Chapter 2
Genetic Bases of Child Development

CHAPTER OVERVIEW

I. Module 2.1: Mechanisms of Heredity
   a. The Biology of Heredity
      i. **Chromosomes**
         1. Egg and sperm each contain 23 chromosomes
      ii. **In vitro fertilization**
      iii. **Autosomes**
      iv. **Sex chromosomes**
         1. X and Y
      v. **Deoxyribonucleic acid (DNA)**
      vi. **Gene**
         1. **Genotype**
         2. **Phenotype**
   b. Single Gene Inheritance
      i. **Alleles**
         1. **Homozygous**
         2. **Heterozygous**
      ii. **Dominant**
      iii. **Recessive**
      iv. **Incomplete dominance**
      v. **Sickle cell trait**
      vi. Table 2-1 *Some Common Phenotypes Associated with Single Pairs of Genes*
   c. Cultural Influences
      i. Why Do African-Americans Inherit Sickle-Cell Disease?
   d. Genetic Disorders
      i. Inherited disorders
         1. **Huntington's disease**
         2. PKU
         3. Table 2-2 *Common Disorders Associated with Recessive Alleles*
   e. Improving Children's Lives
      i. Genetic counseling
      ii. Abnormal number of chromosomes
         1. **Down syndrome**
         2. Table 2-3 *Common Disorders Associated with Sex Chromosomes*

II. Module 2.2: Heredity, Environment, and Development
   a. Behavioral Genetics
      i. **Polygenic inheritance**
      ii. **Behavioral genetics**
      iii. Methods of behavioral genetics
         1. **Monozygotic twins**
         2. **Dizygotic twins**
         3. Twin and adoption studies
   b. Focus on Research
      i. Hereditary Bases of Children's Peer Relationships
   c. Summary Table *Primary Methods for Behavioral Genetics*
   d. Which Psychological Characteristics are Affected by Heredity?
   e. Paths From Genes to Behavior
      i. Heredity and environment interact dynamically throughout development
         1. **Epigenesis**

2. **Methylation**
3. **Heritability coeffecient**

ii. Genes can influence the kind of environment to which a child is exposed
1. **Niche-picking**

iii. Environmental influences typically make children within a family different
1. **Nonshared environmental influences**

CHAPTER MODULE SUPPLEMENTS

MODULE 2.1: MECHANISMS OF HEREDITY

LEARNING OBJECTIVES:

LO1 What are chromosomes and genes?
LO2 What are dominant and recessive traits? How are they inherited?
LO3 Which disorders are inherited? Which are caused by too many or too few chromosomes?

(See Handout 2-1 for a list of the learning objectives for the chapter.)

KEY TERMS:

chromosomes, *p*. 40
in vitro fertilization, *p*. 40
autosomes, *p*. 41
sex chromosomes, *p*. 41
deoxyribonucleic acid (DNA), *p*. 41
gene, *p*. 41
genotype, *p*. 41
phenotype, *p*. 41
alleles, *p*. 41
homozygous, *p*. 41
heterozygous, *p*. 41
dominant, *p*. 42
recessive, *p*. 43
incomplete dominance, *p*. 43
sickle-cell trait, *p*. 43
Huntington's disease, *p*. 44
Down syndrome, *p*. 46

LECTURE SUGGESTIONS, CLASSROOM ACTIVITIES, AND DISCUSSION TOPICS:

Reproductive Technology Debate Have the class divide into two large groups. One group will debate the issue of *in vitro fertilization*, and one group will debate the issue of *surrogacy*. Once the two large groups are decided, each group should subdivide into two smaller groups so that both sides of the debate issue are represented (e.g., pro and con). Give students several class periods to prepare for the debate. On debate day, the first two groups will debate the topic of in vitro fertilization while the other two groups (in the surrogacy group) watch and evaluate. Then the other two groups will debate the topic of surrogacy while the in vitro fertilization group watches. A format for the debate is listed below and can be modified to fit classes of different lengths:

Debate 1: *In Vitro Fertilization* (30 minutes)
I. Constructive Speeches (Presentation of your side of the argument):
A. *PRO* side will present for 7 minutes
1. Cross-examination by the *CON* side for 3 minutes
B. *CON* side will present for 7 minutes
1. Cross-examination by the *PRO* side for 3 minutes
II. Rebuttal Speeches (Your response to the other side's argument):
A. *CON* side will rebut for 5 minutes

B. *PRO* side will rebut for 5 minutes
III. Questions from Audience (5 minutes)

Debate 2: *Surrogacy* (30 minutes)
I. Constructive Speeches (Presentation of your side of the argument):
A. *PRO* side will present for 7 minutes
1. Cross-examination by the *CON* side for 3 minutes
B. *CON* side will present for 7 minutes
1. Cross-examination by the *PRO* side for 3 minutes
II. Rebuttal Speeches (Your response to the other side's argument):
A. *CON* side will rebut for 5 minutes
B. *PRO* side will rebut for 5 minutes
III. Questions from Audience (5 minutes)

Guest Speaker: Infertility Specialist Ask an infertility specialist to speak to your class about his/her work and the challenging issues surrounding this new segment of the health care industry. Contact a local hospital for a referral.

What Would You Do? Handout 2-2 asks students to consider a variety of options they may face if they are confronted with an infertility situation in their own lives. Students should complete the handout in class and discuss the ramifications of each option in small groups.

Send in the Clones Ask your students to respond to the following two questions: Would you want to have another "you" around? Why or why not? Their answers to the "why or why not" question should lead into a discussion of the benefits and risks of genetic engineering in general, and cloning in particular. Several popular sources (*Time* and *Newsweek*) have featured stories on cloning, which may supplement the discussion nicely. Also, inviting a set of (preferably identical) twins to reflect on their developmental experiences will make this class session a memorable one.

Your Genetic Profile To clarify the concepts of phenotype, genotype, and dominant and recessive alleles, ask your students to complete Handout 2-3 either before class or as an in-class exercise. You may want to distribute Handout 2-4 to supplement the textbook coverage of the topic, but students usually do an adequate job of completing Handout 2-3 without additional resources. While heterozygous genotypes may be difficult to determine, the point of this exercise is to make the students maintain clear distinctions between phenotypes and genotypes, and to cause them to reason about dominant and recessive inheritance patterns.

Genetics Worksheet For another activity to clarify the concepts of phenotype, genotype, and dominant and recessive alleles, ask your students to complete Handout 2-5 either before class or as an in-class exercise. The point of this exercise is to make the students maintain clear distinctions between phenotypes and genotypes, and to cause them to reason about dominant and recessive inheritance patterns.

Your Genetic Family Tree This project is an elaboration of the "Your Genetic Profile" exercise described above. As a homework assignment, have your students construct a family tree of genetic characteristics, including normal characteristics and genetic disorders. With their parents' and grandparents' help, the students should be able to trace their genetic ancestry back to their great-great-grandparents.

Guest Speaker: Genetic Counselor Invite a genetic counselor to speak to your class about his/her work (call a local hospital for referrals). Have your students prepare questions in advance of the visit to make the session even more valuable.

Dealing with Down Syndrome Depending upon availability of speakers and the interests of your class, invite to your class an individual who is involved with caregiving for children with Down syndrome. This person may be a parent of a child with Down syndrome, a counselor in a group home or larger facility that serves the needs of children with developmental disorders, a preschool or elementary teacher with special education certification, etc. Ask him/her to share some insight about these children, bringing to your class a personal (rather than simply academic) perspective on this disorder.

Internet Annotated Bibliography Have your students use the Internet to identify 10 websites that give scholarly information on the genetic disorders discussed in this chapter. Students should type an annotated bibliography that includes the following:

1. The **name** of the website (e.g., National Down Syndrome Society).
2. A **valid URL** (website address, e.g., http://ndss.org/).
3. A brief (one or two paragraph) **review** of the website. Reviews should include a brief **summary** of what students can expect to find if they visit the website and a brief **evaluation** of the website.

As a follow-up to this activity, students can combine all of the annotated bibliographies into an Internet Resource Directory that could be distributed in class or use it to complete the *Knowing the Risks* activity described next.

Knowing the Risks To provide students with a more in-depth exposure to genetic disorders, have them complete Handout 2-6 by using the text, library resources, or the Internet (see Internet Resource list for this chapter). Students could also use their Internet Annotated Bibliography from the previous activity. This assignment works well as an individual or small group project.

My Virtual Child *My Virtual Child* is an exciting new supplement that students are sure to find both interesting and educational. With *My Virtual Child,* students log on to the course website where they will be able to create their own virtual child (http://www.myvirtualchild.com). Students are then responsible for "raising" this child from birth through age 18. **Please see the Introduction to *My Virtual Child* listed in Chapter 1 of this manual for more details.**

Part 2–**Three to Nine Months:** In Part 2 of *My Virtual Child,* students are responsible for raising their child from 3 to 9 months of age. As usual, students are asked to make a series of parenting decisions, have access to video clips of children in this age range, and are given a set of discussion questions to reflect on either orally or in writing. Discussion questions for this section are as follows:

1. How does your baby's eating, sleeping and motor development compare to the typical developmental patterns?

2. At 8 months of age was your child an *easy*, *slow-to-warm-up*, or *difficult* baby in terms of Thomas and Chess's classic temperamental categories? On what do you base this judgment?

3. How is your child's attachment to you and your partner developing? What is happening at the 3-month and 8-month periods that might affect attachment security according to Bowlby and Ainsworth, and various research studies?

Students are able to print out these questions directly from the website in advance, and at 9 months of age, they are given a pediatrician's report of their child's development and then given this set of questions again to answer (either in written, oral, or test format, depending on the instructor's preference). This section could be supplemented with activities or information on **object permanence** (Chapter 6)**, Bayley Scales of Infant Intelligence** (Chapter 8)**, temperament** (Chapter 10) and **attachment** (Chapter 10).

FILMS/VIDEOS/INTERNET SOURCES:

http://www.youtube.com/watch?v=65xf1olEpQM – A YouTube video about Huntington's disease, a CBS special (7 minutes, 55 seconds)

http://www.youtube.com/watch?v=KUJVujhHxPQ – a YouTube video about PKU (6 minutes, 2 seconds)

Heredity and the Environment: Blueprints for a Baby from *The Developing Child* series *(*Magna Systems, 1996, 29 minutes). Explores the various aspects of conception and the function of genes and chromosomes, and provides an overview on inheritance and the interaction of nature and nurture. Genetic abnormalities and genetic counseling are also covered.

Human Reproductive Biology (Films for the Humanities and Sciences, 1994, 35 minutes). This program covers the processes leading to normal impregnation as well as various fertilization techniques (e.g., synthetic stimulation of hormones, *in vitro* fertilization, micro-insemination, and test-tube embryo transfer to the womb).

Heredity and the Environment: Blueprints for a Baby from *The Developing Child* series *(*Magna Systems, 1996, 29 minutes). Explores the various aspects of conception and the function of genes and chromosomes, and provides an overview of inheritance and the interaction of nature and nurture. Genetic abnormalities and genetic counseling are also covered.

I am Dekel: Portrait of a Life with Down Syndrome (Films for the Humanities and Sciences, 2000, 28 minutes). A documentary of a day in the life of Dekel Shekarzi, a 21-year-old actor, poet, dancer, and romantic. Hebrew with English subtitles.

The Lily Videos: A Longitudinal View of Life with Down Syndrome (Davidson Films – see details below). Elizabeth Grace captures the essence of her daughter, Lily, as a schoolgirl, a young woman, and an adult with Down syndrome. An engaging and inspiring video series.

Lily: A Story About a Girl Like Me (1978, 14 minutes). Lily at age 10 (3rd grade).
Lily: A Sequel (1988, 15 minutes). Lily, at age 20, graduates from high school, works at a restaurant, and resides in a group home.
Lily at Thirty (1997, 14 minutes). Lily lives in an apartment in an independent living program and is working in a supermarket. She shares her views on life with her disability.

Duo: The True Story of a Gifted Child with Down Syndrome (1996, produced by Alexandre Ginnz and Sergio Sanchez).

Sean's Story—A Lesson in Life – segment from *Lifespan Human Development, Series III* (ABC News/Prentice Hall Video Library, 1996, 16.5 minutes). Video segment details the first months of public school for an 8-year-old child with Down syndrome. Issues of mainstreaming and developmental expectations are portrayed.

Special Needs Students in Regular Classrooms? Sean's Story (Films for the Humanities and Sciences, 1994,
45 minutes). This video tells the story of Sean, an 8-year-old with Down syndrome, whose parents fought to have him in regular classrooms. Comparisons are made to Sean's friend, Bobby, who also has Down syndrome but is enrolled in a special education school.

Children of Men (Universal Pictures, 2006, 109 minutes) and *The Handmaid's Tale* (Bioskop Films, 1990, 108 minutes) – both films deal with a fictionalized future Earth in a time when nationwide infertility problems raise all sorts of ethical issues that students might want to consider.

http://ndss.org/ – website of the National Down Syndrome Society

http://www.ornl.gov/sci/techresources/Human_Genome/home.shtml – Human Genome Project information, gene mapping, and links to the Genetic World (social issues, basic genetic information, resources, etc.)

http://www.marchofdimes.com/ – Home page for the National March of Dimes organization. This site contains information and links that pertain to genetic and chromosomal disorders.

http://www.nhlbi.nih.gov/health/dci/Diseases/Sca/SCA_WhatIs.html - a website about sickle-cell anemia

Websites about Huntington's Disease
http://www.ninds.nih.gov/disorders/huntington/huntington.htm
http://www.neurologychannel.com/huntingtons/index.shtml
http://www.huntingtonsdance.org

http://www.medhelp.org/lib/pku.htm - a website about PKU

MODULE 2.2: HEREDITY, ENVIRONMENT, AND DEVELOPMENT

LEARNING OBJECTIVES:

LO4 What methods do scientists use to study the impact of heredity and environment on children's development?
LO5 How do heredity and environment work together to influence child development?

KEY TERMS:

behavioral genetics, *p.* 48
polygenic inheritance, *p.* 48
monozygotic twins, *p.* 49
dizygotic twins, *p.* 49
epigenesis, *p.* 54
methylation, *p.* 54
heritability coefficient, *p.* 54
niche-picking, *p.* 55
nonshared environmental influences, *p.* 56

LECTURE SUGGESTIONS, CLASSROOM ACTIVITIES, AND DISCUSSION TOPICS:

Nature/Nurture Interactions Sandra Scarr's theory of genotype-environment interaction warrants a demonstration due to its complexity. In her chapter in a book entitled *The Emergence of Personality* (1987), Scarr provides several examples of how genetics and environment interact in shaping one's personality. Handout 2-7 presents several examples that Scarr used to illustrate the three types of genotype-environment interactions. Have your students indicate which type of interaction each example depicts.

Great Expectations Have students watch the video *Great Expectations* (see reference below in the Films/Videos section). Students can write a summary/review of the video, or you can use the following questions to help guide and evaluate students' viewing of the film:

- According to the video, does divorce affect boys and girls differently? Give evidence to support your answer.

- Discuss what you believe Urie Bronfenbrenner meant when he described the nature versus nurture controversy as "out-of-date."
- According to the video, how is development affected by both our own childhood and the experiences of our parents?
- Discuss Jerome Kagan's idea that some aspects of growth are universal.
- Discuss Jerome Kagan's beliefs about how differences in people emerge.

FILMS/VIDEOS/INTERNET SOURCES:

http://www.youtube.com/watch?v=1gwnzW4jOMI&feature=related - A YouTube video about identical twins separated at birth (8 minutes, 51 seconds)

http://www.youtube.com/watch?v=jKwieb2DSsk&feature=fvsr – A YouTube video about nature vs. nurture (1 minute, 5 seconds)

Great Expectations (Ambrose Video Publishing, 1991, 60 minutes). From the series *Childhood*, this video provides a look at the importance of both "nature" and "nurture," and how different societies approach birth.

Biological Growth: Nature's Child (Insight Media, 1991, 60 minutes). Explores the nature-nurture controversy. Examines the influences of genetics on behavior, concentrating on hereditary contributions to intelligence, temperament, personality, sex differences, and mental illness.

Like Two Peas in a Pod (Filmmakers Library, 1991, 55 minutes). Reviews the psychology of twins by following three sets of twins as they develop.

The Ecology of Development (Insight Media, 1992, 30 minutes). This video reviews how environmental and genetic factors influence the development of children from 12 families in 5 countries.

The Human Animal: Nature and Nurture (Films for the Humanities and Sciences, 1991, 52 minutes). Produced by Phil Donahue, this video includes classic footage from Harlow's lab and the Minnesota twin study as well as interviews with prominent psychologists covering the nature/nurture debate.

CHAPTER 2 CASE STUDY

Genetic Bases of Child Development

Barbara and Brenda are adolescent twins. They both have brown hair, hazel eyes, wavy hair, freckles, thin lips, and, at the moment, they have cases of poison ivy. As a child, Brenda enjoyed playing and actively exploring her environment; Barbara was quieter and enjoyed being held by her mother, who was a bright and shy woman. Since Brenda was the "explorer," her extroverted, athletic father (unintentionally) played with her more than he played with Barbara. Barbara participated in more solitary play activities or worked on crafts with her mother. In their teenage years, Brenda was described by her peers as "outgoing, animated, spontaneous, talkative, friendly, and popular." Barbara was described by her peers as "quiet, shy, intelligent, and nice."

1. Many characteristics of Barbara and Brenda are listed in the case above. Do these features represent their phenotypes or genotypes?

2. Which of Barbara and Brenda's characteristics are the results of homozygous genotypes and which are likely the results of heterozygous genotypes?

3. Which characteristics in the above descriptions of Barbara and Brenda are likely the results of single gene inheritance? Polygenic inheritance?

4. What types of careers are Barbara and Brenda likely to pursue? Career selection is an example of what type of gene-environment relation?

CASE STUDY ANSWERS

Genetic Bases of Child Development

1. Phenotypes

2. Homozygous versus heterozygous genotype:

Homozygous Genotype	Heterozygous Genotype
Brown hair Thin lips Susceptibility to poison ivy	Hazel eyes Wavy hair Freckles

3. Single versus polygenic inheritance:

Single Gene Inheritance	Polygenic Inheritance
Hair color Eye color High cheek bones Narrow noses	Childhood activity levels Teenage personality characteristics Teenage intelligence

4. Barbara is likely to pursue a career that does not involve extensive interaction with others (e.g., writing, computer programming). Brenda's outgoing personality will likely guide her toward a career in sales, marketing, politics, law, etc. These are both examples of *niche-picking*.

HANDOUT 2-1

Learning Objectives for Chapter 2

LO1 What are chromosomes and genes?

LO2 What are dominant and recessive traits? How are they inherited?

LO3 Which disorders are inherited? Which are caused by too many or too few chromosomes?

LO4 What methods do scientists use to study the impact of heredity and environment on children's development?

LO5 How do heredity and environment work together to influence child development?

HANDOUT 2-2

What Would You Do?

Directions: Imagine that you have been married for 15 years and are 38 years old. You and your spouse have not yet been able to conceive a child, even though you have been trying concertedly for the past eight years. Rank the following options from most to least preferred (1 = most, 8 = least), and provide some reasons (pros and cons) for your ranking.

_____ a. Hire a surrogate mother (if the wife is infertile).
Pros/Cons:

_____ b. Contact a sperm bank (if the husband is infertile).
Pros/Cons:

_____ c. Pay a lawyer a minimum of $10,000 to try to "buy" a baby for you.
Pros/Cons:

_____ d. Become clients at a fertility clinic even though each attempt at pregnancy will cost $10,000 and the chance of conceiving is very small.
Pros/Cons:

_____ e. Apply to adopt a baby through legal channels although it will take at least five years if you *ever* get
a baby.
Pros/Cons:

_____ f. Adopt a "hard-to-adopt" child (i.e., an older child, one with serious handicaps, etc.).
Pros/Cons:

_____ g. Adopt a baby from another country at the cost of $15,000–$40,000 even though it will take 2-3 years and may not be successful.
Pros/Cons:

_____ h. Redirect your energies into your career, hobbies, socializing, civic activities, etc.
Pros/Cons:

Source: DeWolff, D. K. & Kail, R. V. (1993). *Instructor's resource and testing manual to accompany Developmental Psychology (5th ed.)*. Englewood Cliffs, NJ: Prentice Hall.

HANDOUT 2-3

Your Genetic Profile

Directions: Complete the following table by listing the characteristics of your parents and yourself.

Characteristic	Mother's Trait (her phenotype)	Father's Trait (his phenotype)	Your Trait (your phenotype)	Your Genotype *
Eye color				
Hair color				
Height (*tall, average, short*)				
Body weight (*overweight, average, underweight*)				
Blood type				
Personality (*shy or outgoing; passive or aggressive, etc.*)				

*Homozygous, heterozygous, or incomplete dominance

HANDOUT 2-4

Dominant and Recessive Characteristics

Characteristics in the left-hand column dominate over those characteristics listed in the right-hand column.

	Dominant Traits	Recessive Traits
eye color	brown	gray, green, hazel, blue
vision	farsightedness	normal vision
	normal vision	nearsightedness
	normal vision	night blindness
	normal vision	color blindness*
hair	dark hair	blonde, light, red hair
	non-red hair	red hair
	curly hair	straight hair
	full head of hair	baldness*
	widow's peak	normal hairline
facial features	dimples	no dimples
	unattached earlobes	attached earlobes
	freckles	no freckles
	broad lips	thin lips
appendages	extra digits	normal number of digits
	fused digits	normal digits
	short digits	normal digits
	fingers lack one joint	normal joints
	limb dwarfing	normal proportion
	clubbed thumb	normal thumb
	double-jointedness	normal joints
other characteristics	immunity to poison ivy	susceptibility to poison ivy
	normal skin pigmentation	albinism
	normal blood clotting	hemophilia *
	normal hearing	congenital deafness
	no PKU (normal)	phenylketonuria (PKU)
	Type A blood	Type O blood
	Type B blood	Type O blood
	Rh-positive blood	Rh-negative blood

* sex-linked characteristic

Source: Horton, S. & Preisser, G. (1997). *Instructor's resource manual to accompany Development Across the Lifespan.* Upper Saddle River, NJ: Prentice Hall.

HANDOUT 2-5

Genetics Worksheet

Dominant-Recessive Genetic Relationships (Homozygous-Homozygous):
B = Dark Hair (Dominant) b = Blonde Hair (Recessive)

Dark-Haired Father (Homozygous)

Genotype: **BB**
Phenotype: **Dark Hair**

Blonde Mother (Homozygous)

Genotype: **bb**
Phenotype: **Blonde Hair**

Genotype: _____	Genotype: _____	Genotype: _____	Genotype: _____
Phenotype: _____	Phenotype: _____	Phenotype: _____	Phenotype: _____

Dominant-Recessive Genetic Relationships (Heterozygous-Homozygous):

Dark-Haired Father (Heterozygous)

Genotype: **Bb**
Phenotype: **Dark Hair**

Blonde Mother (Homozygous)

Genotype: **bb**
Phenotype: **Blonde Hair**

Genotype: _____	Genotype: _____	Genotype: _____	Genotype: _____
Phenotype: _____	Phenotype: _____	Phenotype: _____	Phenotype: _____

Dominant-Recessive Genetic Relationships (Homozygous-Heterozygous):
B = Dark Hair (Dominant) b = Blonde Hair (Recessive)

Dark-Haired Father (Homozygous)

Genotype: **BB**
Phenotype: **Dark Hair**

Dark-Haired Mother (Heterozygous)

Genotype: **Bb**
Phenotype: **Dark Hair**

Genotype: _____
Phenotype: _____

Genotype: _____
Phenotype: _____

Genotype: _____
Phenotype: _____

Genotype: _____
Phenotype: _____

Dominant-Recessive Genetic Relationships (Heterozygous-Heterozygous):

Dark-Haired Father (Heterozygous)

Genotype: **Bb**
Phenotype: **Dark Hair**

Dark-Haired Mother (Heterozygous)

Genotype: **Bb**
Phenotype: **Dark Hair**

Genotype: _____
Phenotype: _____

Genotype: _____
Phenotype: _____

Genotype: _____
Phenotype: _____

Genotype: _____
Phenotype: _____

Dominant-Recessive Genetic Relationships (Codominance):
A = Type A Blood (Dominant) B = Type B Blood (Dominant)
o = Type O Blood (Recessive)

Father (Type A –Homozygous)

Genotype: **AA**
Phenotype: **Type A Blood**

Mother (Type B–Homozygous)

Genotype: **BB**
Phenotype: **Type B Blood**

Genotype: _____
Phenotype: _____

Genotype: _____
Phenotype: _____

Genotype: _____
Phenotype: _____

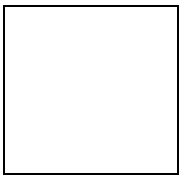
Genotype: _____
Phenotype: _____

Father (Type A –Heterozygous)

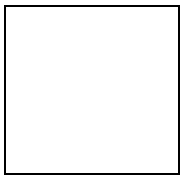
Genotype: **Ao**
Phenotype: **Type A Blood**

Mother (Type B–Heterozygous)

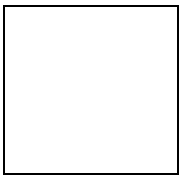
Genotype: **Bo**
Phenotype: **Type B Blood**



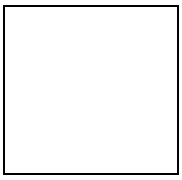
Genotype: _____
Phenotype: _____



Genotype: _____
Phenotype: _____



Genotype: _____
Phenotype: _____



Genotype: _____
Phenotype: _____

Dominant-Recessive Genetic Relationships (X-Linked or Sex-Linked)
X = Normal Female Sex Chromosome (Dominant)
Y = Normal Male Sex Chromosome
X^h = Female Sex Chromosome (Hemophilia Trait – Recessive)

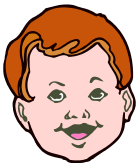
Unaffected Father

Genotype: **XY**
Phenotype: Unaffected Male

Carrier Mother

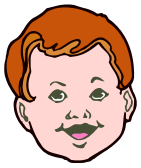
Genotype: **XX^h**
Phenotype: Carrier Female

Boy 1



Genotype: _____
Phenotype: _____

Boy 2



Genotype: _____
Phenotype: _____

Girl 1

Genotype: _____
Phenotype: _____

Girl 2

Genotype: _____
Phenotype: _____

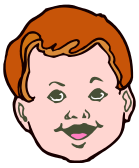
Hemophiliac Father

Genotype: **X^hY**
Phenotype: Hemophiliac Male

Carrier Mother

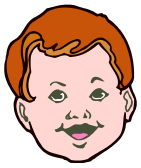
Genotype: **XX^h**
Phenotype: Carrier Female

Boy 1



Genotype: _____
Phenotype: _____

Boy 2



Genotype: _____
Phenotype: _____

Girl 1

Genotype: _____
Phenotype: _____

Girl 2

Genotype: _____
Phenotype: _____

HANDOUT 2-6

Knowing the Risks

Directions: Knowledge of genetic disorders may be your best protection against them. Use the textbook, library resources, or the Internet to locate information on the characteristics, risk factors, and available treatments (if any) for the genetic disorders listed below.

Genetic Disorder	Characteristics of the Disorder	Risk Factors	Treatment (if any)
PKU (phenylketonuria)			
Down syndrome			
Sickle-cell disease			
Huntington's disease			

HANDOUT 2-7

Nature/Nurture Interactions

Sandra Scarr (1987) illustrated several ways in which one's environment and one's genetics interact to shape one's personality. For each of the numbered examples below, label the type of nature/nurture interaction by using one of the following types of interactions:

A. passive gene-environment relation
B. evocative gene-environment relation
C. active gene-environment relation (niche picking)

_____ 1. Smiling, active babies receive more social stimulation than fussy, difficult infants.

_____ 2. Parents who are sociable will expose their children to more social situations than parents who are socially inept and isolated.

_____ 3. Cooperative, attentive preschoolers receive more pleasant and instructional interactions from the adults around them than uncooperative, distractible children.

_____ 4. Children who are quick, strong, and agile will likely become involved in athletic activities.

_____ 5. Preschoolers with long attention spans and good spatial skills often seek games and puzzles to play.

_____ 6. Parents who are assertive, faced with a child who is passive, may exert more pressure and do more assertiveness training than they would with a more assertive offspring.

Source: Scarr, S. (1987). Personality and experience: Individual encounters with the world. In J. Aronoff, A. I. Rabin, & R. A. Zucker (Eds.), *The emergence of personality* (pp. 67-68). New York, NY: Springer.

HANDOUT ANSWERS

HANDOUT 2-5: Genetics Worksheet

Dominant-Recessive Genetic Relationships—*Homozygous-Homozygous*
Genotypes: Bb, Bb, Bb, Bb
Phenotypes: Dark hair, Dark hair, Dark hair, Dark hair

Dominant-Recessive Genetic Relationships—*Heterozygous-Homozygous*
Genotypes: Bb, Bb, bb, bb
Phenotypes: Dark hair, Dark hair, Blonde hair, Blonde hair

Dominant-Recessive Genetic Relationships—*Homozygous-Heterozygous*
Genotypes: BB, Bb, BB, Bb
Phenotypes: Dark hair, Dark hair, Dark hair, Dark hair

Dominant-Recessive Genetic Relationships—*Heterozygous-Heterozygous*
Genotypes: BB, Bb, Bb, bb
Phenotypes: Dark hair, Dark hair, Dark hair, Blonde hair

Dominant-Recessive Genetic Relationships—*Codominance- A-Homozygous-B-Homozygous*
Genotypes: AB, AB, AB, AB
Phenotypes: AB blood type, AB blood type, AB blood type, AB blood type

Dominant-Recessive Genetic Relationships—*Codominance- A-Heterozygous-B-Heterozygous*
Genotypes: AB, Ao, Bo, oo
Phenotypes: AB blood type, A blood type, B blood type, O blood type

Dominant-Recessive Genetic Relationships—Sex-Linked—Unaffected Male-Carrier Mother
Genotypes: XY, X^hY, XX, XX^h
Phenotypes: Normal male, Hemophiliac male, Normal female, Carrier female

Dominant-Recessive Genetic Relationships—Sex-Linked—Hemophiliac Male-Carrier Mother
Genotypes: XY, X^hY, XX^h, X^hX^h
Phenotypes: Normal male, Hemophiliac male, Carrier female, Hemophiliac female

HANDOUT 2-7: Nature/Nurture Interactions

Answer options:

A. passive gene-environment relation
B. evocative gene-environment relation
C. active gene-environment relation

Answer key:

1. B
2. A
3. B
4. C
5. C
6. A