Human Development

- Pre-embryonic period (first 2 weeks)
  -- includes cleavage, implantation and gastrulation.
- Embryonic period (3rd - 8th week)
  -- includes induction.
- Fetal period (3rd to 9th month)
  -- includes growth and development.

Preembryonic period

Cleavage
- Begins 1.5 days after fertilization.
- Completed in 5-6 days, before implantation.
- Zygote becomes a hollow blastula.
- Late blastula composed of:
  -- inner cell mass
  -- trophoblast layer

Late blastula

Implantation
- Trophoblast cells "digest" their way into the uterine lining.
- Trophoblast cells will become the chorion.
- Urine tests for pregnancy detect hCG (human chorionic gonadotrophin).

Gastrulation
- Formation of the three primary germ layers
- Epiblast migrates inward through the primitive streak to form both mesoderm and endoderm.

Gastrulation
- Begins with 2-layered embryo.
- Hypoblast (lower layer) grows down around "yolk" to form yolk sac.
- Epiblast (upper layer)
  -- grows up to form amnionic sac.
  -- invaginates through primitive streak to form mesoderm and endoderm.

Embryonic period
- Basic structures of all organ systems are completed during this phase (3-8th week)
- Induction of organ systems from interaction of three primary germ layers.
- Tubular "heart" beats at 3 weeks.
- Embryo the size of a pea at 5 weeks.

Extraembryonic membranes
- Three grow out of the embryo.
- The fourth (the chorion) surrounds but has no contact with the embryo. It is formed from the trophoblast layer.
Extraembryonic membranes:
Chickens
- Yolk sac = encloses yolk; has blood vessels for food transport to embryo.
- Amnion = holds fluid around embryo.
- Allantois = stores wastes; blood vessels for gas exchange.
- Chorion = gas exchange.

Extraembryonic membranes: Human
- Yolk sac = not functional
- Amnion = "bag of waters" around embryo
- Allantois = its blood vessels used in umbilical cord.
- Chorion = from trophoblast; forms placenta with allantois; secretes hCG; boundary in placenta between mother and fetus.

Primary induction
- The interaction of any two primary germ layers.
- For example, formation of the spinal cord.

Formation of spinal cord
- Mesoderm (specifically, the notochord) induces the overlying ectoderm to form the neural tube, which becomes the spinal cord and brain.
- This is primary induction because the interaction is between primary germ layers.

Spina bifida
- If closure of neural tube is incomplete, child is born with exposed neural tissue.

Secondary induction
- The interaction of two cell layers derived from the same primary germ layer.
- For example, formation of eye.

Formation of eye
- Optic cup (outgrowth of brain) induces overlying ectoderm to become lens of eye.
- Optic cup becomes retina, its lip the iris.
- This is secondary induction because both the optic cup and the skin are from ectoderm.

Tertiary (etc.) induction
- For example, the structural similarities of early embryos of vertebrates.

Vertebrate embryos are similar
- Does "ontogeny recapitulate phylogeny"?
- Does embryonic development retrace the path of evolutionary history?
- If not, then why do human embryos have gill pouches?

Gill pouches in humans
- The pouches never function as gills.
- Gill pouches serve as intermediates in the development of other structures.

Derivatives of gill pouches
- 1st pair become Eustachian tubes from throat to middle ear behind eardrum.
- 2nd pair of pouches becomes the tonsils.
- 3rd pair becomes thymus gland.
- 4th pair the parathyraoids (Ca++ levels)

Fetal period
- Third to Ninth month.
- Growth (from 1 ounce to 7.5 pounds).
- Head to body ratio decreases.

**Abdomen at 0, 20 and 30 weeks**

**Fetal milestones**

- 12 wk = swallowing & sucking reflexes.
- 16 wk = fills womb, abdomen expands.
- 17 wk = "quickening" (abortion deadline according to English Common Law).
- 23 wk = can survive with intensive care.
- 40 wk (+ 2) is considered full term.

**Weight gain (28 lb.)**

- Baby (7.5)
- Amnionic fluid (2) & placenta (1.5)
- Uterus (3) & breasts (1)
- Blood (3) and body fluid (2.5)
- "Unnecessary" (not really) (7.5)

**U.S. Supreme Court (1973)**

- 1st trimester = States cannot outlaw abortion in first 3 months of pregnancy.
- 2nd trimester = States may prohibit abortions except those for health reasons.
- 3rd trimester = States may prohibit abortions all together.

**Childbirth: Stages of labor**

- 1st = dilation of cervix (3 mm to 10 cm)
  - 8-20 hours for 1st baby (3-8 later)
  - breathing to avoid premature push
- 2nd = delivery of baby (0.3-1.5 hr)
  - including crowning, episiotomy, and cutting umbilical cord.
- 3rd = delivery of placenta (5-10 min later)

**Prepared Childbirth**

- Breathing & relaxation to break cycle of pain-tension-pain
- Father is involved.