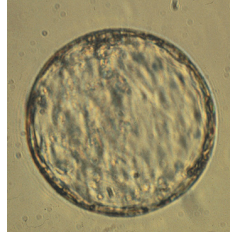


Lecture 18: Embryo Development



Animal Science 434
John Parrish

Updated: 11/13/07

Timing of Insemination

Species	Time of Ovulation	Optimal Insemination Time
Cow	29 hr after start of estrus	End of estrus (12 hr after first seen in estrus)
Ewe	End of estrus	End of 1st day or start of 2nd day of estrus
Sow	End of estrus	End of 1st day or start of 2nd day of estrus
Mare	1-2 days before end of estrus	Every other day beginning day 3 of estrus

Updated: 11/13/07

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

Updated: 11/13/07

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

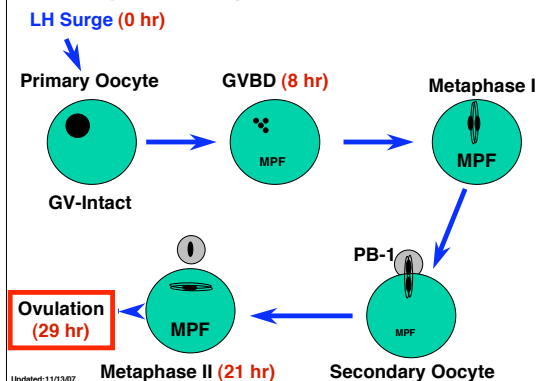
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Errors in Fertilization (cont.)

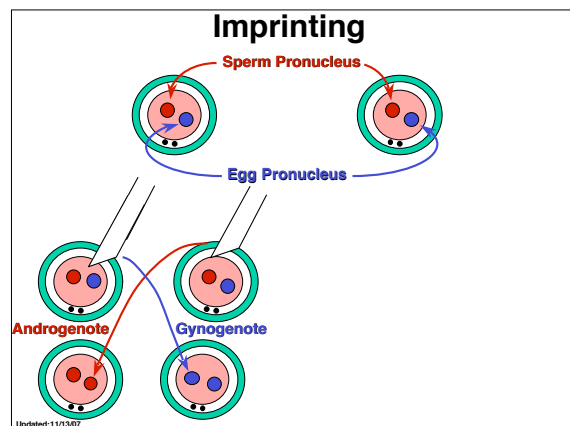
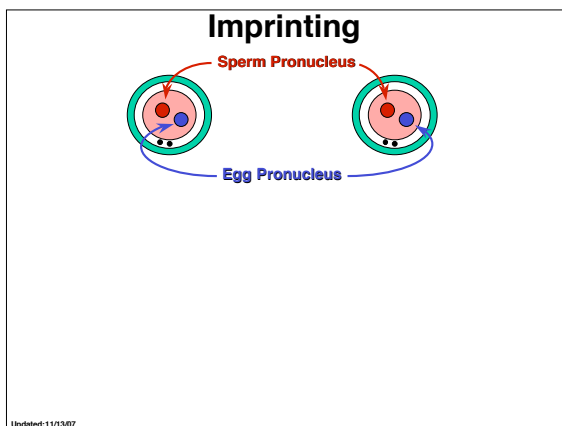
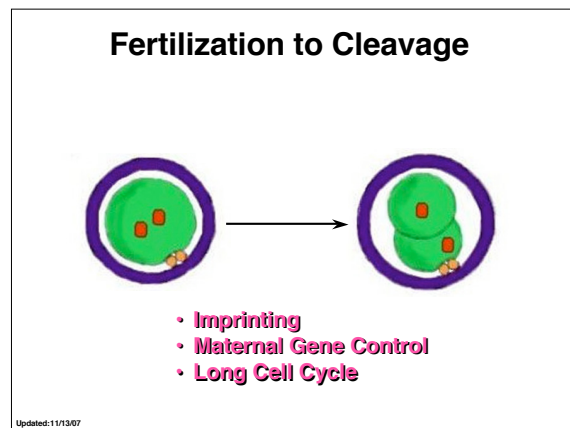
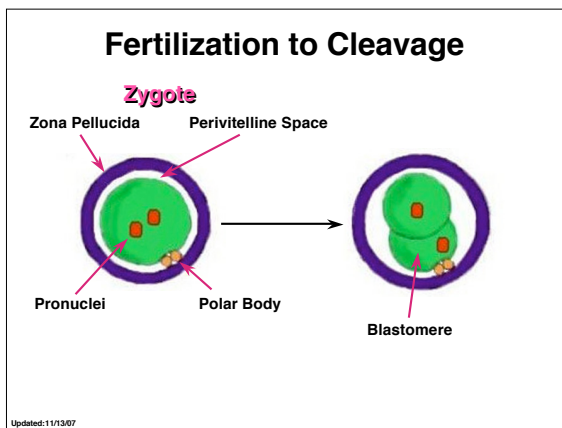
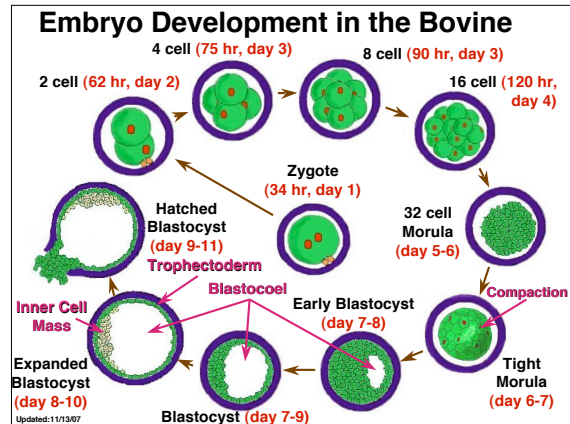
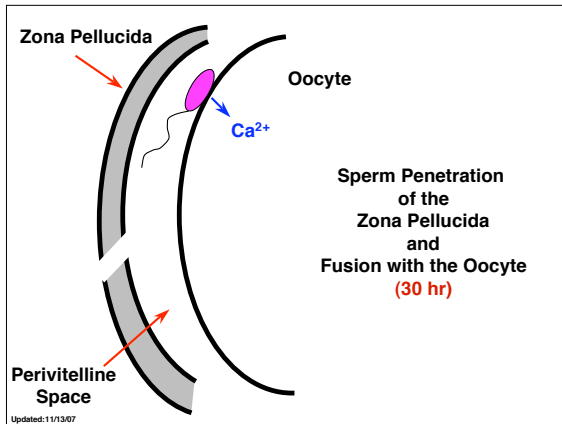
- **Gynogenote**
 - » Union of 2 maternal pronuclei
 - » Artificially created
 - Induced oocyte activation and suppression of PBII extrusion
- **Parthenogenesis**
 - » Activation of the oocyte without a sperm
 - » Embryo is either haploid or gynogenesis occurs to form diploid
 - Platties - sperm activates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

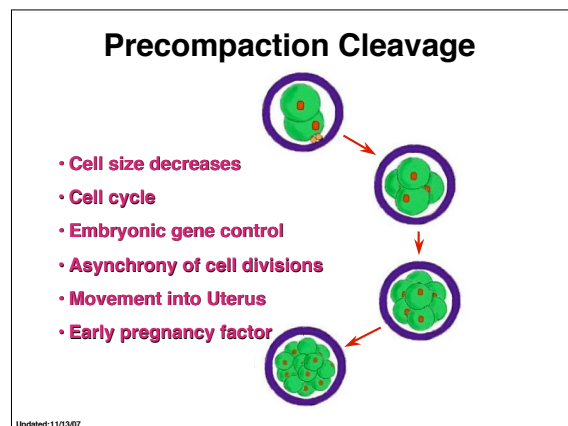
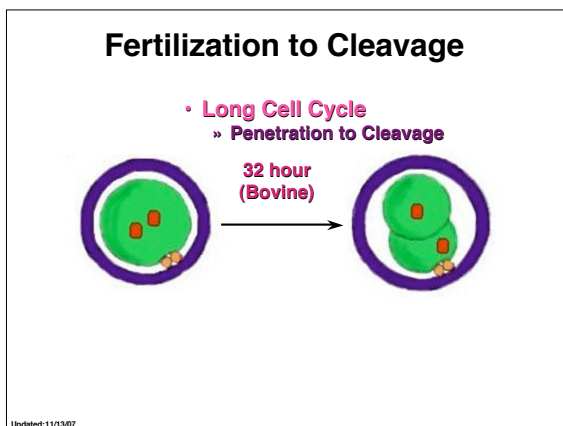
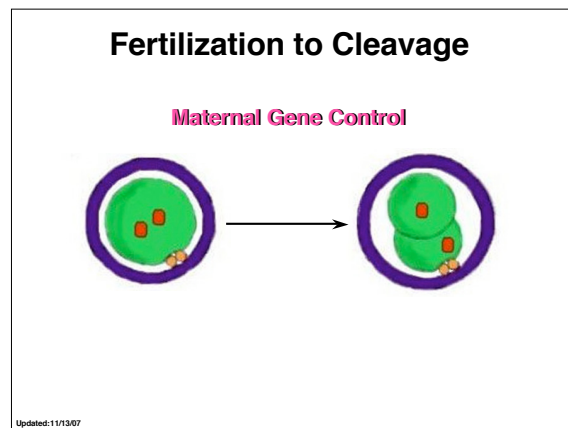
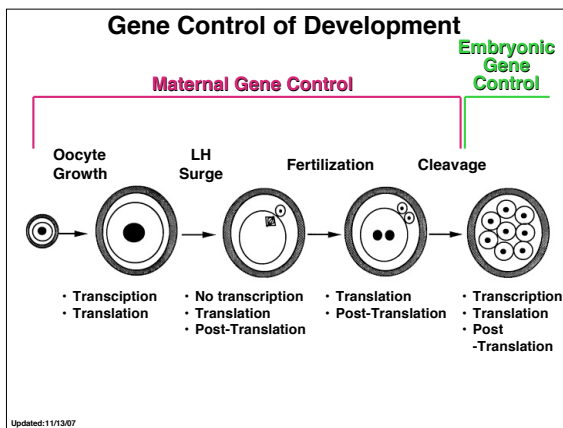
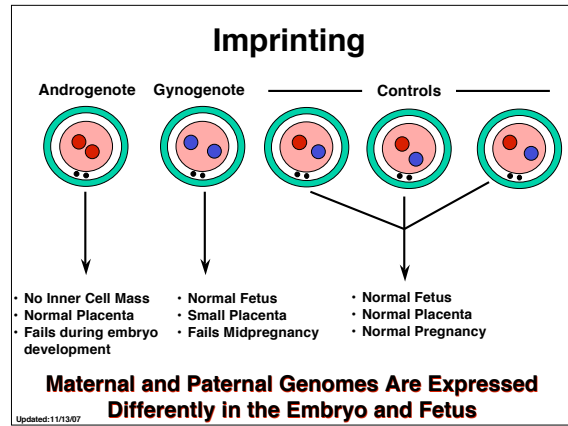
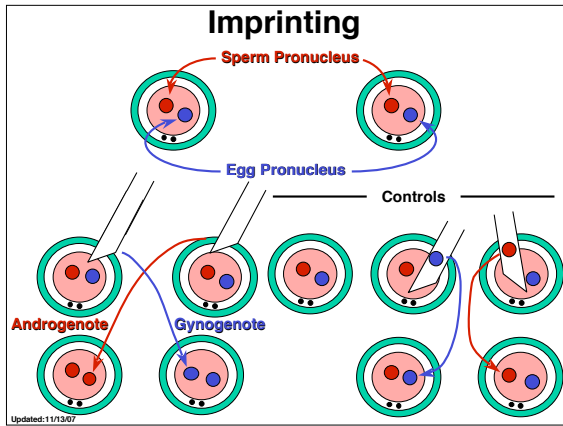
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Oocyte Development and Fertilization



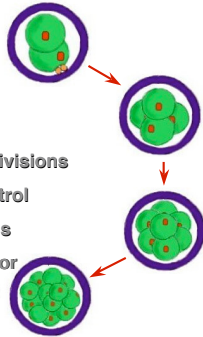
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Precompaction Cleavage

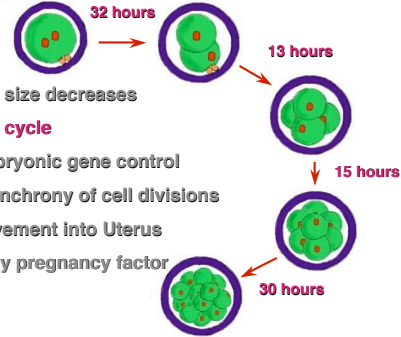
- Cell size decreases
- Cell cycle
- Asynchrony of cell divisions
- Embryonic gene control
- Movement into Uterus
- Early pregnancy factor



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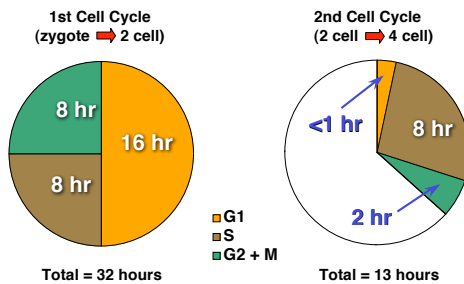
Precompaction Cleavage

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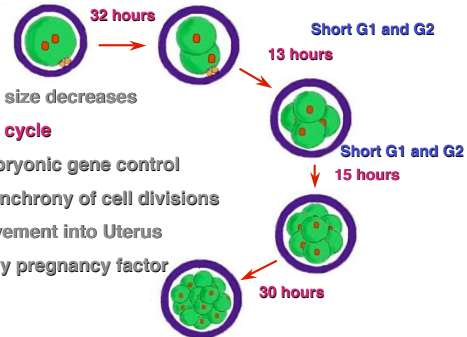
Cell Cycle Lengths



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Precompaction Cleavage

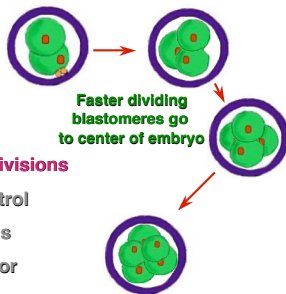
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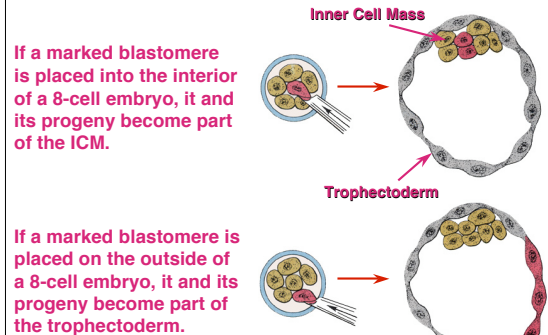
Precompaction Cleavage

- Cell size decreases
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Updated: 11/13/07

Asynchronous Cleavage - Inside Outside Theory



Updated: 11/13/07

Asynchronous Cleavage Use

- Create embryos from different species
 - » Placenta from one species
 - Host mother
 - » Embryo from some other species
 - Donor mother

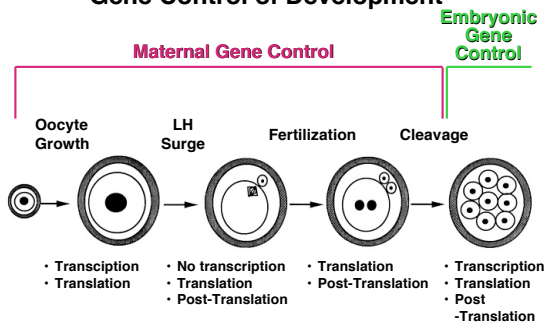
Updated: 11/13/07

Precompaction Cleavage

- Cell size decreases
- Cell cycle
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Updated: 11/13/07

Gene Control of Development



Updated: 11/13/07

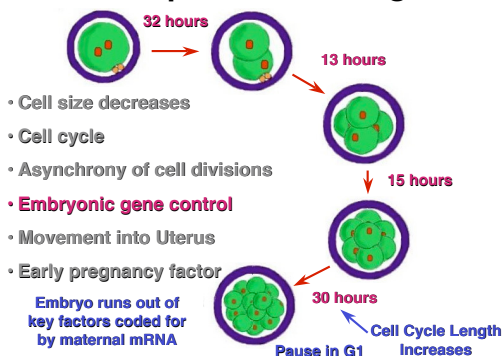
Transition from Maternal to Embryonic Gene Control

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



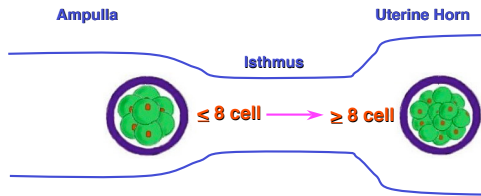
Updated: 11/13/07

Precompaction Cleavage

- Cell size decreases
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Movement into the Uterus

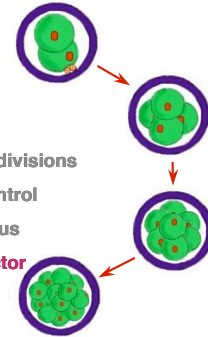


- Occurs around day 4
- Cause
 - » Change in estrogen → progesterone

Updated: 11/13/07

Precompaction Cleavage

- Cell size decreases
- Cell cycle
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- Embryonic gene control
- Movement into Uterus
- Early pregnancy factor



Updated: 11/13/07

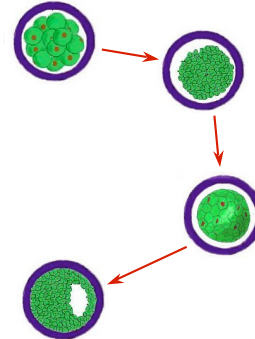
Early Pregnancy Factor

- 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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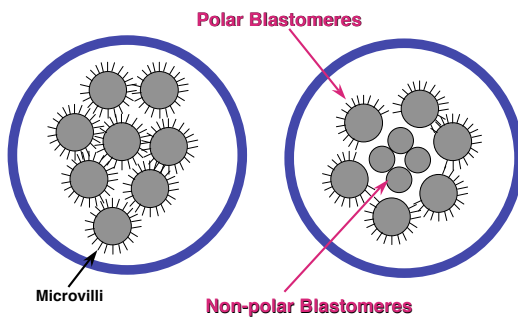
Morula to Blastocyst

- Polarization
- Compaction



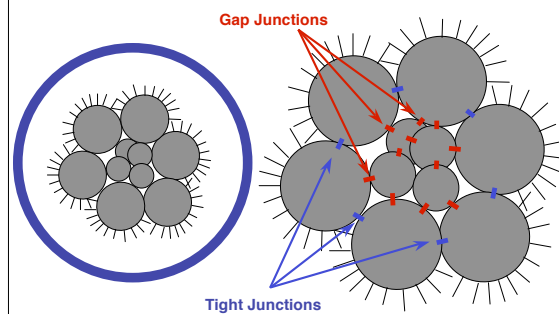
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Polarization

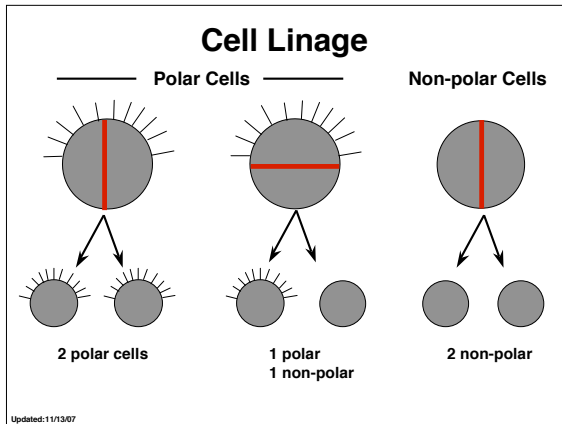


Updated: 11/13/07

Polarization (cont.)



Updated: 11/13/07



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.

Two micrographs showing the process of compaction. The top image shows a morula, a solid ball of cells. The bottom image shows a blastocyst, where the cells are more organized and the inner cell mass is visible. A red arrow points from the morula to the blastocyst.

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