Chapter 3

- The First Nine Months
    - Some of the most rapid and dramatic developments in the human lifespan occur in the first nine months
    - Gestation: the period from conception to birth; takes about 280 days counting the mother's last menstrual period
    - Three main stages:
        - Zygote (first 2 weeks)
            - Development of a new human being starts when a male's sperm pierces the membrane of a woman's ovum, or egg
            - After puberty, a woman experiences ovulation (every 28 days, an egg is released)
            - During puberty, a male's body begins to produce an average of 2 million sperm every day
            - After one sperm penetrates an ovum, the egg develops a protective coating to shut out other sperm
                - "winner take all" competition; natural selection that eliminates weak or damaged sperm
                - Fertilization is most likely to occur if a man and woman have intercourse on or a few days before ovulation
            - Development begins almost instantaneously when conception occurs
                - Within hours, the sperm and egg combine to form a zygote
            - 23 chromosomes from the mother and 23 chromosomes from the father combine to create a genotype (the unique genetic makeup of an individual)
            - Development of the phenotype (physical characteristics) has only just begun
            - As the zygote travels toward the uterus, the original cell divides and multiplies
            - By the end of the first week, differentiation has begun
                - The original stem cells begin to assume specialized roles
                - The zygotes outer cells will become a support system including the placenta (which provides food and oxygen to the developing child and carries away waste products via the umbilical cord)
                - The inner cells will become the embryo
            - During the second week, implantation occurs
                - The zygote embeds itself into the uterine wall (which is nutrient rich) AKA endometrium
                - When implantation is successful, the pregnancy has begun
            - Infertility and Reproductive Technology
                - Every year, around 2 million couples seek help for infertility (the failure to conceive a child after 12 months of sexual intercourse without birth control)
                - The risk on infertility depends on a variety of factors
                    - Couples' overall health

- Infections, STDs
- Malnutrition, obesity

- Lifestyle
  - Alcohol, smoking, drugs
- Age
  - Woman's fertility decreases around age 32
  - Man's decreases around age 35

- Infertility is not sterility (permanent inability to conceive)
- Infertility is often treatable
  - First step to treatment is to identify the cause
  - Simplest treatments are giving a woman hormone-based fertility drugs to stimulate ovulation or performing surgery to repair a damaged part of the man or woman's reproductive system
  - Most common treatment for male infertility is artificial insemination (inserting sperm directly into the woman's uterus with a syringe)
  - More advance technology is available for couples with complex problems
    - Best known and most common is in vitro fertilization (IVF) where the woman first takes fertility drugs and then her ova and a male's sperm are combined in a petri dish and eventually implanted back into her uterus
    - Prenatal adoption enables a couple to experience pregnancy and birth even though the developing child may not share their genes
      - Couples usually use their own gametes
    - A surrogate mother ("gestational carrier") may be arranged for if a woman cannot sustain a pregnancy
- Reproductive technology does not increase the danger of birth defects
  - Main "risk" is a multiple pregnancy, which is linked to pregnancy complications, premature birth, low birth weight, and infant death
  - Another risk is the failure of IVF to succeed, leading to psychological stress, repeated cycles of hope and disappointment

- Embryo (weeks 3-8)
  - Begins about 2 weeks after conception when the zygote is firmly connected to the uterine wall
  - Embryo's cells have formed specialized layers:
    - Ectoderm: outer layer which will become skin, nerves, and sense organs
    - Mesoderm: middle layer which will become muscle, bones, and the circulatory system, and some organs

        - Endoderm: inner layer which will become the digestive system, lungs, urinary tract, and glands
    - Amniotic sac is a protective membrane filled with warm liquid that cushions the tiny embryo
    - During the next 6 weeks, the basic structure for a human being appears and organs begin to function
    - The first visible development is the appearance of the "primitive streak" (a thin line down the center of the embryo that will become the CNS)
        - A portion of the ectoderm folds over to form a neural tube, the beginning of the spinal cord
        - At 3.5 weeks, the brain starts to develop at the top of the neural tube
        - Neurogenesis (the production of neurons or nerve cells) begins
            - Almost all of the neurons in the human brain are generated during prenatal development
            - An average of 250,000 neurons must be generated each minute, although the rate is not constant over the 9 month period
        - 2 months after conception, the embryo is about one inch long and weighs just 0.04 ounces (about one gram), but all of the major organs and body parts have formed
- Fetus (weeks 8-40)
    - Organs, muscles, and the nervous system become more organized and connected
    - Over the next 7 months, the size of the fetus increases twentyfold
    - The Brain and Behavior
        - Brain development accelerates and nuerogenesis is nearly complete by the end of the 6th month
        - Key point is that the CNS becomes active and responsive in midpregnancy
        - The 4th month is the time of quickening (the first fetal movements the mother can feel)
        - Development of brain and behavior is bidirectional
            - Genetically determines brain development permits new behavior and interactions with the environment that shapes further brain development
        - Fetal development becomes increasingly organized
            - At 3 months, the fetus swallows, urinates, kicks, curls its toes, blinks, hiccups, and occasionally yawns
            - At 6 months, fetuses have been observed "breathing" and "crying", brain waves show distinct patterns of waking and sleeping states
                - The fetus' heart rate is ties to its body movement which tells that the fetus is tuning into its environment
            - At 7-8 months, the fetus is less active and more vigorous