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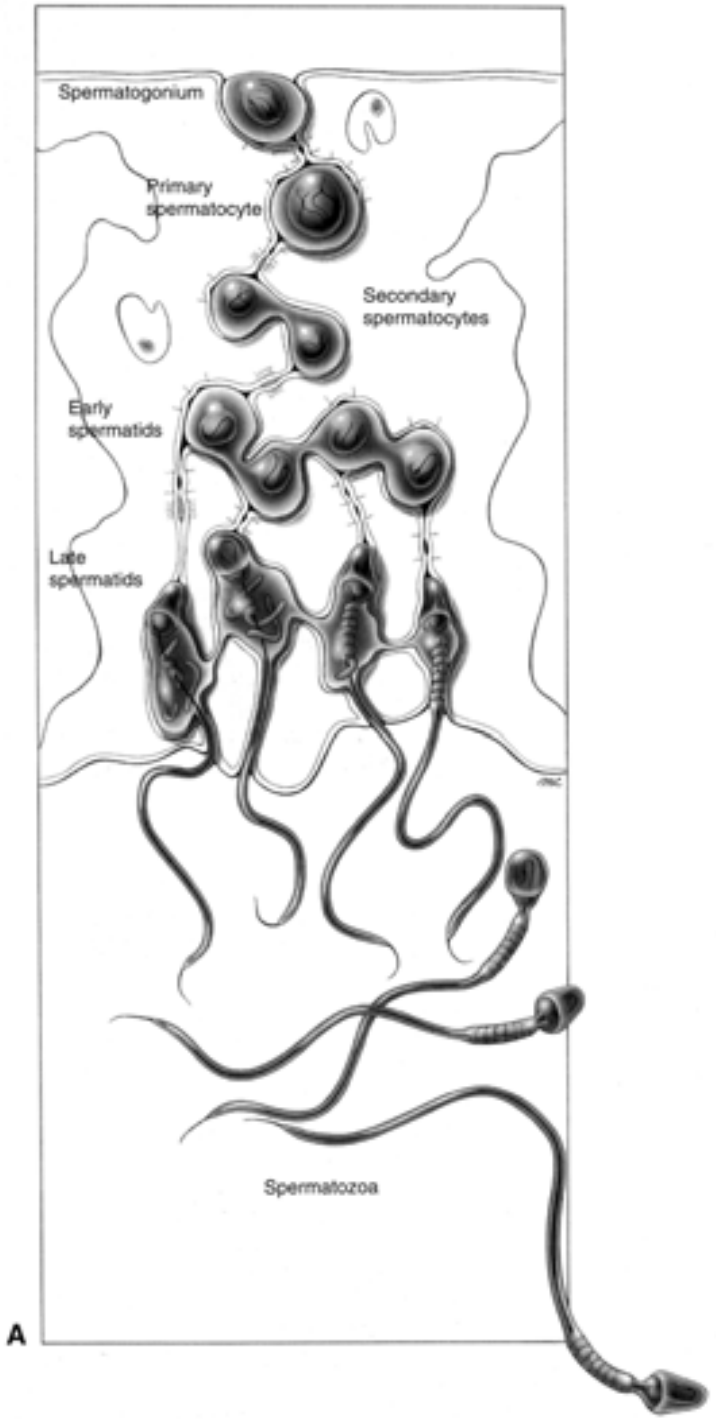
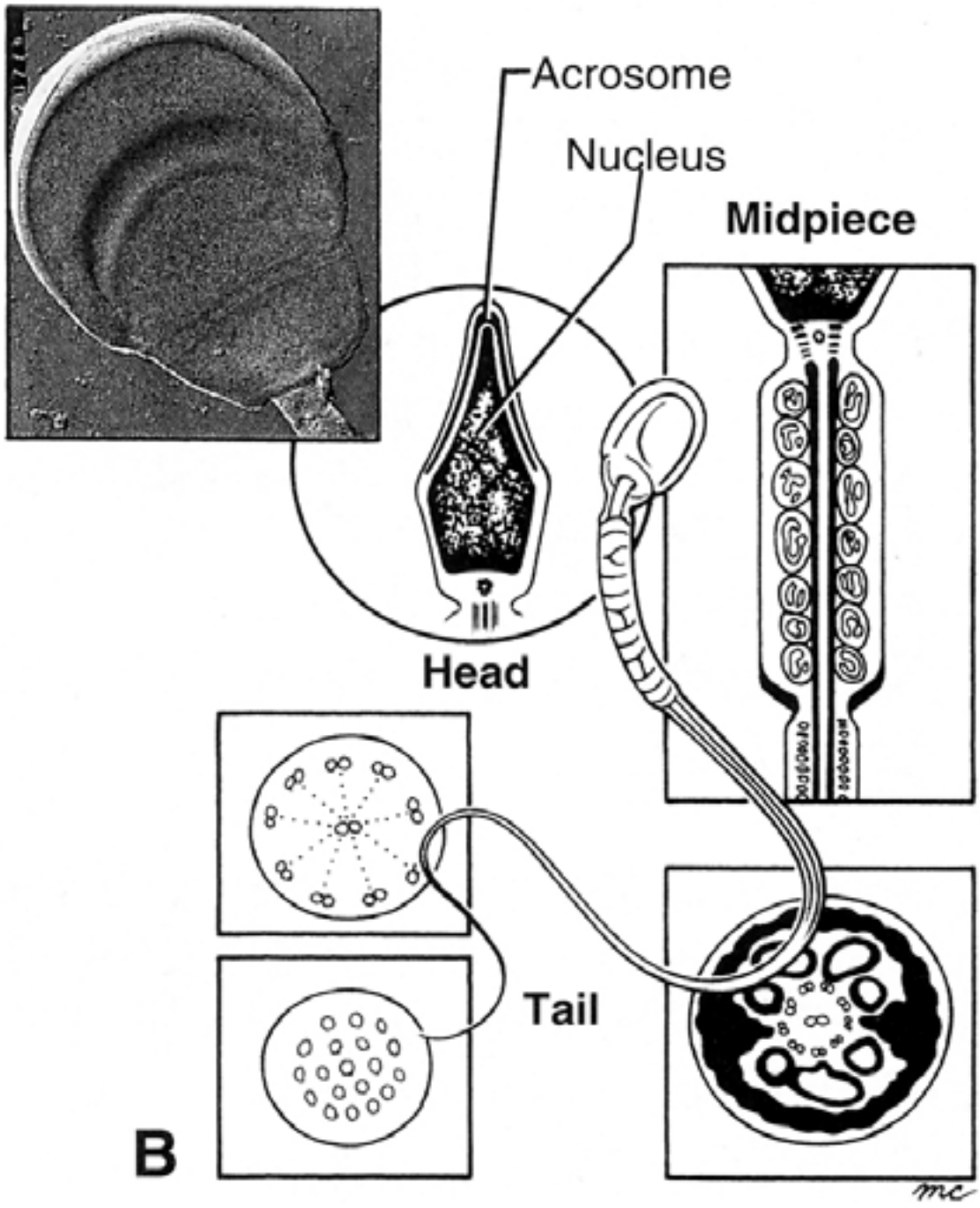
I. Initiation of development

From Fertilization to gastrulation

Sperm differentiation:

1. Meiosis of the begins post-puberty
2. Following meiosis, spermatocytes are remodeled to spermatids and finally to spermatozoa.



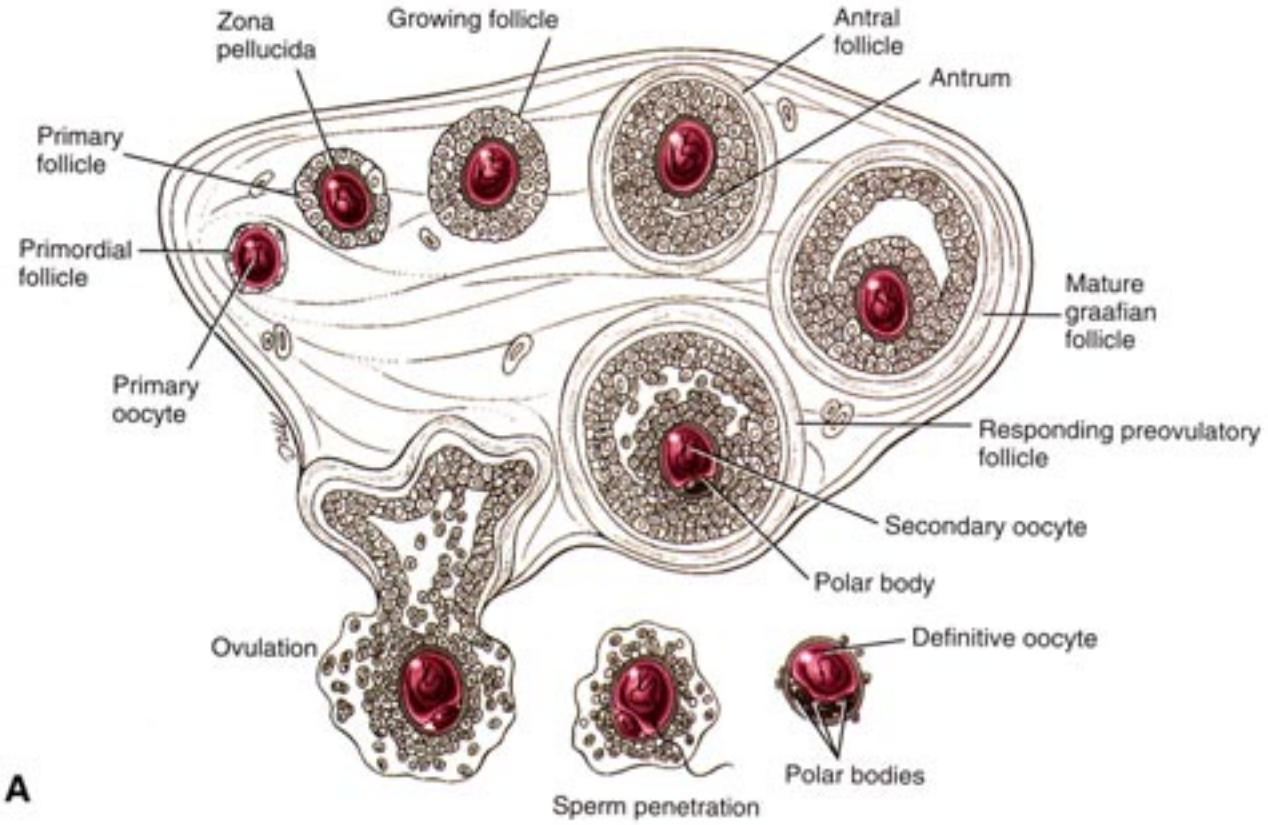

Acrosome
Nucleus
Midpiece
Head
Tail
B

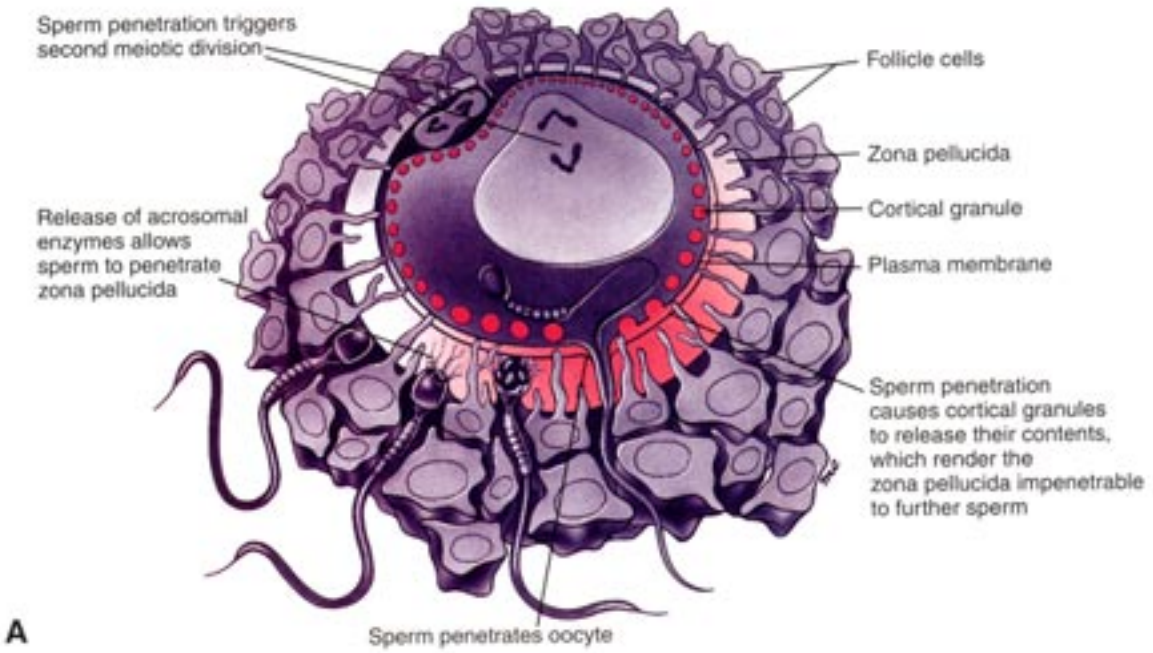
Final phases of sperm maturation.

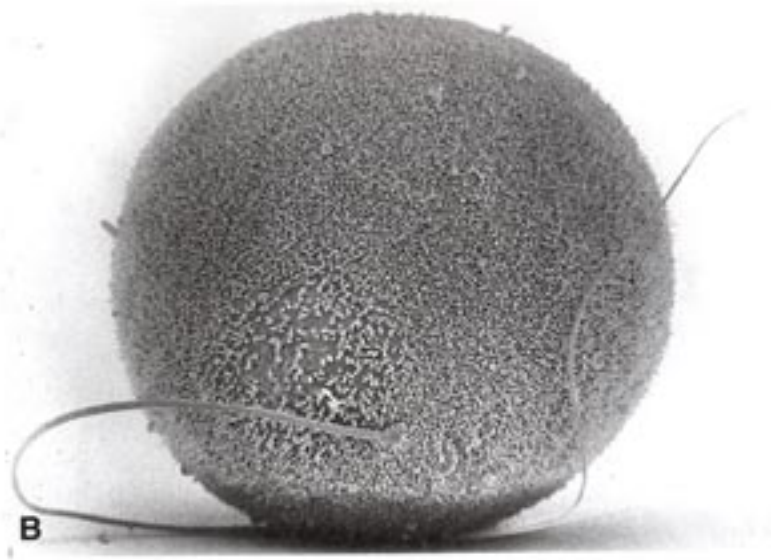
1. in epidymus
2. in female reproductive tract:

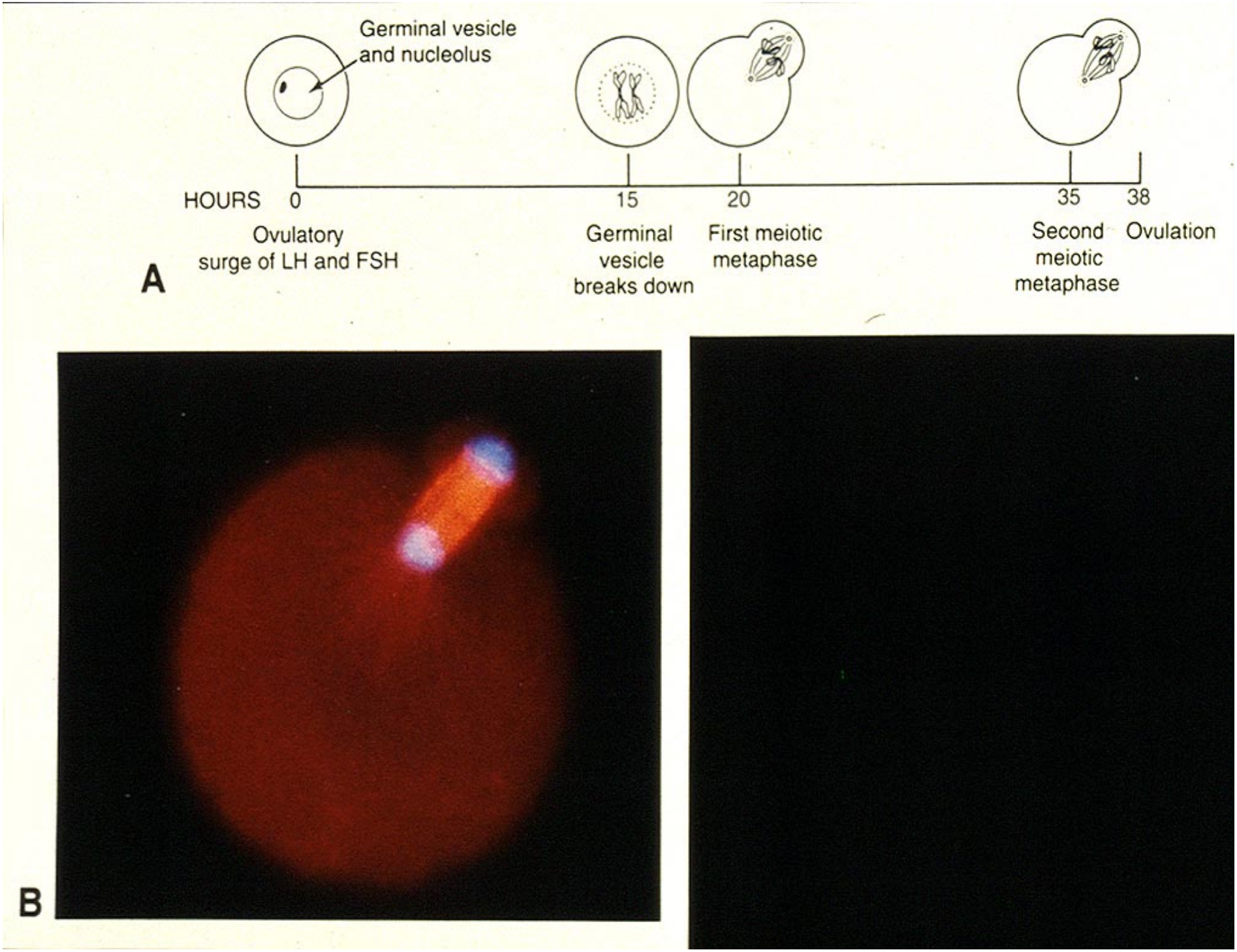
Capacitation and acrosome reaction

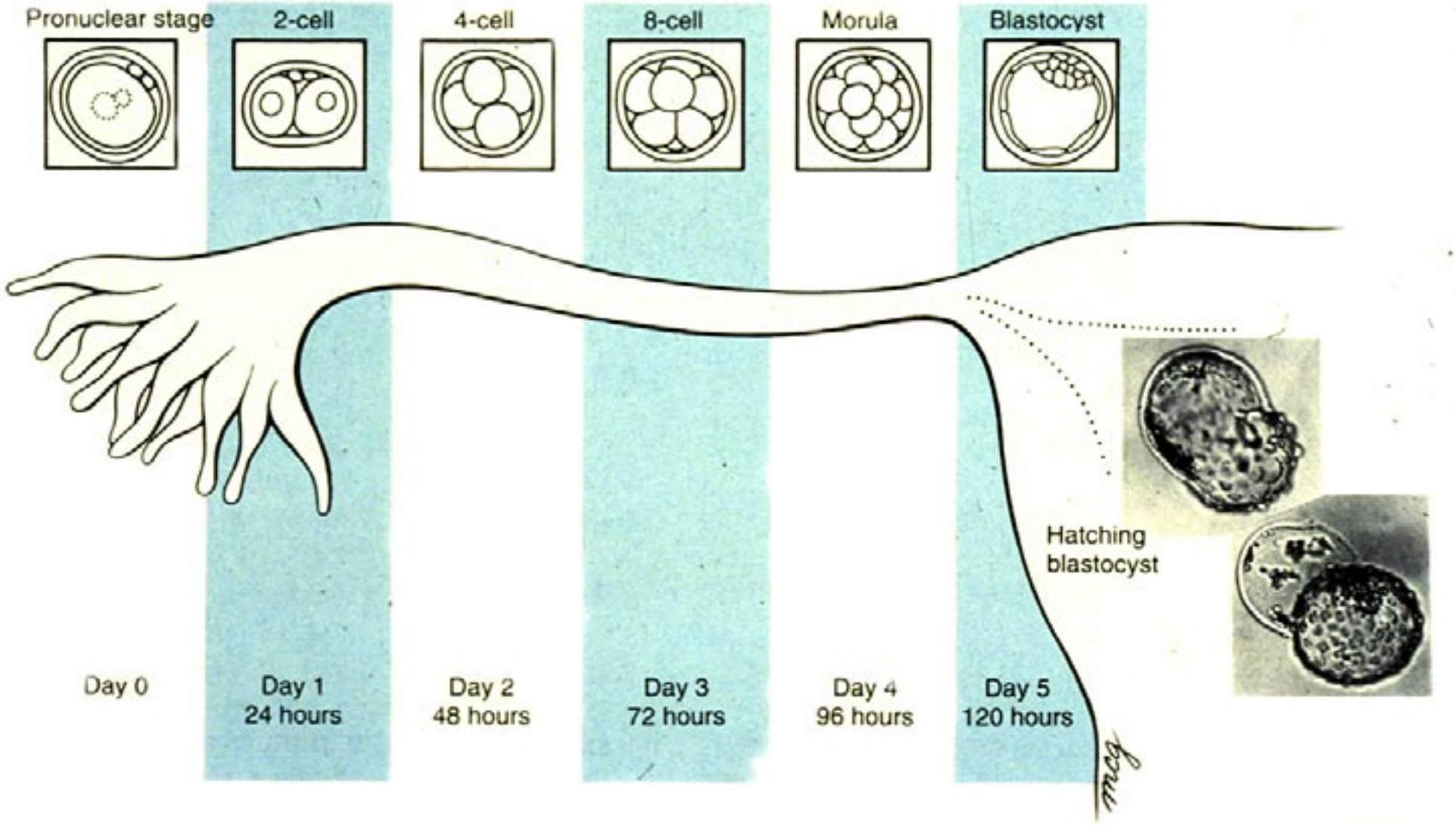
C
a
p
a


Zona pellucida
Growing follicle
Antral follicle
Antrum
Primary follicle
Primordial follicle
Mature graafian follicle
Primary oocyte
Responding preovulatory follicle
Secondary oocyte
Polar body
Ovulation
Definitive oocyte
Polar bodies
Sperm penetration
A


Sperm penetration triggers second meiotic division
Follicle cells
Zona pellucida
Cortical granule
Plasma membrane
Release of acrosomal enzymes allows sperm to penetrate zona pellucida
Sperm penetration causes cortical granules to release their contents, which render the zona pellucida impenetrable to further sperm
Sperm penetrates oocyte
A


B


Germinal vesicle
and nucleolus
HOURS
0
15
20
35
38
Ovulatory
surge of LH and FSH
Germinal
vesicle
breaks down
First meiotic
metaphase
Second
meiotic
metaphase
Ovulation
A
B


Pronuclear stage
2-cell
4-cell
8-cell
Morula
Blastocyst
Hatching blastocyst
Day 0
Day 1
24 hours
Day 2
48 hours
Day 3
72 hours
Day 4
96 hours
Day 5
120 hours

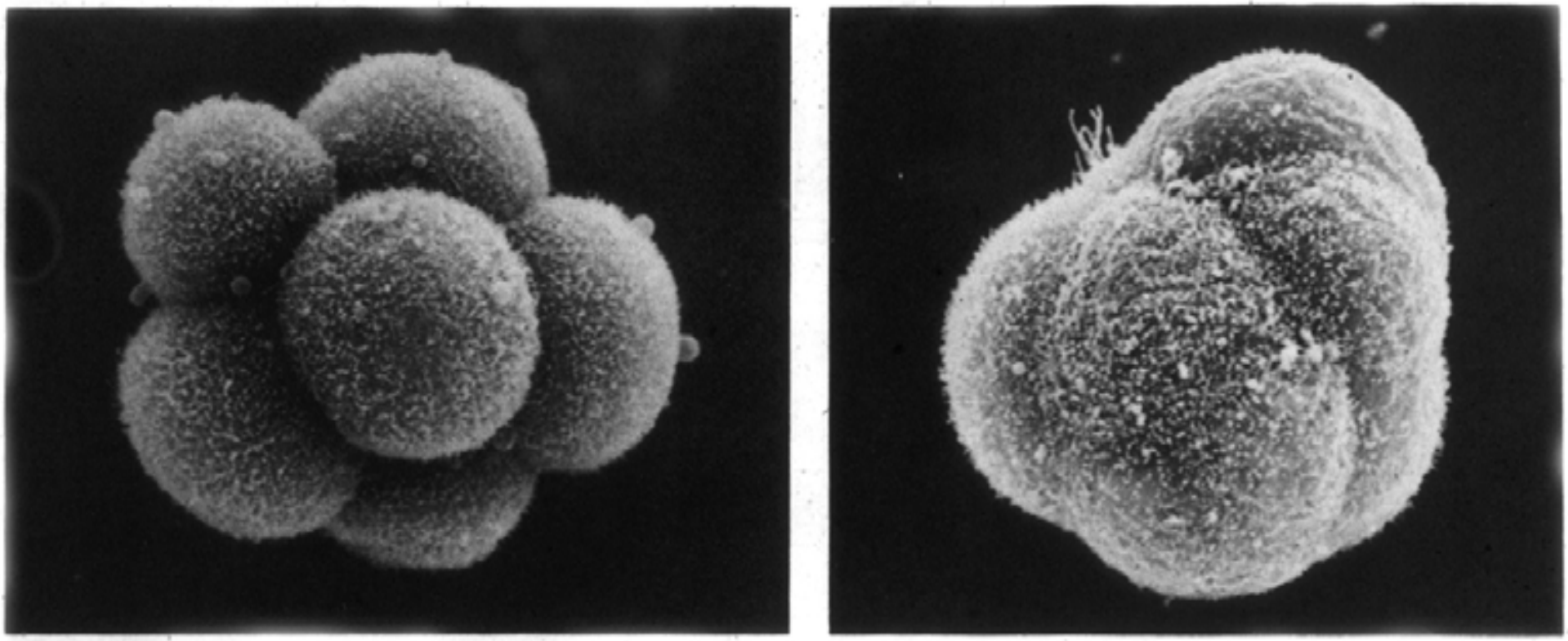


FIGURE 21
Scanning electron micrograph of uncompacted (left) and compacted (right) 8-cell mouse embryo. (Photographs courtesy of C. Ziomek.)

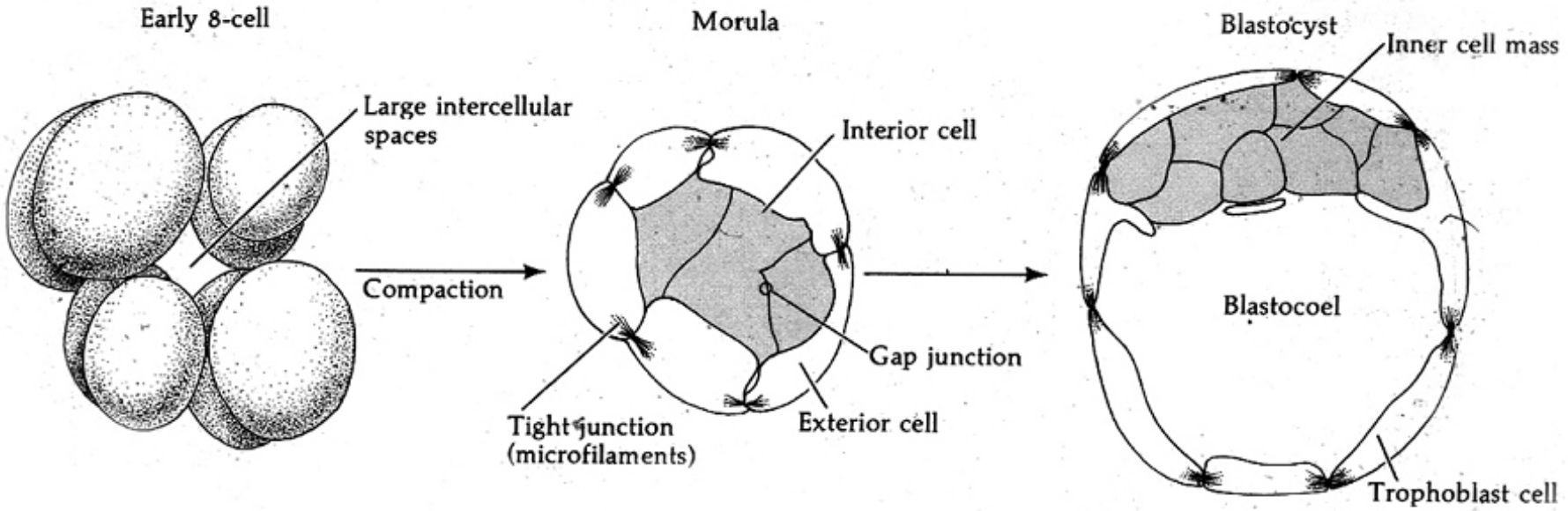
their behavior. They suddenly huddle together, maximizing their contact with the other blastomeres and forming a compact ball of cells (Figure 21). This tightly packed arrangement is stabilized by tight junctions that form between the outside cells of the ball, sealing off the

Fate:

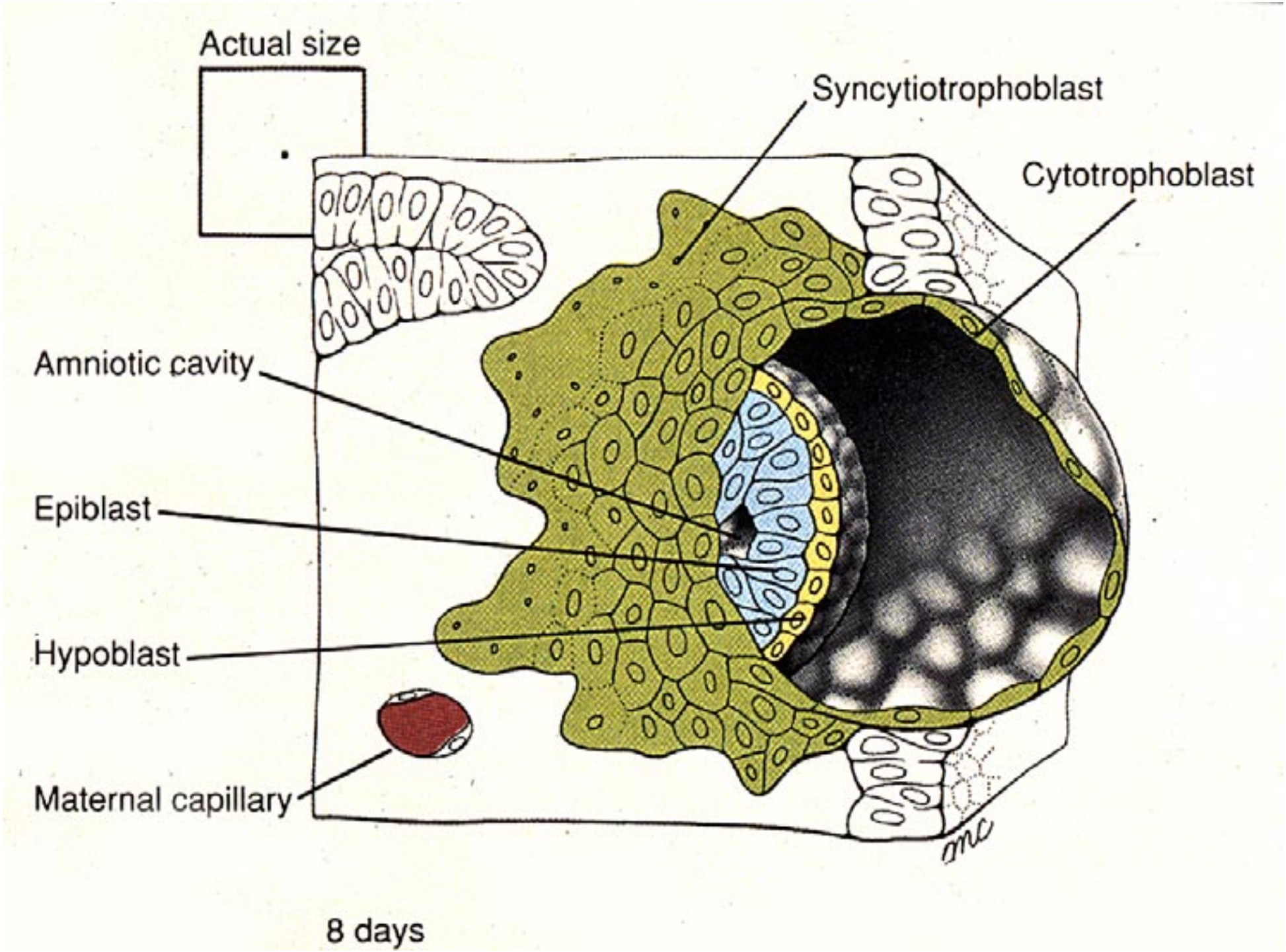
Potency:

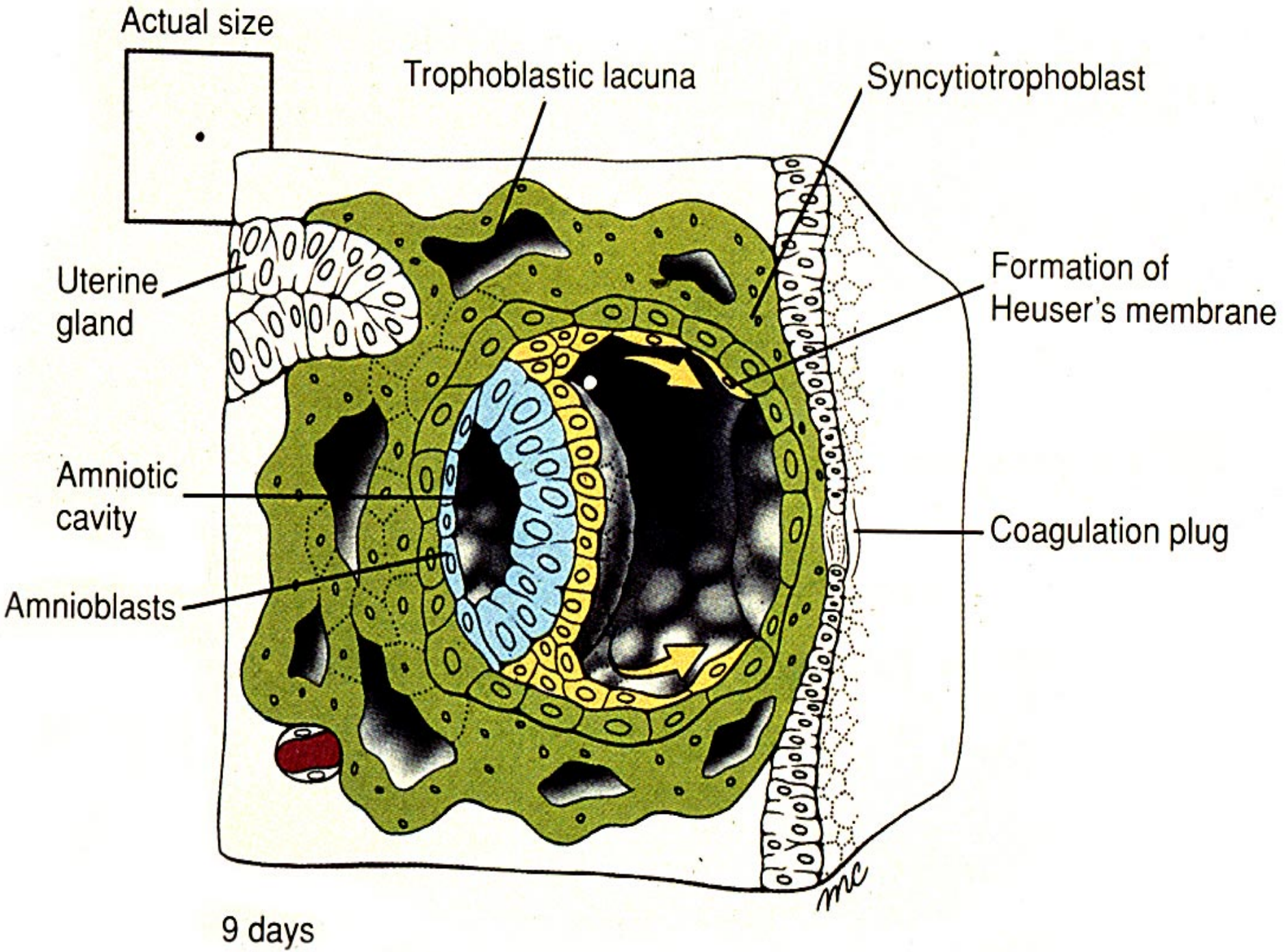
Commitment:

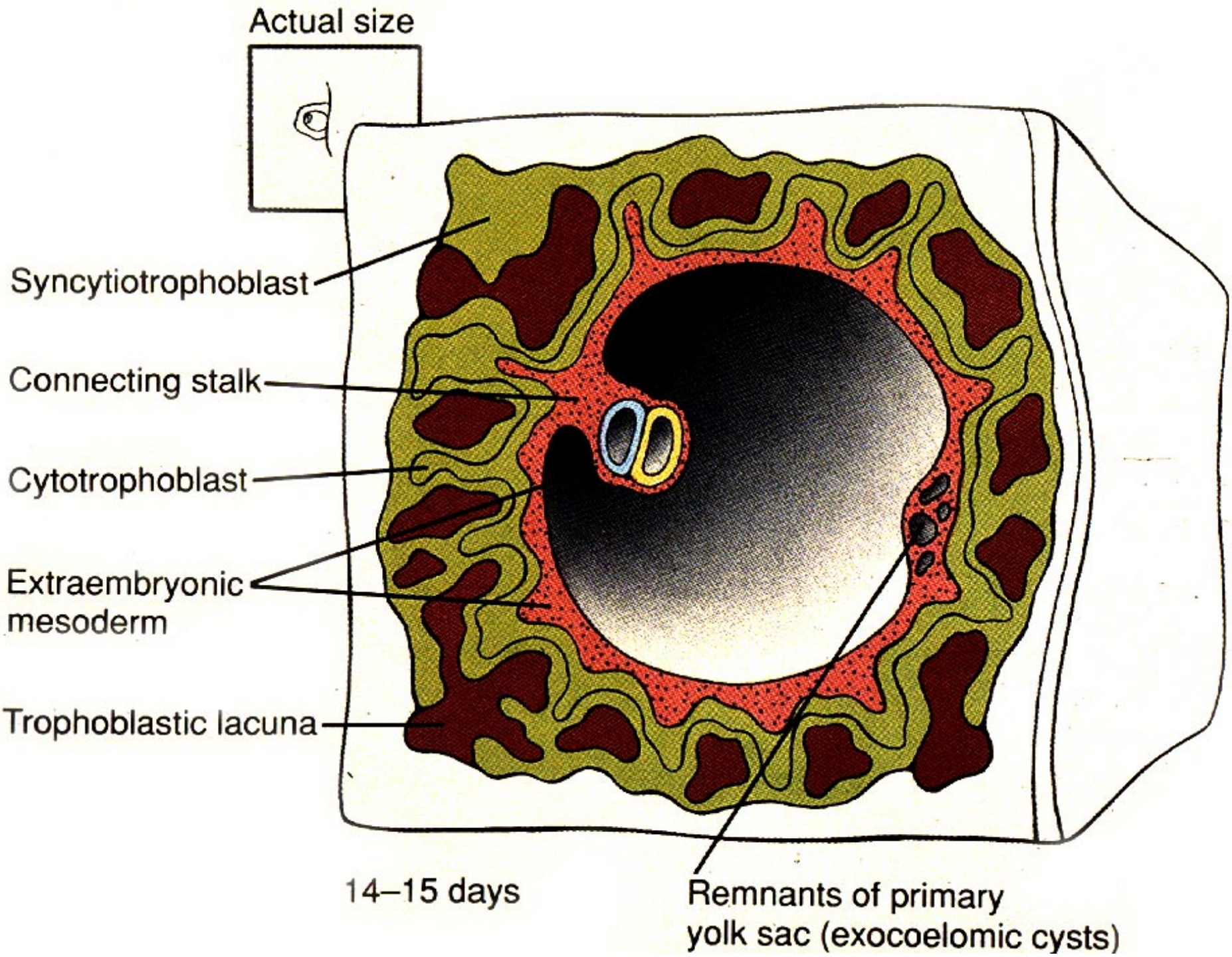
Differentiation:

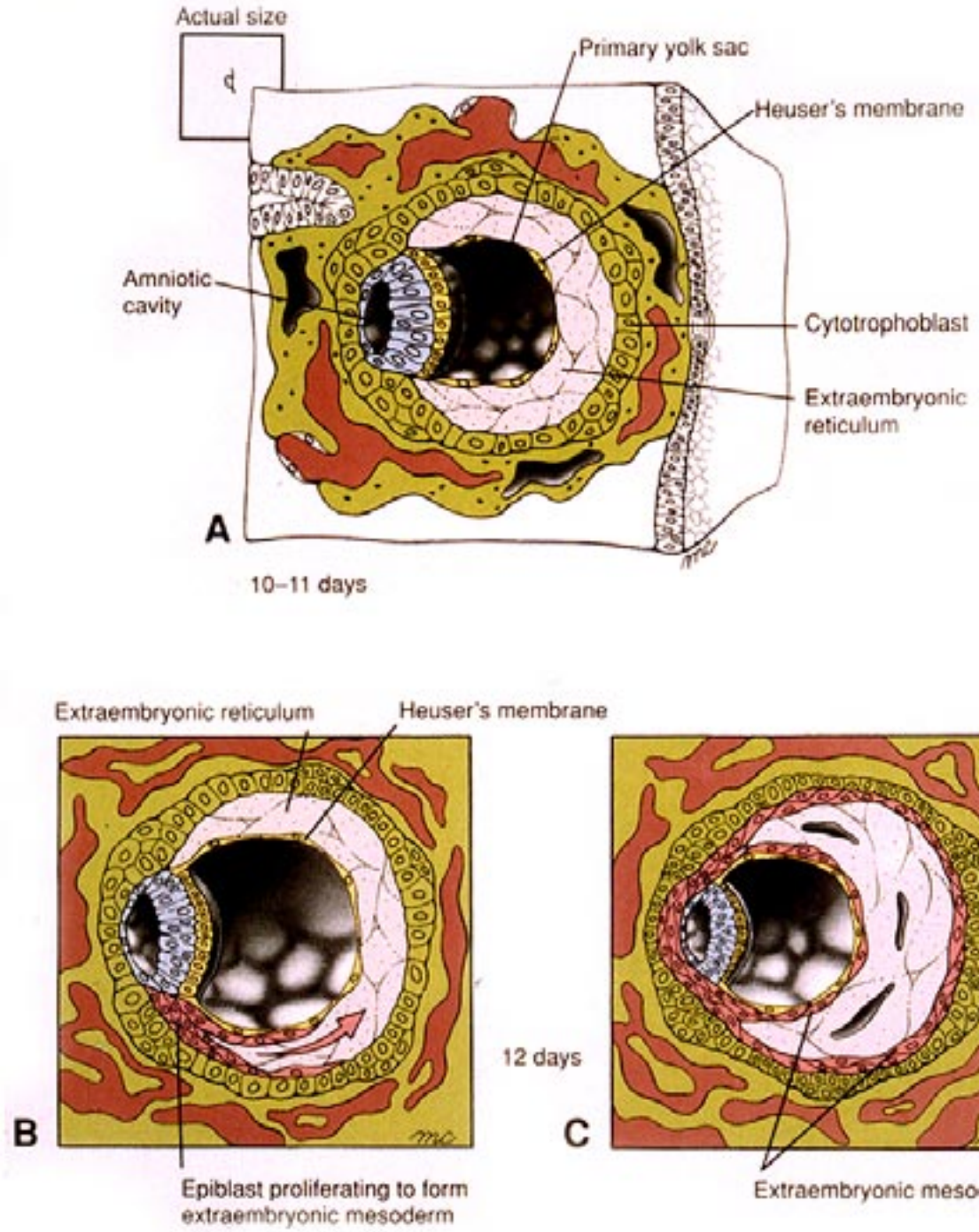

Early 8-cell
Large intercellular spaces
Compaction
Morula
Interior cell
Gap junction
Tight junction (microfilaments)
Exterior cell
Blastocyst
Inner cell mass
Blastocoel
Trophoblast cell

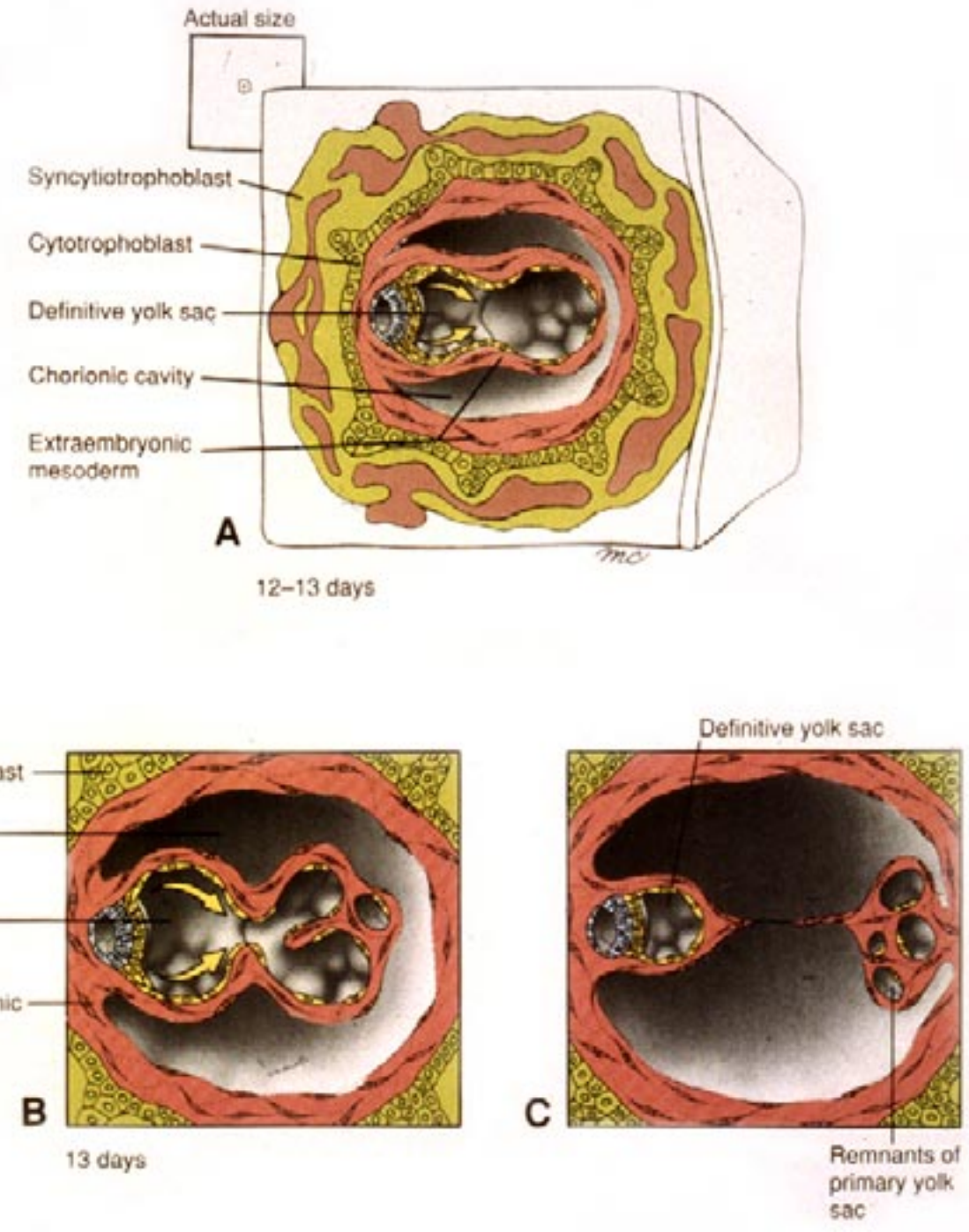
Implantation


Actual size
Syncytiotrophoblast
Cytotrophoblast
Amniotic cavity
Epiblast
Hypoblast
Maternal capillary
mc
8 days


Actual size
Trophoblastic lacuna
Syncytiotrophoblast
Uterine gland
Formation of Heuser's membrane
Amniotic cavity
Coagulation plug
Amnioblasts
9 days


Actual size
Syncytiotrophoblast
Connecting stalk
Cytotrophoblast
Extraembryonic mesoderm
Trophoblastic lacuna
14–15 days
Remnants of primary yolk sac (exocoelomic cysts)


Actual size
Primary yolk sac
Heuser's membrane
Amniotic cavity
Cytotrophoblast
Extraembryonic reticulum
A
10–11 days
Extraembryonic reticulum
Heuser's membrane
B
Epiblast proliferating to form extraembryonic mesoderm
12 days
C
Extraembryonic mesoderm


Actual size
Syncytiotrophoblast
Cytotrophoblast
Definitive yolk sac
Chorionic cavity
Extraembryonic mesoderm
A
12–13 days
Cytotrophoblast
Chorionic cavity
Definitive yolk sac
Extraembryonic mesoderm
B
13 days
Definitive yolk sac
C
Remnants of primary yolk sac

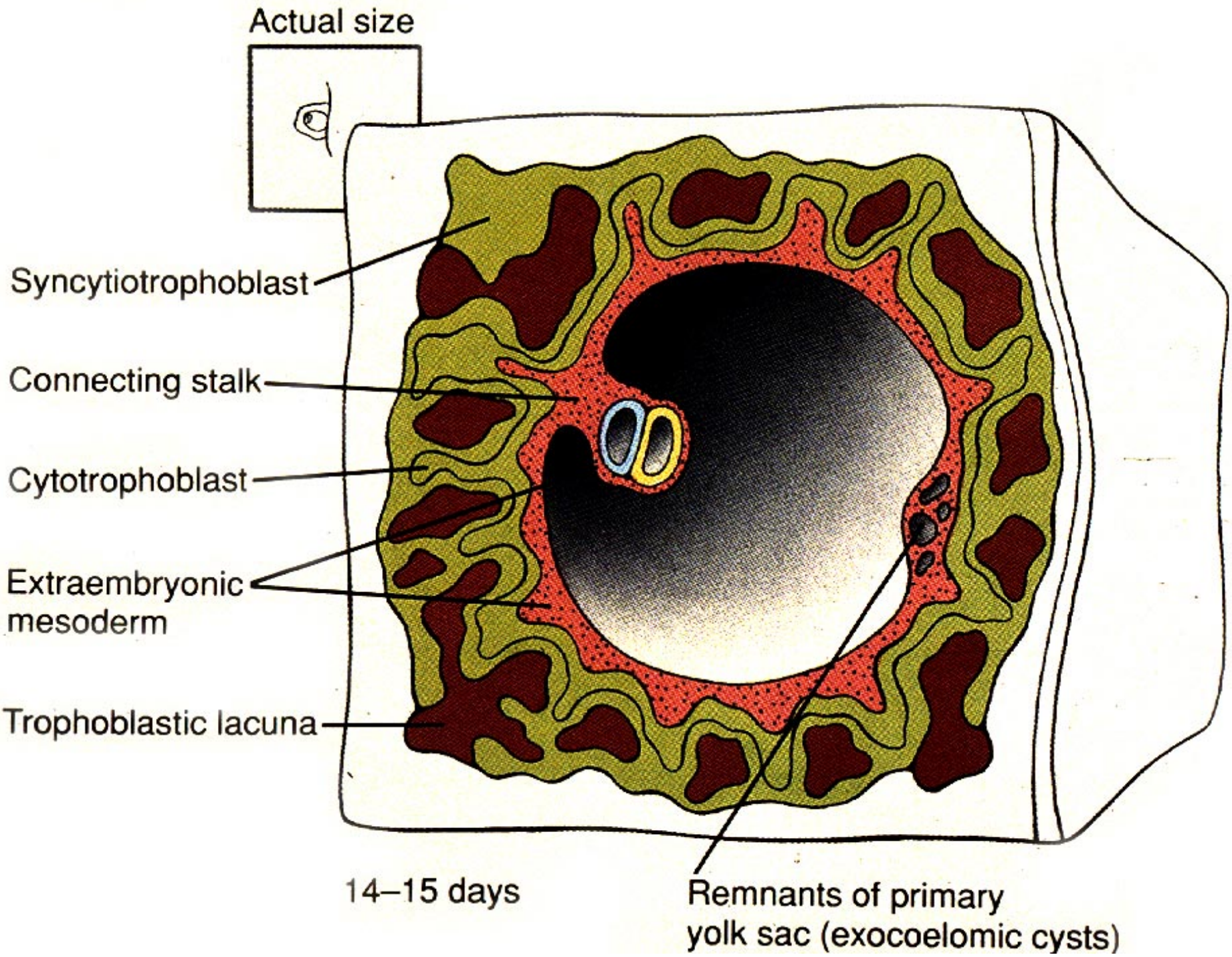
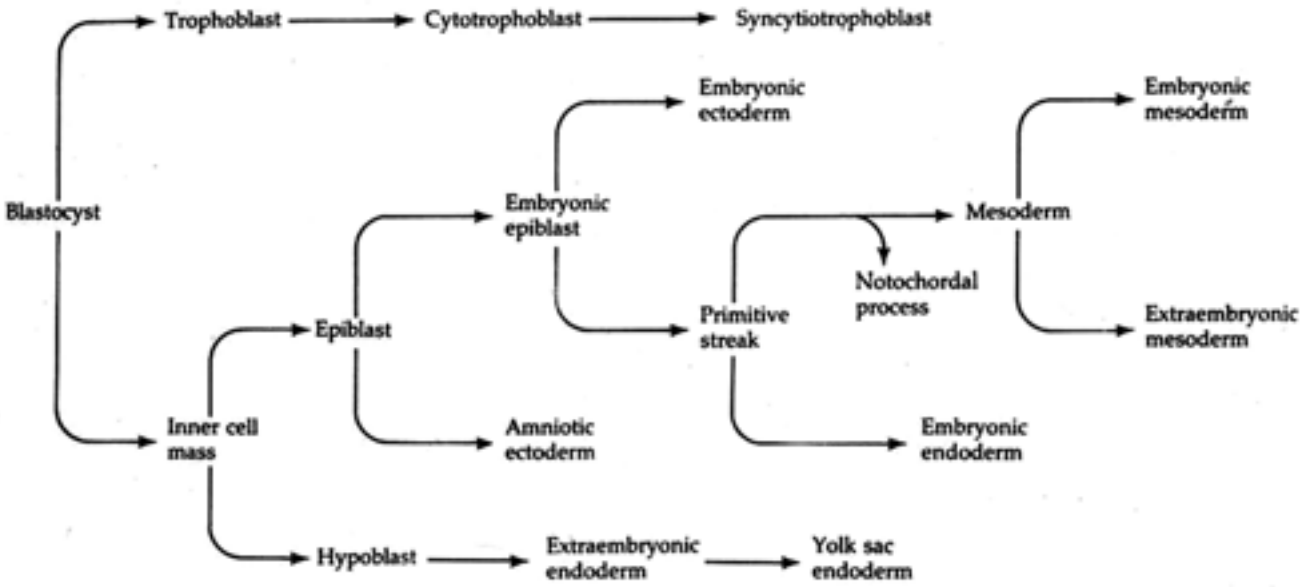

Actual size
Syncytiotrophoblast
Connecting stalk
Cytotrophoblast
Extraembryonic mesoderm
Trophoblastic lacuna
14–15 days
Remnants of primary yolk sac (exocoelomic cysts)

FIGURE 31
Scheme illustrating the derivation of tissues in human and rhesus monkey embryos. (After Luckett, 1978.)



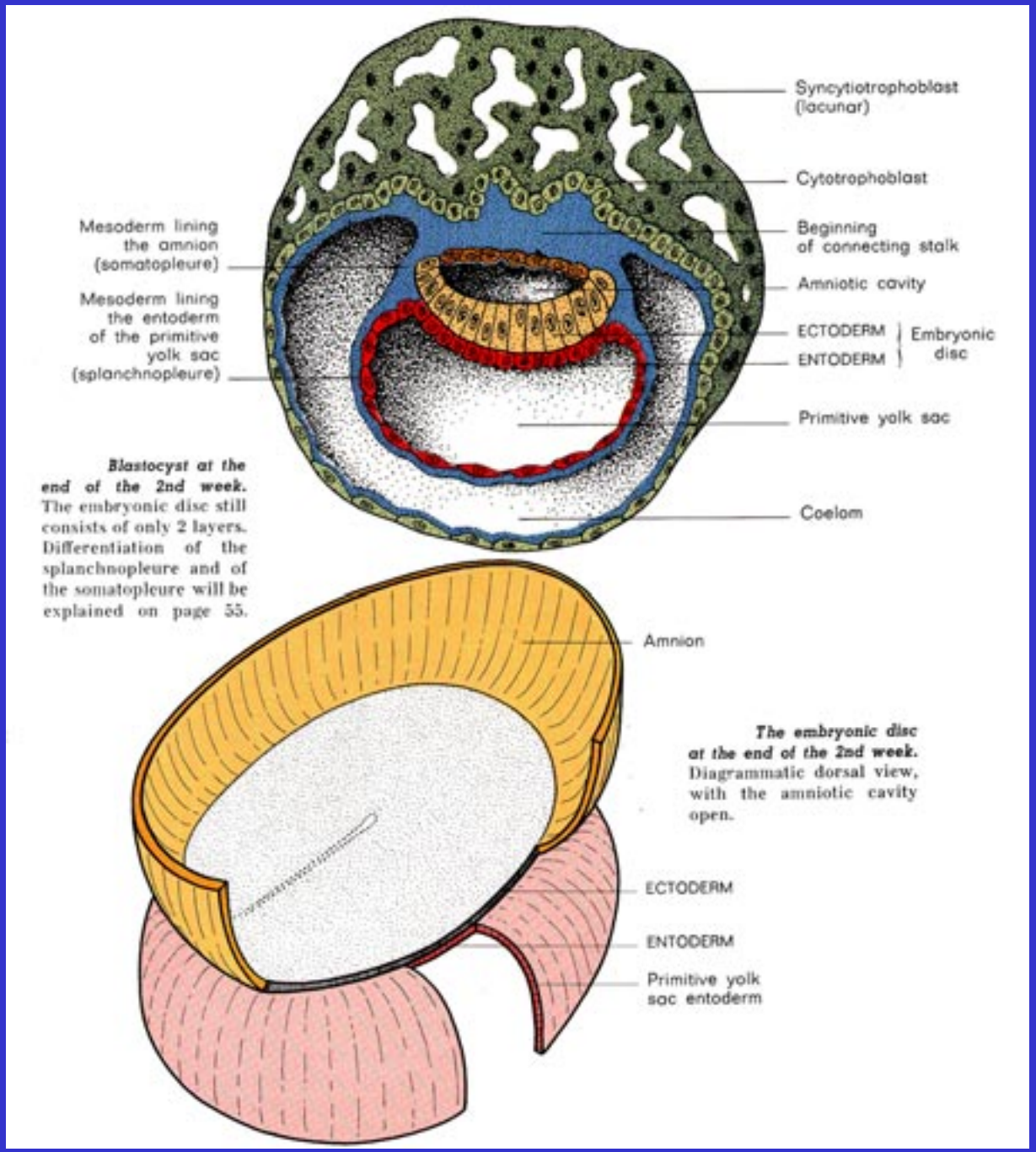
Gastrulation

Formation of the 3 germ layers

Ectoderm: Epidermis and neural tissue

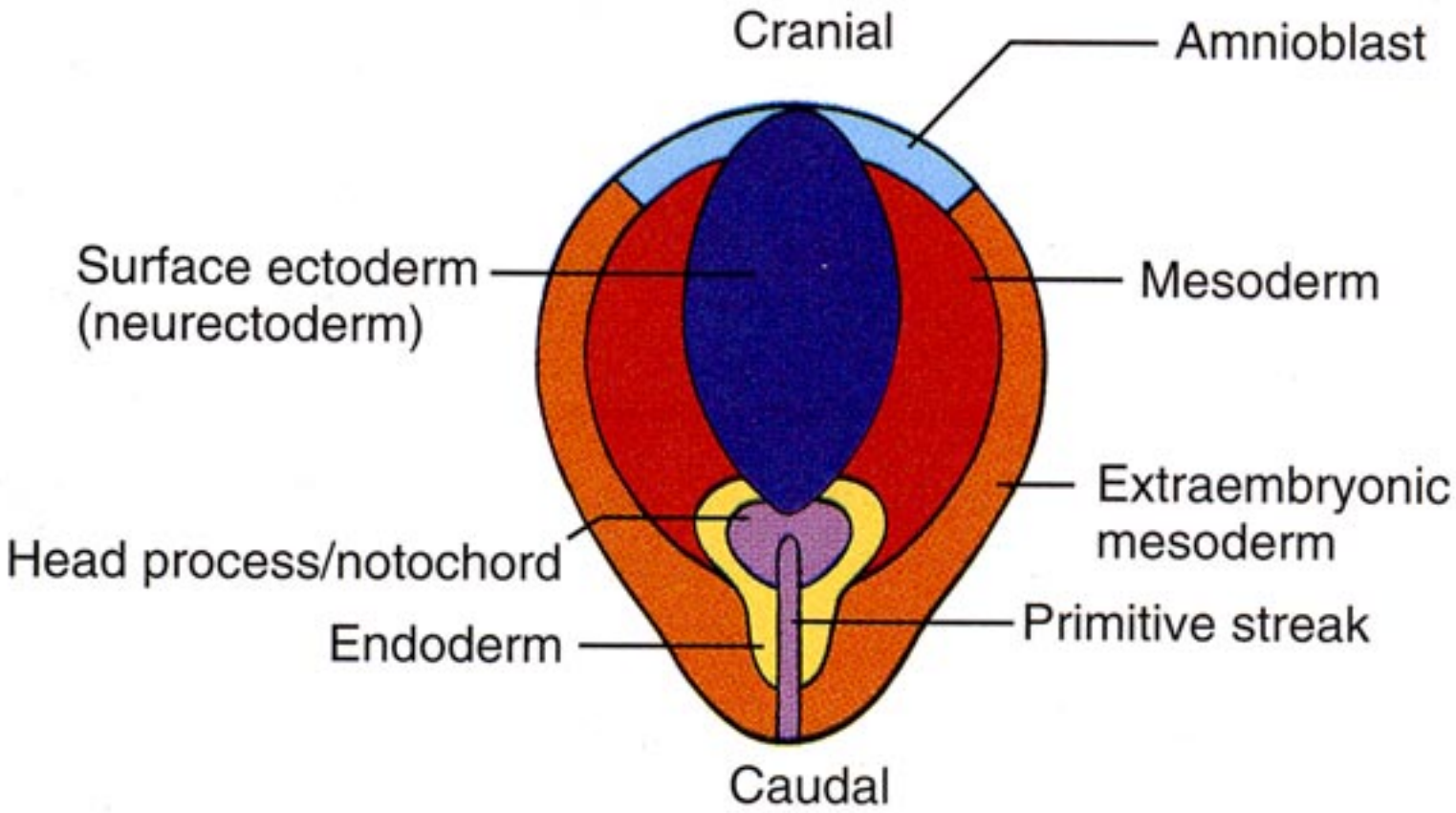
Mesoderm: axial, paraxial, intermediate and lateral plate

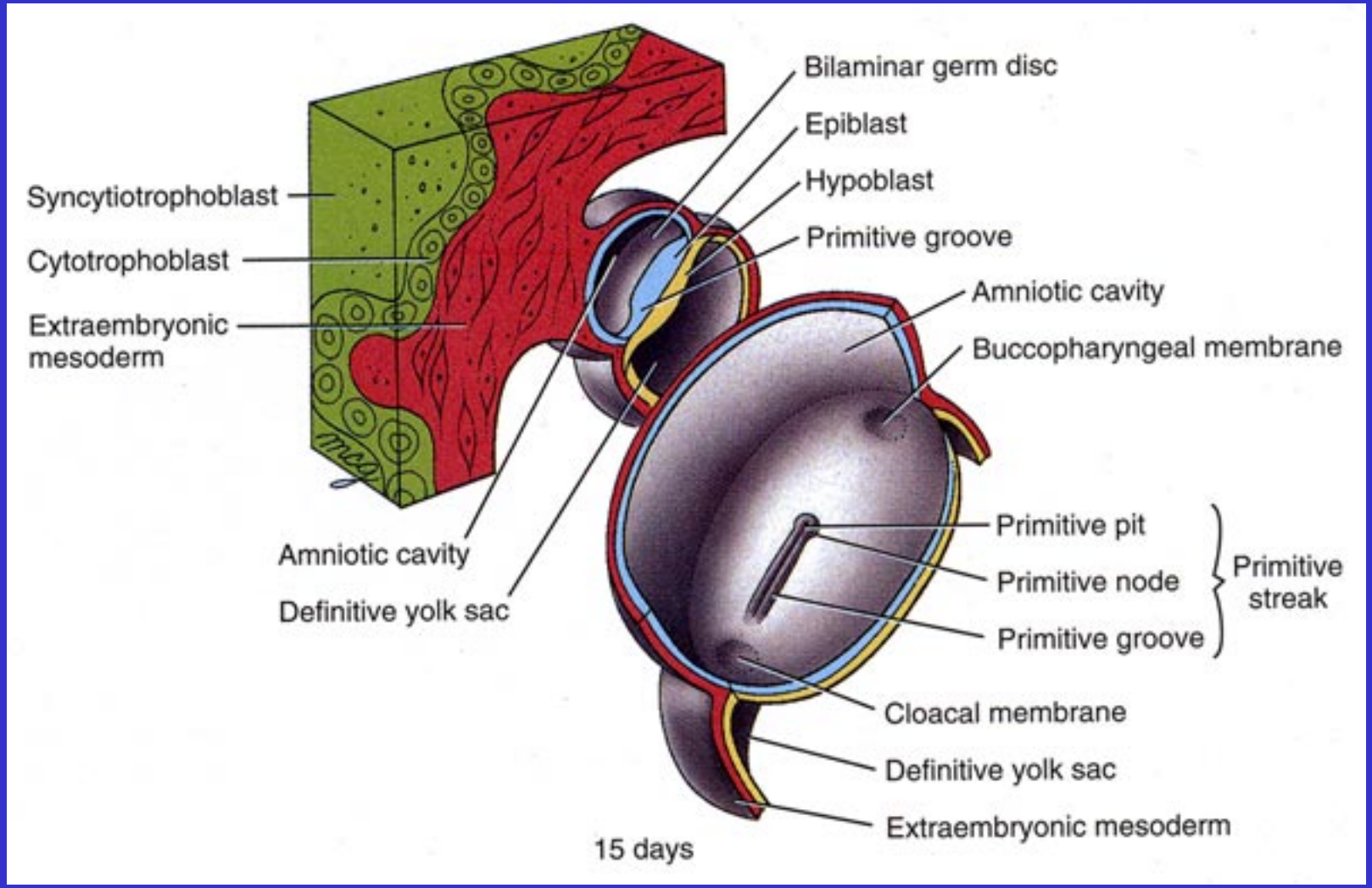
Endoderm: lining of gut and respiratory tract

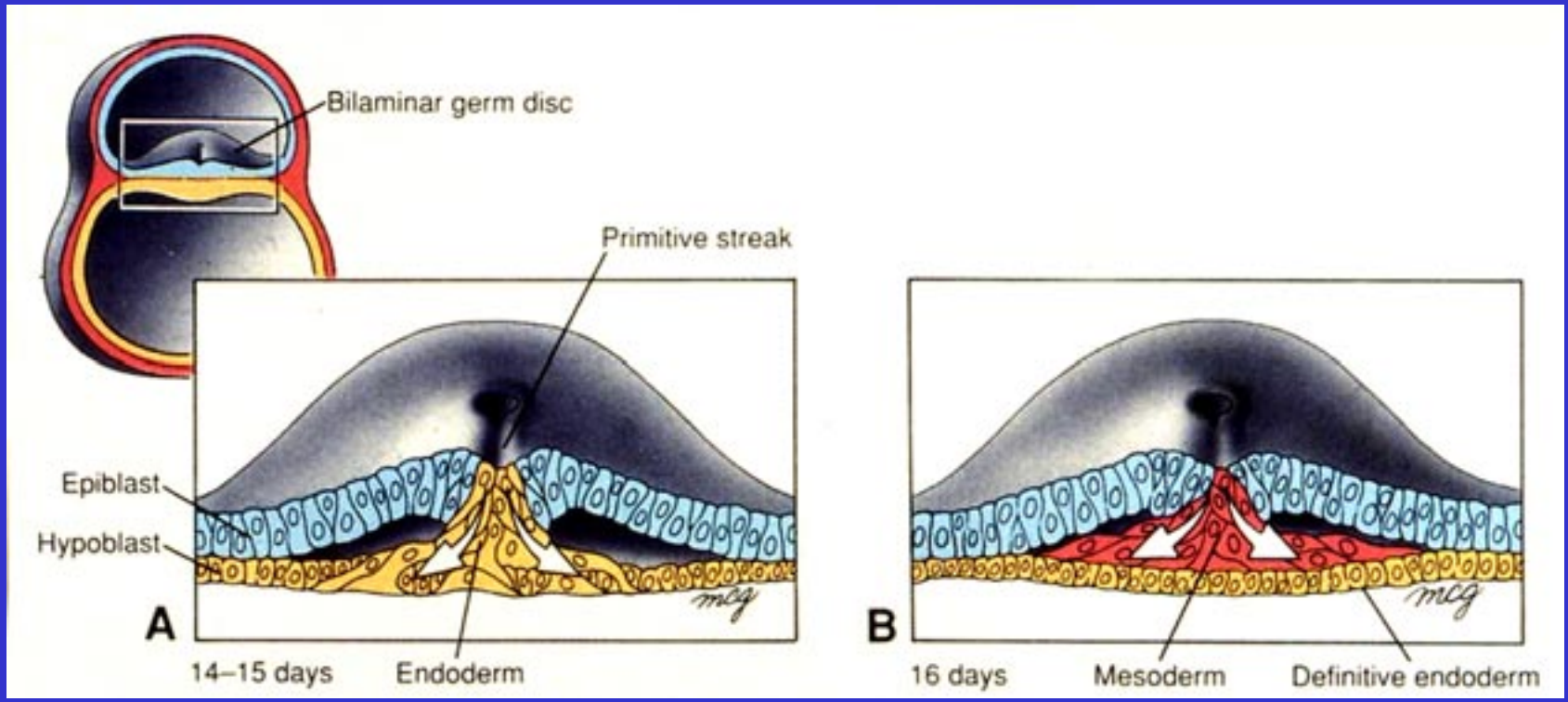


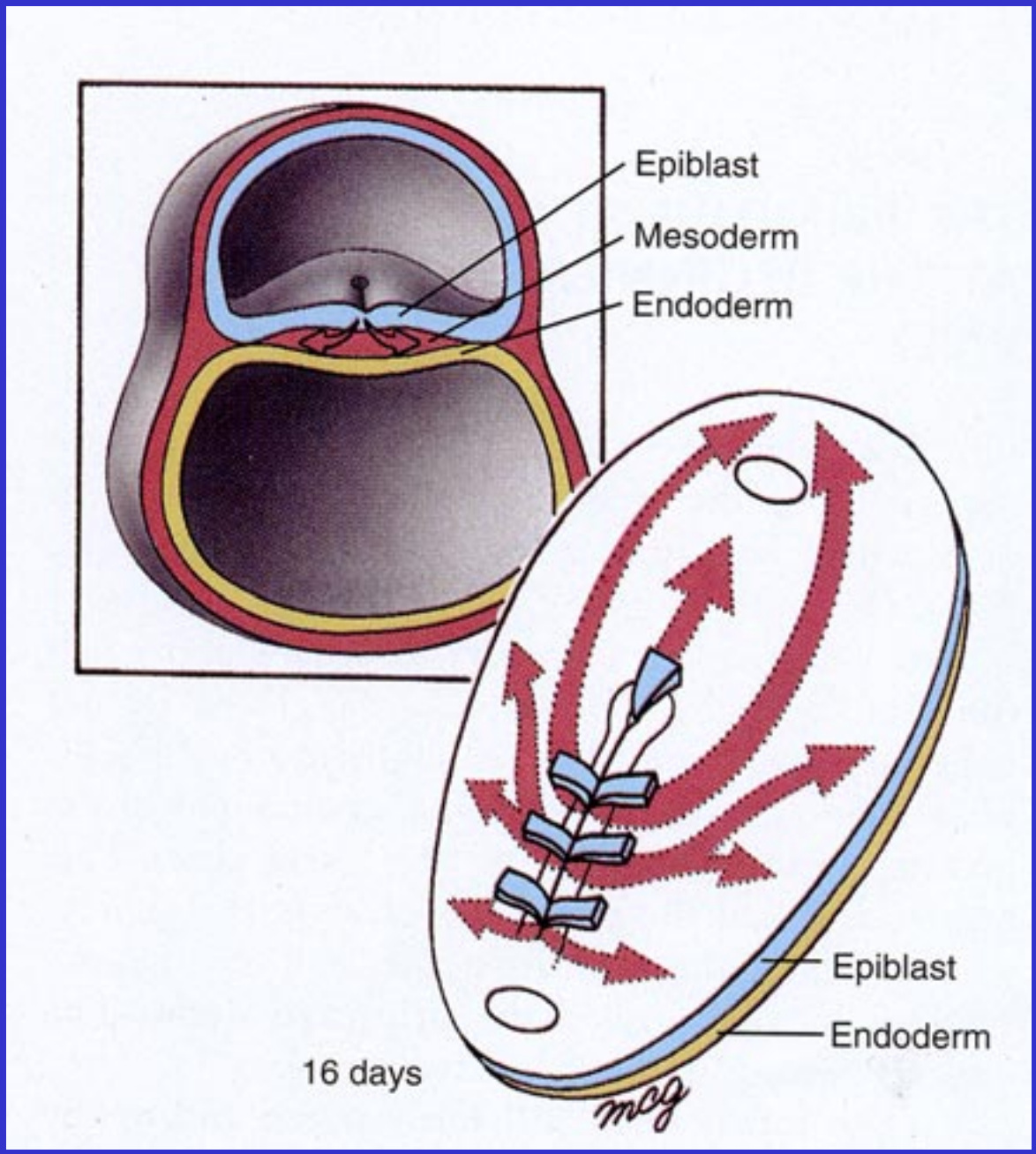
Blastocyst at the end of the 2nd week. The embryonic disc still consists of only 2 layers. Differentiation of the splanchnopleure and of the somatopleure will be explained on page 55.

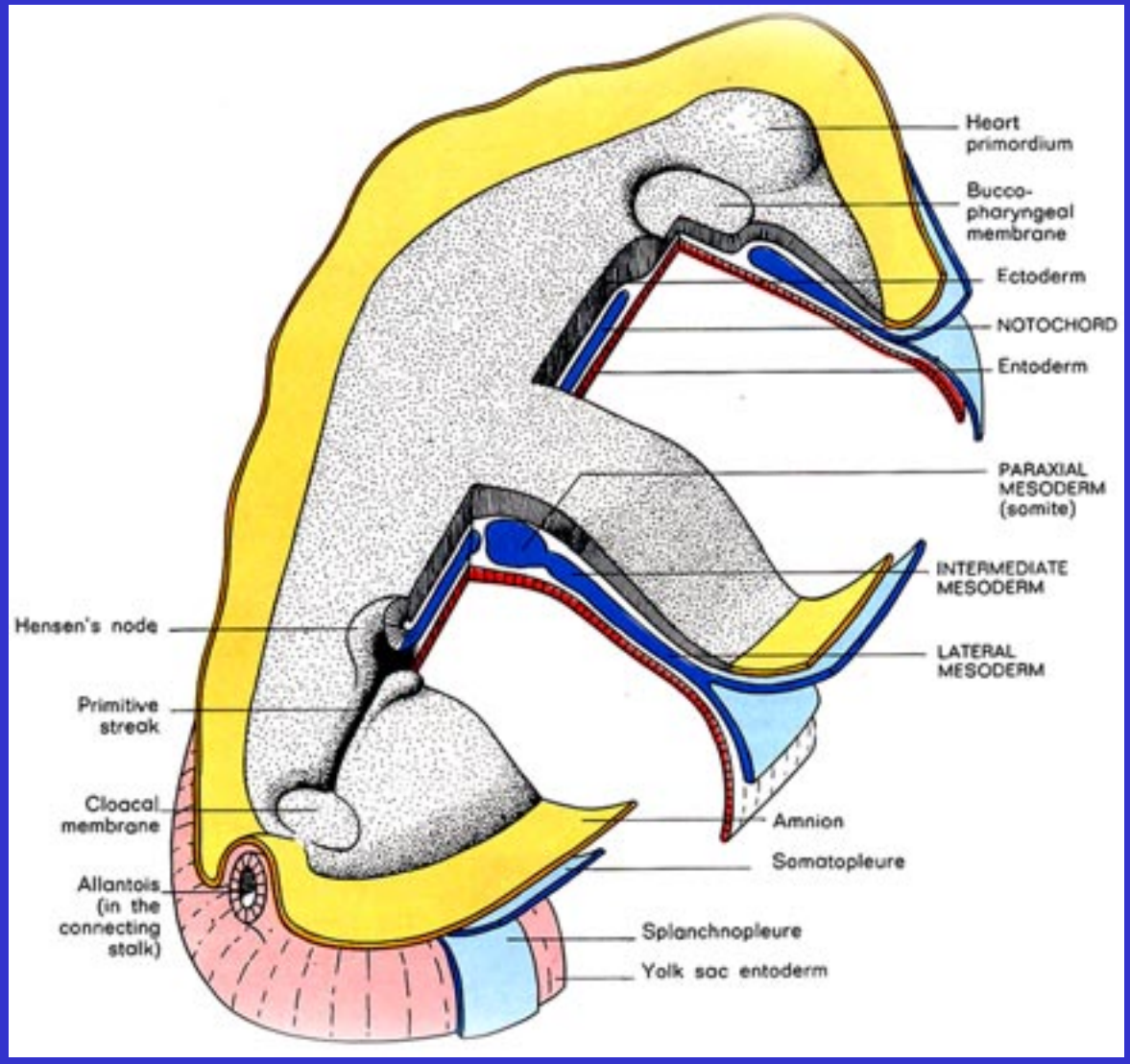
The embryonic disc at the end of the 2nd week. Diagrammatic dorsal view, with the amniotic cavity open.

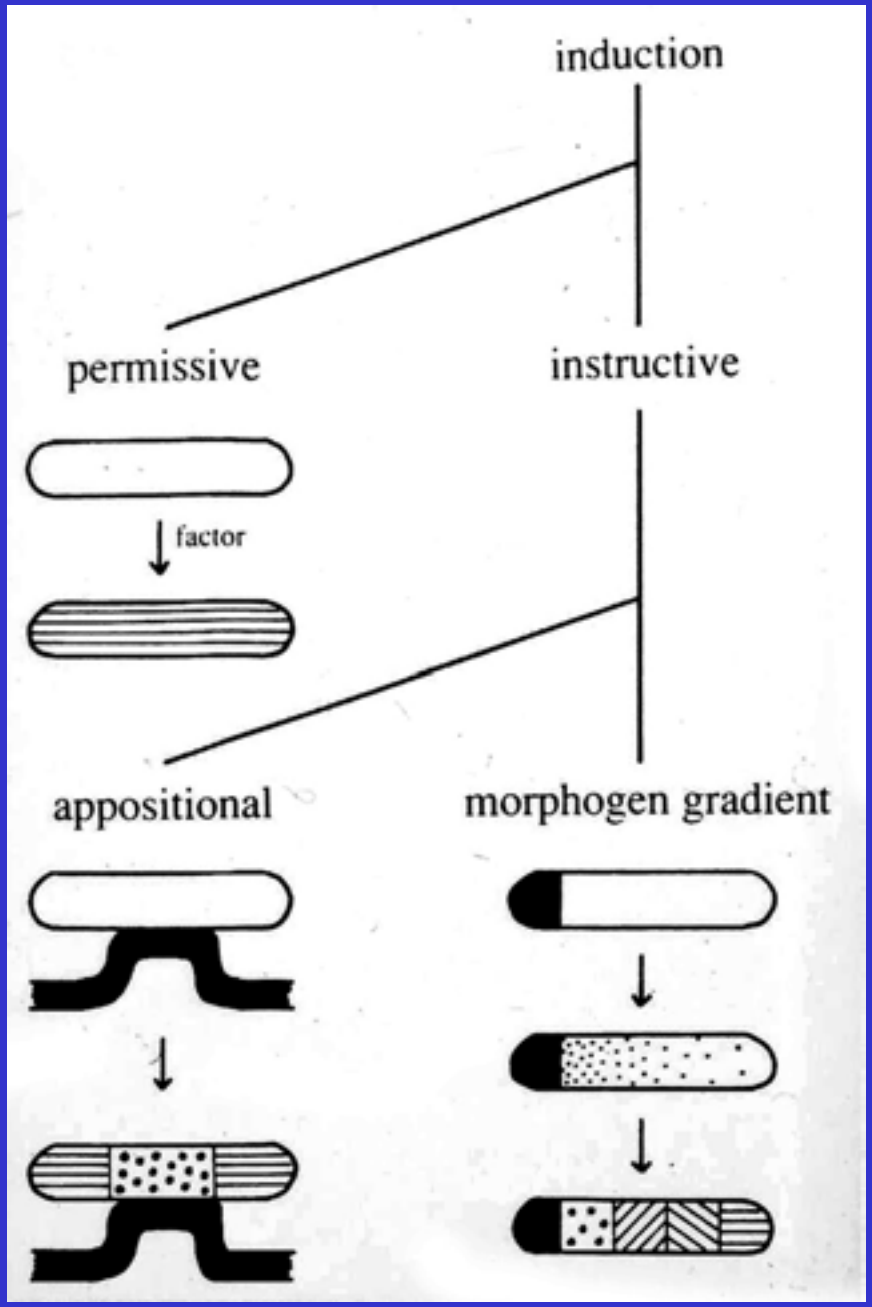

Cranial
Amnioblast
Surface ectoderm
(neurectoderm)
Mesoderm
Extraembryonic
mesoderm
Head process/notochord
Endoderm
Primitive streak
Caudal


Syncytiotrophoblast
Cytotrophoblast
Extraembryonic mesoderm
Bilaminar germ disc
Epiblast
Hypoblast
Primitive groove
Amniotic cavity
Buccopharyngeal membrane
Amniotic cavity
Definitive yolk sac
Primitive pit
Primitive node
Primitive groove
Primitive streak
Cloacal membrane
Definitive yolk sac
Extraembryonic mesoderm
15 days


Bilaminar germ disc
Primitive streak
Epiblast
Hypoblast
A
14–15 days
Endoderm
B
16 days
Mesoderm
Definitive endoderm


Epiblast
Mesoderm
Endoderm
Epiblast
Endoderm
16 days
mcg


Heart primordium
Bucco-pharyngeal membrane
Ectoderm
NOTOCHORD
Entoderm
PARAXIAL MESODERM (somite)
INTERMEDIATE MESODERM
LATERAL MESODERM
Hensen's node
Primitive streak
Cloacal membrane
Allantois (in the connecting stalk)
Amnion
Somatopleure
Splanchnopleure
Yolk sac entoderm


induction
permissive
instructive
factor
appositional
morphogen gradient

End of lecture:

Gamete production and fertilization

Cleavage divisions: setting aside embryonic vs. extraembryonic cells

Initial stages of implantation and formation of extraembryonic spaces.

Gastrulation: from whence you migrate determines your fate. Formation of 3 germ layers.

Introduction to inductive processes.