Reproductive patterns

- Oviparous vs. viviparous
- Semelparous vs. iteroparous

Sex determination

- In vertebrates, reproductive anatomy is “indifferent” at early embryonic stages
- Maleness induced by hormones from the developing testis.

Reproductive duct development

- In females mesonephric duct regresses
- Mullerian tube becomes: oviduct (and uterus, vagina in mammals)
Vertebrate testes

Endothermy and testes

- Sperm cannot develop in temps above 98°F
- Birds perform spermatogenesis at night, mate in morning
- Most mammals have scrotums

Mammal testes

- During development testes descend into scrotum
- Gubernaculum (a ligament) guides the descent

- Pampiniform plexus — network of veins that cool incoming arterial blood
**Vertebrate ovaries**

- **Chondrichthyes** – fertilization internal, few eggs are developed at once
  - Shell gland can store sperm, adds protein layer

| Oviparous or Viviparous | Shark in egg |

**Mammal testes**

- Veins in dorsal and tail fins cool abdominal testes of dolphins, whales

| Superficial veins in dorsal fin | Cooled blood entering venous plexus border |

**Styles of shark viviparity**

- Yolk provides entire nourishment
  - Yolk stalk attaches to mother’s uterus and forms placenta
**Styles of shark viviparity**

- Oophagy in sharks:
  - Developing sharks eat unfertilized eggs provided in uterus.

**Vertebrate ovaries**

- Teleosts -
  - Usually fertilization is external, many eggs
  - Females - usually many ova develop at once

**Vertebrate ovaries**

- Amphibian
- Mammal

**Fertilization**

- Bony fish
  - Usually no copulatory organs
  - Behavioral adaptations to ensure fertilization
Fertilization

Chondrichthyes
- Oviduct has shell gland - produces protein shell for eggs
- Fertilization internal - males with claspers and siphon sac

Amphibians
- Fertilization external (frogs, toads) or internal (salmanders, caecilians)
- No external genitalia

Amniotes
- Males - intromittent organ for internal fertilization
  - single penis - mammals, some reptiles
  - paired hemipenes - lizards, snakes
  - Most birds - just cloaca

- Fertilization internal
  - Birds, reptiles - shell seals egg
  - Mammals - development internal
Mammal fertilization

- Corpora cavernosa, corpus spongiosum - tissues temporarily hold blood

Mammal seminal glands

- Seminal vesicles supply sugar & fibrinogen
- Prostate gland secretes alkaline fluid and clotting enzymes
- Bulbourethral glands add mucus for lubrication

Mammal uterus shapes

- Duplex - marsupials, rodents, rabbits
- Bipartite - carnivores
External adjustments in males to duplex uterus

- Bifurcated penis found in marsupials, monotremes

Mammal uterus shapes

- Bicornate – most ungulates
- Simplex - primates

Amniote embryos

Reptiles and birds produce secretions along their oviduct

- Oviduct adds layers to ova
  - albumen glands, shell glands

Amniote embryos

- Extra-embryonic membranes
**Extra-embryonic membranes**

- Allantois grows and fuses with chorion for gas exchange (reptiles and birds) or to contribute to placenta (eutherian mammals)

**Eutherian mammals**

- Placenta forms from fusion of chorion and allantois (from fetus) and endometrium (from mother)

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**Placenta types**

- Placentas vary in how deeply the embryonic membranes merge with the mother’s endometrium
  - Invasive vs. non-invasive (superficial)

- For invasive placentas, uterine endometrium is shed at birth. (primates, bats, rodents, carnivores)

**Non-invasive placentas**

- Diffuse placenta (pigs, whales, non-ruminant ungulates)
  - Chorioallantois has many little villi and entire membrane used for diffusion
Diffuse placenta

- Pig endometrium
- Horse endometrium

Non-invasive placentas

- **Diffuse placenta** (pigs, whales, non-ruminant ungulates)
  - Chorioallantois has many little villi and entire membrane used for diffusion

- **Cotyledonary placenta** (ruminants)
  - Chorioallantois bunches into cotyledons which join with “prearranged” sites along uterus called caruncles.

Cow fetus with cotyledons
Invasive placentas

- Embryo ‘carves’ a hole for implantation.

• Zonary placenta (carnivores)
• Discoid placenta (rodents, primates, bats)

Eutherian mammals

- Gasses, wastes, nutrients diffuse bw capillaries of mother and fetus
- Drugs, pollutants, chemicals also diffuse