Vertebrate Development 12/16/2014

- Vertebrate Development Embryology
  - Embryology = study of development of embryo
  - 5 stages:
    - 1. gametogenesis
    - 2. Fertilization
    - 3. Cleavage
    - 4. Gastrulation
    - 5. Organogenesis

- Gametogenesis
  - Gamete production = meiosis
  - Spermatogenesis in semiferous tubule
  - Spermatocytes made in meiosis I and II -> sperm cells
    - Meiosis I makes 2n to 2 n n.
    - Meisois II makes each n into 2 more n n
    - After meiosis II = n n n n
    - Characterized by cell differentiation
    - Sertoli cell nucleus = position effect
    - Sertoli cells provide nutrients

- Oogenesis in ovary
  - Every 28 days FSH of pituitary = follicle develops
    - Oocyte = meiosis = produce 2nd oocyte and polar body
    - 2nd oocyte at meiosis II at puberty
    - Primary oocyte at meiosis I at birth
    - Completion of meiosis I gives first polar body
    - Completion of meiosis II gives 2nd polar body
  - LH of pituitary = ovulation
    - Cell growth enlargement

- Fertilization
  - Union of sperm and egg cell = 2n zygote
  - Sperm must penetrate
    - 1. Egg's outer layer
    - 2. Vitellin layer (glycoproteins)
    - 3. Egg's plasma membrane
  - This penetration occurs via acrosomal reaction
    - Hydrolytic enzymes in acrosome of sperm break down egg
    - Must enter glycoprotein matrix
  - Monospermy: fusion of single sperm and egg nuclei
  - Prevention of polyspermy: fusion of many sperm

- Sea urchins – layers become depolarized to prevent fusion
- Calcium released by egg ER and Calcium wave sweeps across egg
- High Calcium causes a cortical rxn and creates a perivitellin space
- After fertilization also creates hardened area
- High Ca also leads to activation of egg = cell respiration and protein synthesis
- All this takes place in first minute

- Cleavage
  - Rapid succession of cell divisions without cell growth
  - No increase in size
  - Begins in oviduct
  - Only increase in number
  - Morula: still surrounded by fertilization
  - Blastula: single layer of cells surrounds blastocoel
  - Outermost blastomeres join via tight junctions and seal interior cell mass
  - Na is pumped into cavity called blastocoel
  - Blastocyst implants in endometrium
  - Blastocyst = trophoblast becomes placenta in mammals
  - Inner mass of cell becomes embryo
  - General cleavage pattern depends upon yolk
  - Animal pole: embryo part hosting primary tissues