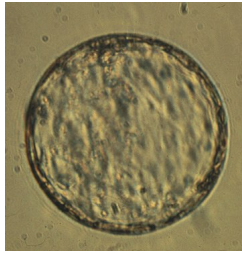


Embryo Development



Animal Science 434
John Parrish

1

Errors in Fertilization

- **Polyspermy - polyandry**
 - » Multiple sperm penetration
 - » Invertebrates
 - excess sperm eliminated because sperm centriole contributes to first embryonic cleavage spindle
 - » Mammals
 - Sperm centriole not essential so development continues but fails early to midpregnancy due to multiploidy
 - Occurs most often in aged oocytes due to failure of zona block to polyspermy

2

Errors in Fertilization (cont.)

- **Polygyny**
 - » Multiple maternal pronuclei + 1 paternal pronuclei
 - » Artificially created only
 - Suppress extrusion of the PBII
- **Androgenote**
 - » Union of 2 paternal pronuclei
 - » Artificially created only
 - From pronuclear exchange

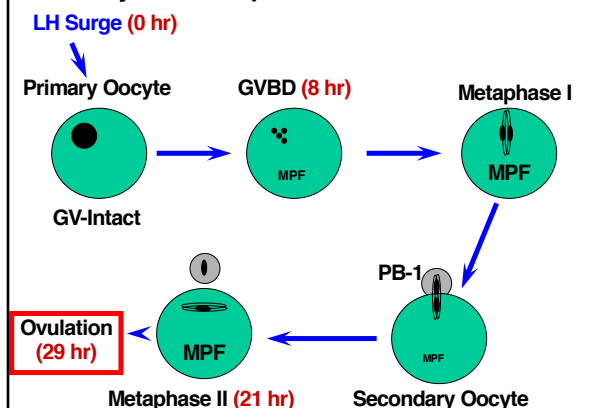
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Errors in Fertilization (cont.)

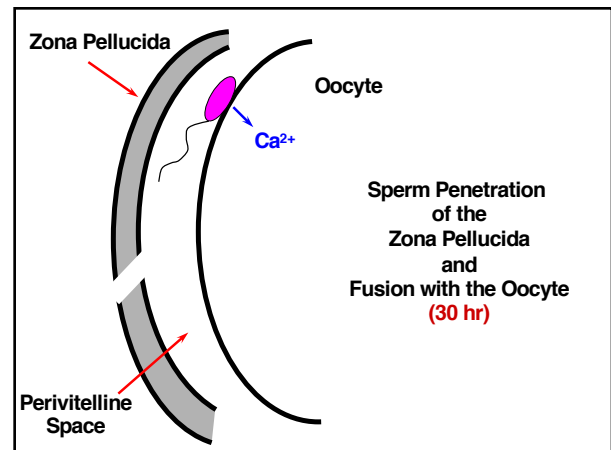
- **Gynogenote**
 - » Union of 2 maternal pronuclei
 - » Artificially created
 - Induced oocyte activation and suppression of PBII extrusion
- **Parthenogenesis**
 - » Activation of the oocyte without a sperm
 - » Embryo is either haploid or gynogenesis occurs to form diploid
 - Platties - sperm activates but then gynogenesis occurs and sperm extruded from embryo

4

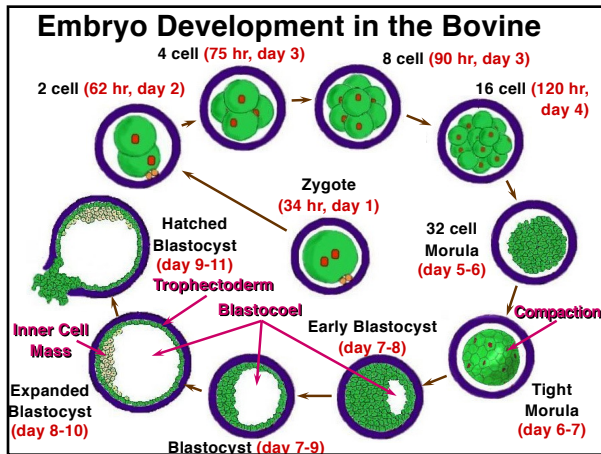
Oocyte Development and Fertilization



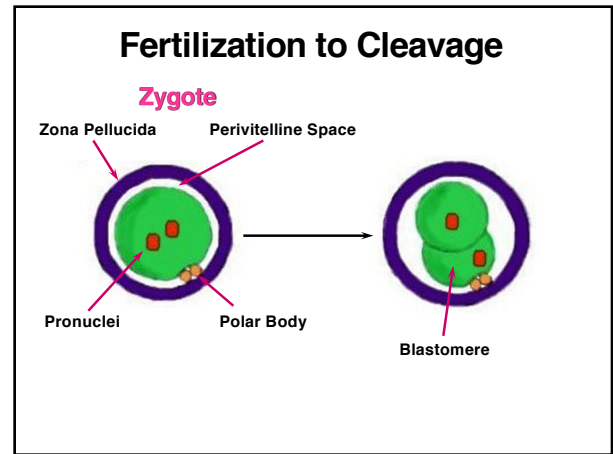
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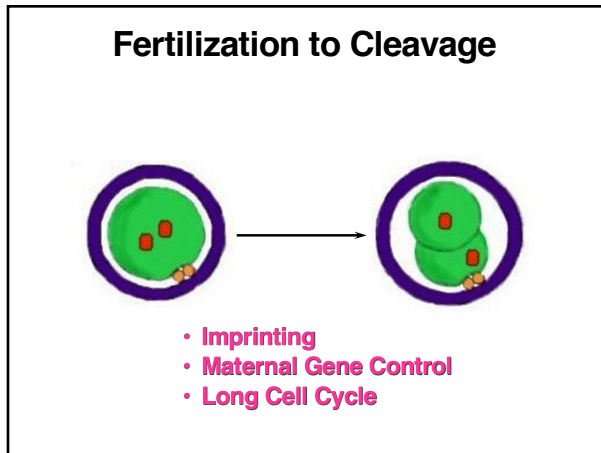
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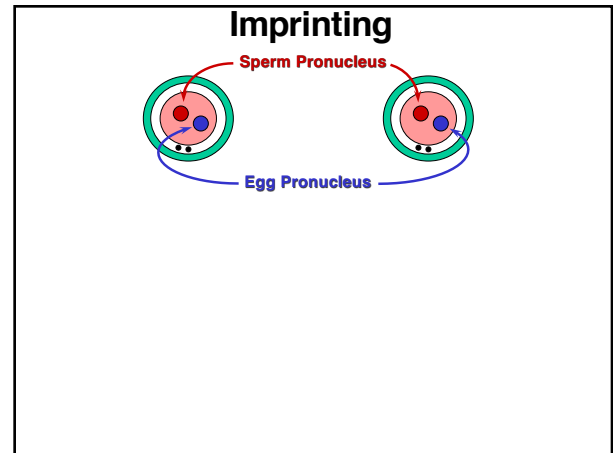
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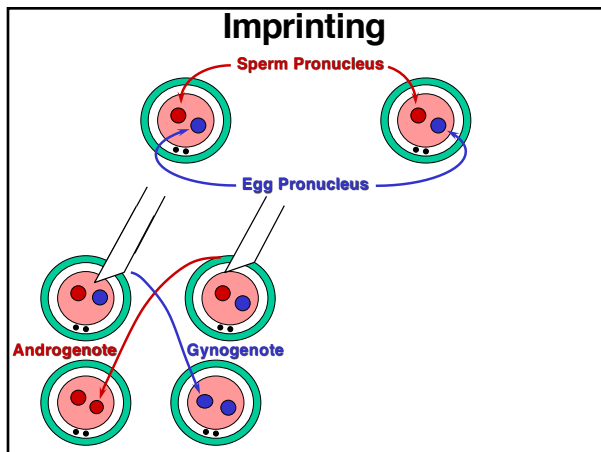
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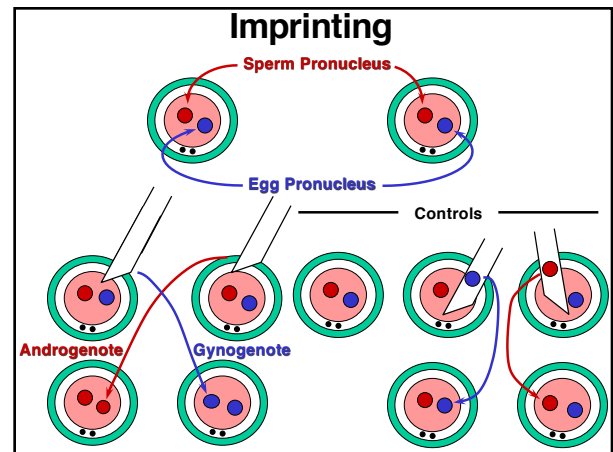
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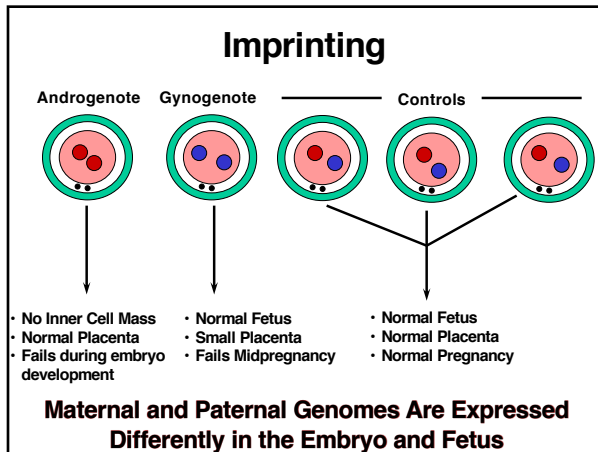
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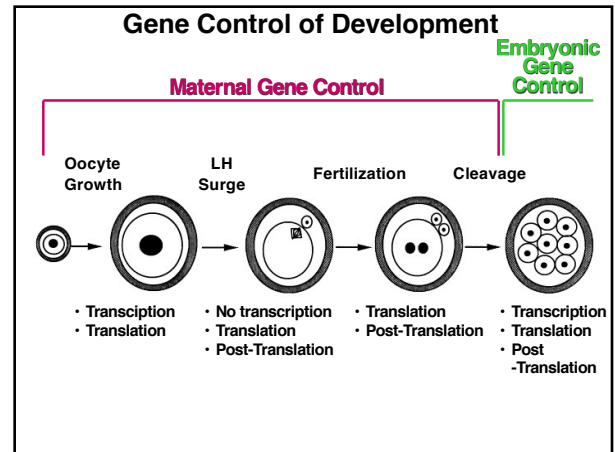
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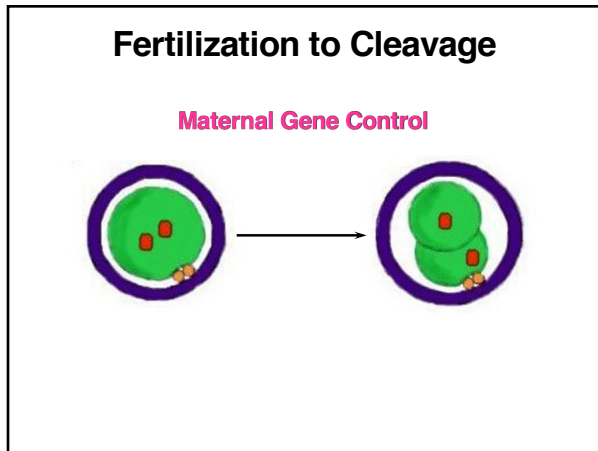
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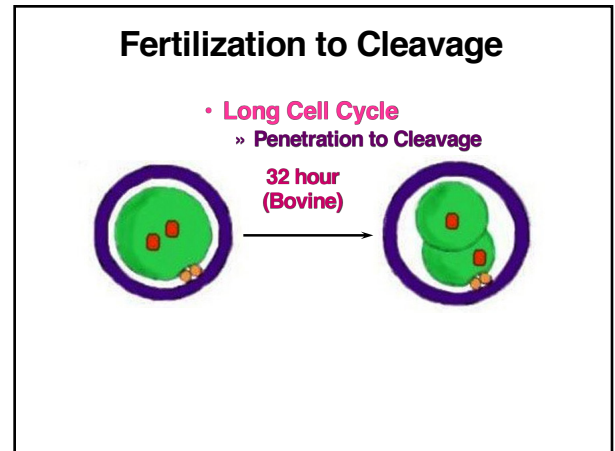
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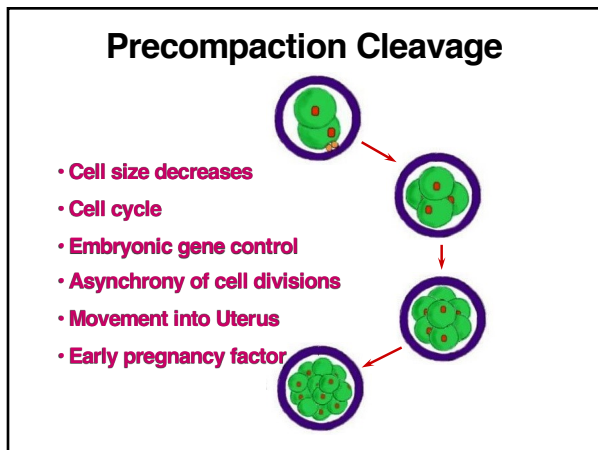
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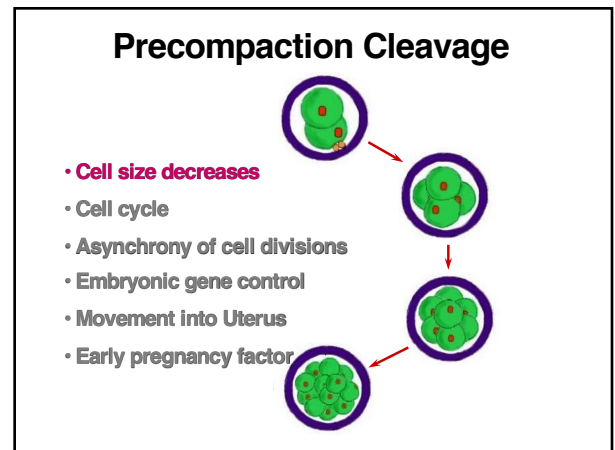
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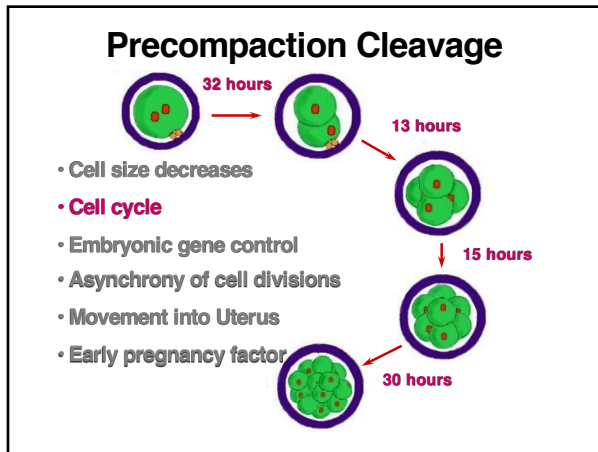
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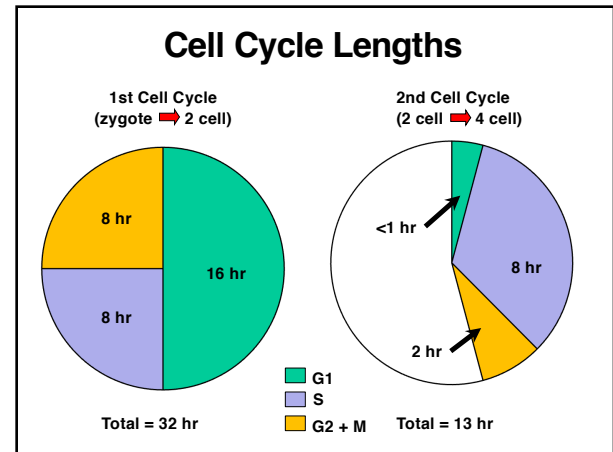
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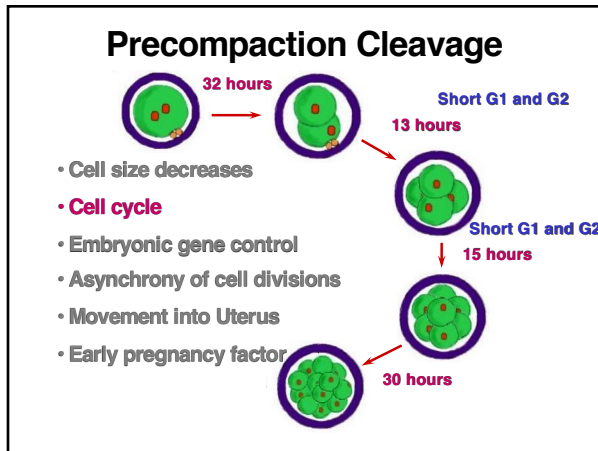
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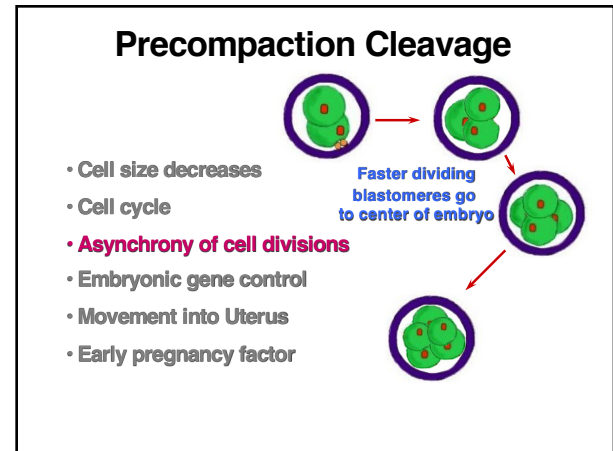
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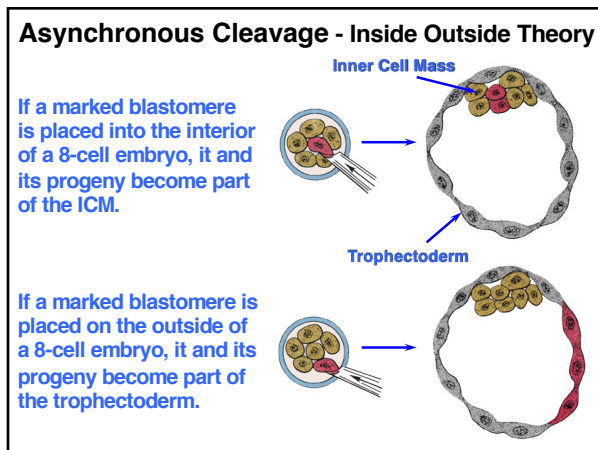
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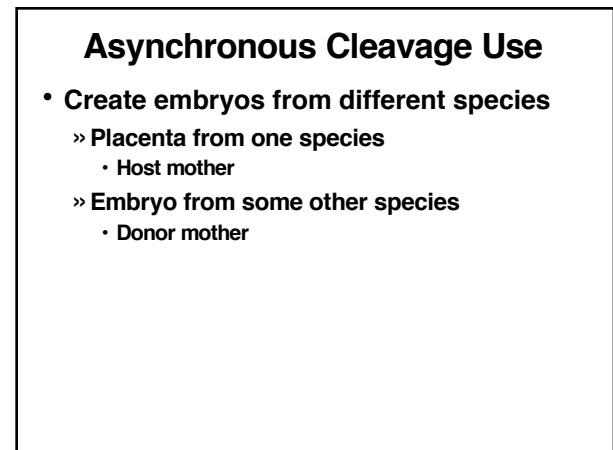
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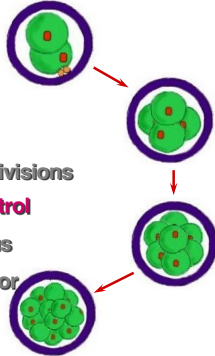
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24

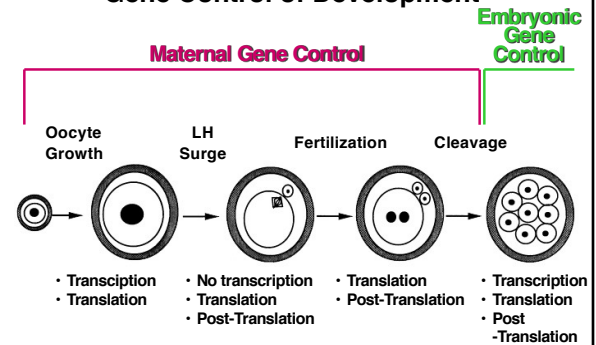
Precompaction Cleavage

- Cell size decreases
- Cell cycle
- Asynchrony of cell divisions
- **Embryonic gene control**
- Movement into Uterus
- Early pregnancy factor



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Gene Control of Development



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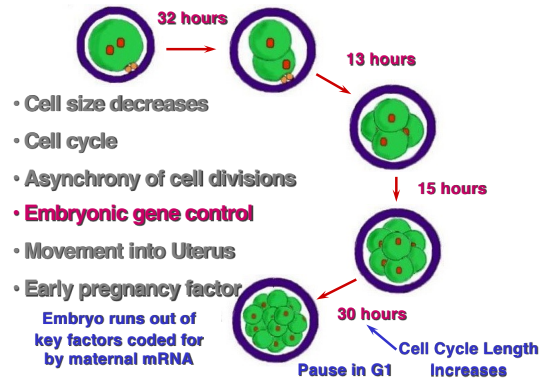
Transition from Maternal to Embryonic Gene Control

Species	Transcription of the embryonic genome	
	First begins	Development is dependent on
Mouse	1 cell	2 cell
Rabbit	2 cell	8 cell
Pig	4 cell	8 cell
Cattle	4 cell	8-16 cell
Sheep	8 cell	16 cell
Human	4 cell	8 cell

In vitro blocks to development often occur here!!!!

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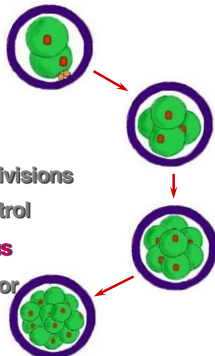
Precompaction Cleavage



28

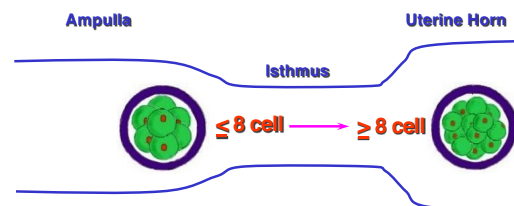
Precompaction Cleavage

- Cell size decreases
- Cell cycle
- Asynchrony of cell divisions
- Embryonic gene control
- **Movement into Uterus**
- Early pregnancy factor



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Movement into the Uterus

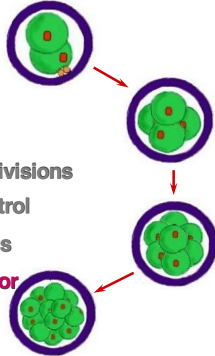


- Occurs around day 4
- Cause
 - » Change in estrogen → progesterone

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Precompaction Cleavage

- Cell size decreases
- Cell cycle
- Asynchrony of cell divisions
- Embryonic gene control
- Movement into Uterus
- **Early pregnancy factor**



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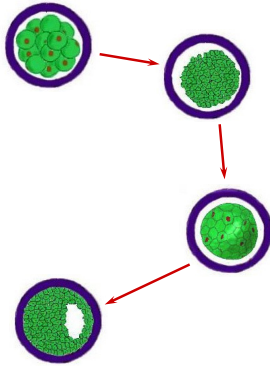
Early Pregnancy Factor

- Found at 24 - 72 hours after fertilization
 - » Mice, hamster, sheep, cattle, swine, human
- Seen only in viable pregnancy
 - » More recent experience in cattle may not agree with this
- Function
 - » Sensitize the uterus to implantation
 - » Basis for early pregnancy kit in cattle

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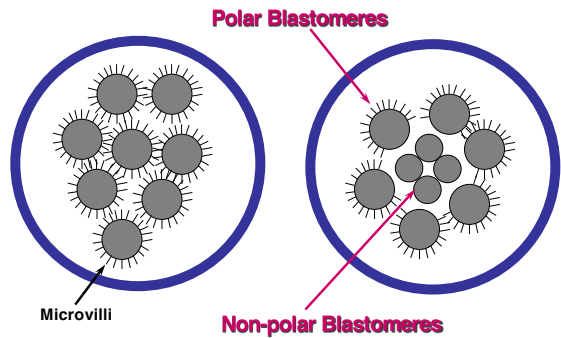
Morula to Blastocyst

- **Polarization**
- **Compaction**



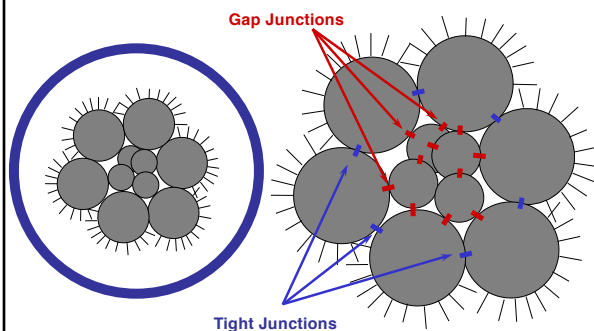
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Polarization



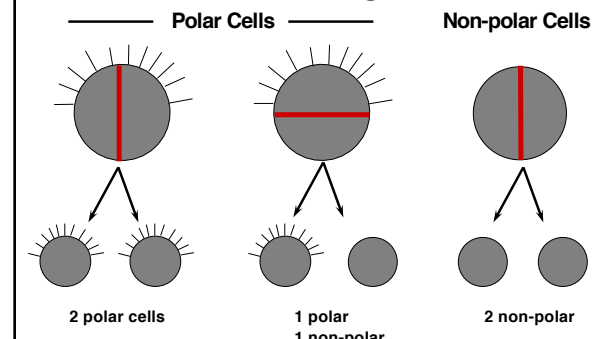
34

Polarization (cont.)



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Cell Lineage



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Compaction

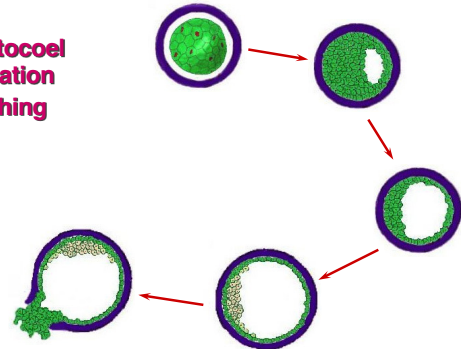
- Occurs at fixed time after fertilization
- Membranes are very close and begin to flatten. Resulting in loss of the round cell outlines.
- Differentiation event
- Genome controlled and involves microtubules and microfilaments.



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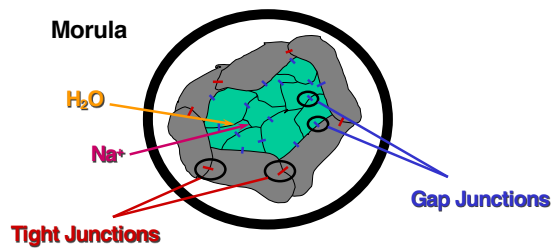
Blastocyst Formation and Hatching

- Blastocoel formation
- Hatching



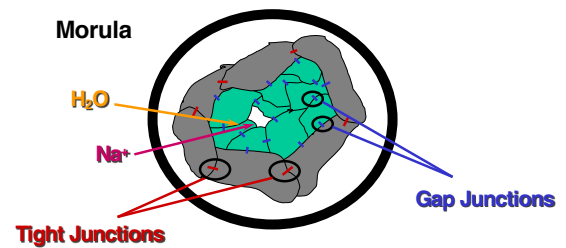
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Blastocoel Formation



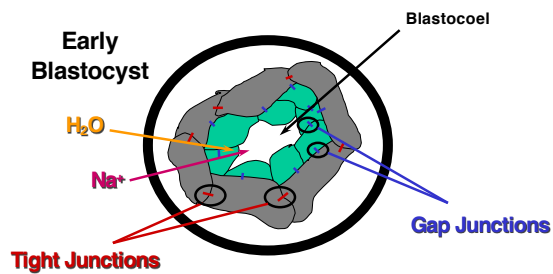
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Blastocoel Formation



40

Blastocoel Formation



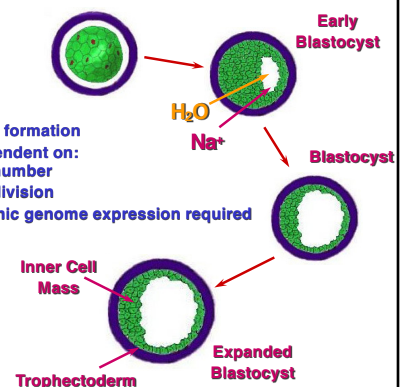
41

Blastocyst Formation and Hatching

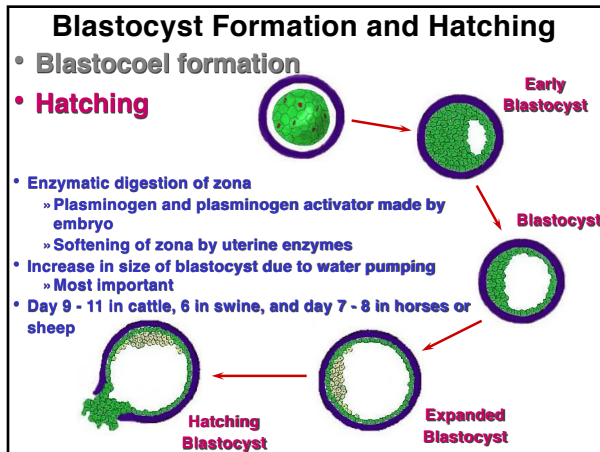
- Blastocoel formation
- Hatching

Blastocoel formation

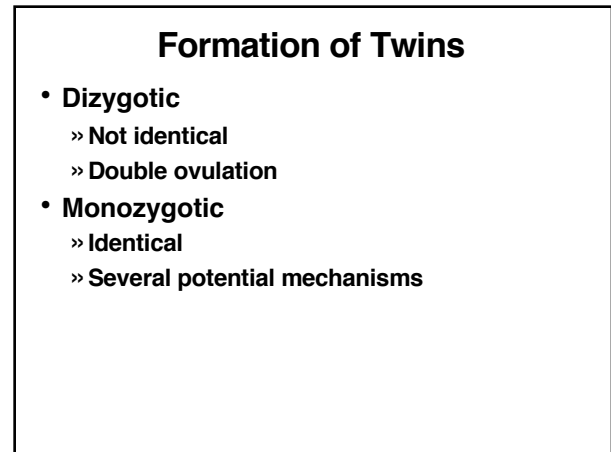
- not dependent on:
 - » Cell number
 - » Cell division
- Embryonic genome expression required



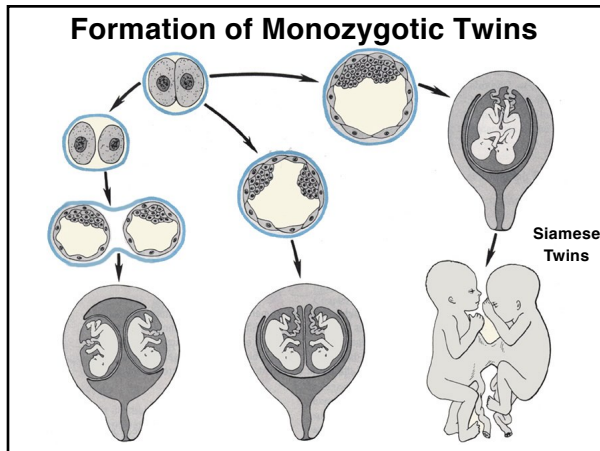
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