Placentation and Maternal Recognition of Pregnancy

Animal Science 434
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Hatching

- Bovine
  » 9 - 11 days
- Equine, Ovine
  » 7 - 8 days
- Porcine
  » 6 days

Conceptus Growth

Occurs in cow, pig and sheep

Cow
- Day 15, 1-2 mm
- Day 18-19, 10-20 cm

Development of Porcine Conceptuses from Day 10 to 12

- 5 mm Spherical
- 10 mm Spherical
- 15 mm Tubular
- 150 mm Filamentous

Elongated Day 15 Porcine Conceptus

- Embryo
Uterine Location of Elongating Ruminant Blastocyst

Pig Intrauterine Migration

Day 5

Day 7

Day 12

Trans-uterine Migration in the Mare

Gastrulation

Fixation can occur in either horn!

Fixation on day 15 - 16

Corpus Luteum

Corpus Luteum

Pig Intrauterine Migration

Embryos become fixed

Transuterine migration is rare in cow and ewe!

Inner Cell Mass

Trophectoderm

Endoderm

Blastocele Cavity

Bovine and Ovine

Formation of Germ Layers
Placental Membranes

- Yolk Sack
  - In birds to nourish embryo
  - In mammal atrophies but source of blood cells and primordial germ cells
- Amnion
  - Non-vascular, fluid filled
  - Fluid produced by fetus
  - Protective cushion
  - Ruptures at birth (not breaking of water)

Placental Membranes (cont.)

- Allantois
  - Blood vessels
  - Fuses with chorion
    - Allantochorion or chorioallantois
    - Brings blood vessels to chorion
- Chorion
  - Outermost membrane
  - Attachment to mother

Maternal Recognition of Pregnancy
Luteal Regression

CL Status

Recognition of Pregnancy

Recognition of Pregnancy in Bovine and Ovine

Recognition of Pregnancy in the Porcine

Recognition of Pregnancy in the Porcine
Recognition of Pregnancy in the Porcine

- Estradiol
- Critical Days: 11 to 12
- Mechanism:
  - Antiluteolytic
    - Redirect PGF2α
    - Requires 2 embryos per horn

Recognition of Pregnancy in the Mare

- Conceptus Secretion
- Critical Days: 10 to 14
- Mechanism:
  - Antiluteolytic

Recognition of Pregnancy in the Human

- Conceptus Secretes
  - HCG
- Critical Days: 6 to 12
- Mechanism:
  - Luteotrophic

Recognition of Pregnancy

- Conceptus Secretions
  - Proteins
  - Steroids
- INF-α
- HCG
- Estradiol

Dog and Cat

- CL does not regress if not pregnant
  - No uterine effect
- Psuedopregnancy
  - CL last similar length as in pregnancy

Implantation
### Time of Implantation

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<th>Completion</th>
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### Type of Implantation

- **Superficial**
  - Chorion lies opposed to uterine wall
  - Farm animals
- **Eccentric**
  - Chorionic sack in a uterine fold
  - Rodent
- **Interstitial**
  - Embryo digests part of uterine wall
  - Human

### Degree of Tissue Loss at Parturition

- **Deciduate**
  - Eccentric, interstitial
  - Rodent, human
- **Indeciduate or Nondeciduate**
  - Superficial
  - Farm animals

### Shape or Distribution of Chorionic Villi

- **Cotelydonary** - cow, sheep
- **Diffuse** - pig, horse
- **Zonary** - dog, cat
- **Discoid** - human
Placental Attachment in Ruminant

- Chorion
- Uterine Epithelium
- Stroma
- Binucleate Cell
- Capillary
- Syncytiun
- Multinucleated Cells in Uterine Epithelium

Day 23 Migration of Binucleate Cells and Formation of Syncytiun

- Binucleate Cell
- Migrate and fuse with uterine epithelium
- Fusion of Binucleate cells and uterine epithelium
- Multinucleated Cells in Uterine Epithelium

Binuclear Giant Cells
- 20% of fetal placenta
- Invade endometrium
- Source
  - Placental lactogen
  - Pregnancy specific protein B

Placental Lactogens (Protein Hormones)

Prolactin-like activity: Stimulates Milk Synthesis

Not Present in Pig and Mare

- May regulate maternal metabolism to facilitate fetal growth
- High levels in the last 1/3 of gestation.
- High levels facilitate higher milk production.
- Dairy cows have higher blood concentrations than beef cows

Pregnancy Specific Protein B

- Unique to ruminants
- Function uncertain
- Has been used to detect pregnancy
  - Cattle, sheep, deer
  - Can be used to detect pregnancy in cows after day 25
  - Not early pregnancy factor!!!

Diffuse Placenta

- Pig
- Horse
- Microcotyledons
**Microcotelydons**

- Increase placental surface area.

**Endometrial Cups in Mare**

- From both trophoblast and endometrium
- 5 to 10
- Form between days 35 to 60
- Produce equine chorionic gonadotropin (eCG, PMSG)
- Sloughed off after day 60

**Zonary Placenta**

(bitch, queen)

**Discoid Placenta**

(human)

**Cell Layers Separating Maternal and Fetal Blood**

**Histological Classification**

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Important!!!

- Fetal and maternal blood does not mix during gestation.
- Mixing may occur at parturition and may result in antibodies against specific fetal blood type. **Impacts future fetuses or neonates!!!**
  » Erythoroblastosis Fetalis – Human
    - Antibodies cross placenta (Rh factor)
  » Neonatal Isoerythrolysis – Cat and Horse
    - Antibodies in colostrum and absorbed first 24 hr of neonate’s life