Chapter 16
Development and Aging

Outline
  - Fertilization
  - Development before Birth
    - Fetal Circulation
    - Embryonic Development
  - Fetal Development
  - Birth
  - Development after Birth
  - Aging

Fertilization
  - Steps of fertilization.
    - Several sperm penetrate corona radiata.
    - Several sperm attempt to penetrate zona pellucida.
    - One sperm enters egg and nuclei fuse, producing a zygote.
      - Egg's plasma membrane and zona pellucida change to prevent polyspermy.

Fertilization

Occurrence of Pregnancy
  - When a zygote begins dividing, it is termed an embryo.
    - Developing embryo travels down oviduct and eventually implants in endometrium.
      - Presence of human gonadotropic hormone in the blood confirms pregnancy.
        - If implantation does not occur, a woman never knows fertilization took place.

Human Development before Implantation

Development before Birth
  - Processes of development.
    - Cleavage - Cell division without growth.
    - Morphogenesis - Shaping of embryo.
    - Differentiation - Cells take on specific structure and function.
    - Growth - Increase in size of cells.

Development before Birth
  - Stages of development.
    - Morula - Solid mass of cells resulting from cleavage.
    - Blastocyst - Ball of cells formed from morula.
Embryonic disk - Inner mass of cells of blastocyst.
- Gastrula - Embryo composed of three tissues.
- Ectoderm, mesoderm, endoderm.

9 Early Developmental Stages
10 Development before Birth
  - Stages of development.
    - Neurula - Nervous system develops from ectoderm located just above the notochord.
      - Involves induction as one tissue influences the development of another tissue.

11 Primitive Streak and Neurula
12 Extraembryonic Membranes
  - Membranes that extend out beyond the embryo.
    - Amnion - Provides fluid environment for developing embryo and fetus.
    - Yolk sac - First site of red blood cell formation.
    - Allantois - Contributes to cardiovascular system.

13 Extraembryonic Membranes
14 Fetal Circulation
  - The umbilical cord stretches between the placenta and the fetus and contains the umbilical arteries and veins.
    - Exchange of gases and nutrients between maternal and fetal blood takes place in the umbilical arteries.
    - Umbilical vein carries blood and oxygen away from the placenta to the fetus.

15 Fetal Circulation and the Placenta
16 Embryonic Development
  - Embryonic development occurs from the second week to the eighth week.
  - Fetal development occurs from the third month through the ninth month.

17 Embryonic Development
  - Immediately after fertilization, the embryo divides and develops into a blastocyst.
    - Bounded by a layer of cells that becomes the chorion.
    - Implantation completed by the end of the second week.
  - Embryo is a gastrula by the end of the third week.
  - Placenta is forming by end of fourth week.

18 Embryonic Development
19 Embryonic Development
  - By the end of the second month, all organs have appeared and the
placenta is fully functioning.
- Embryonic development complete.

20 Five-Week-Old Embryo
21 Fetal Development
- At the beginning of the third month, head growth begins to slow and the body increases in length.
- Ossification centers appear in bones.
- Sex can be determined sometime in the third month.

22 Three-to-Four Month-Old Fetus
23 Fifth through Seventh Months
- Mother begins to feel fetal movement.
- Wrinkled skin covered by fine hair, lanugo, is covered by a greasy substance vernix caseosa.
- Lungs lack surfactant.

24 Six-Month-Old-Fetus
25 Eighth and Ninth Months
- Fetus usually rotates so head is pointed down toward cervix.
- Fetus is now about 530 mm in length and weighs about 3,400 g.
- Full-term babies have the best chance of survival.

26 Development of Male and Female Sex Organs
- Sex of an individual is determined at the moment of fertilization.
  - Gonads arise from indifferent tissue that can develop into ovaries or testes, depending on the action of hormones.
  - In the absence of a Y chromosome and in the presence of two X chromosomes, ovaries develop instead of testes.

27 Birth
- True labor is marked by uterine contractions that occur regularly every 15-20 minutes and last for 40 seconds or more.
- Positive feedback control.
- Parturition.
  - Stage 1.
    - Mucous plug may be expelled from cervical canal.
    - Cervix dilates completely.

28 Birth
- Stage 2.
  - Baby's head descends into the vagina.
  - Baby is delivered.
- Stage 3.
  - Placenta delivered.
29 (a) Stages of Parturition
30 (a) Female Breast and Lactation
   - Female breast contains 15-20 lobules, each with a milk duct beginning at
     the nipple and ending in alveoli.
     - In pregnancy, breasts enlarge as ducts and alveoli increase in number
       and size.
       ◦ Milk usually not produced during pregnancy.
       >> Prolactin suppressed due to increase in estrogen and
           progesterone.
       >> Suckling stimulates release of oxytocin.
31 (a) Female Breast Anatomy
32 (a) Development after Birth
   - Aging encompasses progressive changes that contribute to an increased
     risk of infirmity, disease, and death.
     - Theories.
       ◦ Genetic in Origin.
       ◦ Whole-Body Process.
       ◦ Extrinsic Factors.
33 (a) Effect of Age on Body Systems
   - Skin.
     - Skin becomes less elastic due to changes in elastic fibers.
   - Processing and transporting.
     - Heart shrinks due to a reduction in cardiac muscle.
     - Blood pressure gradually increases.
     - Liver not as efficient in metabolizing drugs.
     - Blood supply to kidneys reduced.
34 (a) Effect of Age on Body Systems
   - Integration and coordination.
     - Few neural cells of the cerebral cortex are lost during the aging process.
     - Reaction time slows.
     - Loss of skeletal muscle mass not uncommon.
   - Reproductive system.
     - Females undergo menopause.
     - Male androgen levels fall between ages 50-90, but sperm produced until
       death.