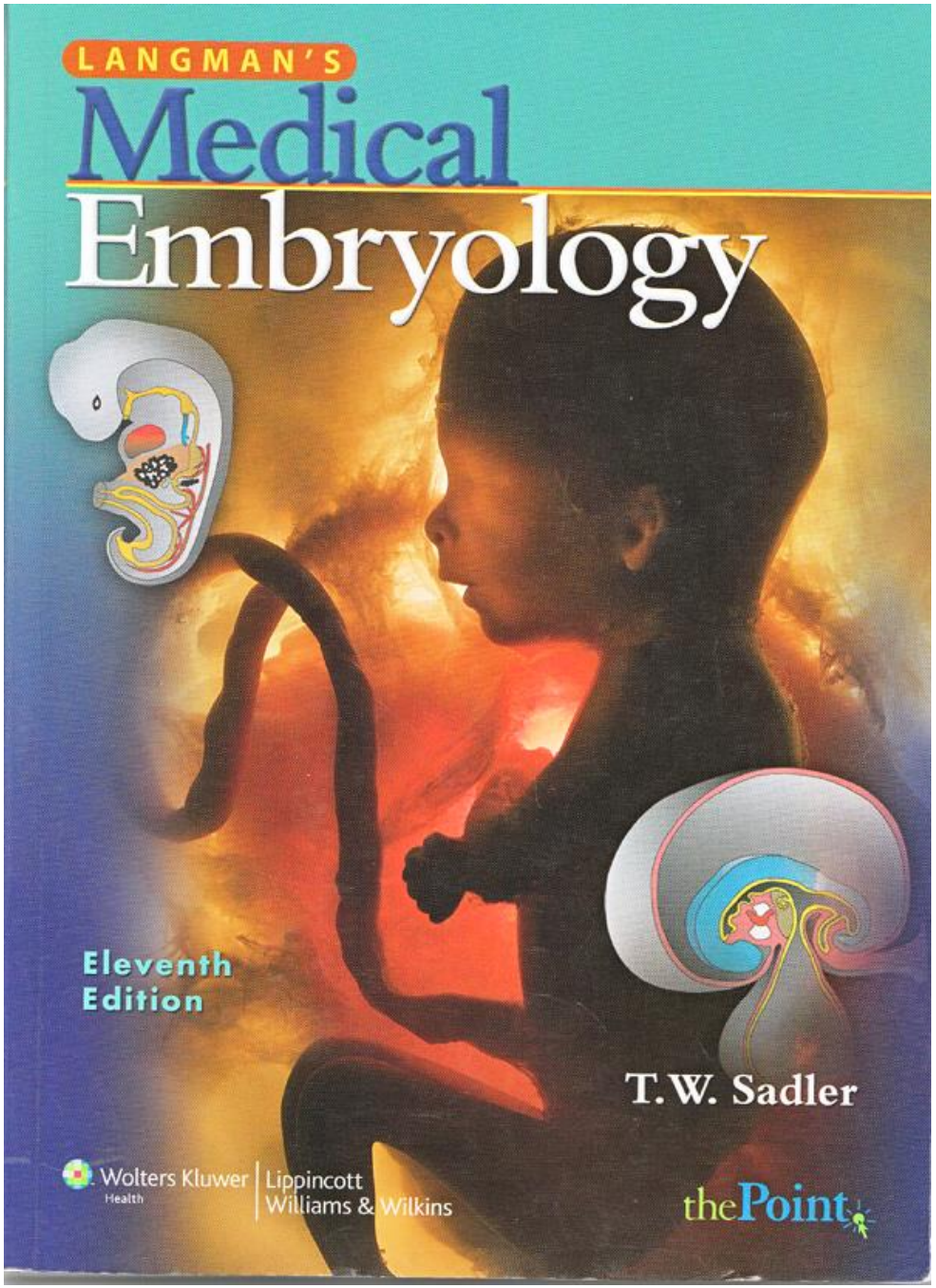


Embryology lab 1

Ass.Lec. Sada AL_Musawi

Textbook: ***Langmans's Medical Embryology, 11th ed.***

Follicle Maturation and Ovulation

Oocytes

~2 million at birth

~40,000 at puberty

~400 ovulated over lifetime

Leutinizing Hormone surge (from pituitary gland) causes changes in tissues and within follicle:

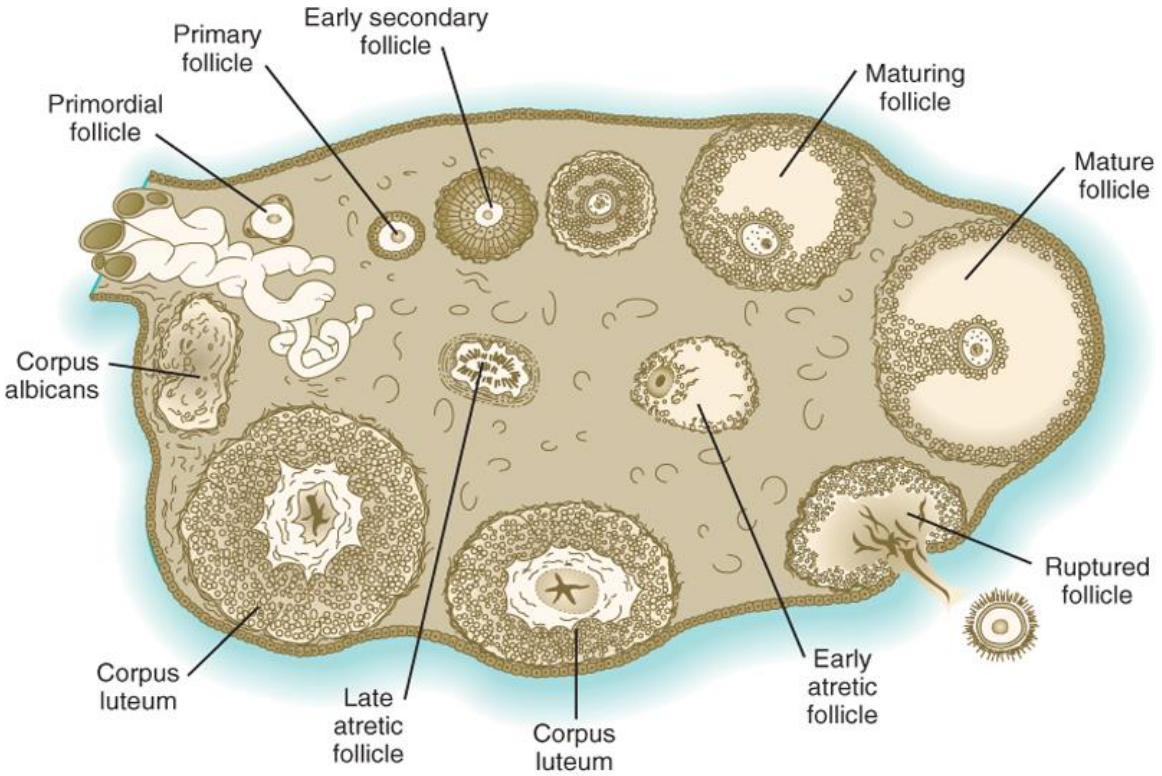
- Swelling within follicle due to increased hyaluronan
- Matrix metalloproteinases degrade surrounding tissue causing rupture of follicle

Egg and surrounding cells (corona radiata) ejected into peritoneum

Corona radiata provides bulk to facilitate capture of egg

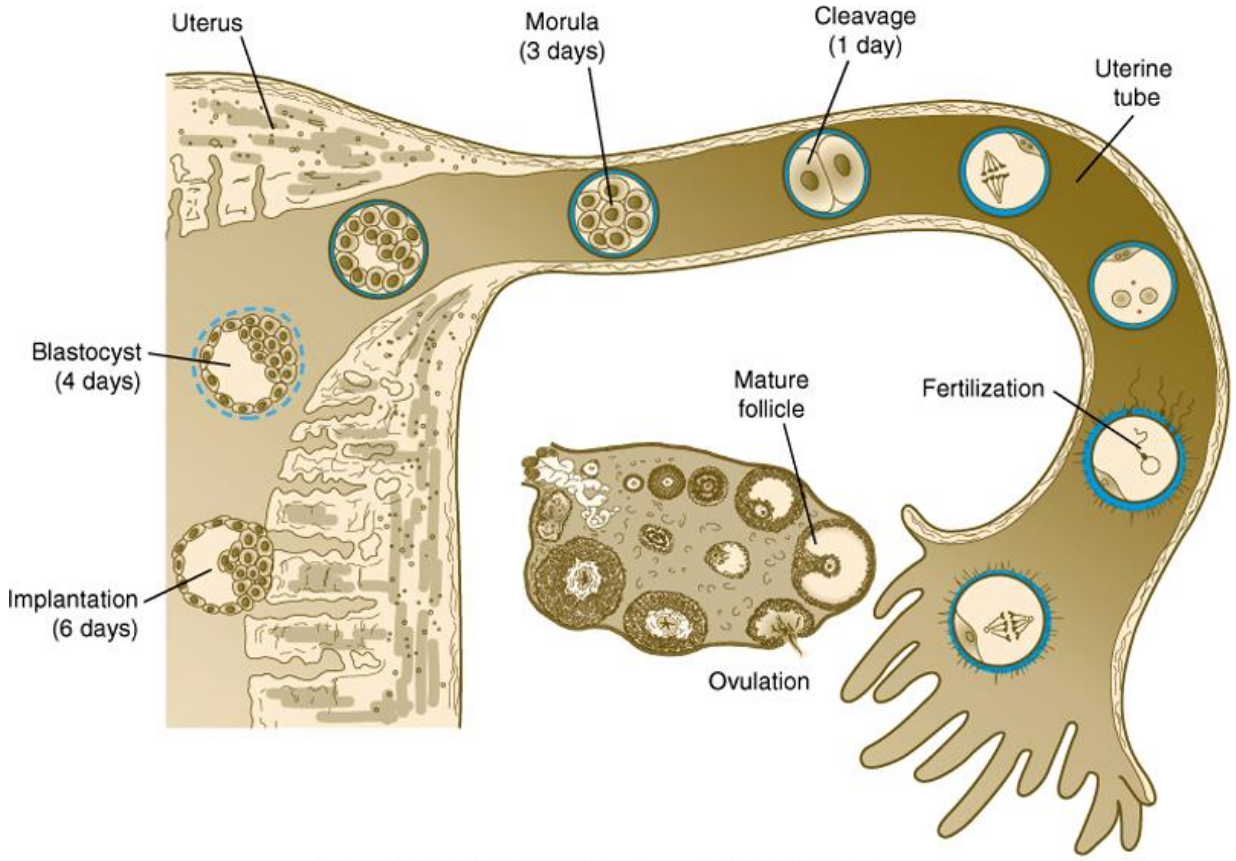
.

Ass.Lec. Sada AL_Musawi



The egg (and corona radiata) at ovulation

Transport through the oviduct



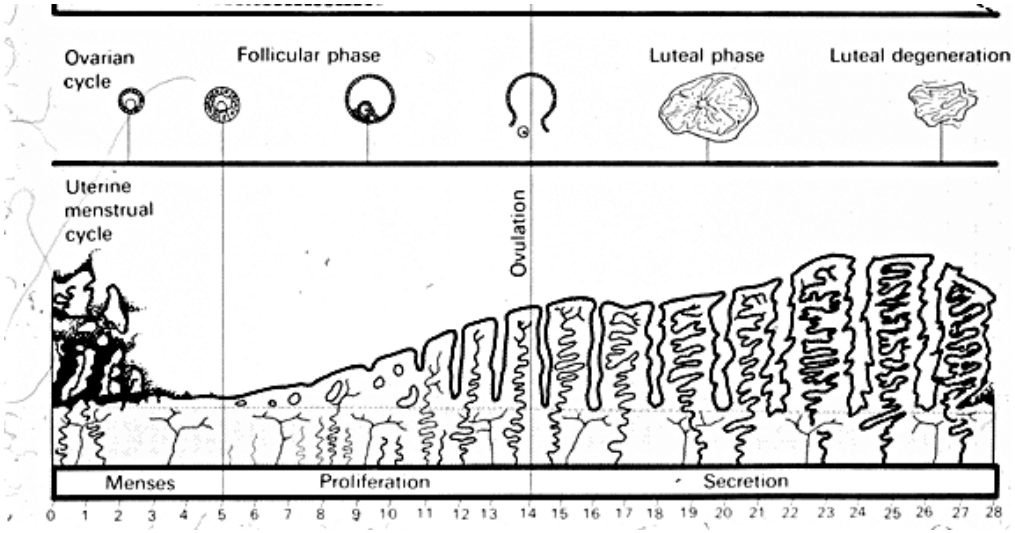
At around the midpoint of the menstrual cycle (~day 14), a single egg is **ovulated** and swept into the oviduct.

Fertilization usually occurs in the **ampulla** of the oviduct within 24 hrs. of ovulation.

Series of cleavage and differentiation events results in the formation of a **blastocyst** by the 4th embryonic day.

- **Inner cell mass** generates **embryonic tissues**
- Outer **trophectoderm** generates **placental tissues**

Implantation into the uterine wall occurs ~6th embryonic day (day 20 of the menstrual cycle)



Timing of pregnancy

Embryologists

Fertilization age: moment of fertilization is dO

Division of pregnancy corresponding to development:

- 0-3 weeks –early development
- 3-8 weeks –embryonic period (organogenesis)
- 8 wks-term –fetal period

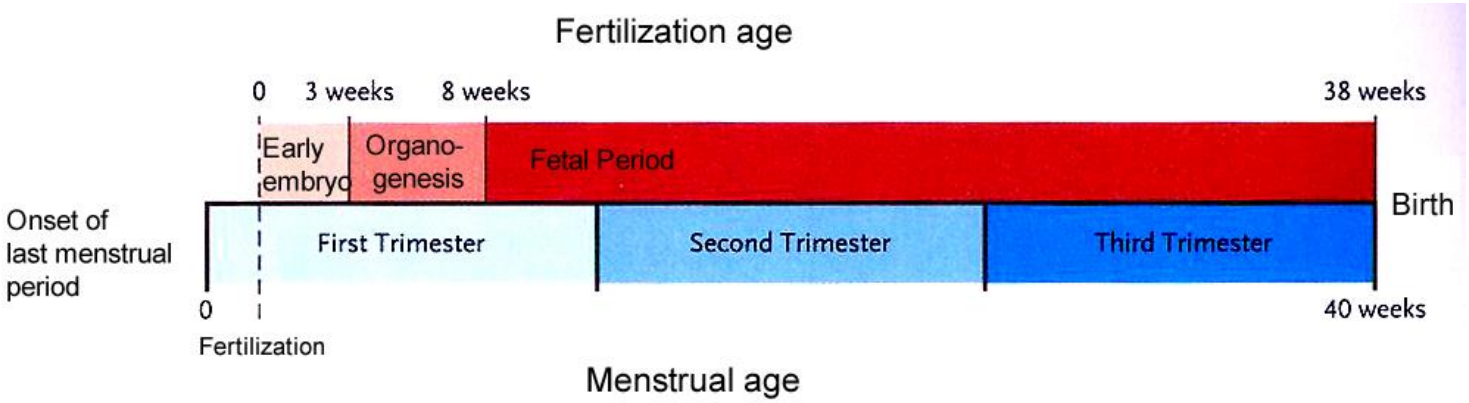
Total gestation time = 38 weeks

Clinicians

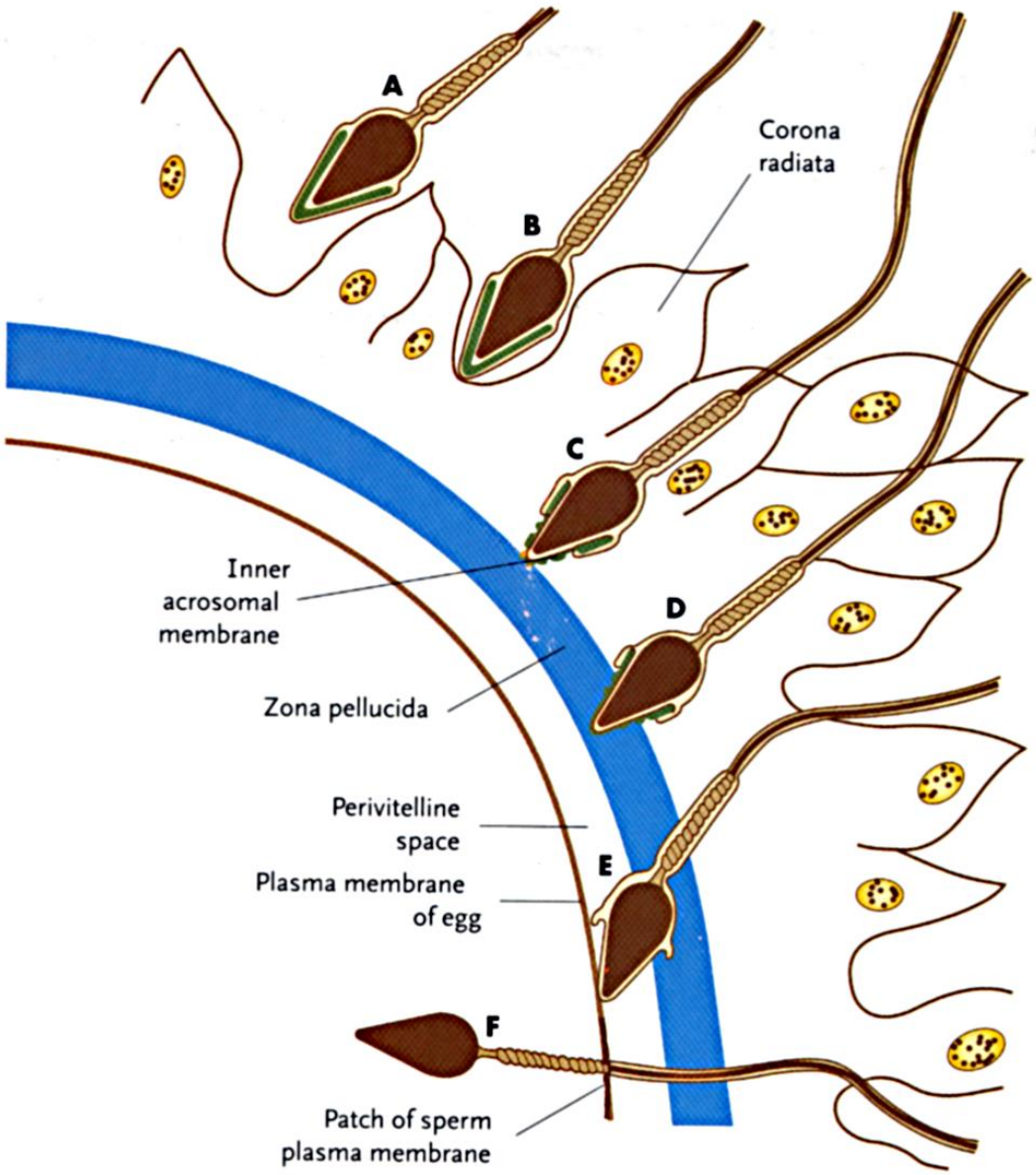
Menstrual age: last menses is dO

Division of pregnancy into trimesters

Total gestation time = 40 weeks



Fertilization : is a multi-step process whereby multiple sperm bind to the corona radiata, but only a single sperm usually fertilizes the egg



1. Acrosome Rx

sperm bind to ZP proteins in the zona pellucida; this initiates the release of enzymes from the sperm allowing it to burrow through the zona pellucida.

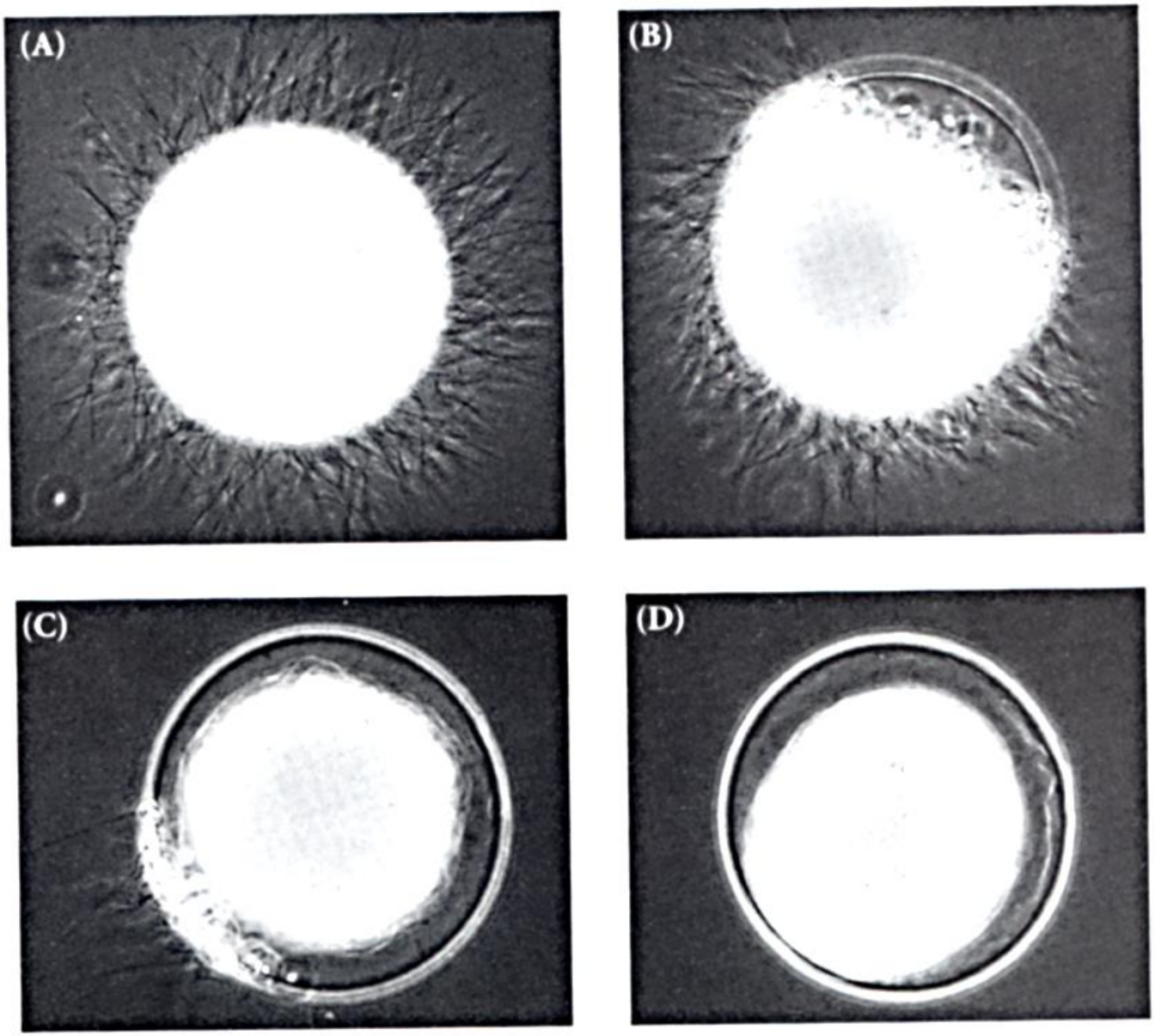
2. Zona Rx

binding of the sperm and egg plasma membranes initiates Ca+ influx into the egg and release of **cortical granules** from the egg that block other sperm from fertilizing the egg.

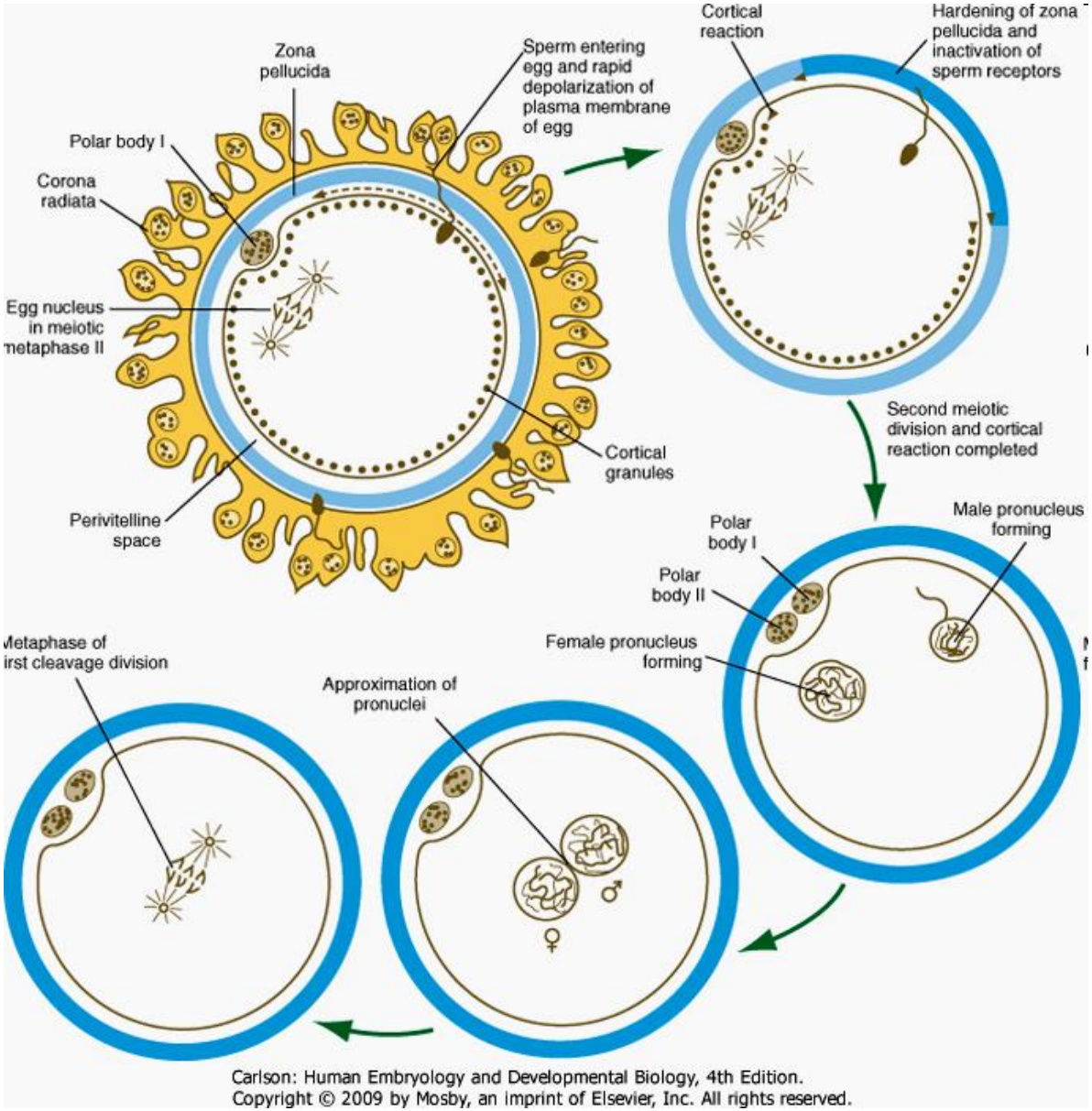
This so-called cortical reaction prevents other sperm from fertilizing the egg (aka “polyspermy”)

Cortical granule enzymes digest ZP proteins so other sperm can no longer bind.

Hyaluronic acid and other proteoglycans are also released that become hydrated and swell, thus pushing the other sperm away.



Fertilization



Meiosis II complete

Formation of male and female pronuclei

Decondensation of male chromosomes

Fusion of pronuclei

Zygote

Week 1: days 1-6

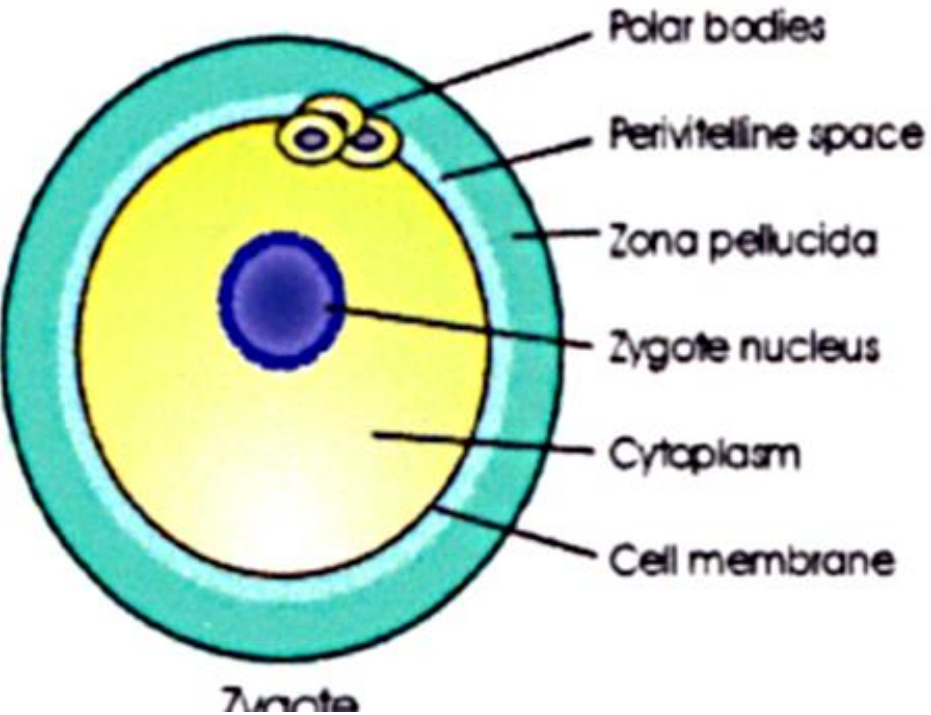
- Fertilization, day 1
- Cleavage, day 2-3
- Compaction, day 3
- Formation of blastocyst, day 4
- Ends with implantation, day 6

Fertilized egg (zygote)

Fertilized egg
2 polar bodies
2 pronuclei

Day 1
0.1 mm

Cleavage



Cleavage = cell division

Goals: grow unicellular zygote to multicellular embryo.
Divisions are slow: 12 - 24h ea
No growth of the embryo- stays at ~100 um in diameter
Divisions are not synchronous

Cleavage begins about 24h after pronuclear fusion

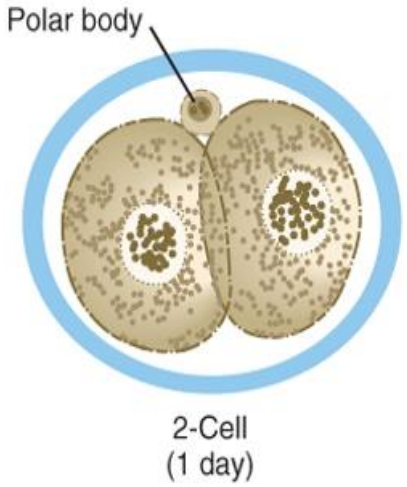
2 Cell Stage

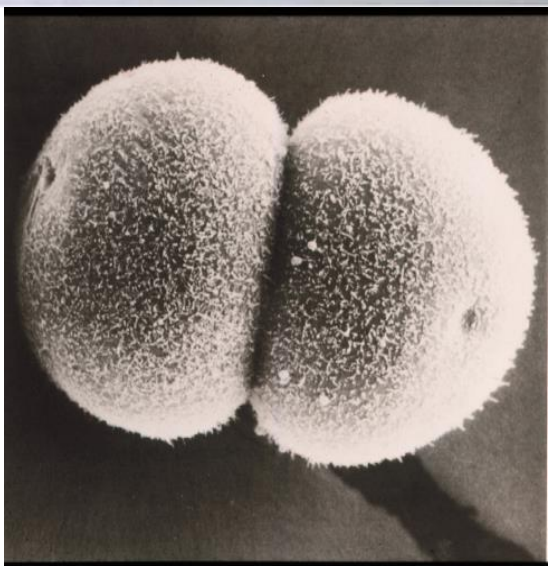
Individual cells = blastomeres

Mitotic divisions maintain
2N (diploid) complement

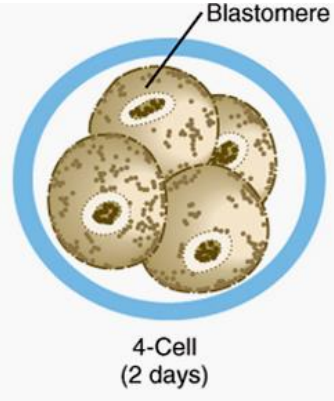
Cells become <u>smaller</u>

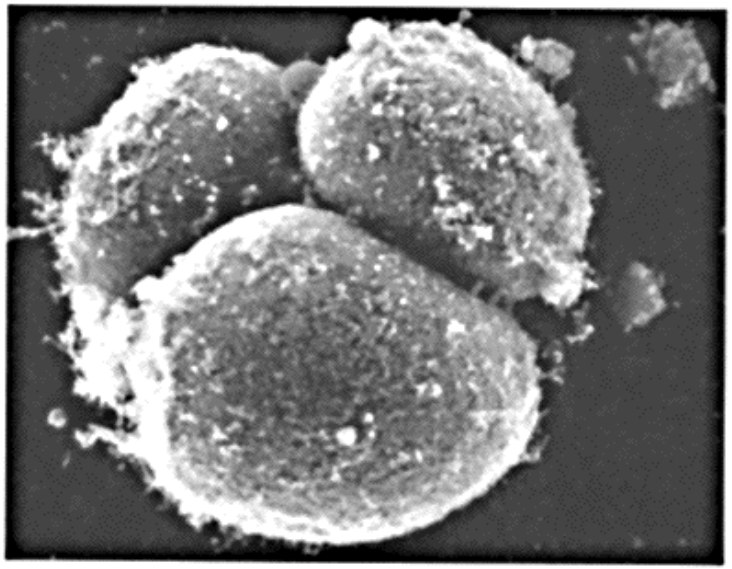
Blastomeres are equivalent (aka totipotent).





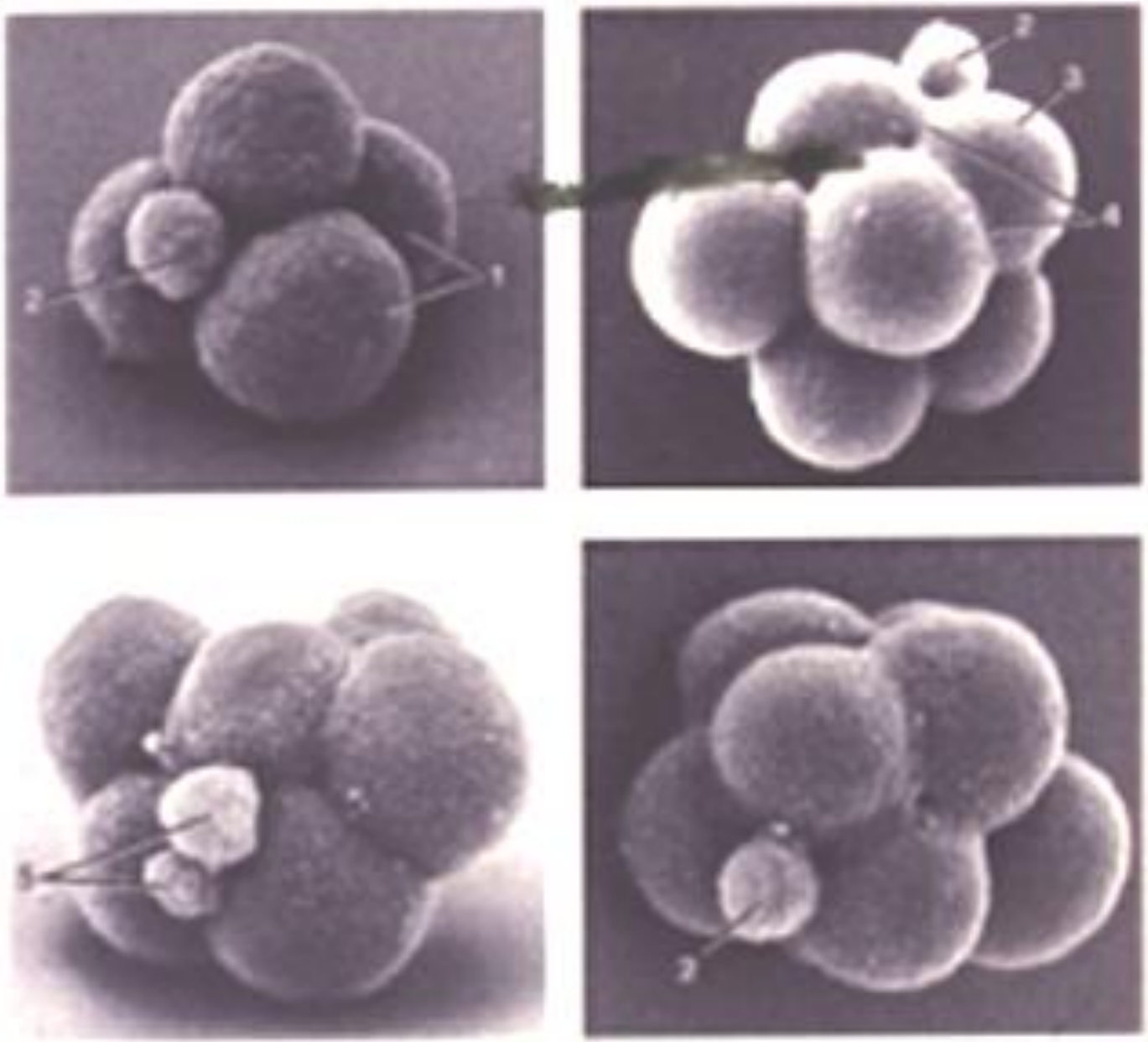
4 cell; second cleavage





4 equivalent blastomeres

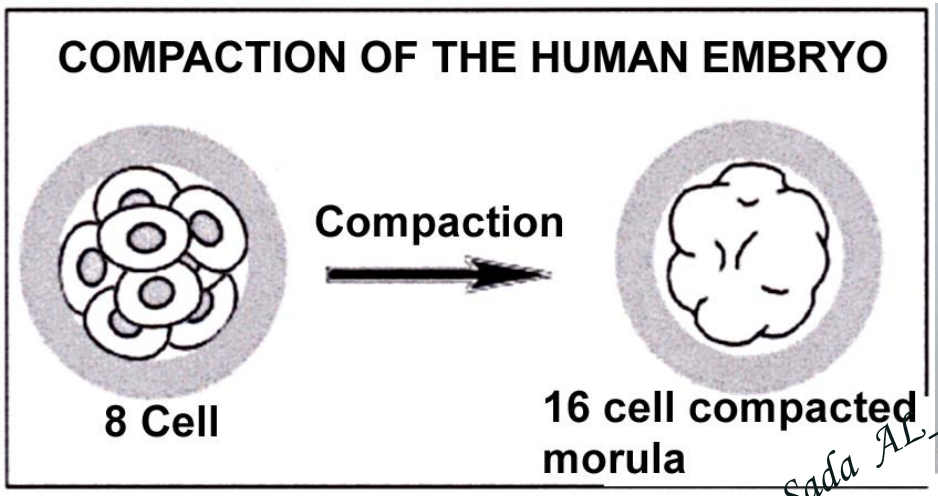
Still in zona pellucida

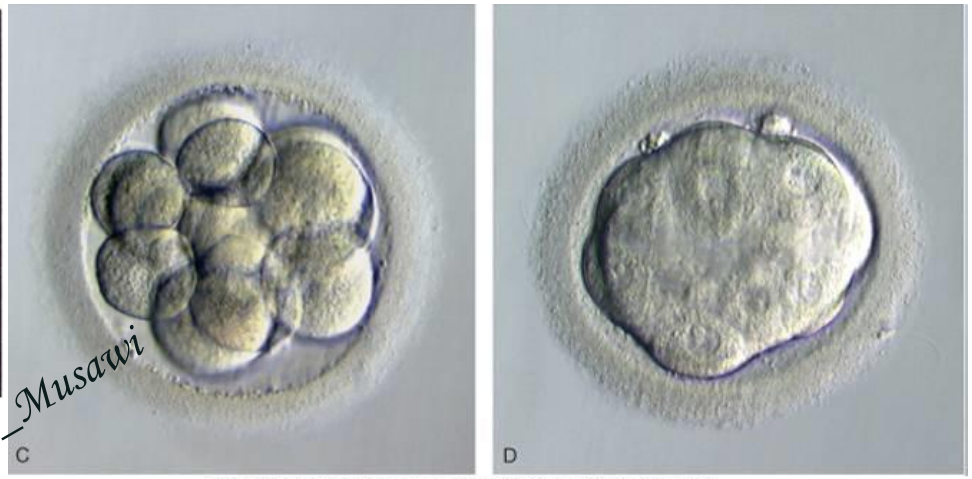


8 Cell; third cleavage

Blastomeres still equivalent

Embryo undergoes **compaction** after 8-cell stage: first differentiation of embryonic lineages



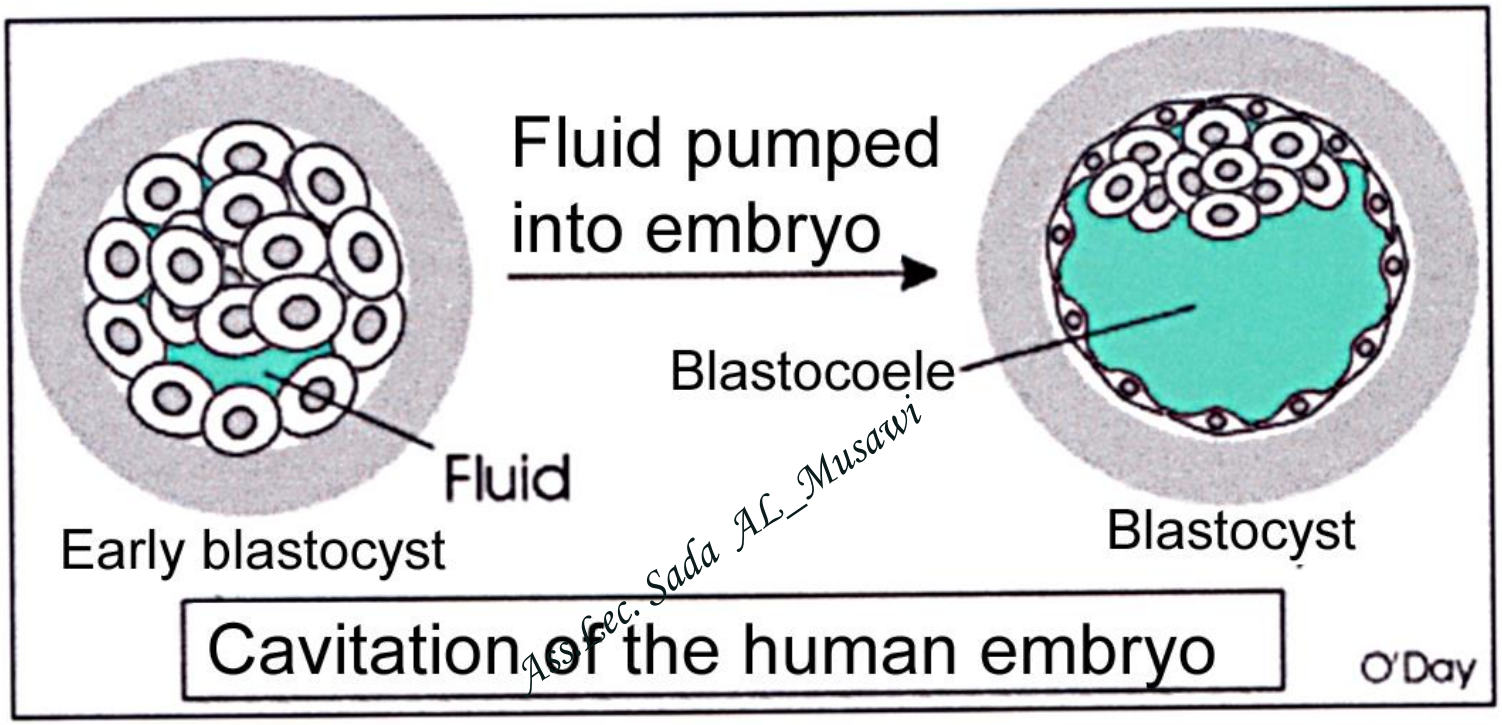


Caused by increased cell-cell adhesion

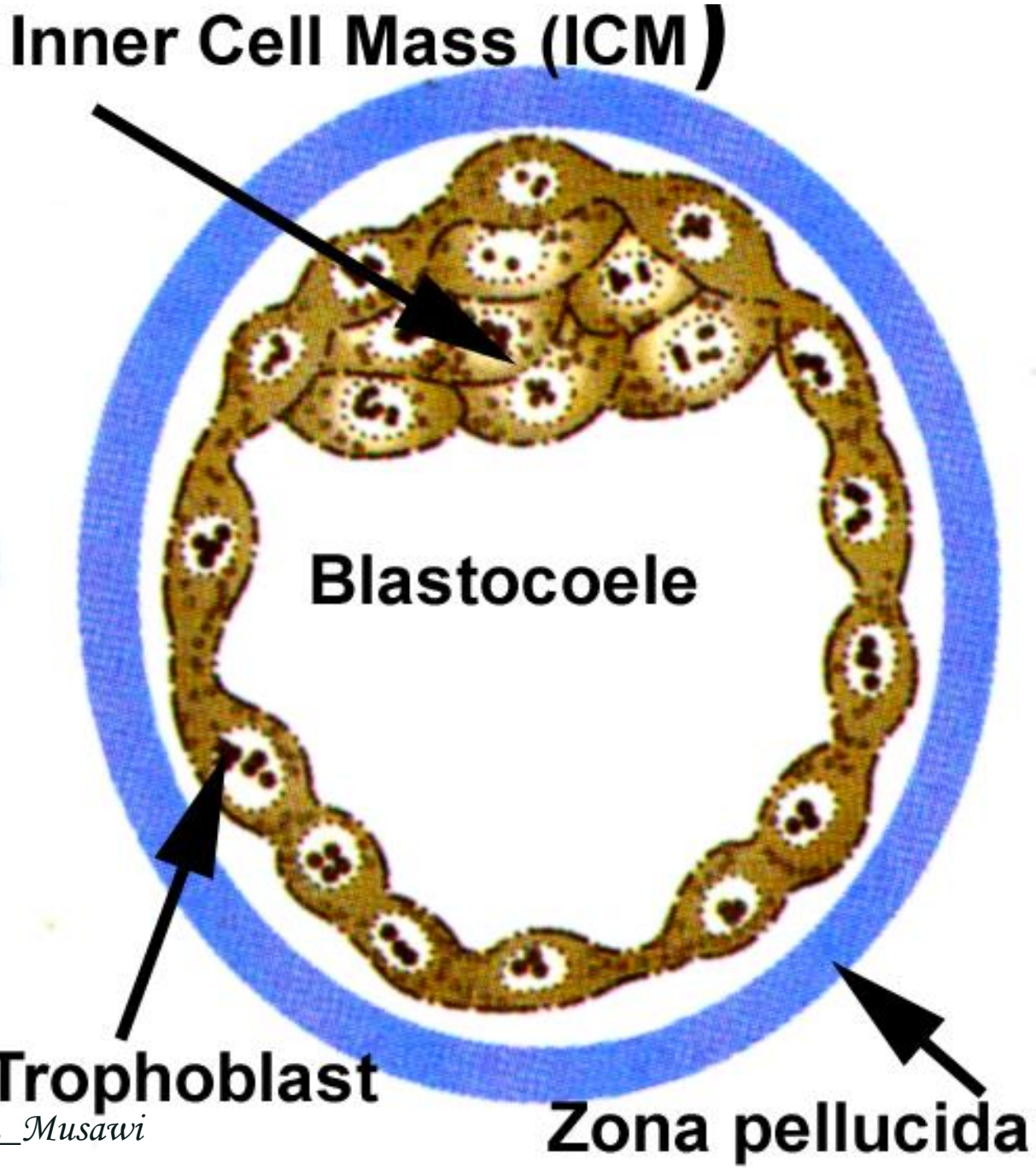
Cells that are forced to the outside of the morula are destined to become **trophoblast**--cells that will form **placenta**

The **inner cells** will form the embryo proper and are called the **inner cell mass** (ICM).

Formation of the blastocyst



Sodium channels appear on the surface of the outer trophoblast cells; sodium and water are pumped into the forming blastocoele. Note that the embryo is still contained in the zona pellucida.


Inner Cell Mass (ICM)
Blastocoele
Trophoblast
Zona pellucida

Early blastocyst
Day 3

Later blastocyst
Day 5