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

[Link to OctoMom Giving Birth]
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

[Conception to birth on TED.com](https://www.ted.com)
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
Sperm Penetration

- Sperm
- Corona radiata
- Zona pellucida
- First polar body
- Oocyte in second meiotic division

- Sperm nucleus
- Acrosome
  - Acrosomal reaction
- Granulosa cells of corona radiata
- Zona pellucida
- Extracellular space
- Oocyte plasma membrane
- Cortical granule
- Oocyte cytoplasm

- Fusion of oocyte and sperm plasma membranes
- Cortical reaction
- Sperm nucleus engulfed by oocyte cytoplasm
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**
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
- The “Rabbit Died”
- Mash 4077 Rabbit Test
Placentation

- Decidua basalis
- Maternal blood
- Chorionic villus
- Umbilical blood vessels in umbilical cord
- Amnion
- Amniotic cavity
- Yolk sac
- Extraembryonic coelom
- Chorion
- Decidua capsularis

(d) 4 1/2-week embryo

Lumen of uterus
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
Primary Germ Layers

(a) Embryo (See Figure 28.7c)

(b) ... turned 90°
(c) 3-D view
(d) Section view in (e)

(e) Bilayered embryonic disc, lateral-superior view

Amniotic sac (amnion) Yolk sac

Cut edge of amnion

Primitive streak

Hypoblast

Epiblast

Future opening between mouth and pharynx

Head

Left

Tail

Right

Yolk sac
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
Endodermal Differentiation

- Pharynx
- Parathyroid glands and thymus
- Thyroid gland
- Esophagus
- Trachea
- Right and left lungs
- Stomach
- Liver
- Pancreas
- Gallbladder
- Small intestine
- Large intestine

5-week embryo
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
By the 8\textsuperscript{th} 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

[Link to Fetal Circulation Rap]
Embryo at 40 Days
Figure 4.4 Rate of body growth during the fetal period. Increase in size is especially dramatic from the ninth to the twentieth week. ADAPTED FROM MOORE & PERSAUD, 1993.
(a) When physical structures develop

Reproductive system
- Ears
- Eyes
- Upper and lower limbs
- Heart

Central nervous system

(b) When different teratogens disrupt development

- Accutane
- Diethylstilbestrol
- Thalidomide
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

(a) Before conception  (b) 4 months  (c) 7 months  (d) 9 months
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
Effects of Pregnancy: Physiological Changes

- 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
Parturition: Initiation of Labor

Estrogen
- From ovaries
- Induces oxytocin receptors on uterus

Oxytocin
- From fetus and mother's posterior pituitary
- Stimulates uterus to contract
- Stimulates placenta to make Prostaglandins
- Stimulate more vigorous contractions of uterus

Positive feedback
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: Dilation Stage

(a)

(b)

- Umbilical cord
- Placenta
- Uterus
- Cervix
- Vagina
- Pubis symphysis
- Sacrum
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
Stages of Labor: Expulsion Stage

Perineum
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.
Stages of Labor: Expulsion Stage
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
The Apgar score rates:
- Respiration, crying
- Reflexes, irritability
- Pulse, heart rate
- Skin color of body and extremities
- Muscle tone
<table>
<thead>
<tr>
<th></th>
<th>0 Points</th>
<th>1 Point</th>
<th>2 Points</th>
<th>Points totaled</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
<td>Absent</td>
<td>Arms and legs flexed</td>
<td>Active movement</td>
<td></td>
</tr>
<tr>
<td>(muscle tone)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pulse</strong></td>
<td>Absent</td>
<td>Below 100 bpm</td>
<td>Over 100 bpm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grimace</strong></td>
<td>Flaccid</td>
<td>Some flexion of Extremities</td>
<td>Active motion (sneeze, cough, pull away)</td>
<td></td>
</tr>
<tr>
<td>(reflex irritability)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Appearance</strong></td>
<td>Blue, pale</td>
<td>Body pink, Extremities blue</td>
<td>Completely pink</td>
<td></td>
</tr>
<tr>
<td>(skin color)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Respiration</strong></td>
<td>Absent</td>
<td>Slow, irregular</td>
<td>Vigorous cry</td>
<td></td>
</tr>
</tbody>
</table>

- Severely depressed: 0-3
- Moderately depressed: 4-6
- Excellent condition: 7-10
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
Lactation

- Colostrum
  - Solution rich in vitamin A, protein, minerals, and IgA antibodies
  - Is released the first 2–3 days
  - Is followed by true milk production
After birth, milk production is stimulated by the sucking infant.
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
BREASTFEEDING

It Rocks!
PRENATAL DEVELOPMENT AND BIRTH
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)
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

Happiness and age is a state of mind!!!
The Cat In The Hat On Aging

I cannot see
I cannot pee
I cannot chew
I cannot screw
Oh, my God, what can I do?
My memory shrinks
My hearing stinks
No sense of smell
I look like hell
My mood is bad -- can you tell?
My body's drooping
Have trouble pooping
The Golden Years have come at last
The Golden Years can kiss my ass
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
<table>
<thead>
<tr>
<th>Organ System</th>
<th>Aging-Related Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integumentary</td>
<td>Degenerative loss of collagenous and elastic fibers in dermis; decreased production of pigment in hair follicles; reduced activity of sweat and sebaceous glands; skin thins, wrinkles, and dries out; hair turns gray and then white</td>
</tr>
<tr>
<td>Skeletal</td>
<td>Degenerative loss of bone matrix; bones become thinner, less dense, and more likely to fracture; stature may shorten due to compression of intervertebral discs and vertebrae</td>
</tr>
<tr>
<td>Muscular</td>
<td>Loss of skeletal muscle fibers; degenerative changes in neuromuscular junctions; loss of muscular strength</td>
</tr>
<tr>
<td>Nervous</td>
<td>Degenerative changes in neurons; loss of dendrites and synaptic connections; accumulation of lipofuscin in neurons; decreases in sensation; decreasing efficiency in processing and recalling information; decreasing ability to communicate; diminished senses of smell and taste; loss of elasticity of lenses and consequent loss of ability to accommodate for close vision</td>
</tr>
<tr>
<td>Endocrine</td>
<td>Reduced hormonal secretions; decreased metabolic rate; reduced ability to cope with stress; reduced ability to maintain homeostasis</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>Degenerative changes in cardiac muscle; decrease in lumen diameters of arteries and arterioles; decreased cardiac output; increased resistance to blood flow; increased blood pressure</td>
</tr>
<tr>
<td>Lymphatic</td>
<td>Decrease in efficiency of immune system; increased incidence of infections and neoplastic diseases; increased incidence of autoimmune diseases</td>
</tr>
<tr>
<td>Digestive</td>
<td>Decreased motility in gastrointestinal tract; reduced secretion of digestive juices; reduced efficiency of digestion</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Degenerative loss of elastic fibers in lungs; fewer alveoli; reduced vital capacity; increase in dead air space; reduced ability to clear airways by coughing</td>
</tr>
<tr>
<td>Urinary</td>
<td>Degenerative changes in kidneys; fewer functional nephrons; reductions in filtration rate, tubular secretion, and tubular reabsorption</td>
</tr>
<tr>
<td>Reproductive</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Reduced secretion of sex hormones; enlargement of prostate gland; decrease in sexual energy</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Degenerative changes in ovaries; decrease in secretion of sex hormones; menopause; regression of secondary sex characteristics</td>
</tr>
<tr>
<td>Cause</td>
<td>% of total 2,397,615 deaths</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>1. Heart disease</td>
<td>27.2</td>
</tr>
<tr>
<td>2. Cancer</td>
<td>23.1</td>
</tr>
<tr>
<td>3. Stroke</td>
<td>6.2</td>
</tr>
<tr>
<td>4. Chronic obstructive pulmonary disease (COPD)</td>
<td>0.5</td>
</tr>
<tr>
<td>5. Injuries</td>
<td>0.4</td>
</tr>
<tr>
<td>6. Diabetes mellitus</td>
<td>0.3</td>
</tr>
<tr>
<td>7. Alzheimer disease</td>
<td>0.3</td>
</tr>
<tr>
<td>8. Influenza and pneumonia</td>
<td>0.2</td>
</tr>
<tr>
<td>9. Kidney disease</td>
<td>0.2</td>
</tr>
<tr>
<td>10. Infection (septicemia)</td>
<td>0.1</td>
</tr>
</tbody>
</table>
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
Figure 4.5 The critical periods of prenatal development. Each organ or structure has a critical period when it is most sensitive to damage from teratogens. Dark band indicates the most sensitive periods. Light band indicates the time that each organ or structure is somewhat less sensitive to teratogens, although damage may still occur. ADAPTED FROM MOORE & PERSAUD, 1993.
<table>
<thead>
<tr>
<th>Prenatal week</th>
<th>Period of the embryo</th>
<th>Period of the fetus</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>CNS</td>
<td>Brain</td>
</tr>
<tr>
<td>4</td>
<td>Eye</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Heart</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ear</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Palate</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>External genitalia</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Site of birth defect**

(the part of the embryo or fetus where damage is most likely to occur)

- Heart
- Leg
- Arm
- Teeth
- Palate
- External genitalia
- Brain

**Severity of defects**

(dark orange shading indicates the most highly sensitive period for teratogenic effects)

- Heart
- Arms
- Eyes
- Legs
- Teeth
- Palate
- External genitalia
- Ear

**Major structural abnormalities**

- Physiological defects and minor structural abnormalities
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
Future Mothers of the Year?
Characteristic features of a child with fetal alcohol syndrome (FAS).

- Small eye openings
- Flat midface
- Short nose
- Indistinct groove between nose and mouth
- Epicanthal folds
- Low nasal bridge
- Minor ear anomalies
- Thin upper lip

In the young child
<table>
<thead>
<tr>
<th>Disease</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken pox</td>
<td>Chicken pox can cause spontaneous abortion, premature delivery, and slow growth, although fewer than 2% of exposed fetuses develop limb, facial, or skeletal malformations.</td>
</tr>
<tr>
<td>Cytomegalovirus</td>
<td>This common infection shows mild flulike symptoms in adults. About 25% of infected newborns develop hearing or vision loss, mental retardation, or other impairments, and 10% develop severe neurological problems or even die.</td>
</tr>
<tr>
<td>Influenza (flu)</td>
<td>The more powerful strains can cause spontaneous abortions or neural abnormalities early in pregnancy.</td>
</tr>
<tr>
<td>Rubella</td>
<td>Rubella may cause vision and hearing loss, mental retardation, heart defects, cerebral palsy, and microcephaly (see main text).</td>
</tr>
<tr>
<td>Toxemia</td>
<td>Affecting about 5% of mothers in the third trimester, its mildest form, preeclampsia, causes high blood pressure and rapid weight gain in the mother. Untreated, preeclampsia may become eclampsia and cause maternal convulsions, coma, and death of the mother, the unborn child, or both. Surviving infants may be brain damaged.</td>
</tr>
<tr>
<td>Toxoplasmosis</td>
<td>This illness, caused by a parasite in raw meat and cat feces, leads to blindness, deafness, and mental retardation in approximately 40% of infants born to infected mothers.</td>
</tr>
</tbody>
</table>
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 toxicity
<table>
<thead>
<tr>
<th>DRUG</th>
<th>EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>Results include a small head, facial abnormalities, heart defects, low birth weight, and intellectual retardation (see main text).</td>
</tr>
<tr>
<td>Antiepileptic drugs</td>
<td>Drugs such as Dilantin, Luminal, and Tegretol, used to treat seizures, increase the incidence of cleft lip and palate, neural tube defects, kidney disease and restricted growth (Kothare &amp; Kaleyias, 2007).</td>
</tr>
<tr>
<td>Aspirin and nonsteroidal and anti-inflammatory drugs</td>
<td>An occasional low dose is OK, but used in large quantities, such drugs may cause neonatal bleeding and anti-inflammatory drugs gastrointestinal discomfort. Large amounts of these over-the-counter pain killers (e.g., Advil) have been associated with low birth weight and increased risk of miscarriage (Li, Liu, &amp; Odouli, 2003).</td>
</tr>
<tr>
<td>Chemotherapy drugs</td>
<td>Such drugs cross the placenta and attack rapidly dividing cells. They can increase malformations and lead to miscarriage.</td>
</tr>
<tr>
<td>Marijuana</td>
<td>Heavy use of marijuana has been linked to premature birth, low birth weight, and mild behavioral abnormalities such as irritability at birth.</td>
</tr>
<tr>
<td>Narcotics</td>
<td>Addiction to heroin, codeine, methadone, or morphine increases the risk of premature delivery and low birth weight. The newborn is often addicted and experiences potentially fatal withdrawal symptoms (e.g., vomiting and convulsions). Longer-term cognitive deficits are sometimes evident.</td>
</tr>
<tr>
<td>Sex hormones</td>
<td>Birth control pills containing female hormones have been known to produce heart defects and cardiovascular problems, but today’s pill formulas are safer. Progesterone in drugs used to prevent miscarriage may masculinize the fetus. Diethylstilbestrol, once prescribed to prevent miscarriage, increased the risk of cervical cancer and created infertility and pregnancy problems in exposed daughters (DESAAction, 2007; Kaufman et al., 2000).</td>
</tr>
<tr>
<td>Stimulants</td>
<td>Heavy caffeine use has been linked to miscarriages, higher heart rates, and abnormal reflexes and irritability at birth, but it does not seem to have long-lasting effects on development (Barr &amp; Streissguth, 1991). Cocaine use can cause premature delivery, spontaneous abortion, and low birth weight, and it may result in later learning and behavioral problems (see main text). Amphetamine use has been linked to aggressive behavior and low school achievement (Billing et al., 1994).</td>
</tr>
<tr>
<td>Tobacco</td>
<td>Babies of smokers tend to be small and premature, have respiratory problems, and sometimes show intellectual deficits or behavioral problems later in development (see main text). Sons whose mothers smoked during their pregnancy may later have fertility problems (Storgaard et al., 2003). Secondhand smoke in the pregnant woman’s environment can increase her risk of miscarriage (George et al., 2006).</td>
</tr>
<tr>
<td>Disease or Condition</td>
<td>Effects</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>SEXUALLY TRANSMITTED DISEASES (STDs)</strong></td>
<td></td>
</tr>
<tr>
<td>Acquired immunodeficiency syndrome (AIDS)</td>
<td>If transmitted from mother to child, AIDS destroys defenses against disease and may lead to death. Mothers can acquire it through sexual contact or contact with contaminated blood (see main text).</td>
</tr>
<tr>
<td>Chlamydia</td>
<td>Chlamydia can lead to premature birth, low birth weight, eye inflammation, or pneumonia in newborns. This most common STD is easily treatable.</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>This STD attacks the eyes of the child during birth; blindness is prevented by administering silver nitrate eyedrops to newborns.</td>
</tr>
<tr>
<td>Herpes simplex (genital herpes)</td>
<td>This disease may cause eye and brain damage or death in the first trimester. Mothers with active herpes are advised to undergo cesarean deliveries to avoid infecting their babies during delivery, because 85% of infants born with herpes acquire the virus during birth through the birth canal.</td>
</tr>
<tr>
<td>Syphilis</td>
<td>Untreated, it can cause miscarriage or serious birth defects such as blindness and mental retardation (see main text).</td>
</tr>
</tbody>
</table>
### Table 4.3 Partial List of Drugs and Treatments Used by the Mother That Affect (or Are Thought to Affect) the Fetus or the Newborn

<table>
<thead>
<tr>
<th>Maternal drug use</th>
<th>Effect on fetus/newborn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>Small head, facial abnormalities, heart defects, low birth weight, and mental retardation (see text).</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>Premature delivery, stillbirth, irritability, and poor feeding among newborns.</td>
</tr>
<tr>
<td>Dextroamphetamine</td>
<td></td>
</tr>
<tr>
<td>Methamphetamine</td>
<td></td>
</tr>
<tr>
<td>Antibiotics</td>
<td>Heavy use of streptomycin by mothers can produce hearing loss in fetuses. Terramycin and tetracycline may be associated with premature delivery, restricted skeletal growth, cataracts, and staining of the baby’s teeth.</td>
</tr>
<tr>
<td>Streptomycin</td>
<td></td>
</tr>
<tr>
<td>Terramycin</td>
<td></td>
</tr>
<tr>
<td>Tetracycline</td>
<td></td>
</tr>
<tr>
<td>Aspirin</td>
<td>See text. (In clinical doses, acetaminophen is a very safe alternative to aspirin and ibuprofen.)</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td></td>
</tr>
<tr>
<td>Barbiturates</td>
<td>All barbiturates taken by the mother cross the placental barrier. In clinical doses, they cause the fetus or newborn to be lethargic. In large doses, they may cause anoxia (oxygen starvation) and restrict fetal growth. One barbiturate, primidone, is associated with malformations of the heart, face, and limbs.</td>
</tr>
<tr>
<td>Hallucinogens</td>
<td>Lysergic acid diethylamide (LSD) slightly increases the likelihood of limb deformities.</td>
</tr>
<tr>
<td>LSD</td>
<td></td>
</tr>
<tr>
<td>Marijuana</td>
<td>Heavy marijuana use during pregnancy is linked to behavioral abnormalities in newborns (see text).</td>
</tr>
<tr>
<td>Lithium</td>
<td>Heart defects, lethargic behavior in newborns.</td>
</tr>
<tr>
<td>Disease</td>
<td>Miscarriage</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Sexually transmitted diseases (STDs)</td>
<td></td>
</tr>
<tr>
<td>Acquired immunodeficiency syndrome (AIDS)</td>
<td>?</td>
</tr>
<tr>
<td>Herpes simplex (genital herpes)</td>
<td>+</td>
</tr>
<tr>
<td>Syphilis</td>
<td>+</td>
</tr>
<tr>
<td>Other maternal diseases/conditions</td>
<td></td>
</tr>
<tr>
<td>Chickenpox</td>
<td>0</td>
</tr>
<tr>
<td>Cholera</td>
<td>+</td>
</tr>
<tr>
<td>Cytomegalovirus</td>
<td>+</td>
</tr>
<tr>
<td>Diabetes</td>
<td>+</td>
</tr>
<tr>
<td>Influenza</td>
<td>+</td>
</tr>
<tr>
<td>Malaria</td>
<td>+</td>
</tr>
<tr>
<td>Mumps</td>
<td>+</td>
</tr>
<tr>
<td>Rubella</td>
<td>+</td>
</tr>
<tr>
<td>Toxemia</td>
<td>+</td>
</tr>
<tr>
<td>Toxoplasmosis</td>
<td>+</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>+</td>
</tr>
<tr>
<td>Urinary tract infection (bacterial)</td>
<td>+</td>
</tr>
</tbody>
</table>