

Detailed Chapter Outline with Key Terms

Chapter 3: Forming a New Life

Focus: Abel Dorris and Fetal Alcohol Syndrome

CONCEIVING NEW LIFE

- *Animalculists:* Early school of biological thought that claimed that fully-formed “little people” were contained in the heads of sperm, ready to grow in the nurturing womb.
- *Ovists:* Early school of biological thought that claimed that a female’s ovaries contained tiny, already-formed humans whose growth was activated by the male’s sperm.

How Fertilization Takes Place

- **Fertilization:** Fusion of sperm and ovum to produce a zygote; also called *conception*.
- *Gametes:* The sex cells, ovum and sperm.
- **Zygote:** One-celled organism resulting from fertilization.
- *Follicle:* Small sac in the ovary containing the immature ovum.
- *Ovulation:* The rupture of a mature follicle and expulsion of the ovum.
- *Cilia:* Tiny hair cells in the fallopian tubes that sweep the ovum along.
- *Cervix:* The opening of the uterus.

What Causes Multiple Births?

- **Dizygotic (two-egg) twins:** Twins conceived by the union of two different ova (or a single ovum that has split) with two different sperm cells; also called *fraternal twins*.
- **Monozygotic (one-egg) twins:** Twins resulting from the division of a single zygote after fertilization; also called *identical twins*.
- **Temperament:** Characteristic disposition, or style of approaching and reacting to situations.

MECHANISMS OF HEREDITY

- *Heredity:* The inborn factors, inherited from the biological parents that affect development.

The Genetic Code

- **Deoxyribonucleic acid (DNA):** Chemical that carries inherited instructions for the formation and function of body cells.
- *Bases:* Chemical units that make up DNA; adenine, thymine, cytosine, and guanine.
- **Genetic code:** Sequence of base pairs within DNA, which determine inherited characteristics.
- **Chromosomes:** Coils of DNA that carry the genes.
- **Genes:** Small segments of DNA located in definite positions on particular chromosomes.

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- *Meiosis*: Type of cell division in which each sex cell (gamete) ends up with only 23 chromosomes.
- *Mitosis*: Type of cell division in which each cell divides in half over and over again, resulting in new cells with 46 chromosomes.

What Determines Sex?

- **Autosomes**: The 22 pairs of chromosomes not related to sexual expression.
- **Sex chromosomes**: Pair of chromosomes that determines sex: XX in the normal female, XY in the normal male.
- *X-chromosomes*: Chromosomes containing the genes for femaleness.
- *Y-chromosomes*: Chromosomes containing the genes for maleness.
- *Wnt-4*: A signaling molecule that appears to control the development of female characteristics.

Patterns of Genetic Transmission

Dominant and Recessive Inheritance

- **Alleles**: Paired genes (alike or different) that affect a trait.
- **Homozygous**: Possessing two identical alleles for a trait.
- **Heterozygous**: Possessing differing alleles for a trait.
- **Dominant inheritance**: Pattern of inheritance in which, when a child receives contradictory alleles, only the dominant one is expressed.
- **Recessive inheritance**: Pattern of inheritance in which a child receives identical recessive alleles, resulting in expression of a nondominant trait.
- **Polygenic inheritance**: Pattern of inheritance in which multiple genes affect a complex trait.
- **Multifactorial transmission**: Combination of genetic and environmental factors to produce certain complex traits.

Genotypes and Phenotypes: Multifactorial Transmission

- **Phenotype**: Observable characteristics of a person.
- **Genotype**: Genetic makeup of a person, containing both expressed and unexpressed characteristics.

Genetic and Chromosomal Abnormalities

Defects Transmitted by Dominant or Recessive Inheritance

- **Incomplete dominance**: Partial expression of a trait.

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Defects Transmitted by Sex-Linked Inheritance

- **Sex-linked inheritance:** Pattern of inheritance in which certain characteristics carried on the X chromosome inherited from the mother are transmitted differently to her male and female offspring.
- *Carrier:* Person who does not have an expressed genetic trait but can pass on the gene for it to offspring.

Mutations

- **Mutations:** Permanent alterations in genes or chromosomes that may produce harmful characteristics.

Genome (Genetic) Imprinting

- *Genome (genetic) imprinting:* The phenomenon in which some genes seem to be temporarily imprinted, or chemically altered, in either the mother or the father. When transmitted to offspring, these genes have different effects than do counterpart genes from the other parent.

Chromosomal Abnormalities

- **Down syndrome:** Chromosomal disorder characterized by moderate-to-severe mental retardation and by such physical signs as a downward-sloping skin fold at the inner corners of the eyes.
- *Trisomy-21:* Down syndrome in which there is an extra twenty-first chromosome or a translocation of part of the twenty-first chromosome onto another chromosome.

Genetic Counseling and Testing

- **Genetic counseling:** Clinical service that advises couples of their probable risk of having children with hereditary defects.
- *Karyotype:* Arranged enlarged photographic chart of the chromosomes in a cell.

NATURE AND NURTURE: INFLUENCES OF HEREDITY AND ENVIRONMENT

Studying Heredity and Environment

- **Behavioral genetics:** Quantitative study of relative hereditary and environmental influences.

Measuring Heritability

- **Heritability:** Statistical estimate of contribution of heredity to individual differences in a specific trait within a given population.
- *Family studies:* Study in which researchers measure the degree to which biological relatives share certain traits and whether the

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closeness of the familial relationship is associated with the degree of similarity.

- *Adoption studies*: Study in which researchers look at similarities between adopted children and their adoptive families, and also between adopted children and their biological families.
- *Studies of twins*: Study in which researchers compare pairs of monozygotic and same-sex dizygotic twins.
- **Concordant**: Term describing twins who share the same trait or disorder.

How Heredity and Environment Work Together

- *Developmental system*: The combination of constitutional factors (related to biological and psychological makeup), social, economic, and cultural factors that help shape development.

Reaction Range and Canalization

- **Reaction range**: Potential variability, depending on environmental conditions, in the expression of a hereditary trait.
- *Norm of reaction*: Term used in the developmental system model in place of reaction range; the idea that the limits set by heredity are unknowable and their effects unpredictable because of the complexity of development.
- **Canalization**: Limitation on variance of expression of certain inherited characteristics.

Genotype-Environment Interaction

- **Genotype-environment interaction**: The portion of phenotypic variation that results from the reactions of genetically different individuals to similar environmental conditions.

Genotype-Environment Correlation

- **Genotype-environment correlation** (*genotype-environment covariance*): Tendency of certain genetic and environmental influences to reinforce each other; may be passive, reactive (evocative), or active.
 - *Passive correlations*: The parents, who provide the genes that predispose a child toward a trait, also tend to provide an environment that encourages development of that trait.
 - *Reactive, or evocative, correlations*: Children with differing genetic makeups evoke different responses from adults.
 - *Active correlations*: Older children actively choose or create experiences consistent with their genetic tendencies.
- **Niche-picking**: Tendency of a person, especially after early childhood, to seek out environments compatible with his or her genotype.

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What Makes Siblings Different? The Nonshared Environment

- **Nonshared environmental effects:** The unique environment in which each child grows up, consisting of distinctive influences or influences that affect one child differently than another.

Some Characteristics Influenced by Heredity and Environment

Physical and Physiological Traits

- **Obesity:** Extreme overweight. Research suggests that as much as 80 percent of the risk of obesity is genetic.

Intelligence and School Achievement

Personality

Psychopathology

- **Schizophrenia:** Mental disorder marked by a loss of contact with reality; symptoms include hallucinations and delusions.
- **Autism:** Pervasive developmental disorder of the brain, characterized by lack of normal social interaction, impaired communication and imagination, and repetitive, obsessive behaviors.
 - *Autistic spectrum disorders (ASD):* Mild to severe disorders of the autistic type.
 - *Pervasive developmental disorder (PDD):* A disorder related to classic autism.
 - *Asperger's disorder:* The most common PDD, children with this disorder usually have normal or even high verbal intelligence, are curious, and do well in school; but they have limited, fixed interests, repetitive speech and behavior, and difficulty understanding social and emotional cues.
 - *Joint attention:* The ability to point to an object to call attention to it or look at another person to see whether the two of them are paying attention to the same event, which is weak in individuals with Asperger's disorder.
 - *Theory of mind:* Awareness of the mental processes of oneself and others.

PRENATAL DEVELOPMENT

- **Gestation:** The approximately nine-month period of development between conception and birth.
- **Gestational age:** Age of the organism from conception.
- **Zygote:** A fertilized ovum.

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- *Morphogens*: Molecules produced by certain genes. These molecules are switched on after fertilization and direct the differentiation of the various body parts.

Stages of Prenatal Development

- **Cephalocaudal principle**: Principle that development proceeds in a head-to-tail direction; that is, the upper parts of the body develop before lower parts.
- **Proximodistal principle**: Principle that development proceeds from within to without; that is, that parts of the body near the center develop before the extremities.

Germinal Stage (Fertilization to 2 Weeks)

- **Germinal stage**: First 2 weeks of prenatal development, characterized by rapid cell division, increasing complexity and differentiation, and implantation in the wall of the uterus.
- *Mitosis*: Type of cell division and duplication.
- *Blastocyst*: A fluid-filled sphere of cells that will float into the uterus and implant in the lining.
- *Embryonic disk*: A thickened cell mass located on the blastocyst, from which the embryo begins to develop.
- *Ectoderm*: The upper layer of the embryonic disk that will form into the outer layer of skin, the nails, hair, teeth, sensory organs, and the nervous system.
- *Endoderm*: The lower layer of the embryonic disk that will form into the digestive system, liver, pancreas, salivary glands, and respiratory system.
- *Mesoderm*: The inner layer of the embryonic disk that will form into the inner layer of skin, muscles, skeleton, and excretory and circulatory systems.
- *Placenta*: Organ that provides oxygen and nourishment to the developing baby and removes its body wastes.
- *Umbilical cord*: Cord that connects the placenta to the baby and vice-versa.
- *Amniotic sac*: Fluid-filled membrane that encases the developing baby, protecting it and giving it room to move.
- *Chorion*: Outermost layer of the amniotic sac.

Embryonic Stage (2 to 8 Weeks)

- **Embryonic stage**: Second stage of gestation (2 to 8 weeks), characterized by rapid growth and development of major body systems and organs.

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- *Trimester*: A three-month period of pregnancy.
- **Spontaneous abortion**: Natural expulsion from the uterus of a conceptus that cannot survive outside the womb; also called miscarriage.
- *Stillborn*: Term for a baby that is dead at its birth.

Fetal Stage (8 Weeks to Birth)

- **Fetal stage**: Final stage of gestation (from 8 weeks to birth), characterized by increased detail of body parts and greatly enlarged body size.
- **Ultrasound**: Prenatal medical procedure using high-frequency sound waves to detect the outline of a fetus and its movements, so as to determine whether a pregnancy is progressing normally.

Environmental Influences: Maternal Factors

- **Teratogenic**: Capable of causing birth defects.
- *Transforming growth factor alpha*: A variant of a growth gene, this factor causes a fetus to have six times more risk than other fetuses of developing a cleft palate if the mother smokes while pregnant.

Nutrition and Maternal Weight

Physical Activity and Strenuous Work

Drug Intake

Medical Drugs

Alcohol

- **Fetal alcohol syndrome (FAS)**: Combination of mental, motor, and developmental abnormalities affecting the offspring of some women who drink heavily during pregnancy.
- *Fetal alcohol spectrum disorder (FASD)*: Other, less severe alcohol-related conditions.
- *Corpus callosum*: Brain tissue that connects and coordinates signals between the right and left hemispheres of the brain.
- *Fetal alcohol effects*: A less severe condition that can include mental retardation, retardation of intrauterine growth, and minor congenital abnormalities.

Nicotine

Caffeine

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Marijuana and Cocaine

HIV/AIDS

- **Acquired immune deficiency syndrome (AIDS):** Viral disease that undermines effective functioning of the immune system.

Other Maternal Illnesses

- *Toxoplasmosis:* An infection caused by a parasite harbored in the bodies of cattle, sheep, pigs, and in the intestinal tracts of cats.

Maternal Age

Outside Environmental Hazards

Environmental Influences: Paternal Factors

Monitoring Prenatal Development