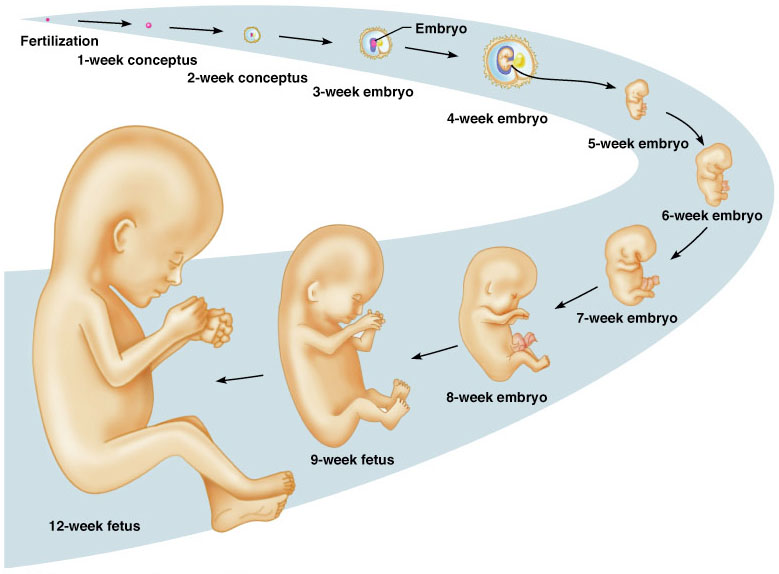
**Pregnancy and Human Development**

**Dr. Gary Mumaugh**

**From Egg to Embryo**

* Pregnancy – events that occur from fertilization until the infant is born
* Conceptus – the developing offspring
* Gestation period – from the last menstrual period until birth
* Preembryo – conceptus from fertilization until it is two weeks old
* Embryo – conceptus during the third through the eighth week
* Fetus – conceptus from the ninth week through birth

**Relative Size of Human Conceptus**

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**Accomplishing Fertilization**

* The oocyte is viable for 12 to 24 hours
* Sperm is viable 24 to 72 hours
* For fertilization to occur, coitus must occur no more than:
* Three days before ovulation
* 24 hours after ovulation
* Fertilization – when a sperm fuses with an egg to form a zygote

**Sperm Transport**

* Fates of ejaculated sperm
  + Leak out of the vagina immediately after deposition
  + Destroyed by the acidic vaginal environment
  + Fail to make it through the cervix
  + Dispersed in the uterine cavity or destroyed by phagocytic leukocytes
  + Reach the uterine tubes

**Polyspermy**

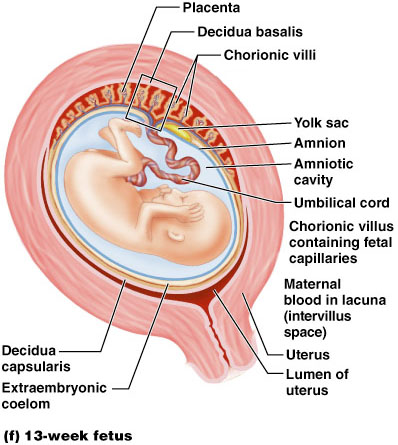
* Polyspermy – multiple sperm penetrations
* Only one sperm is allowed to penetrate oocyte
* Blocks to polyspermy
  + Egg membrane depolarizes to prevent sperm from fusing
  + Proteins destroy sperm receptors
  + Proteins cause already attached sperm to death

**Implantation**

* Begins six to seven days after ovulation when the trophoblasts adhere to a properly prepared endometrium
* The trophoblasts then proliferate and form two distinct layers
* Implantation is completed by the fourteenth day after ovulation

**Placentation**

* The placenta is fully formed and functional by the end of the third month
* The placenta also secretes other hormones
  + Human placental lactogen, human chorionic thyrotropin, and relaxin



**Pregnancy Testing**

* Human chorionic gonadotropin, or hCG

**Primary Germ Layers**

* Serve as primitive tissues from which all body organs will derive
* Ectoderm – forms structures of the nervous system and skin epidermis
* Endoderm – forms epithelial linings of the digestive, respiratory, and urogenital systems
* Mesoderm – forms all other tissues
* Endoderm and ectoderm are securely joined and are considered epithelia

**Specialization of Ectoderm**

* Neuralization
  + First event of organogenesis giving rise to the brain and spinal cord.
  + Ectoderm thickens and forms neural plate which folds into neural tube.
  + By the 22nd day, neural folds fuse into a neural tube, which pinches off into the body.
  + The anterior end becomes the brain; the rest becomes the spinal cord.

**Specialization of Endoderm**

* Embryonic folding begins with lateral folds.
* Next, head and tail folds appear.
* An endoderm tube forms the epithelial lining of the GI tract.
* Organs of the GI tract become apparent, and oral and anal openings perforate.
* Endoderm forms epithelium linings of the hollow organs of the digestive and respiratory tracts.

**Specialization of the Mesoderm**

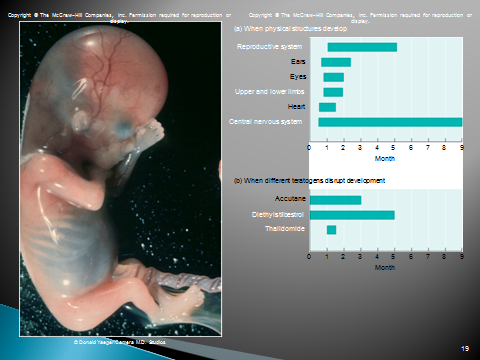
* The 40 pairs of somites have three functional parts:
  + Sclerotome – produce the vertebrae and ribs
  + Dermatome – help form the dermis of the skin on the dorsal part of the body
  + Myotome – form the skeletal muscles of the neck, trunk, and limbs
* Intermediate mesoderm forms the gonads and the kidneys
* Somatic mesoderm forms the:
  + Dermis of the skin in the ventral region
  + Parietal serosa of the ventral body cavity
  + Bones, ligaments, and dermis of the limbs
* Splanchnic mesoderm forms:
  + The heart and blood vessels
  + Most connective tissues of the body

**Organogenesis**

* By the 8th week all organ systems are recognizable

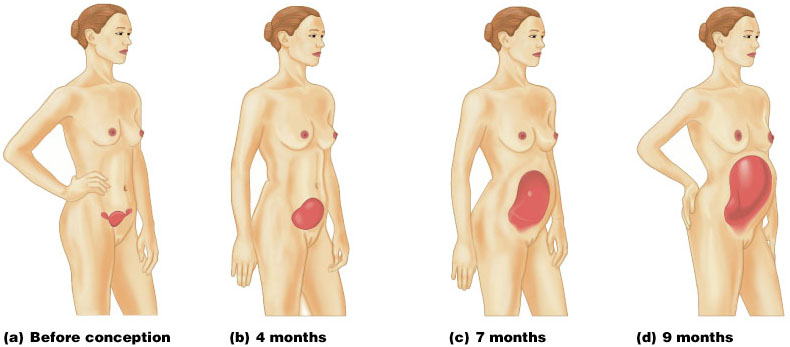
**Development of Fetal Circulation**

* By the end of the 3rd week:
  + The embryo has a system of paired vessels
  + The vessels forming the heart have fused
* Unique vascular modifications seen in prenatal development include umbilical arteries and veins, and three vascular shunts (occluded at birth)
  + Ductus venosus – venous shunt that bypasses the liver
  + Foramen ovale – opening in the interatrial septa to bypass pulmonary circulation
  + Ductus arteriosus – transfers blood from the right ventricle to the aorta

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**Effects of Pregnancy: Anatomical Changes**

* Chadwick’s sign – the vagina develops a purplish hue
* Breasts enlarge and their areolae darken
* The uterus expands, occupying most of the abdominal cavity
* Lordosis is common due to the change of the body’s center of gravity
* Relaxin causes pelvic ligaments and the pubic symphysis to relax
* Typical weight gain is about 29 pounds
* Relative Uterus Size During Pregnancy

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**Effects of Pregnancy: Metabolic Changes**

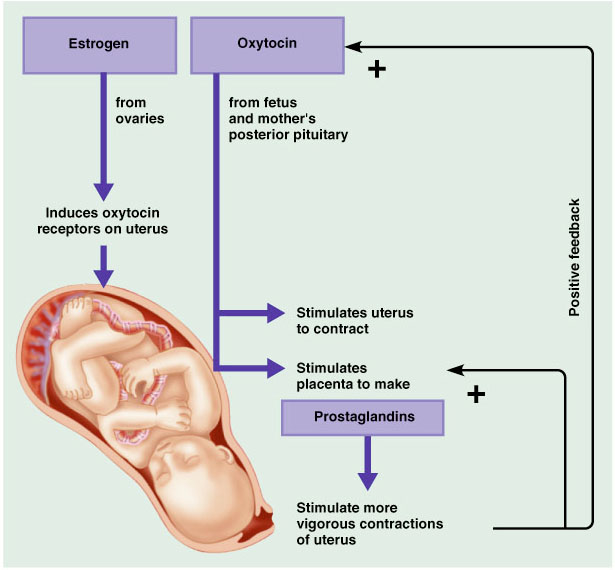
* The placenta secretes human placental lactogen (hPL), also called human chorionic somatomammotropin (hCS), which stimulates the maturation of the breasts
* hPL promotes growth of the fetus and exerts a maternal glucose-sparing effect
* Human chorionic thyrotropin (hCT) increases maternal metabolism
* Parathyroid hormone levels are high, ensuring a positive calcium balance

**Effects of Pregnancy: Physiological Changes**

* GI tract – morning sickness occurs due to elevated levels of estrogen and progesterone
* Urinary system – urine production increases to handle the additional fetal wastes
* Respiratory system – edematous and nasal congestion may occur
* Dyspnea (difficult breathing) may develop late in pregnancy
* Cardiovascular system – blood volume increases   
  25-40%
  + Venous pressure from lower limbs is impaired, resulting in varicose veins

**Parturition: Initiation of Labor**

* Estrogen reaches a peak during the last weeks of pregnancy causing myometrial weakness and irritability
* Weak Braxton Hicks contractions may take place
* As birth nears, oxytocin and prostaglandins cause uterine contractions
* Emotional and physical stress:
  + Activates the hypothalamus
  + Sets up a positive feedback mechanism, releasing more oxytocin

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**Stages of Labor: Dilation Stage**

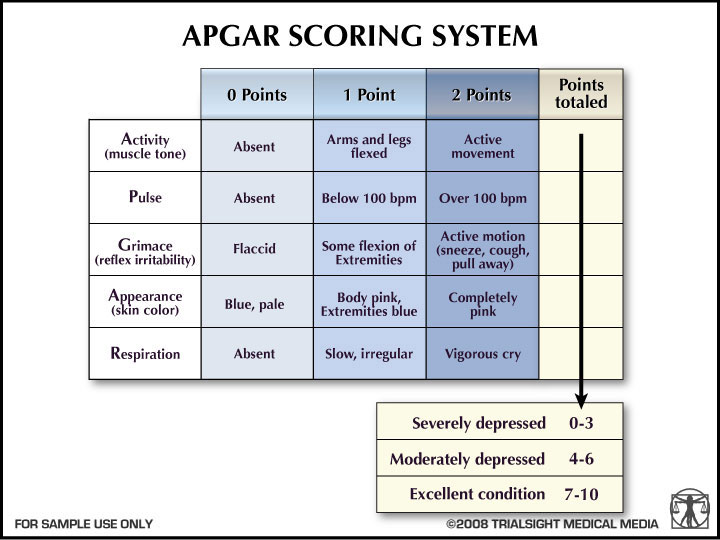
* From the onset of labor until the cervix is fully dilated (10 cm)
* Initial contractions are 15–30 minutes apart and 10–30 seconds in duration
* The cervix effaces and dilates
* The amnion ruptures, releasing amniotic fluid (breaking of the water)
* Engagement occurs as the infant’s head enters the true pelvis

**Stages of Labor: Expulsion Stage**

* From full dilation to delivery of the infant
* Strong contractions occur every 2–3 minutes and last about 1 minute
* The urge to push increases in labor without local anesthesia
* Crowning occurs when the largest dimension of the head is distending the vulva
* The delivery of the placenta is accomplished within 30 minutes of birth
* Afterbirth – the placenta and its attached fetal membranes
* All placenta fragments must be removed to prevent postpartum bleeding

**Extrauterine Life**

* At 1-5 minutes after birth, the infant’s physical status is assessed based on five signs: heart rate, respiration, color, muscle tone, and reflexes
* Each observation is given a score of 0 to 2
* Apgar score – the total score of the above assessments
  + 8-10 indicates a healthy baby - Lower scores reveal problems





**First Breath**

* Once carbon dioxide is no longer removed by the placenta, central acidosis occurs
* This excites the respiratory centers to trigger the first inspiration
* This requires tremendous effort – airways are tiny and the lungs are collapsed
* Once the lungs inflate, surfactant in alveolar fluid helps reduce surface tension

**Transitional Period**

* Unstable period lasting 6-8 hours after birth
* The first 30 minutes the baby is alert and active
  + Heart rate increases (120-160 beats/min.)
  + Respiration is rapid and irregular
  + Temperature falls
* Activity then diminishes and the infant sleeps about three hours
* A second active stage follows in which the baby regurgitates mucus and debris
* After this, the infant sleeps, with waking periods occurring every 3-4 hours

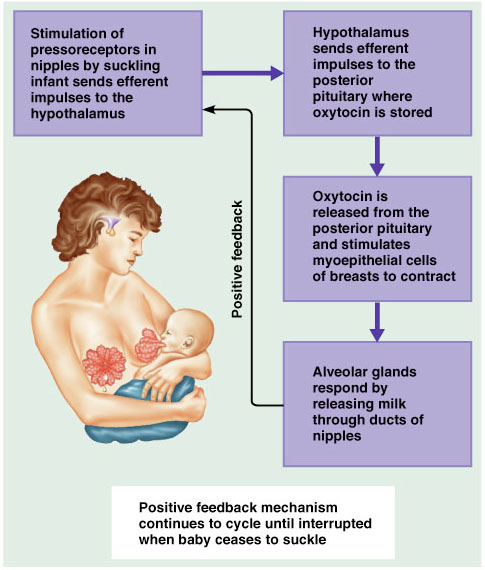
**Lactation**

* The production of milk by the mammary glands
* Estrogens, progesterone, and lactogen stimulate the hypothalamus to release prolactin-releasing hormone (PRH)
* The anterior pituitary responds by releasing prolactin
* Colostrum
  + Solution rich in vitamin A, protein, minerals, and IgA antibodies
  + Is released the first 2–3 days
  + Is followed by true milk production

**Lactation and Milk Let-down Reflex**

* After birth, milk production is stimulated by the sucking infant

[](http://www.google.com/imgres?hl=en&sa=X&rlz=1I7GGLD_en&biw=1366&bih=589&tbm=isch&prmd=imvns&tbnid=jNFnQN3AhQGyUM:&imgrefurl=http://www.nctba.org/moms-2/new-moms/5-things-breastfeeding-moms-don%E2%80%99t-really-need/&docid=Orp1D64PsUFR-M&imgurl=http://www.nctba.org/wp-content/uploads/2011/07/Breastfeeding_public.jpg&w=656&h=505&ei=u7lOT77iEPPJiQL5nvyBCw&zoom=1)

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**Breast Milk**

* Advantages of breast milk for the infant
  + Fats and iron are better absorbed
  + Its amino acids are metabolized more efficiently than those of cow’s milk
  + Beneficial chemicals are present – IgA, other immunoglobulins, complement, lysozyme, interferon, and lactoperoxidase
  + Interleukins and prostaglandins are present, which prevent overzealous inflammatory responses
  + Its natural laxatives help cleanse the bowels of meconium

**Prenatal Stages**

* Germinal period: Days 1-14
  + Implantation: One-half are successful
  + Miscarriage: 15% to 50%
* Embryonic period: 3rd to 8th week
  + Organogenesis, Sexual differentiation
  + Brain development starts at 3-4 weeks
* Fetal period: 9th week – birth
  + Proliferation, Migration
  + Ends in tremendous brain development
  + Age of viability at 23 weeks (5 ½ months)

**Stages of Life**

**Infancy**

* From the end of the 4th week to one year
* The growth rate is high
* The teeth begin to erupt
* The muscular and nervous systems mature
* Communication begins

**Childhood**

* From one year to puberty
* The growth rate is high
* Permanent teeth appear
* Muscular control is achieved
* Bladder and bowel controls are established
* Intellectual abilities mature

**Adolescence**

* From puberty to adulthood
* The person becomes reproductively functional and emotionally more mature
* Growth spurts occur
* Motor skills continue to develop
* Intellectual abilities continue to mature

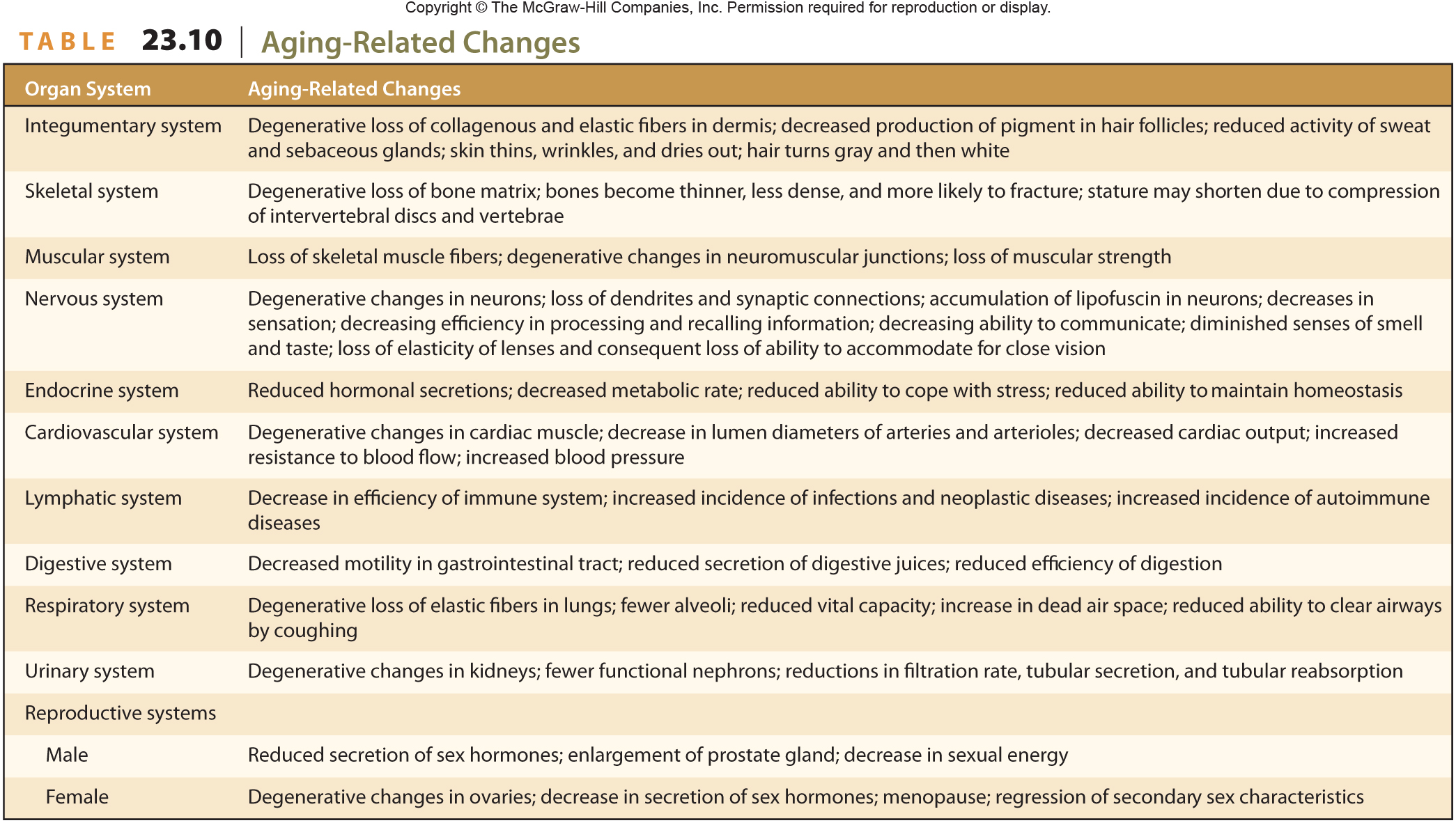
**Adulthood**

* Adolescence to old age
* The person remains relatively unchanged anatomically and physiologically
* Degenerative changes begin

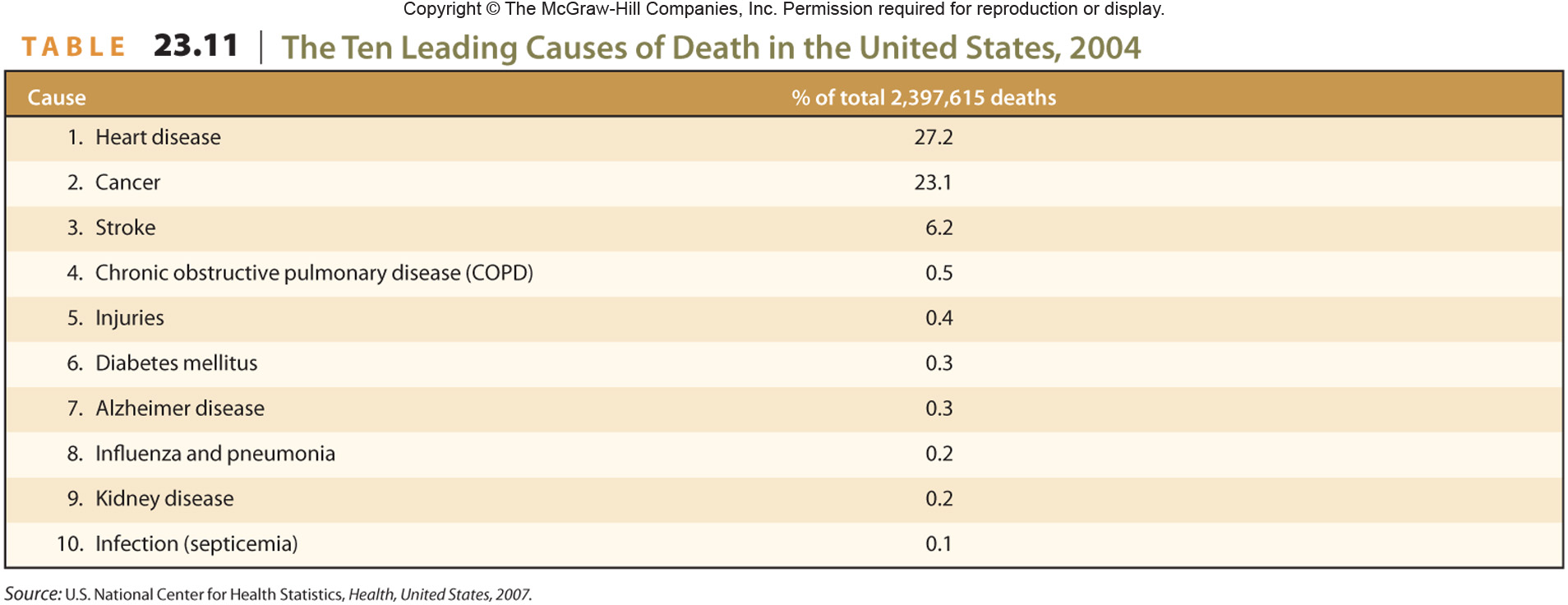
**Senescence**

* Old age to death
* Degenerative changes continue
* The body becomes less able to cope with the demands placed on it
* Death results from various conditions and diseases

**Age Related Changes**



**Ten Leading Causes of Death in USA 2004**



**Teratogen**

* Any disease, drug or environmental agent that can harm a developing fetus
* 15% of newborns have minor problems
* 5% of newborns have significant problems
* Generalizations about the effects of teratogens
  + Critical period is worse in organogenesis
  + Dosage and duration
  + Genetic make-up of mom determines susceptibility



**Teratogens: Drugs**

* Thalidomide
  + For morning sickness in the 1950s
  + All or parts of limbs missing
* Tobacco
  + Miscarriage, low birth weight, SIDS, slows fetal growth
* Alcohol: FAS
  + Small, facial deformities, retardation
* Cocaine
  + Processing difficulties



**Teratogens - Diseases**

* Rubella (German Measles)
  + Blind, deaf, heart, brain
* Syphilis
  + Miscarriage, blind, deaf, heart, brain
* AIDS: Mothers transmit to babies
  + Without treatment 15%-35% of infected babies will become HIV positive
  + Even those infected, 75% are alive at age 5

**Teratogens: Environmental Hazards**

* Radiation
  + MR, leukemia, cancer, mutations, spontaneous abortions, etc.
  + Avoid X-rays when pregnant
* Pollutants
  + In air and water
  + Lead: MR (also postnatally)
    - 1 in 4 children live in homes with lead paint
* One estimate is that there are 70,000 synthetic chemicals are available for exposure, and only 20% have been tested for toxity

