Reproductive patterns

- Oviparous vs. viviparous
- Semelparous vs. iteroparous

Lizard with live Young developing

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)

Eggs rupture into coelum

EREAL

LATE

Developing Ovary
Cortical Cords
Fimbriae
Parous or Mullerian Duct
Mesonephric or Wolffian Duct
Oviduct
Epoophoron
Paroophoron
Gartner’s Duct
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

Mammal testes
- Pampiniform plexus – network of veins that cool incoming arterial blood
**Cremaster muscle**
- = internal oblique

**Withdraws testes after breeding season**

**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

**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 oocytes**

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

**Vertebrate ovaries**

**Amphibian**

- Oogonium in primary follicles
- Secondary oocyte cells

**Mammal**

- Oogonium in primary follicles
- Secondary oocyte cells

**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

Fertilization

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

Fertilization

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

Fertilization

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

- Corpora cavernosa, corpus spongiosum - tissues temporarily hold blood

- Many mammals - baculum exists between the corpora cavernosa

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)

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.

**Eutherian mammals**

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

**Invasive placentas**

- Zonary placenta (carnivores)

- Discoid placenta (rodents, primates, bats)