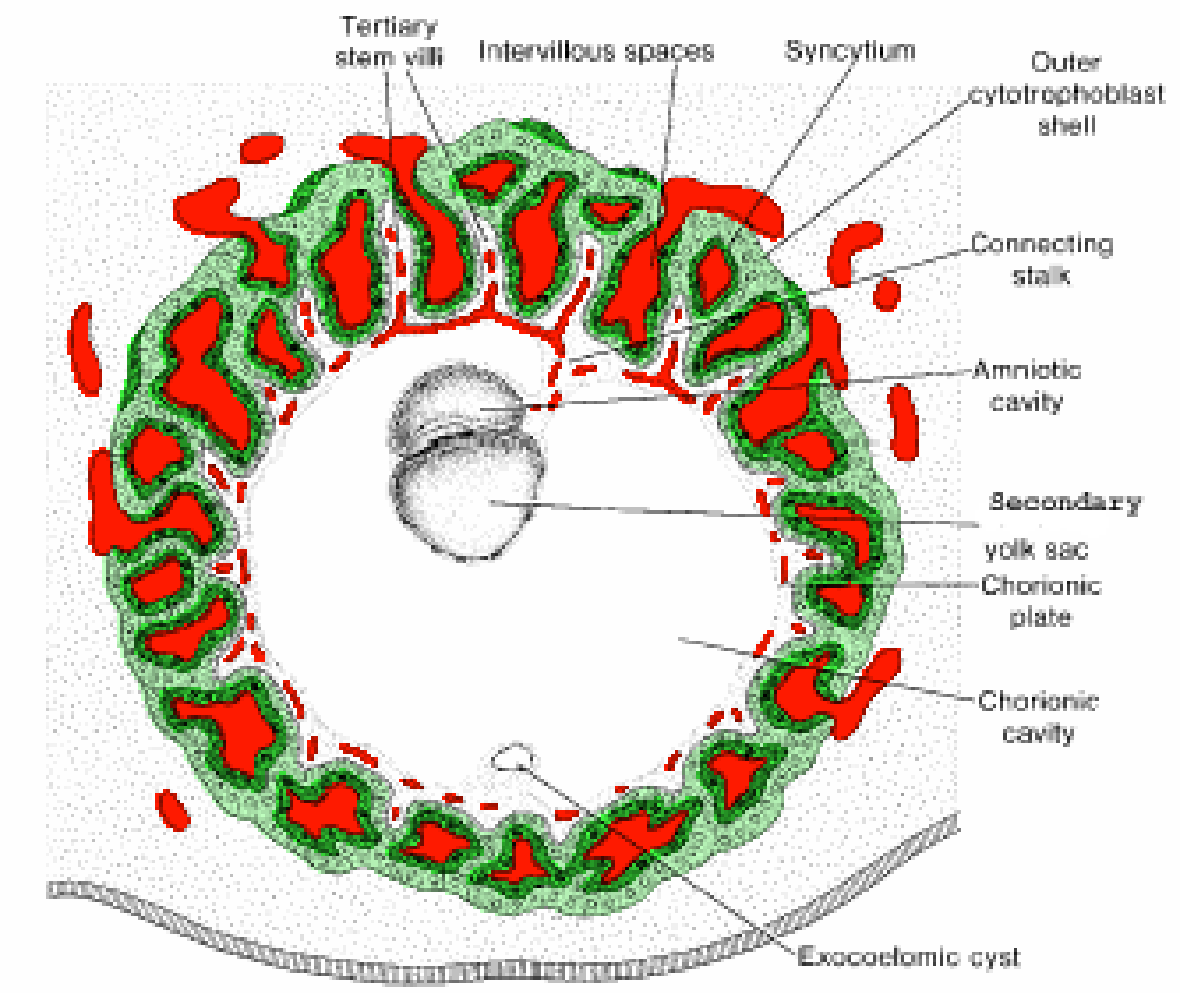

Trophoblastic lacunae
Enlarged blood vessels
Syncytiotrophobla
Cytotrophoblas
Amniotic cavity
Epiblast
Exocoel m
Exocoelomic cavity (primitive yolk sac)
Fibrin coagulum


Uterine epithelium
Uterine stroma
Trophoblast cells
Blastocyst cavity
Embryoblast
Outer cell mass or trophoblast


Amniotic cavity
Epiblast
Hypoblast
Definitive yolk sac
Syncytiotrophoblast
Cytotrophoblast
Extraembryonic mesoderm


Trophoblastic lacunae
Maternal sinusoids
Endoderm cells
Extraembryonic coelom
Extraembryonic splanchnopleuric mesoderm
Exocoelomic cavity (primitive yolk sac)
Exocoelomic membrane
Extraembryonic somatopleuric mesoderm


Buccopharyngeal membrane
Primary villi
Trophoblastic lacunae
Maternal sinusoid
Connecting stalk
Amniotic cavity
Secondary yolk sac
Extraembryonic somatopleuric mesoderm (chorionic plate)
Extraembryonic coelom (chorionic cavity)
Exocoelomic cyst


Tertiary stem villi
Intervillous spaces
Syncytium
Outer cytotrophoblast shell
Connecting stalk
Amniotic cavity
Secondary yolk sac
Chorionic plate
Chorionic cavity
Exocoelomic cyst

Trophoblast

Cytotrophoblast

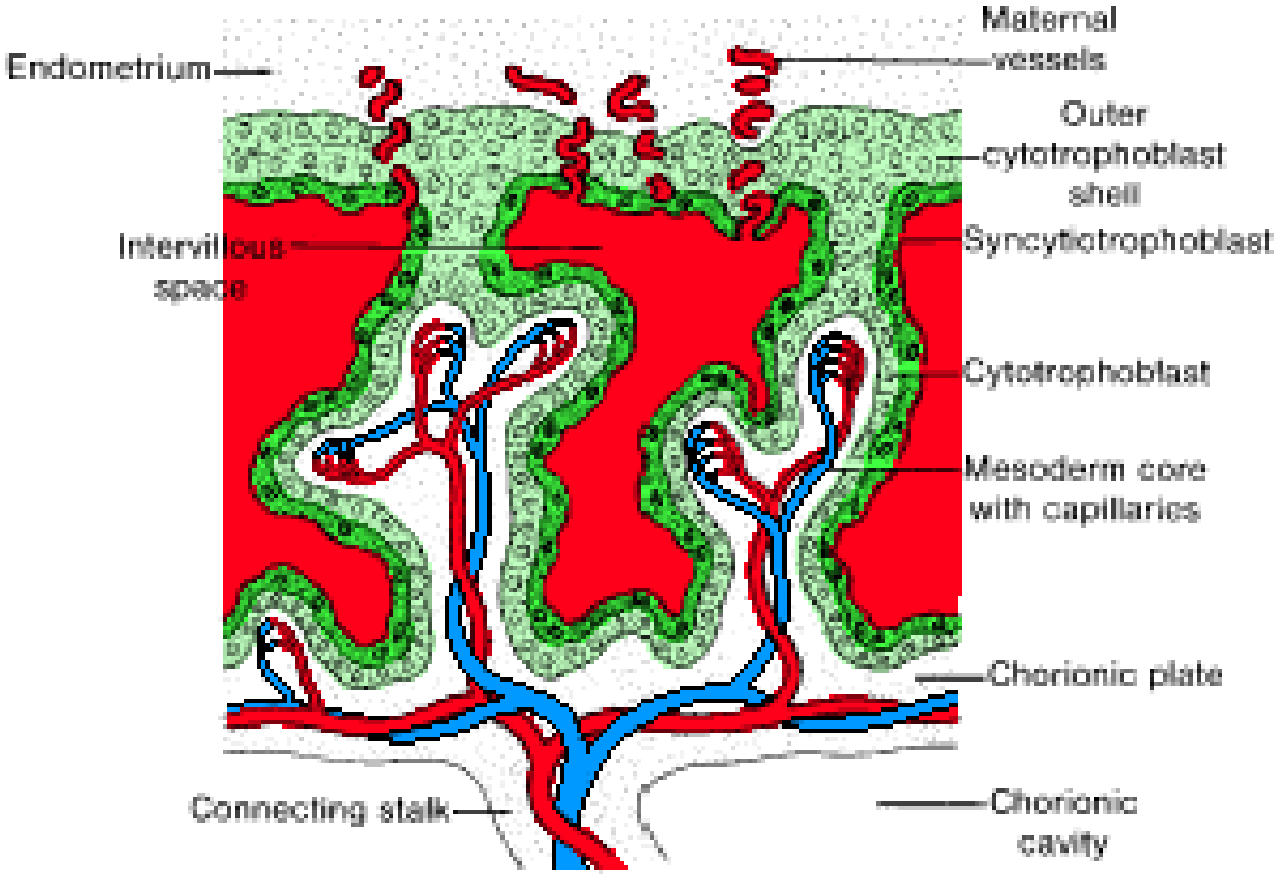
Syncytiotrophoblast

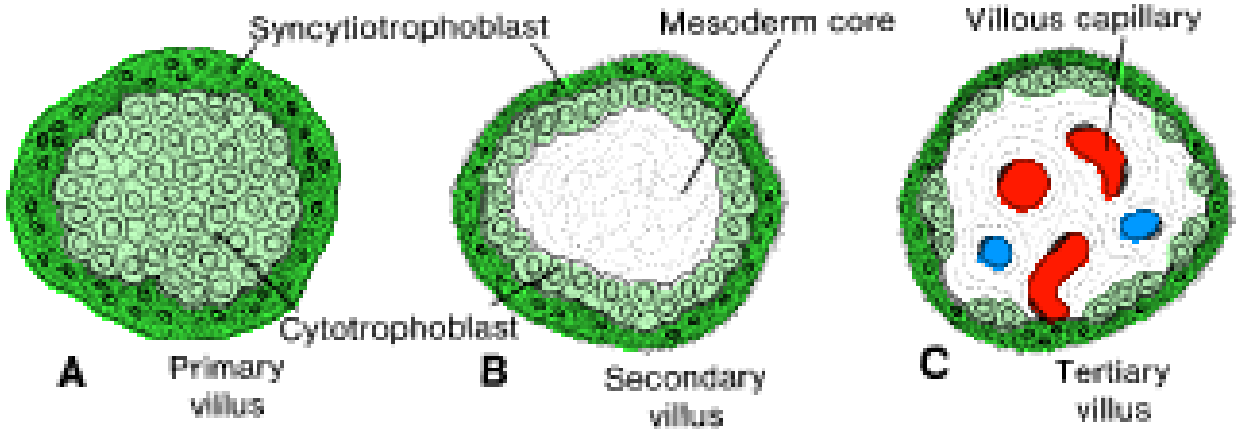
Lacunar stage

Start of uteroplacental circulation

Formation of primary Villi

Initially villi cover whole surface
-villi at embryonic pole disappear-chorionic laeve (smooth)
-villi at embryonic pole expand--chorionic frondosum (bushy)


Endometrium
Maternal vessels
Outer cytotrophoblast shell
Intervillous space
Syncytiotrophoblast
Cytotrophoblast
Mesoderm core with capillaries
Chorionic plate
Connecting stalk
Chorionic cavity


Syncytiotrophoblast
Mesoderm core
Villous capillary
Cytotrophoblast
A
Primary villus
B
Secondary villus
C
Tertiary villus

Formation of Secondary Villi

Formation of Tertiary Villi

Foetal contribution- Chorionic frondosum

Maternal contribution- Decidua basalis

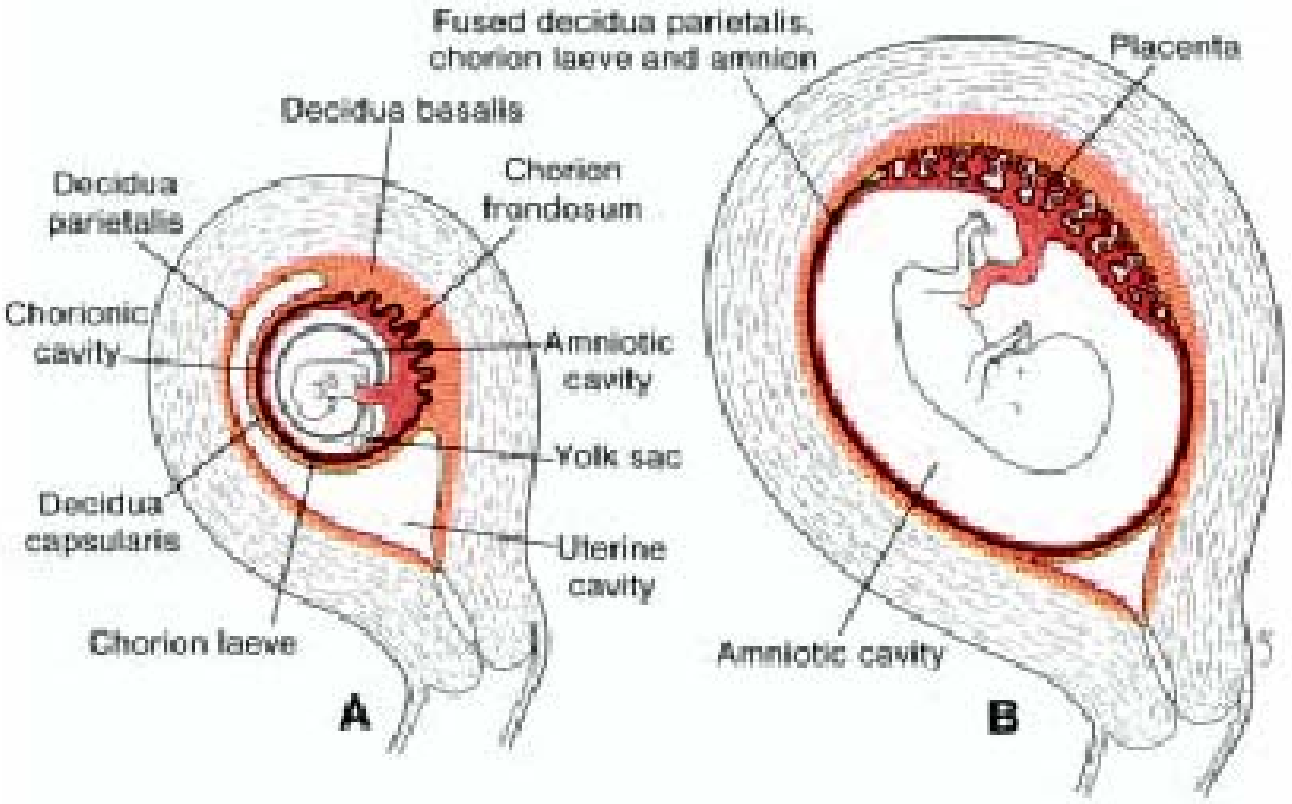
Decidua which is shed off in labour

1.decidua capsularis--covers abembryonic pole

2. decidua basalis--covers embryonic pole

3. decidua parietalis-- rest of uterine wall

•Decidua capsularis disappears
•Chorionic laeve adheres to decidua parietalis; uterine cavity obliterates.
•Amnion increases in size rapidly; amnion fuses to chorion -chorionic cavity obliterates-amniochorionic membrane formed
•Decidua sends septa into intervillous space
-these septa are incomplete
-divide the maternal surface into compartments-cotyledons


Fused decidua parietalis, chorion laeve and amnion
Placenta
Decidua basalis
Chorion frondosum
Decidua parietalis
Chorionic cavity
Amniotic cavity
Yolk sac
Decidua capsularis
Uterine cavity
Chorion laeve
A
Amniotic cavity
B

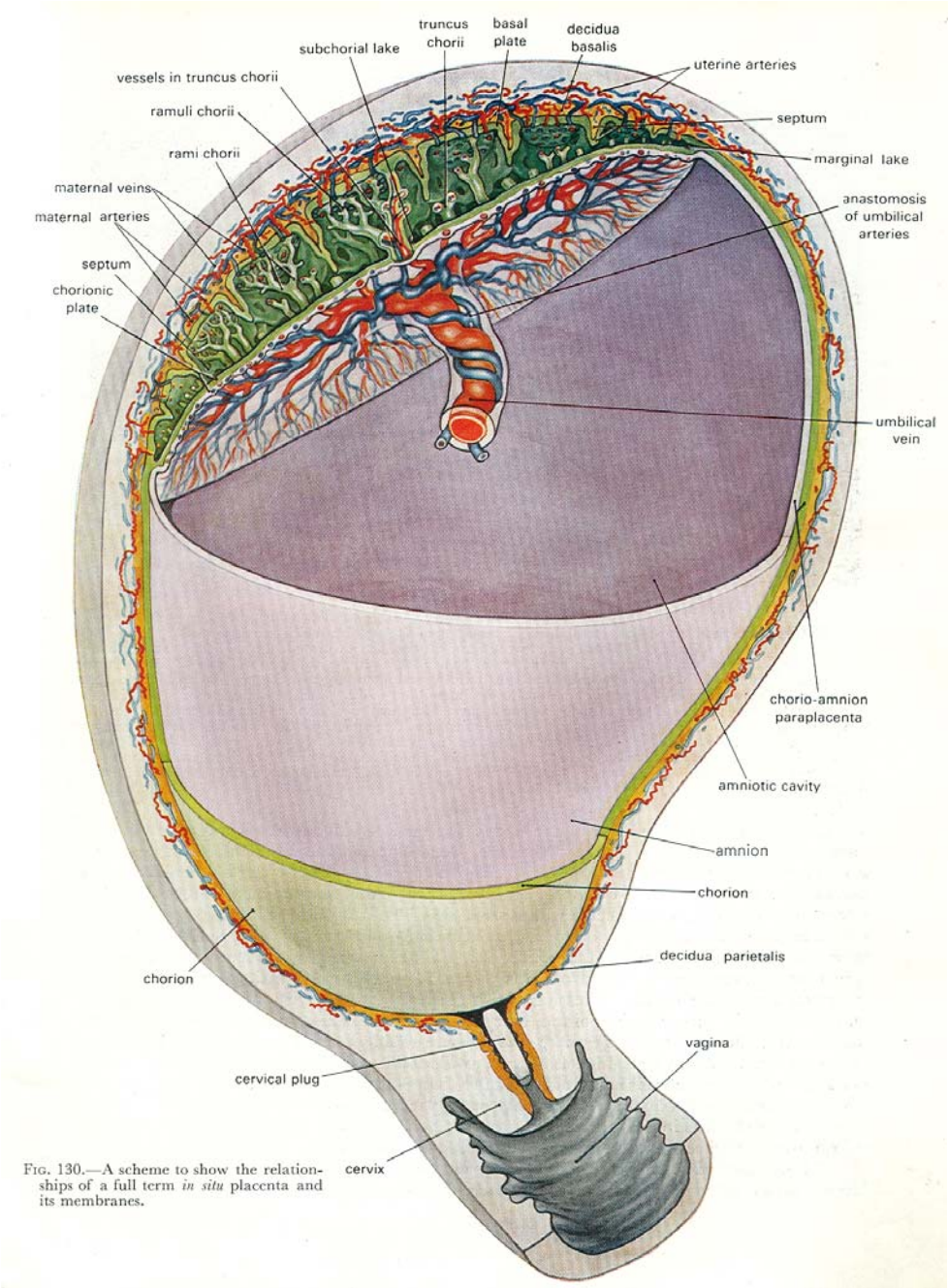
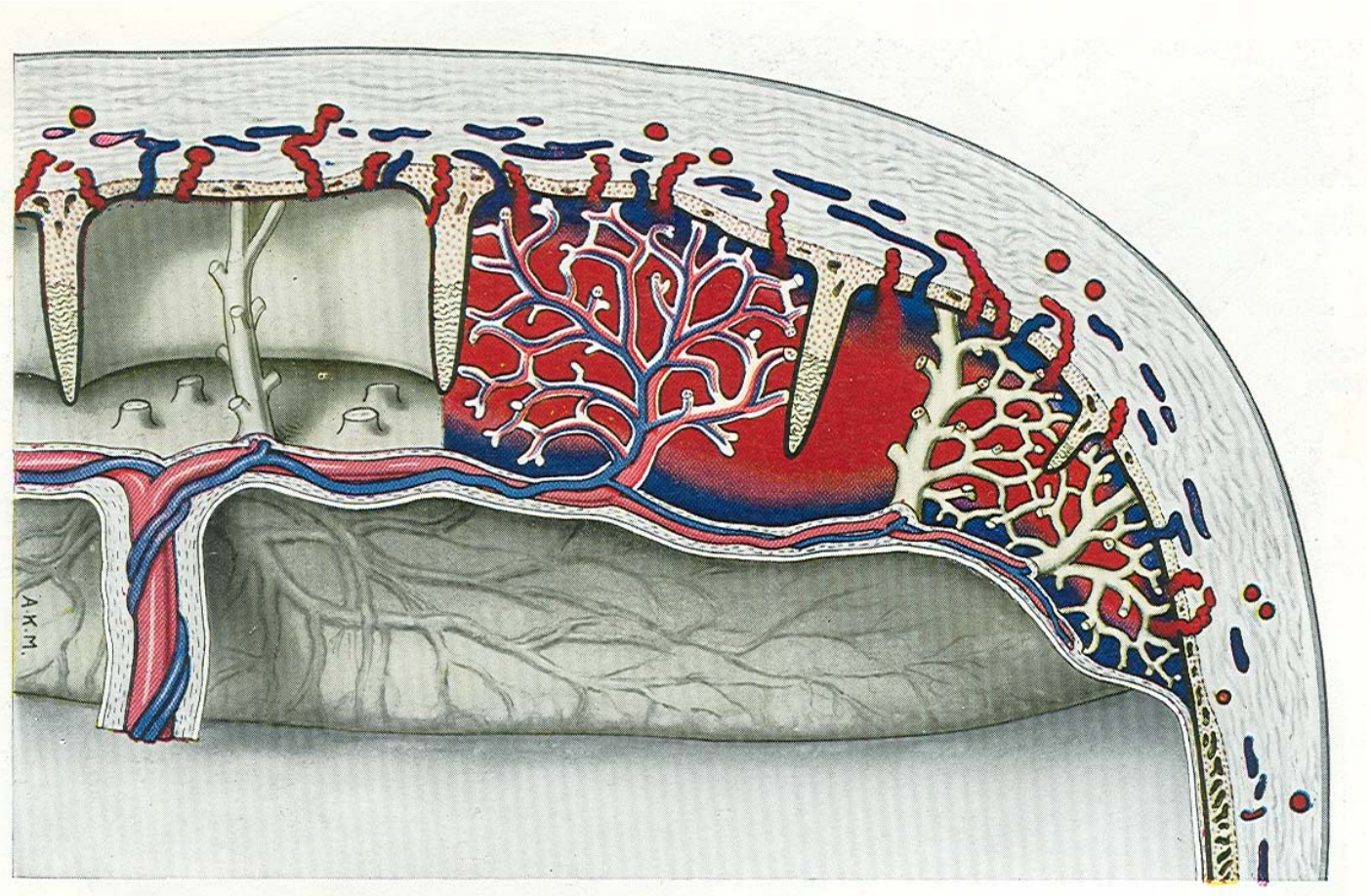


FIG. 130.—A scheme to show the relationships of a full term *in situ* placenta and its membranes.

Placental Circulation

- 80 to 100 spiral endometrial vessels pierce cytotrophoblast shell
- Maternal arterial blood bathes intervillous space

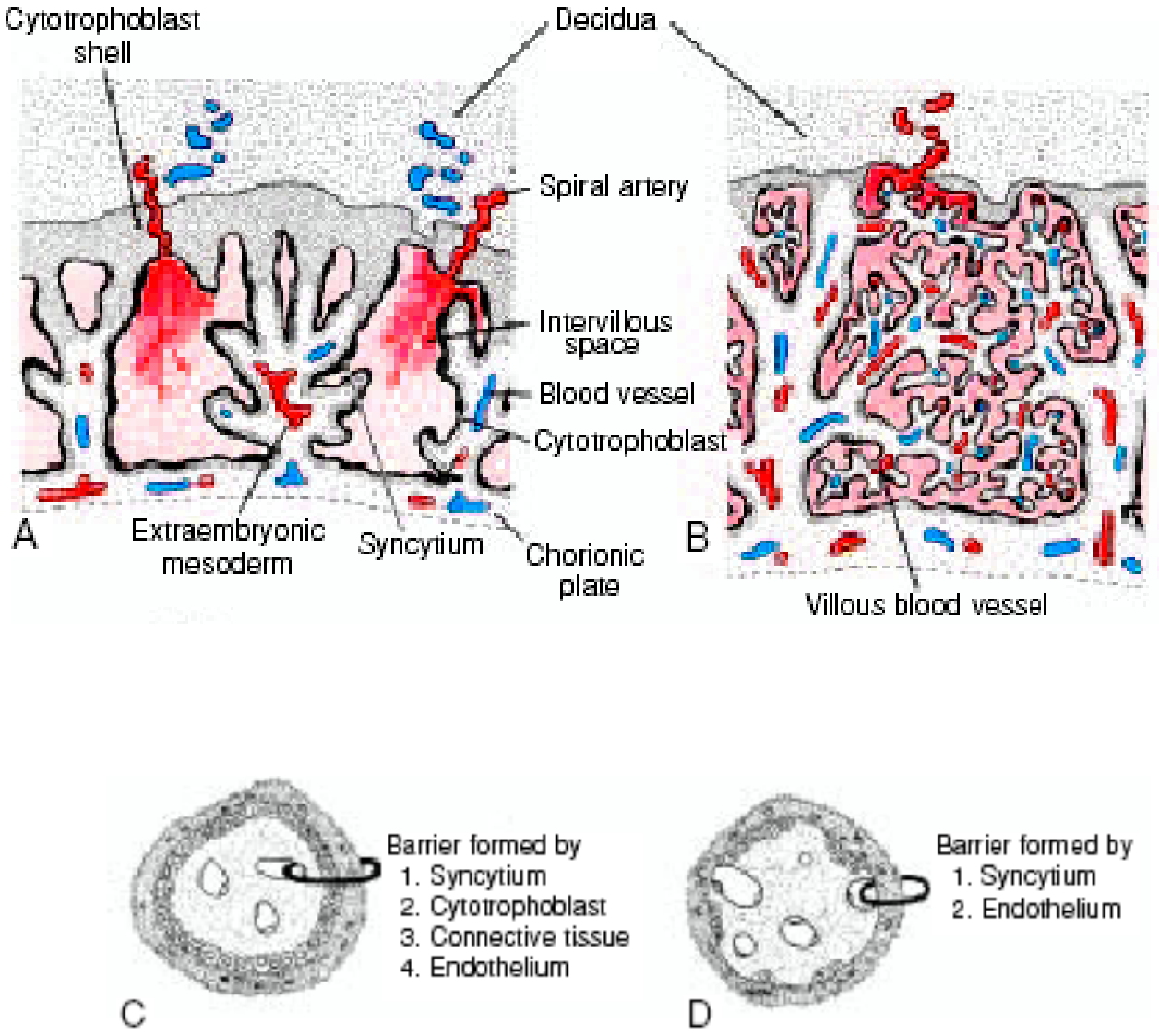
- oxygenated blood is at high pressure in spiral artery
- enters foetal (chorionic) vessels via intervillous space and placental membrane
- from chorionic veins it flows to umblical veins endometrial veins are at low pressure so carry venous blood back through the same route


A.K.M.

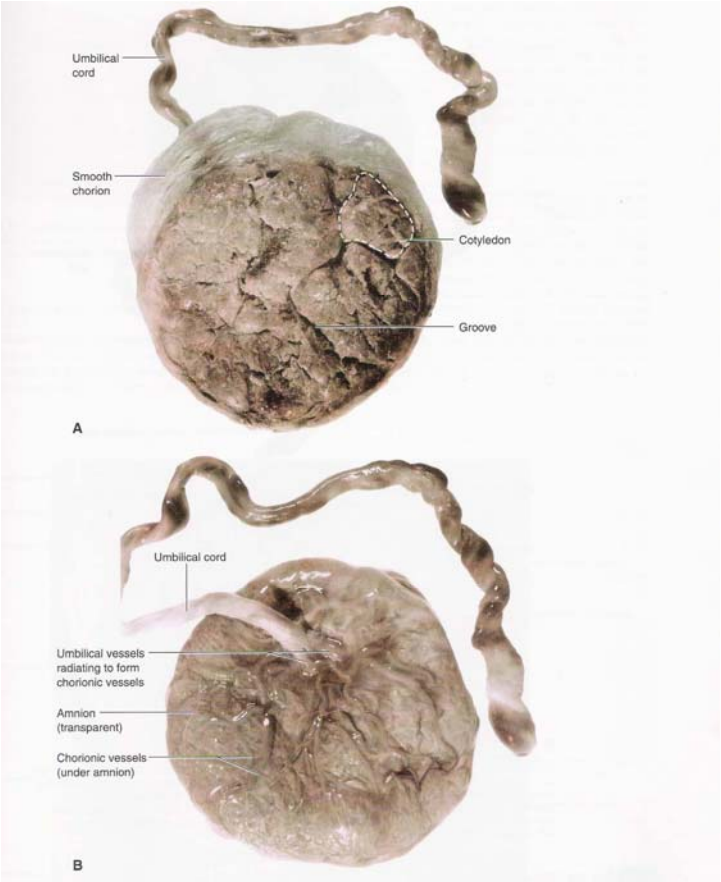
Placental membrane

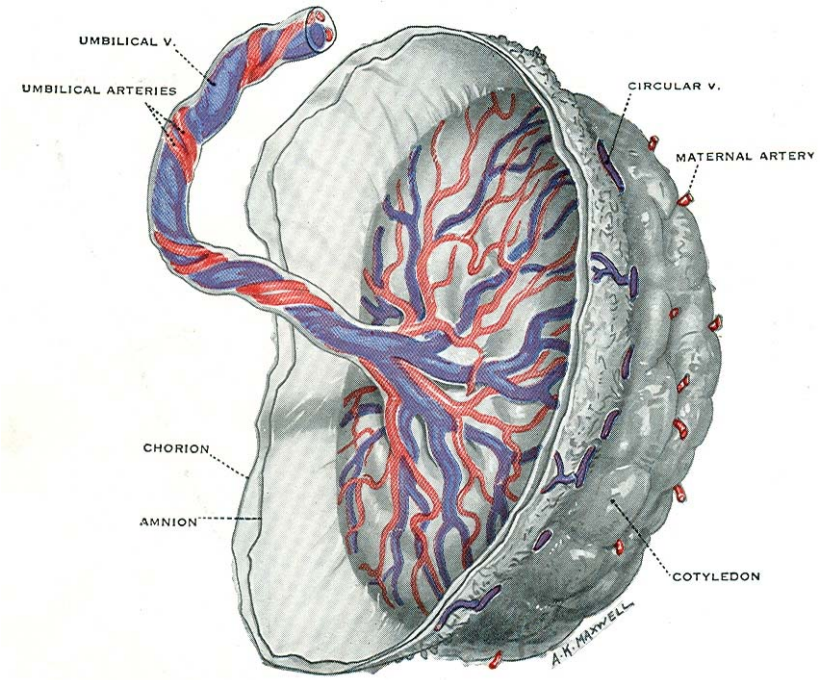
Placental membrane initially composed of

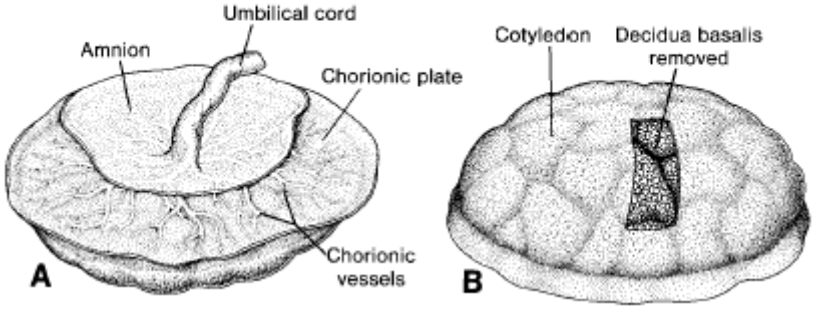
- Endothelium of fetal vessel
- connective tissue (extra embryonic mesoderm)
- syncytiotrophoblast
- cytotrophoblast


Cytotrophoblast shell
Decidua
Spiral artery
Intervillous space
Blood vessel
Cytotrophoblast
A
Extraembryonic mesoderm
Syncytium
Chorionic plate
B
Villous blood vessel
C
Barrier formed by
1. Syncytium
2. Cytotrophoblast
3. Connective tissue
4. Endothelium
D
Barrier formed by
1. Syncytium
2. Endothelium

- Full term placenta is discoid
- Diameter –15-25cm
- Thickness –3cm
- Weight----500 to 600gm
- No of cotyledons ---15 to 20
- Haemochorial
- Fetal surface smooth
- Maternal surface ----bulging cotyledons seen




UMBILICAL V.
UMBILICAL ARTERIES
CIRCULAR V.
MATERNAL ARTERY
CHORION
AMNION
COTYLEDON
A.H. MAWELL


Umbilical cord
Amnion
Chorionic plate
Chorionic vessels
A
Cotyledon
Decidua basalis removed
B

Near the end of pregnancy

- Placental exchange decreases
- Fibrosis of villus core
- Thickening of basement membrane of villi
- Fibrin deposition on cytotrophoblast
- Small capillaries disappear

Amniotic Cavity

- clear watery fluid in amniotic cavity
- secreted by amniotic cells and maternal blood
- provides protective cushion
- Volume 30 ml at 10 weeks
  - 450ml at 20 weeks
  - 1000 ml at 37 weeks

Functions

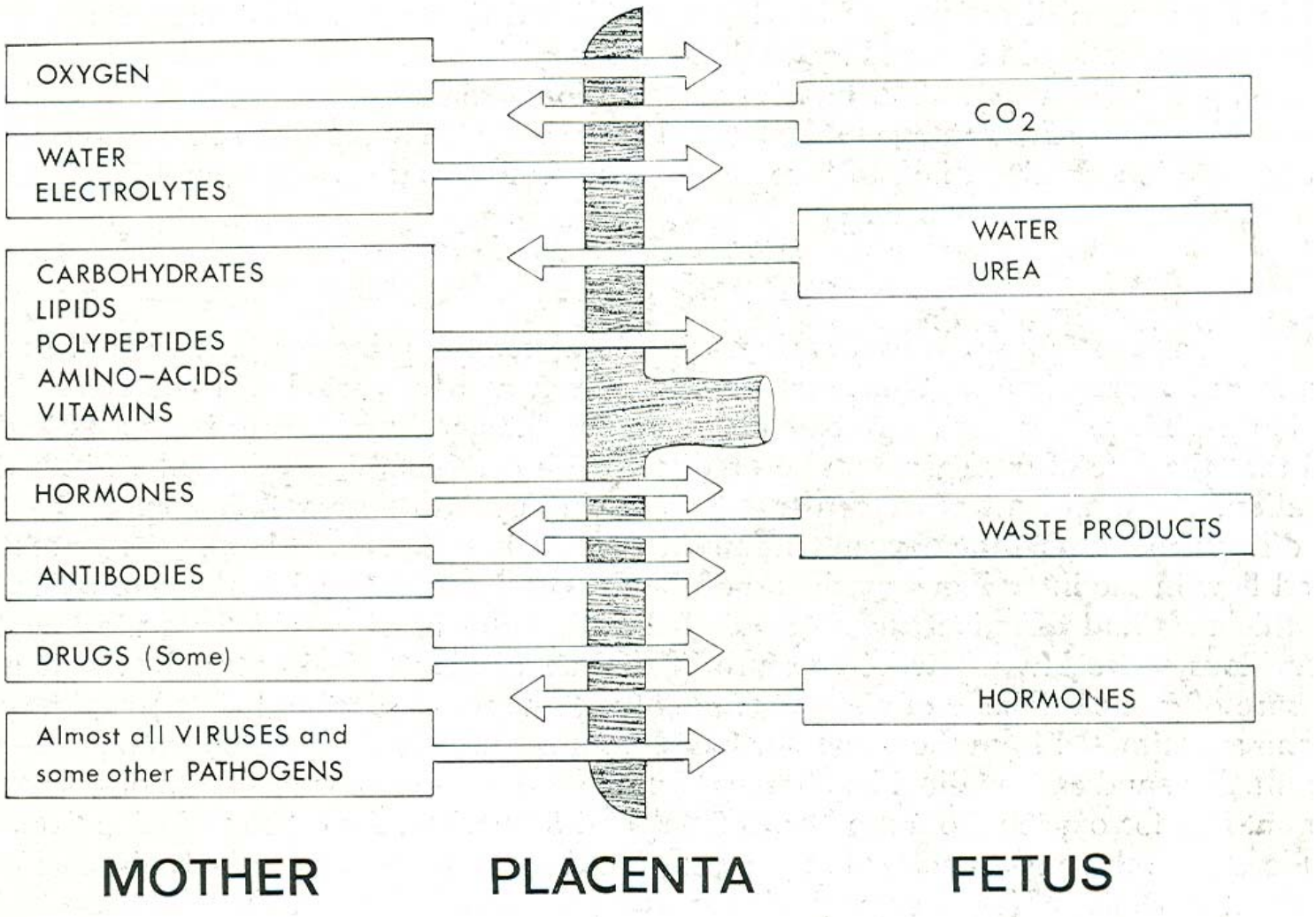
- Exchange of gases
- Exchange of nutrients and electrolytes
- Transmission of maternal antibodies
- Hormone production

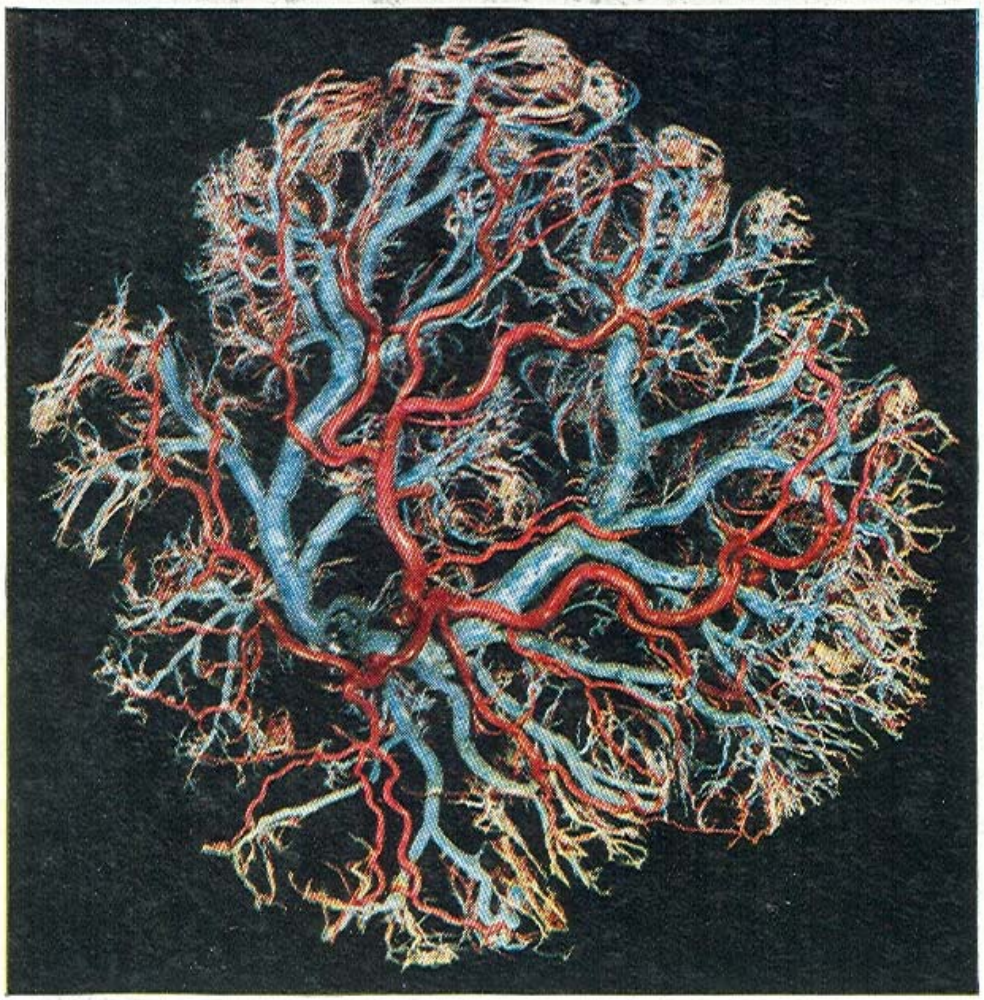
  Progesterone (after 4th month)

  Hcg (1st two months)

  Estrogens

  Somatomammotrophin


OXYGEN
WATER
ELECTROLYTES
CARBOHYDRATES
LIPIDS
POLYPEPTIDES
AMINO–ACIDS
VITAMINS
HORMONES
ANTIBODIES
DRUGS (Some)
Almost all VIRUSES and
some other PATHOGENS
CO_2
WATER
UREA
WASTE PRODUCTS
HORMONES
MOTHER
PLACENTA
FETUS



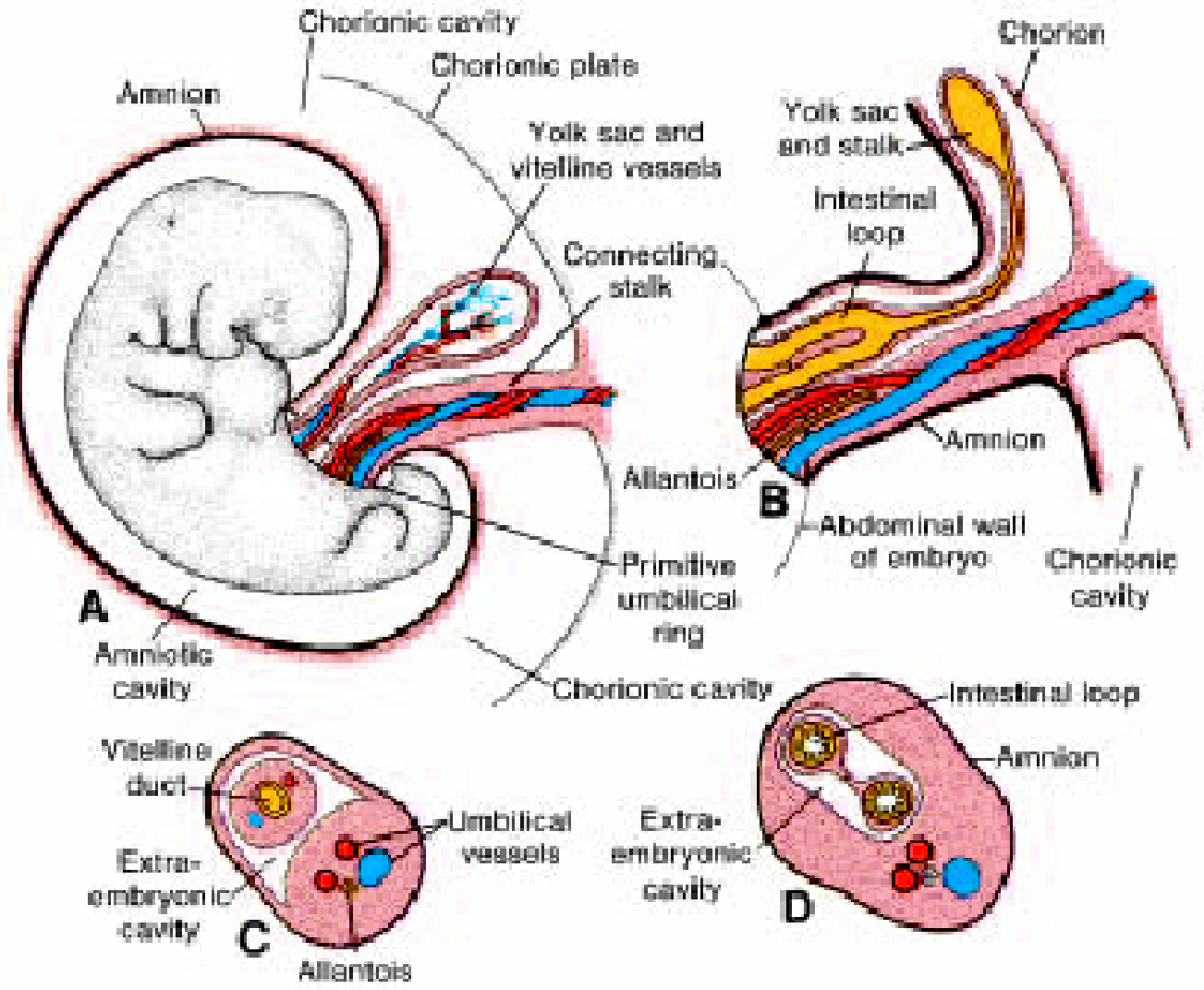

Maternal side of placenta with cotyledons
Amnion

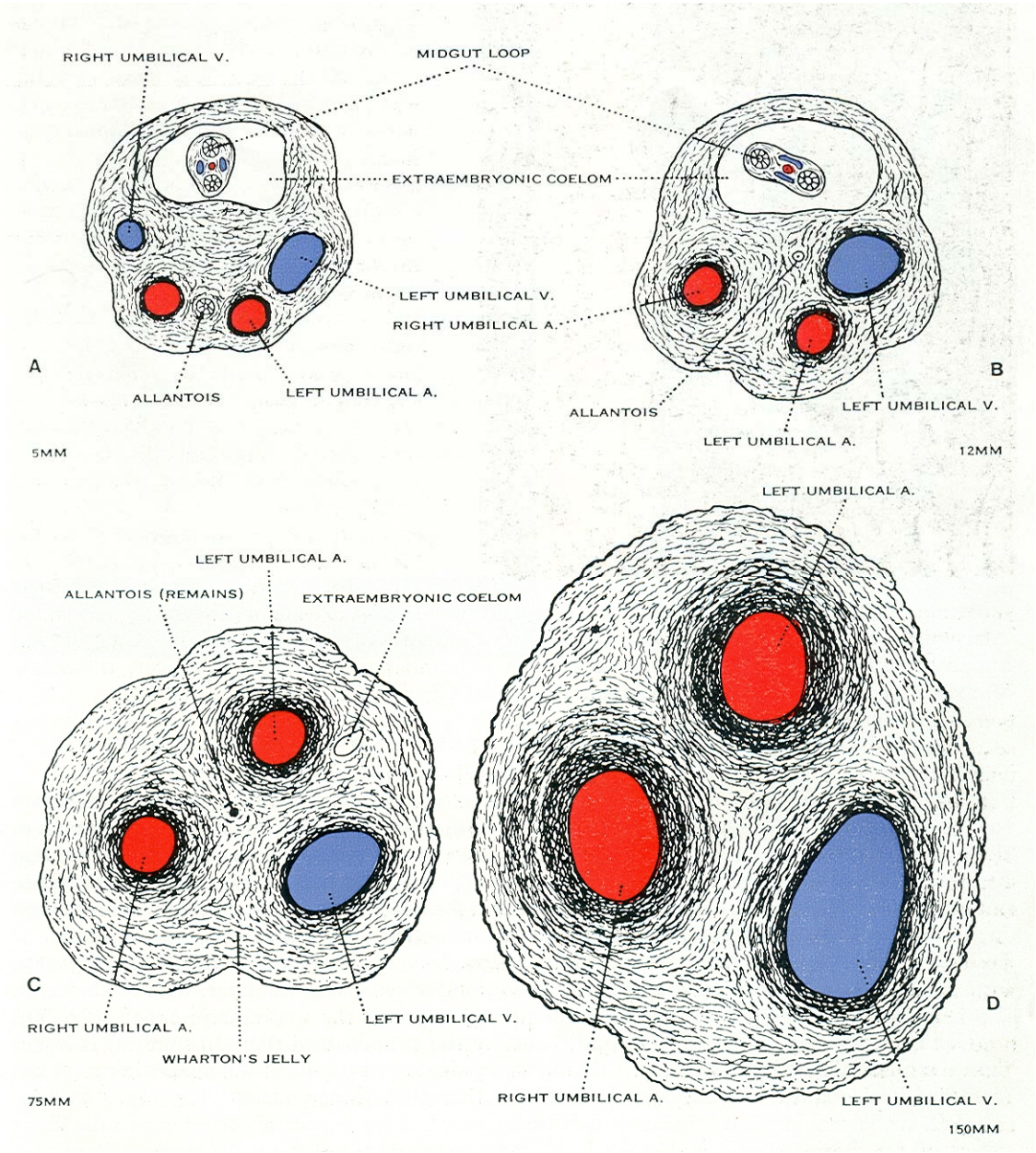
Umbilical Ring

- Comprises of-
- connecting stalk with allantois and umbilical vessels
- yolk stalk with vitelline vessels
- canal connecting intra and extraembryonic cavity

Umbilical Cord

- It forms when amnion envelops umbilical ring structures.
- yolk sac obliterates by third month.
- loops of intestine may enter umbilical ring.
- allantois, vitelline duct and vessels disappear.
- Wharton's jelly now protects umbilical vessels.
- it is rich in proteoglycans.


Chorionic cavity
Chorionic plate
Amnion
Yolk sac and vitelline vessels
Connecting stalk
Primitive umbilical ring
A
Amniotic cavity
Chorionic cavity
Chorion
Yolk sac and stalk
Intestinal loop
Amnion
Allantois
B
Abdominal wall of embryo
Chorionic cavity
Vitelline duct
Umbilical vessels
Extra-embryonic cavity
C
Allantois
Intestinal loop
Amnion
Extra-embryonic cavity
D


RIGHT UMBILICAL V.
MIDGUT LOOP
EXTRAEMBRYONIC COELOM
LEFT UMBILICAL V.
RIGHT UMBILICAL A.
A
ALLANTOIS
LEFT UMBILICAL A.
5MM
B
ALLANTOIS
LEFT UMBILICAL V.
LEFT UMBILICAL A.
12MM
LEFT UMBILICAL A.
LEFT UMBILICAL A.
ALLANTOIS (REMAINS)
EXTRAEMBRYONIC COELOM
C
RIGHT UMBILICAL A.
WHARTON'S JELLY
LEFT UMBILICAL V.
75MM
D
RIGHT UMBILICAL A.
LEFT UMBILICAL V.
150MM