Lecture 20
Pregnancy and Fetal Development

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Placental Functions

- Exchange
  - Gas
  - Nutrients
  - Waste products
- Endocrine
  - Transient
  - Estrogen
  - Progesterone
  - HCG
  - eCG
- Chemical Protection
  - Immunosuppression
  - Prevents infiltration by maternal defenses
  - Filters toxins
- Physical Protection
  - Shock Absorber

Similarities in Early Development

<table>
<thead>
<tr>
<th>Developmental Horizons</th>
<th>Mare</th>
<th>Cow</th>
<th>Ewe</th>
<th>Sow</th>
<th>Woman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germ layers</td>
<td>13-14</td>
<td>14</td>
<td>10-14</td>
<td>7-8</td>
<td>10-14</td>
</tr>
<tr>
<td>Open neural tube</td>
<td>20</td>
<td>15-21</td>
<td>13</td>
<td></td>
<td></td>
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<tr>
<td>Fusion of chorioamniont folds</td>
<td>18</td>
<td>17</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart beat apparent</td>
<td>24</td>
<td>21-22</td>
<td>20</td>
<td>16</td>
<td>25</td>
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<tr>
<td>Limb buds visible</td>
<td>24</td>
<td>25</td>
<td>28-35</td>
<td>17-18</td>
<td>28</td>
</tr>
<tr>
<td>Cotelodyons first appear</td>
<td>30</td>
<td></td>
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<tr>
<td>Eye differentiation</td>
<td>40</td>
<td>30-45</td>
<td>42-49</td>
<td>21-28</td>
<td></td>
</tr>
<tr>
<td>Birth</td>
<td>340</td>
<td>280</td>
<td>147-155</td>
<td>112</td>
<td>266</td>
</tr>
</tbody>
</table>

Critical Organ Systems Develop Early!

Fetal Development in the Human

Developmental Features

Parturition

Length (cm)

Weight (kg)

Age of Fetus (weeks since last menstruation)

Ovulation

Birth
Estimates of Age

- Crown rump length
- Length femur, radius or tibia
- Circumference of head

Factors Influencing Fetal Growth

- Genetics
  - Species
  - Breed
  - Litter size
  - Genotype

- Environment
  - Mother
  - Nutrition
  - Size, Parity
  - Placenta
  - Blood flow
  - Size

- Fetal Hormones
  - Thyroid
  - Insulin
  - Growth hormone

CERTAINS lines of animals may grow faster.
Factors Influencing Fetal Growth

Environment:
- Mother
  - Nutrition
  - Size, Parity
- Placenta
  - Blood flow
  - Size

Factors Influencing Fetal Growth

Skeletal and muscular development
- Increased energy substrate availability
  - and stimulates placental growth
- Stimulates fetal growth

Fetal Hormones
- Thyroid
- Insulin
- Growth hormone

Uterine Size Changes During Pregnancy
- Hyperplasia
  - Increase in # of cells
- Hypertrophy
  - Increase in size of cells
- Stretching

Relative P<sub>4</sub> and E<sub>2</sub>

Ovulation
Weeks of Gestation
Progesterone Maintains Pregnancy!

Corpus Luteum

Placenta

Species | Gestation Length | Placental Takeover |
--------|------------------|-------------------|
Sow     | 3.8 mo           | 3.8 mo (none)     |
Cow     | 9 mo             | 6 - 8 mo          |
Ewe     | 5 mo             | 50 d              |
Mare    | 11 mo            | 70 d              |
Human   | 9 mo             | 60-70 d           |

Other Species in Which Placenta Does not Take-over Progesterone Production

- Bitch
- Queen
- Alpaca, Llama, Camel
- Rabbit
- Goat