veterinary
EMBRYOLOGY

cleavage and blastulation

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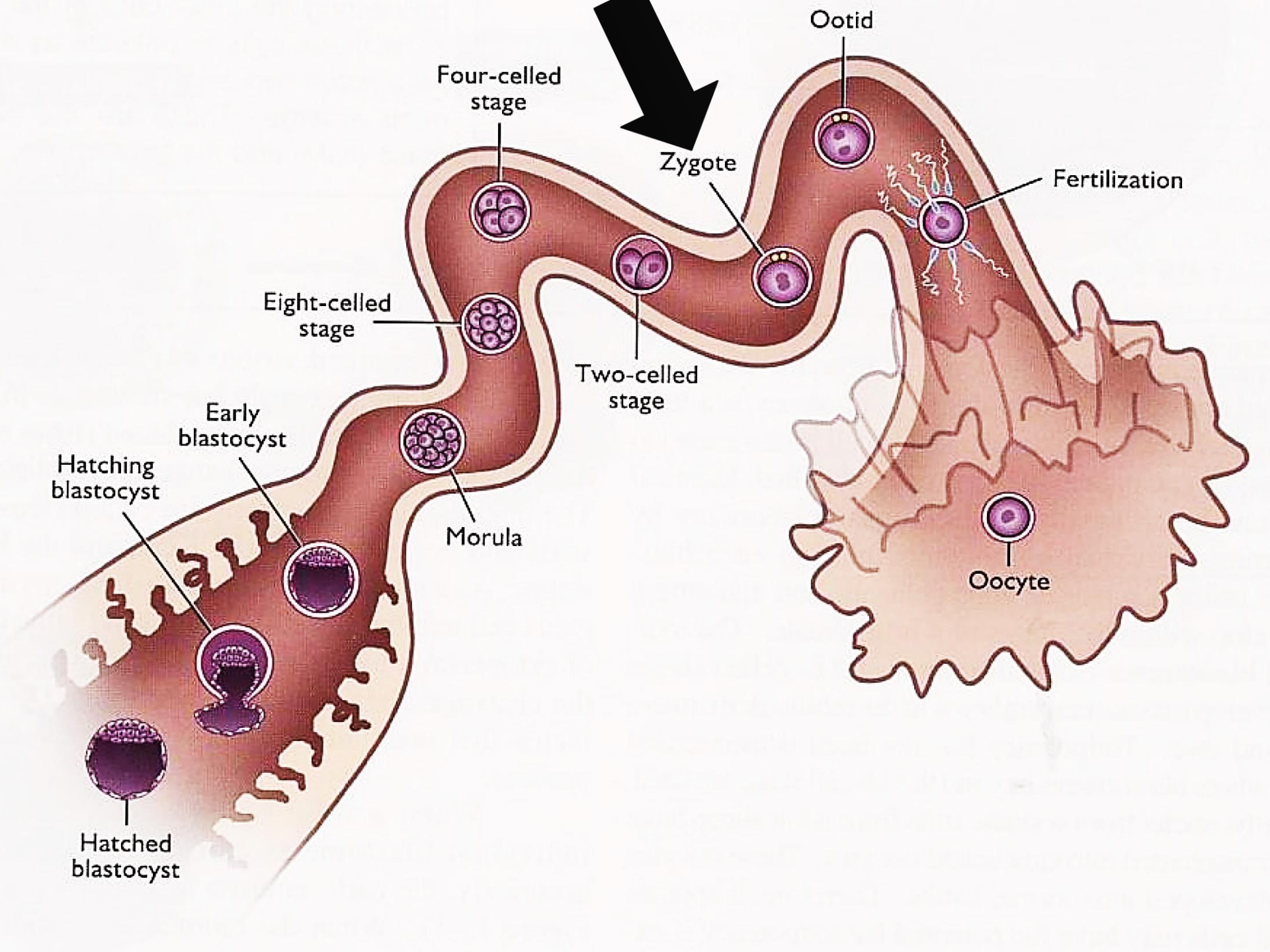
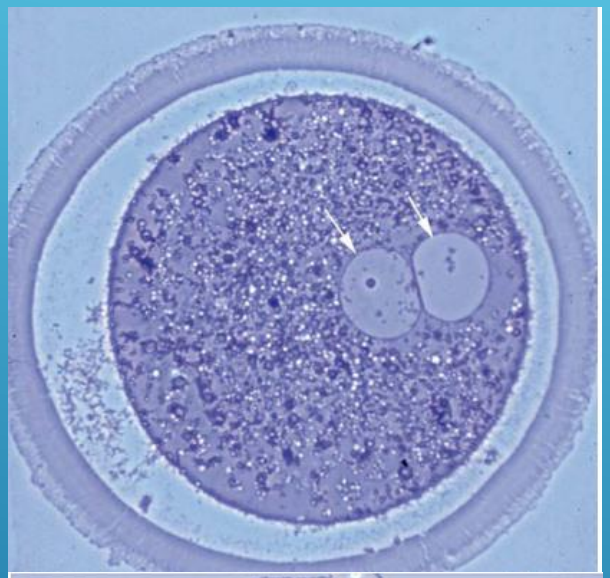
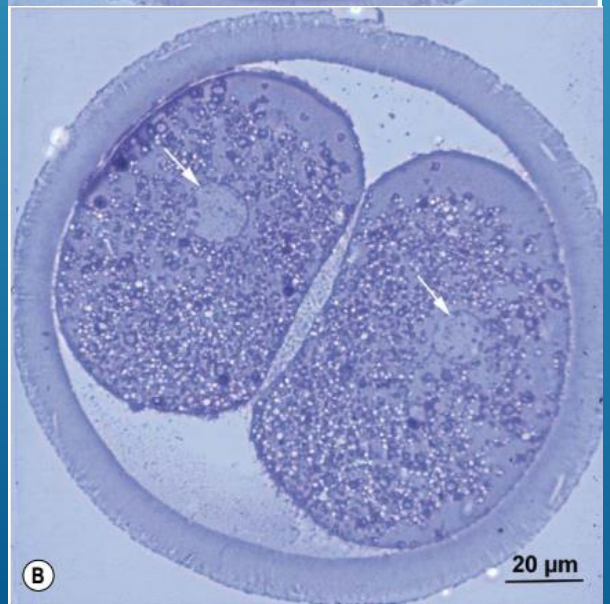
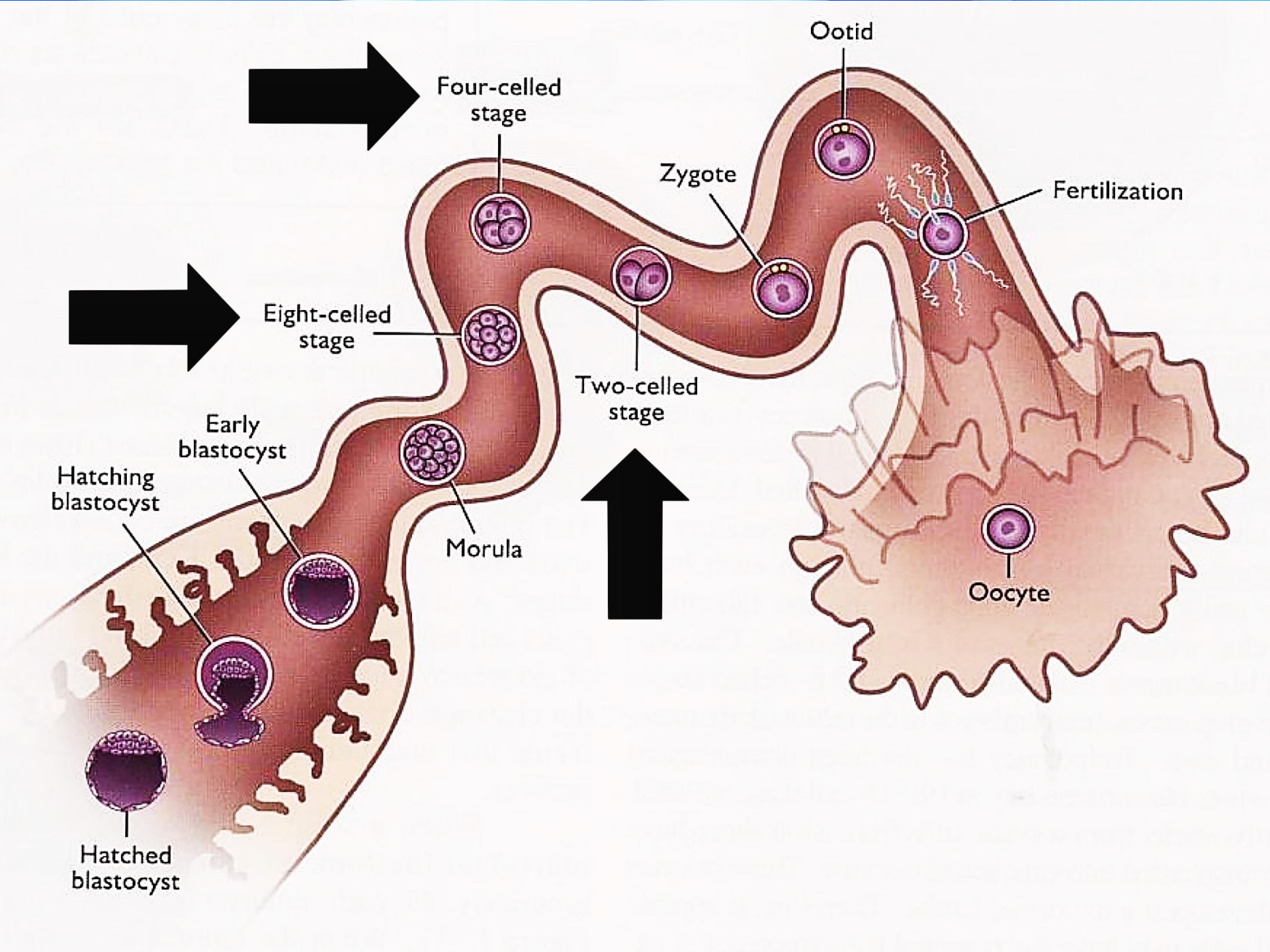

Ootid
Four-celled stage
Zygote
Fertilization
Eight-celled stage
Two-celled stage
Early blastocyst
Hatching blastocyst
Morula
Oocyte
Hatched blastocyst

cleavage





- The series of mitotic divisions of the early embryo within the confines of the zona pellucida giving rise to daughter cells, called **blastomeres.**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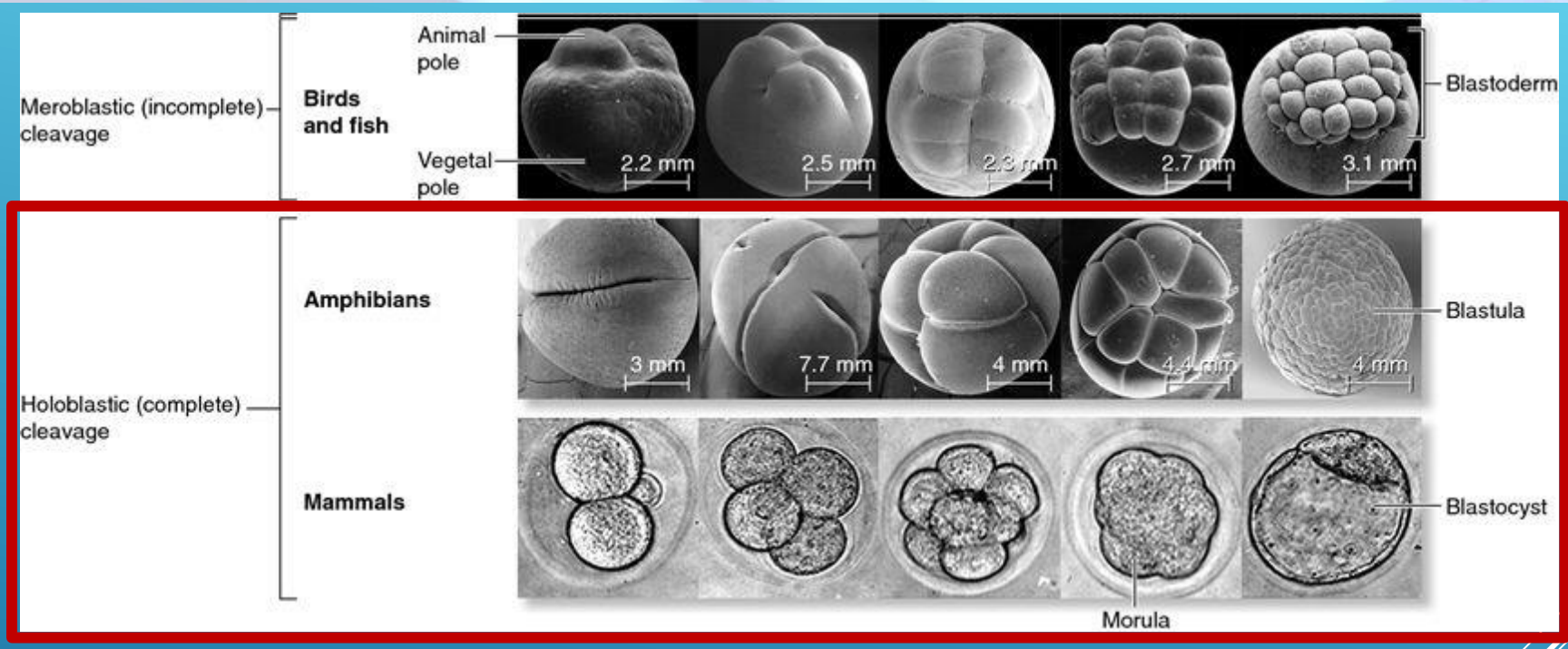
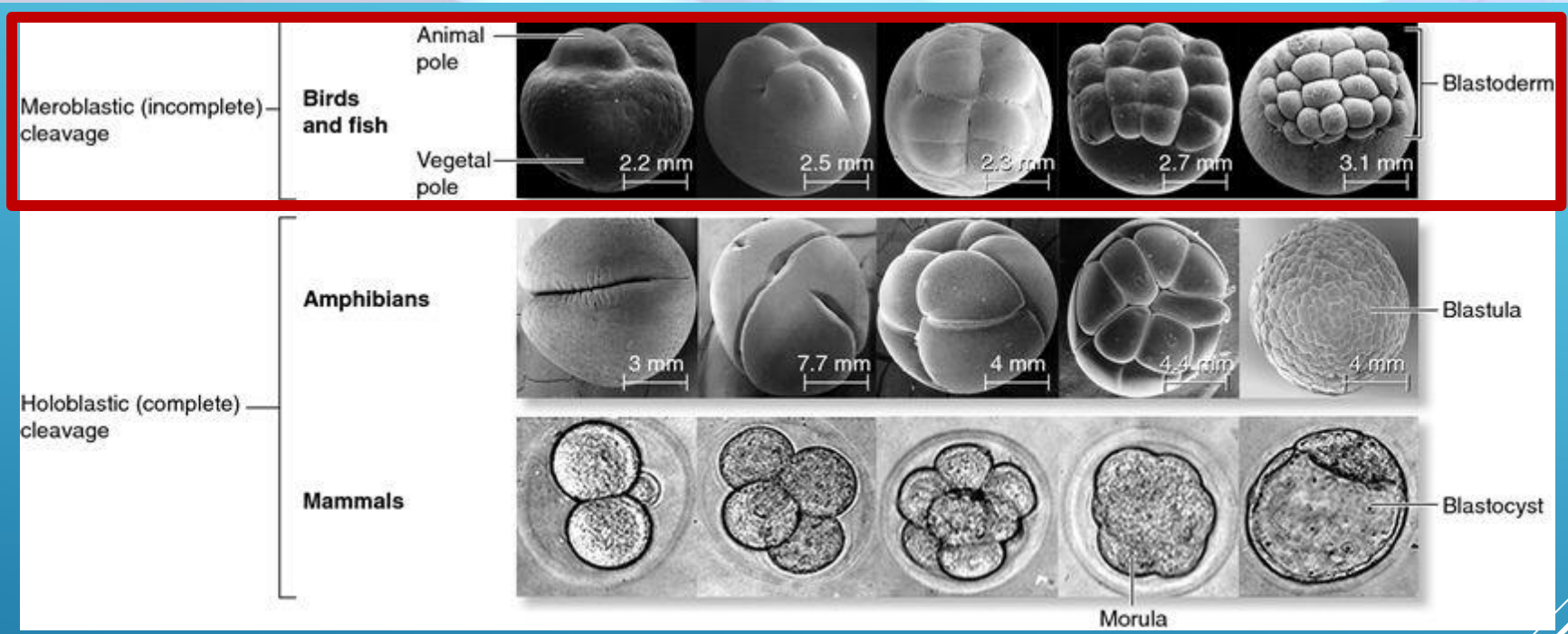
Types of cleavage



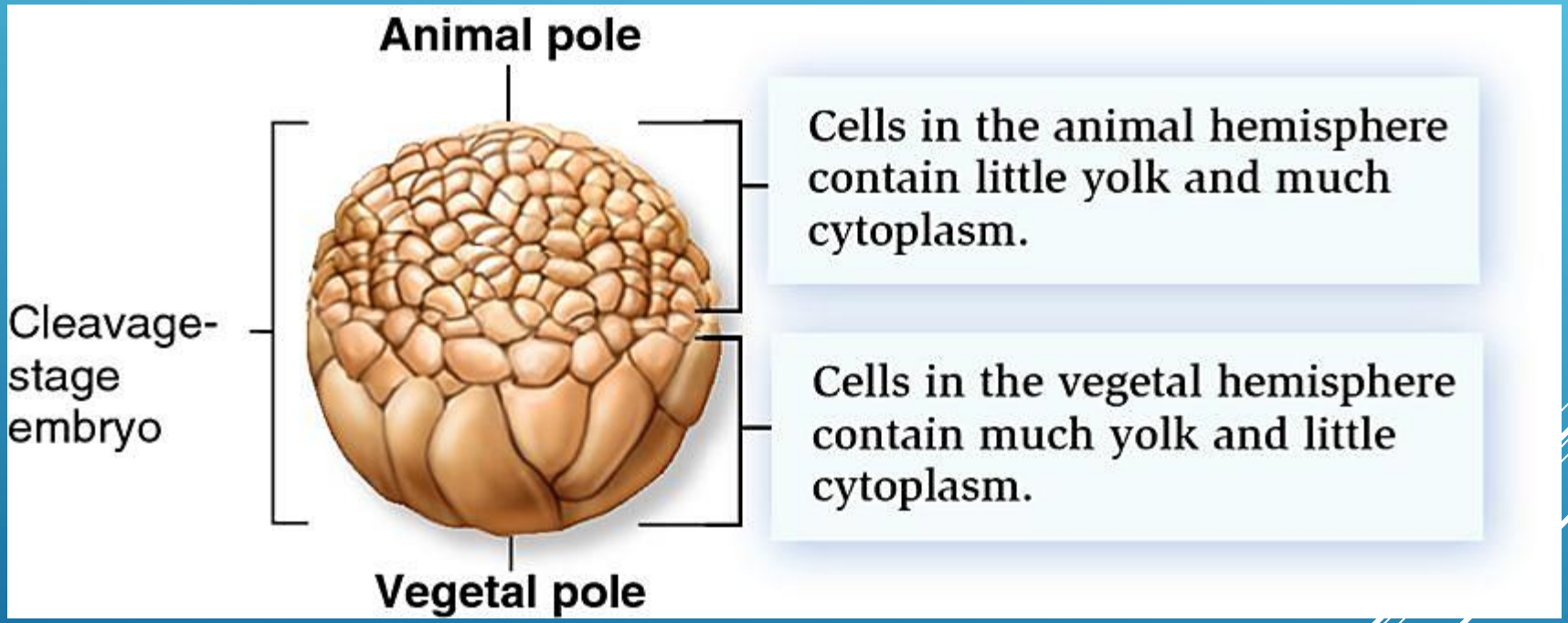
- **HOLOBLASTIC CLEAVAGE**
  - Complete cleavage
  - The type of cleavage during which the whole of the egg becomes subdivided into blastomeres

Types of cleavage



- **MEROBLASTIC CLEAVAGE**
  - Incomplete cleavage
  - The type of cleavage in which only a part of the egg is subdivided into blastomeres

Egg cytoplasm



Types of egg

Based on the amount of yolk

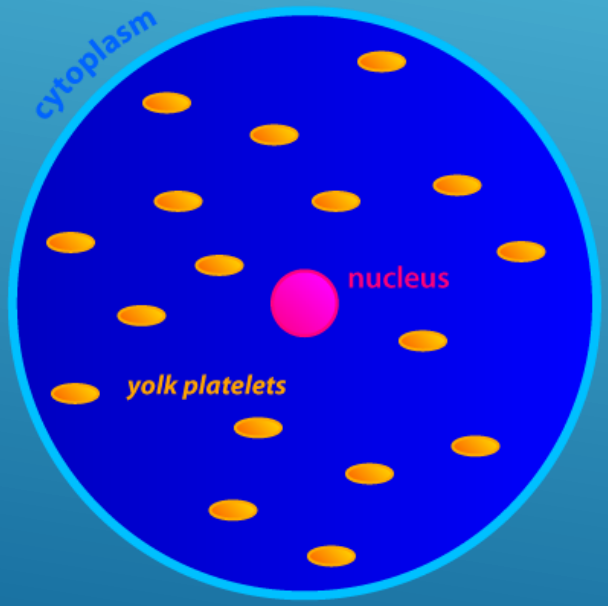
- Oligolecithal
- Mesolecithal
- Polylecithal

Based on the distribution of yolk

- Isolecithal
- Telolecithal
- Centrolecithal

Amount of yolk

- **MIOLECITHAL (OLIGOLECITHAL)**
  - Ovum with very small amount of yolk



Amount of yolk

- **MEDIALECITHAL (MESOLECITHAL)**
  - Ovum with a moderate amount of yolk

Amount of yolk

- **MEGALECITHAL (POLYLECITHAL)**
  - Ovum with huge amount of yolk

Yolk distribution

- **ISOLECITHAL**
  - Ovum with evenly distributed yolk

Yolk distribution

- **CENTROLECITHAL**
  - Ovum in which the yolk is concentrated in the interior of the egg and the cytoplasm is distributed as a thin coat on the external surface

Yolk distribution

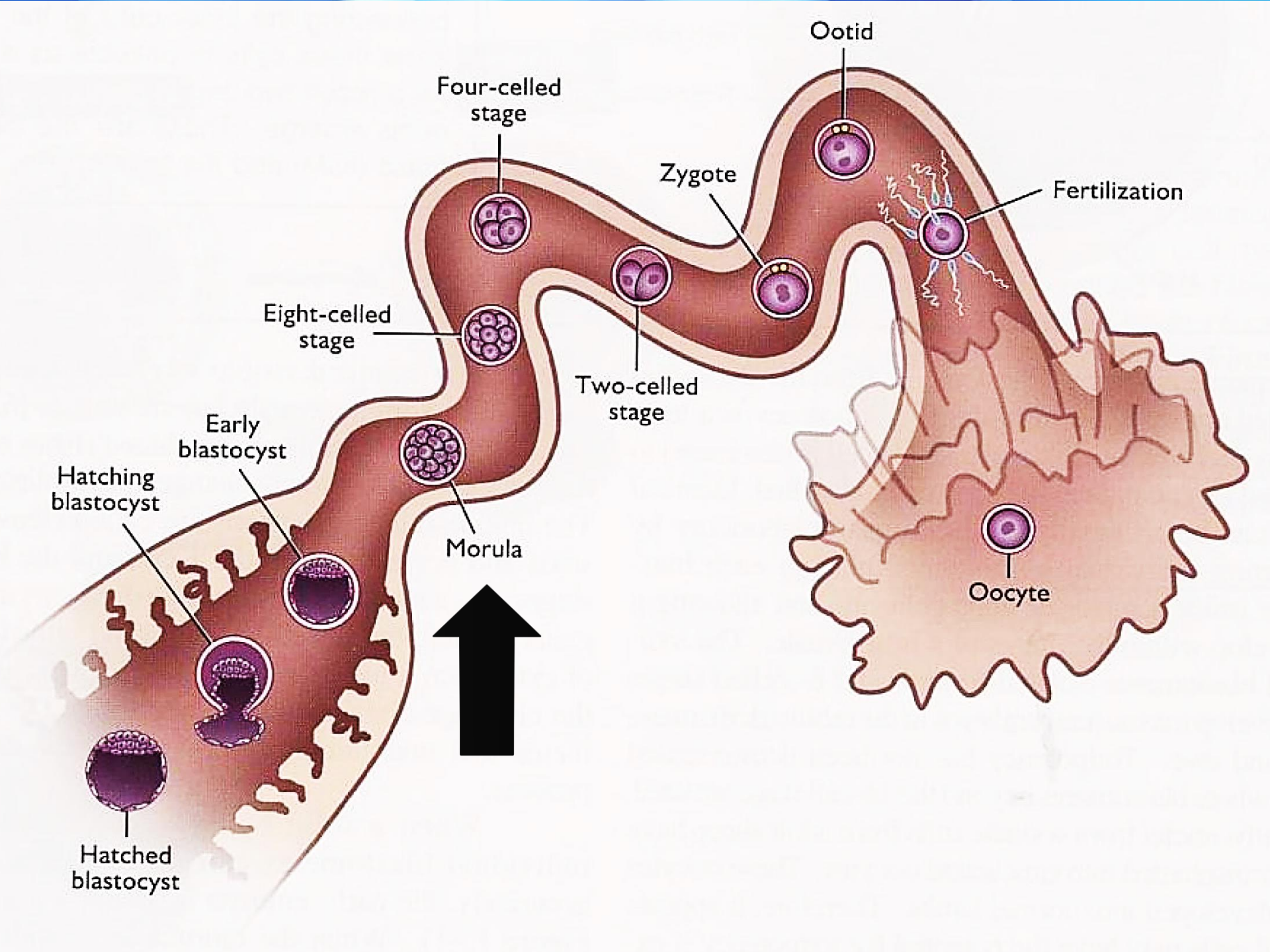
- **TELOLECITHAL**
  - Ovum in which the amount of yolk present displaces the embryo-forming cytoplasm into a small area at the animal pole

CLEAVAGE PATTERNS

Type of Egg	Type of Cleavage	Animals
Isolecithal/ Oligolecithal	Holoblastic	Mammals, molluscs
Mesolecithal	Holoblastic	Amphibians, some fishes
Telolecithal/ Polylecithal	Meroblastic	Avians, reptiles, most fishes
Centrolecithal	Meroblastic	Insects, arthropods

cleavage

- Compared with the usual form of mitosis, the daughter cells in cleavage become progressively smaller with each division.
- After a few cell divisions, the embryo takes the shape of a small ball of cells referred to as **morula.**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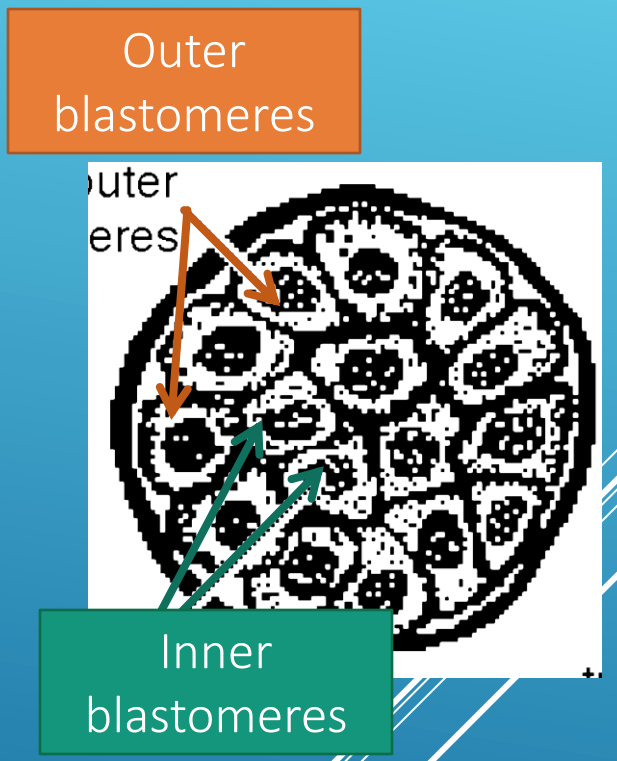
morula

- Commonly called “ball of cells”
- After the Latin name for mulberry.
- Cellular mass of the embryo occupies most of the perivitelline space

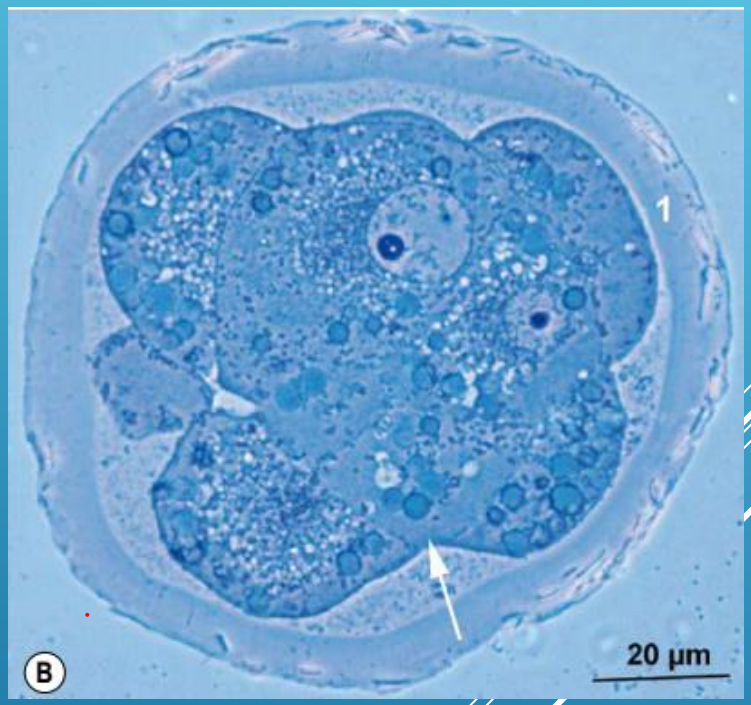
morula

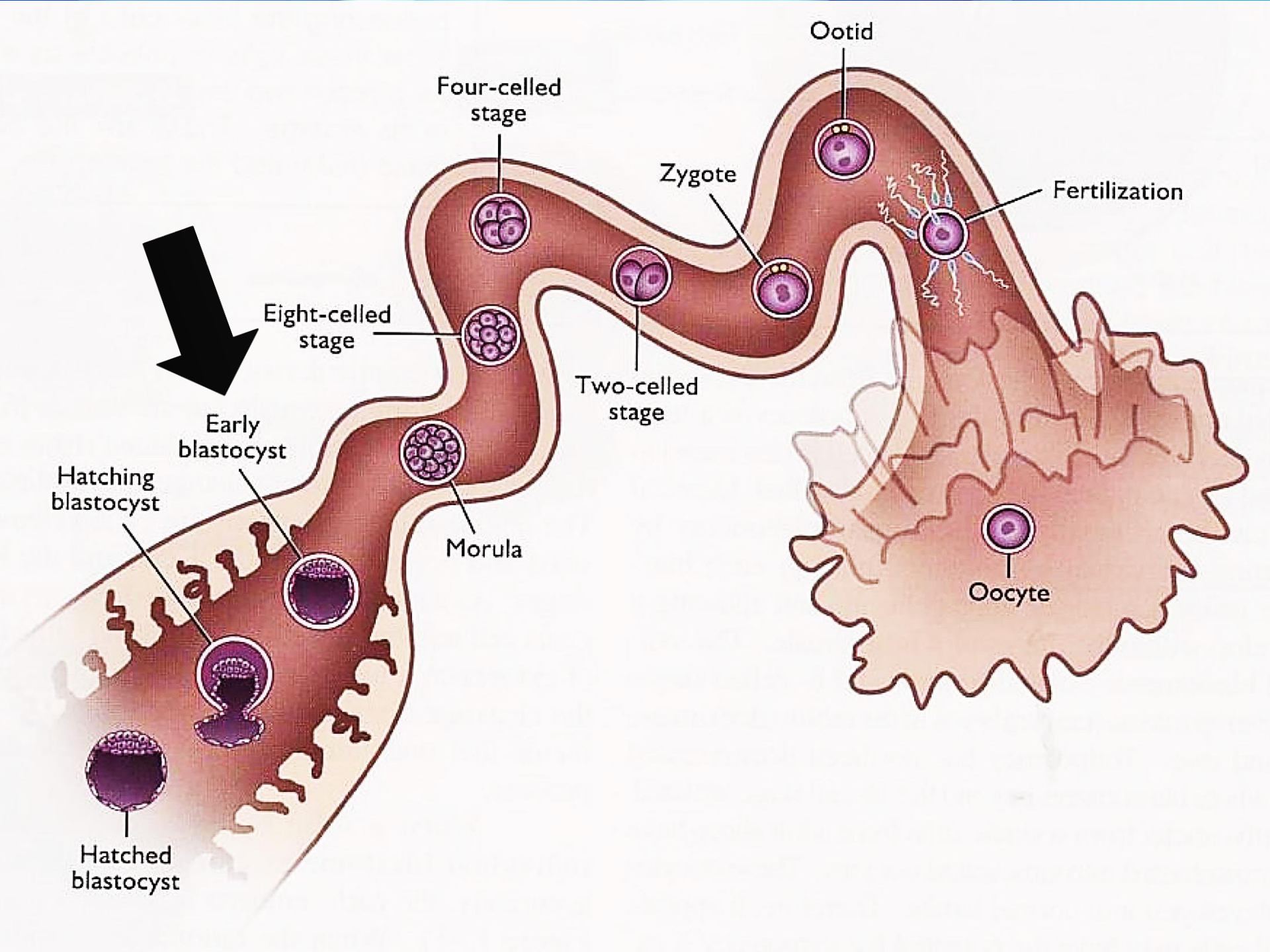
- **Outer blastomeres**
  - Form tight junctions
  - Destined to become trophoblast or trophoectoderm
- **Inner blastomeres**
  - Form gap junctions
  - Destined to become inner cell mass



COMPACTED morula

- Blastomeres coalesced forming a compact mass
- Embryo mass occupies 60 –70% of the perivitelline space which means a larger perivitelline space than in morula.

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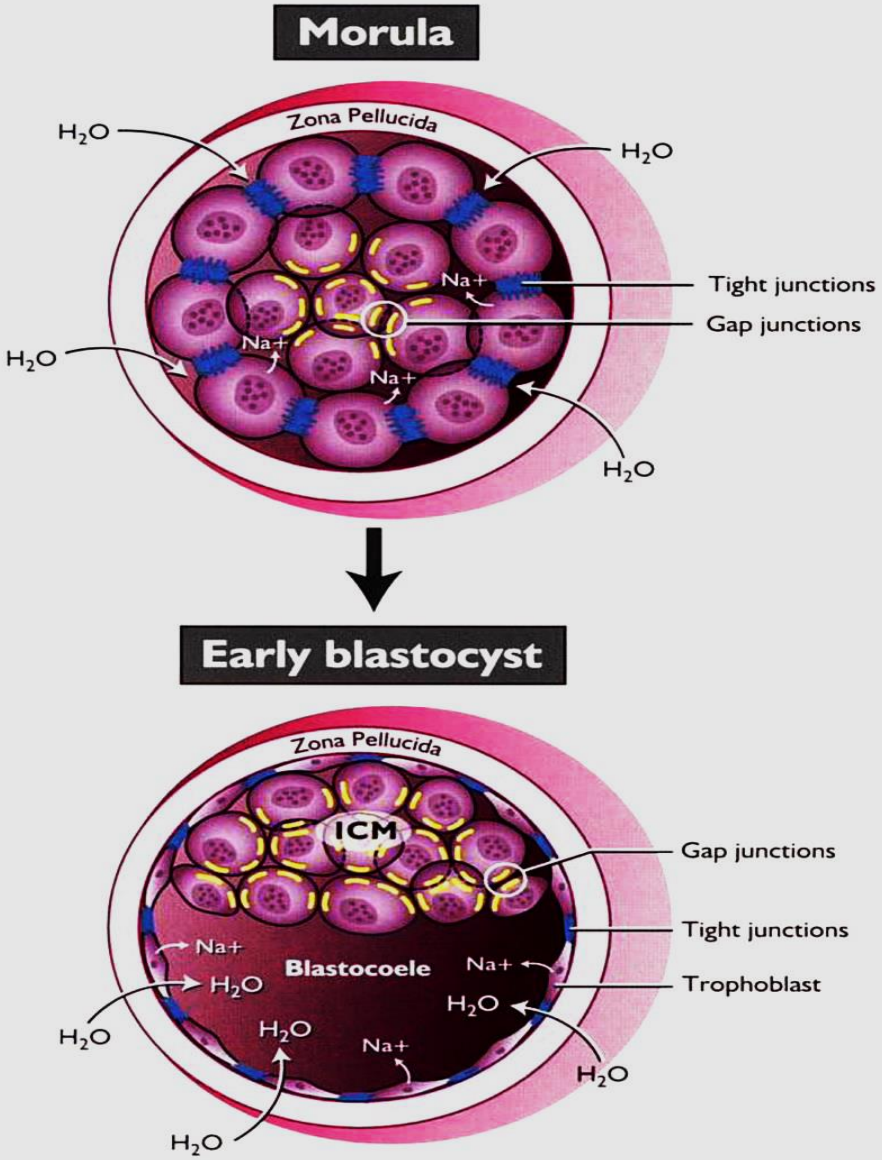


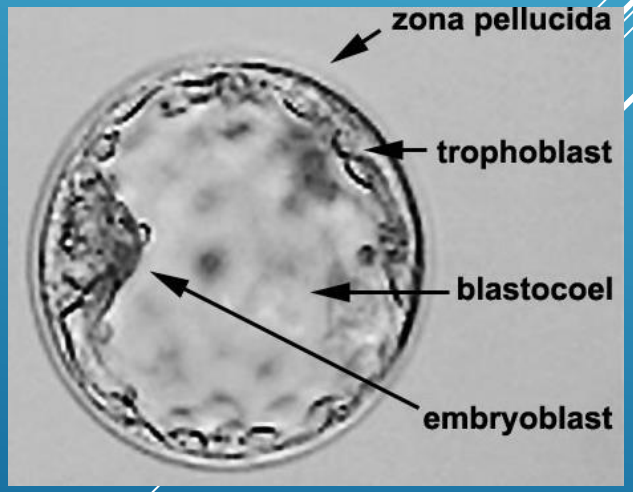
Tight junctions form between the outer cells of the morula. Gap junctions form between the inner cells thus creating two groups of cells. Sodium is pumped into the intercellular spaces by the outer cells of the morula and water follows osmotically. Therefore, fluid begins to accumulate within the morula.

As fluid accumulates, the outer cells become flattened and a cavity known as the blastocoele is formed. The gap junctions connecting the inner cells of the morula allow these cells to polarize as a group. As a result two separate cellular components emerge. These are, the inner cell mass (ICM) and the trophoblast.

blastocyst

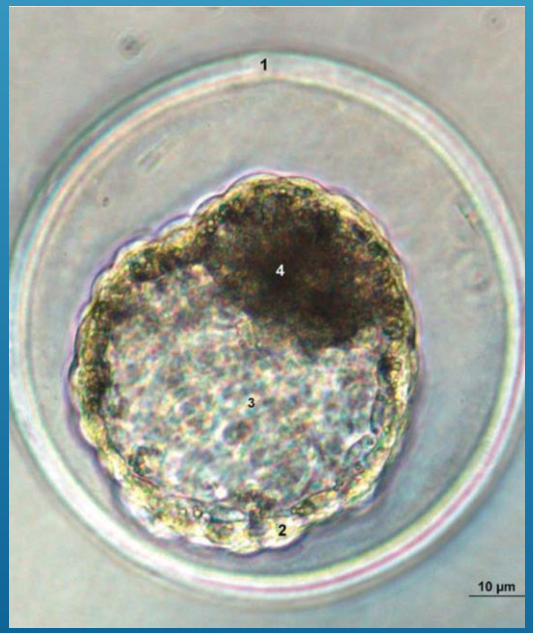
- Blastula

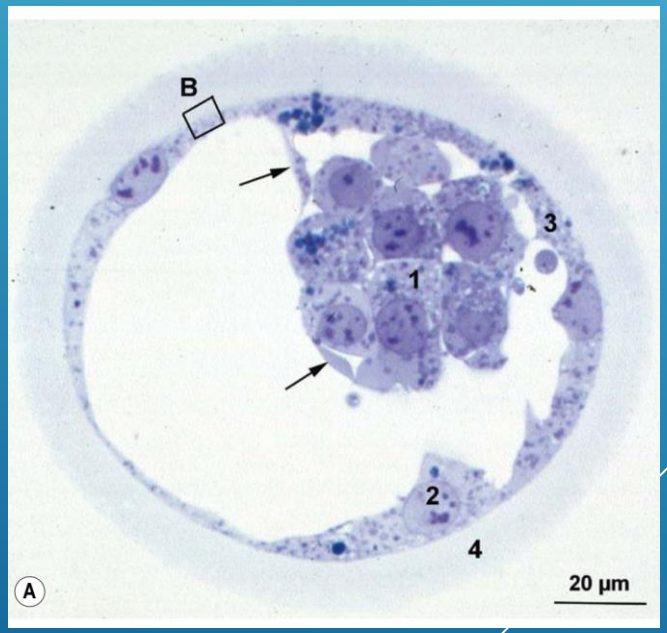
- Consist of:
  - **Inner cell mass** (embryoblast)- a collection of cells localized inside one pole (end) of the blastula.
  - **Trophoblasts**- the surface cells of the blastocyst
  - **Blastocoele**- the fluid cavity



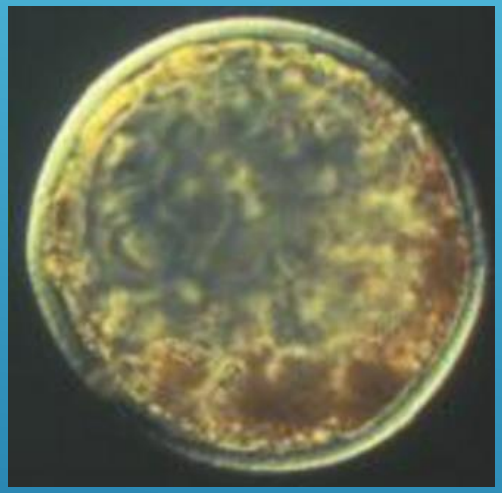
blastocyst

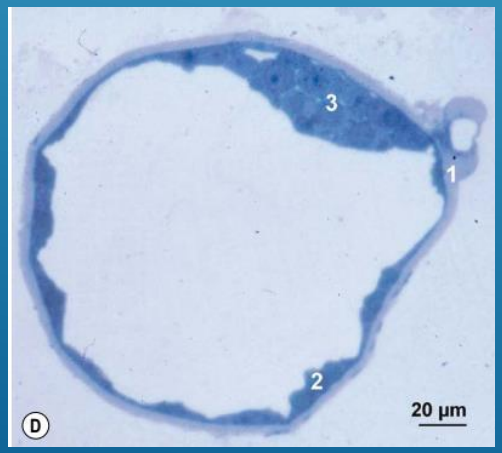
- The portion of the trophoectoderm covering the inner cell mass is referred to as the **polar trophoectoderm** whereas the rest is known as the **mural trophoectoderm.**



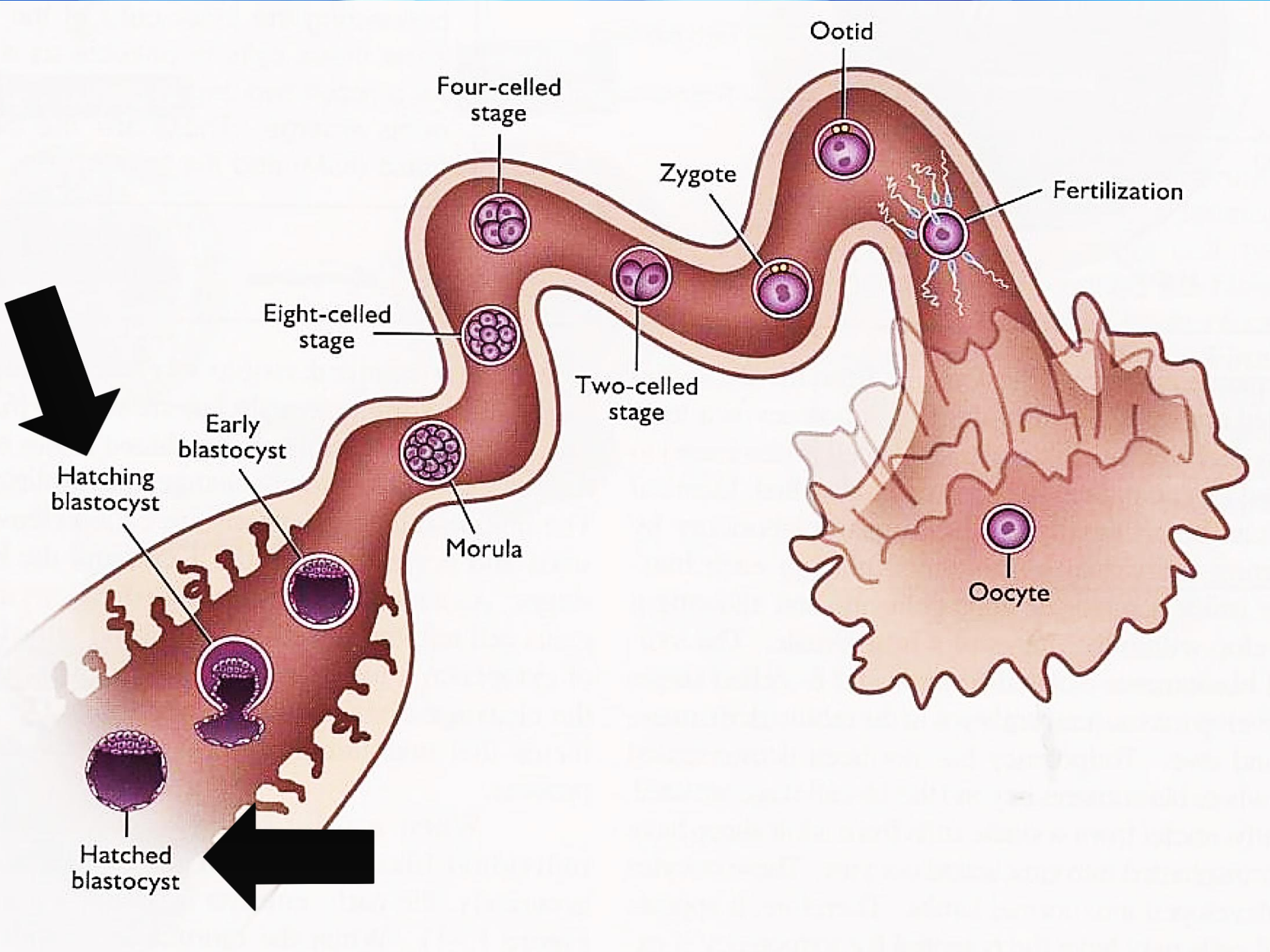


EXPANDED blastocyst





- Diameter of the embryo dramatically increased with concurrent thinning of the zona pellucida
- ET is best done on blastocyst stage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HATCHING blastocyst

- Zona pellucida is digested **enzymatically**
- The blastocyst leaves the zona pellucida and attaches (adheres) to the uterine mucosa, followed by the implantation and the placentation of the embryo.

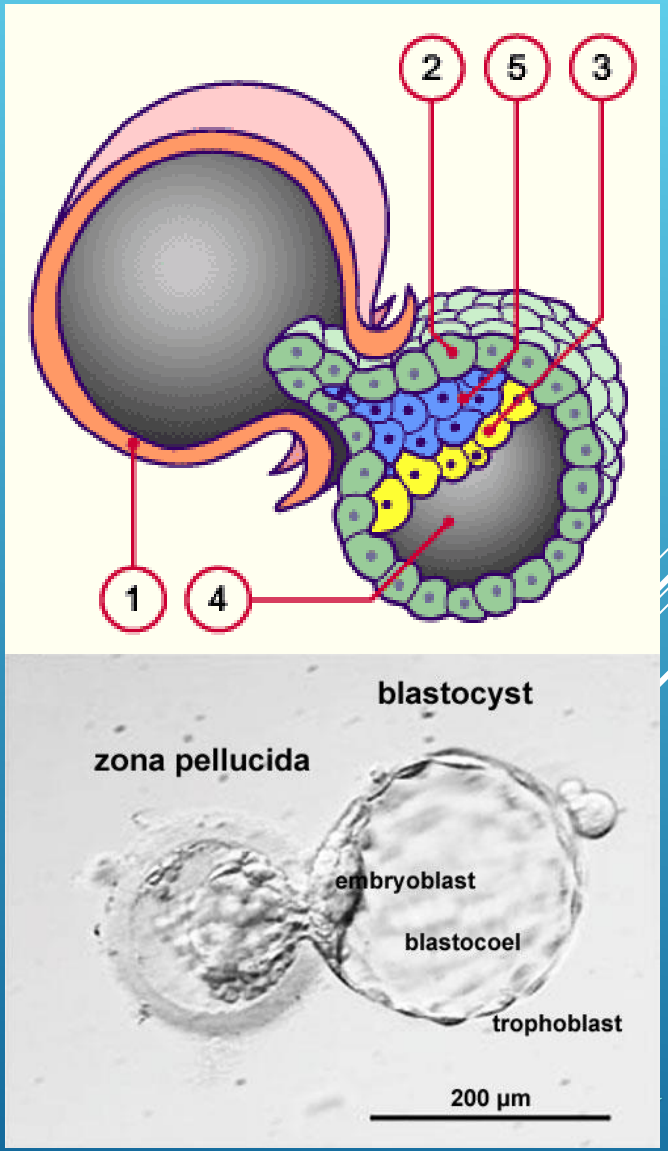
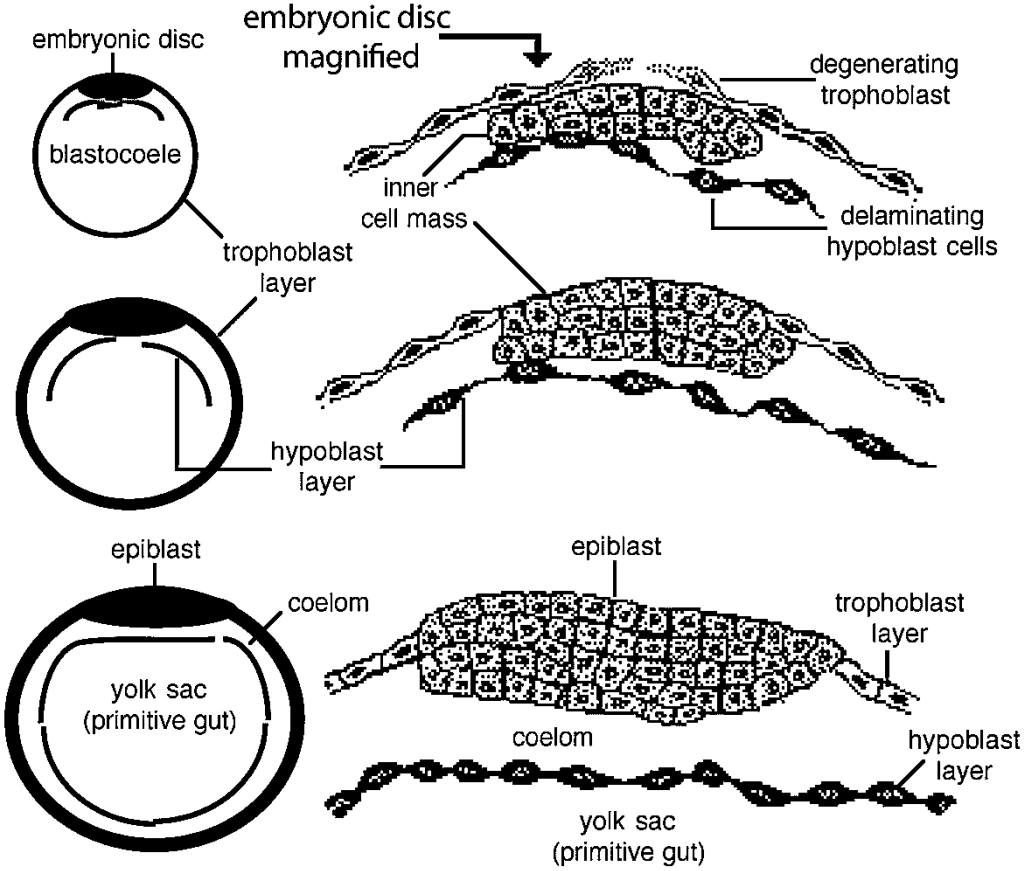


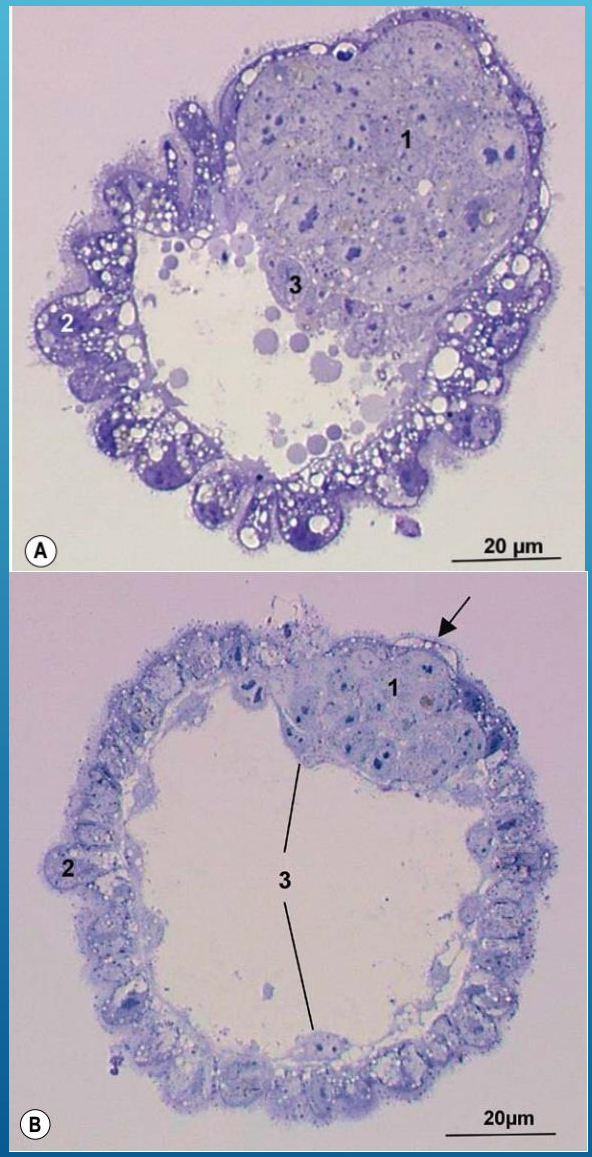
Table 6-1: Times of passage of the embryo from the oviduct into the uterus, and of blastocyst formation, in different species

Species	Passage into the uterus		Time of blastocyst formation (days after ovulation)
	Days after ovulation	Stage of development	
Pig	2	4–8 cell	5–6
Cattle	3–3 ½	8–16 cell	7–8
Sheep	3	8–16 cell	6–7
Horse	5–6	Morula	6
Dog	8	Blastocyst	8

HATCHING blastocyst



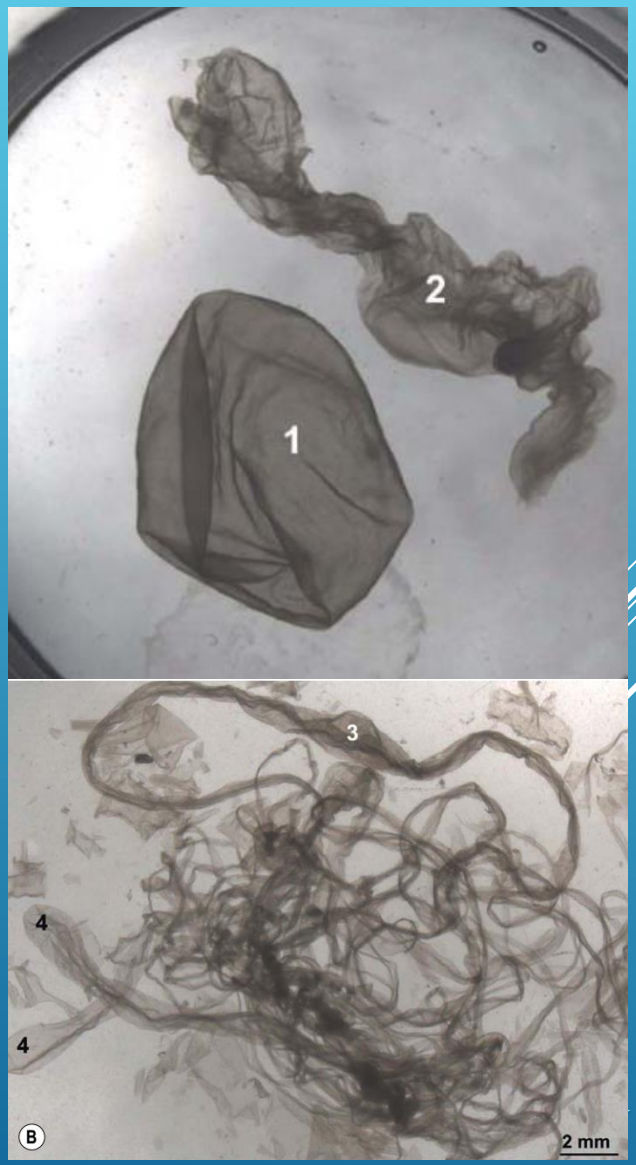
HATCHING blastocyst



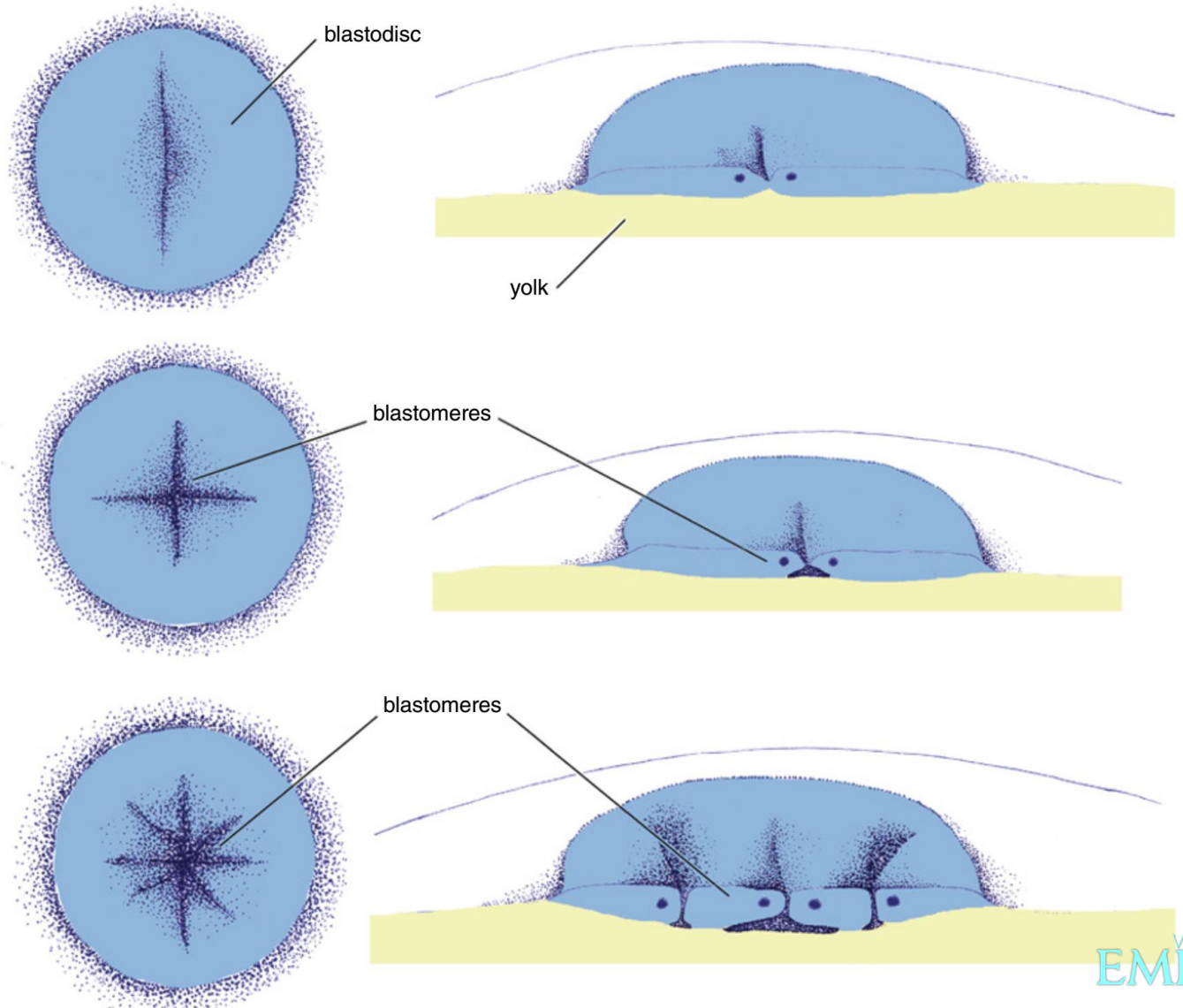
- ICM differentiates into **two cell populations:**
  - Those facing the blastocyst cavity become flattened and delaminate, forming an inner cell sheet referred to as the **hypoblast.**
  - The remaining cells form the multilayered **epiblast.**

Blastocyst elongation

- Horses, dogs, cats and rabbits- marked **round to oval** expansion of the blastocyst
- Cattle, sheep, pig- marked **thread-like** expansion
- Primates, rodents, guinea pigs- little expansion occurs because blastocyst invades the endometrium



IN AVIAN SPECIES



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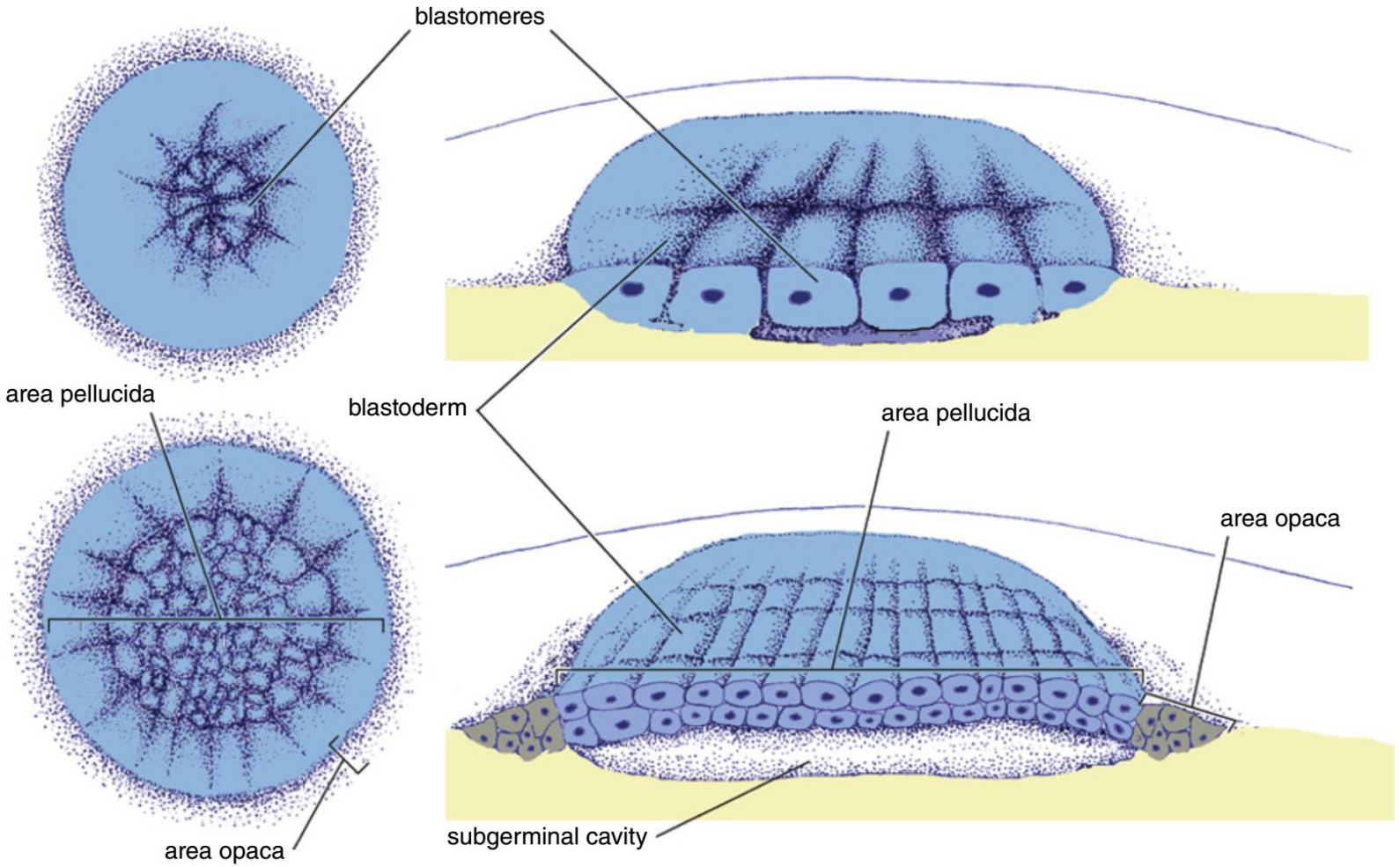
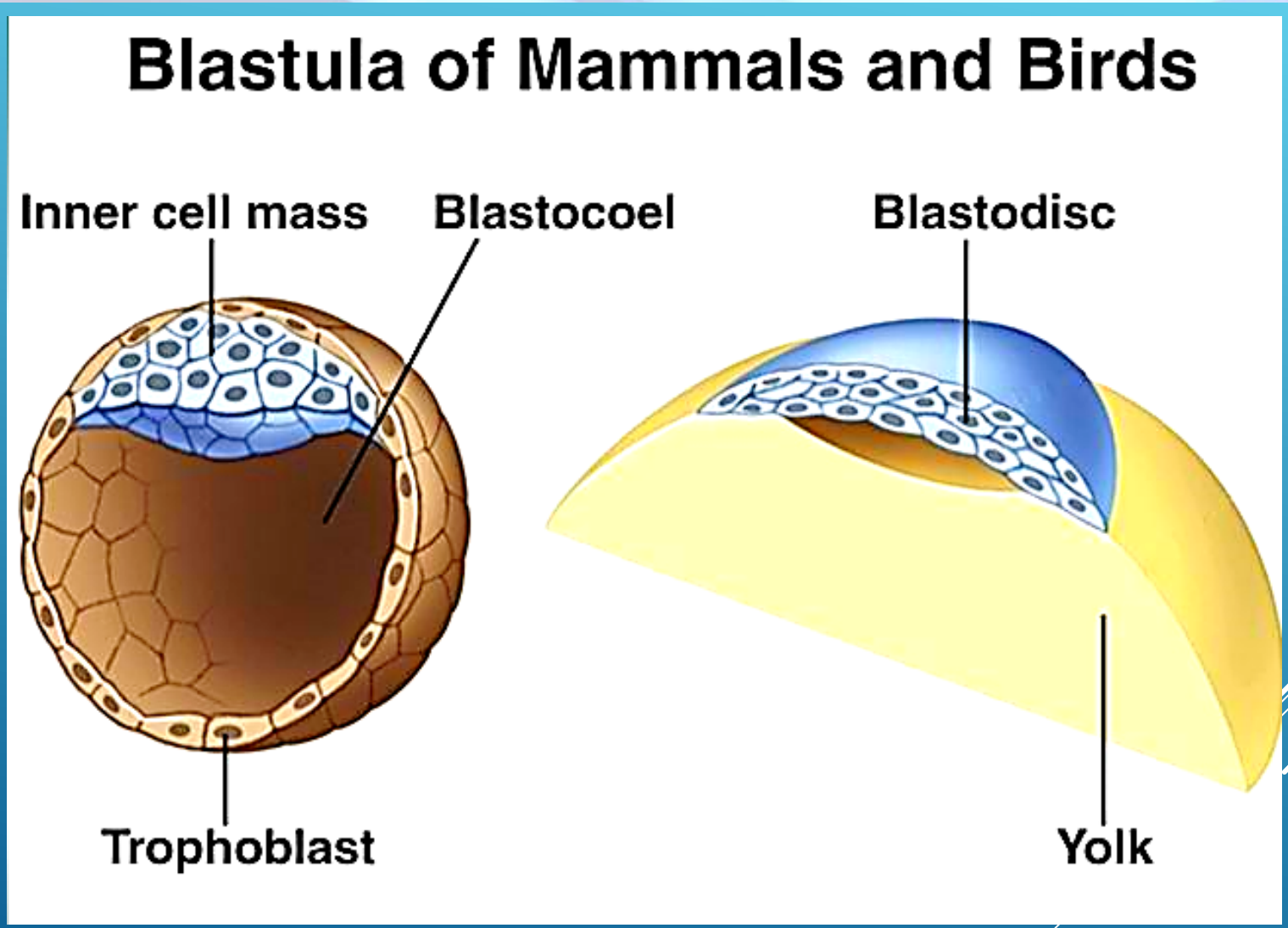


IN AVIAN SPECIES

- Blastoderm is composed of **two regions:**
  - **Area pellucida**
    - Consists of a thin layer of cells and overlies the subgerminal cavity and with no yolk material attached
  - **Area opaca**
    - Consists of a layer of large cells and overlies the unaltered yolk

comparison


Blastula of Mammals and Birds
Inner cell mass
Blastocoel
Blastodisc
Trophoblast
Yolk

end… Thank you!