Research Techniques for Studying Development

- Correlational studies
  - No direct cause-and-effect
- Experimental studies
  - Independent variable versus dependent variable
Research Techniques for Studying Development

- Correlational studies

*New York Times, July, 1999*
Biological and Environmental Foundations of Development

- The Nature-Nurture Interaction
  - Complex (from beginning)
  - Genes interact (don’t act alone)
  - Whether or not a gene is expressed depends on interaction with other genes and with environment

- Phenotype = OBSERVABLE TRAITS (e.g., skin coloration; intelligence)
  …is the result of: Genotype x Environment

Nature-Nurture: Direction of Effects?

- Bias in much developmental literature is to view child’s behavior as a function of the environment
- Equally important to recognize that a child also affects the environment
- “Reanalyze” a correlational study of adult-child interaction
- Consider the child’s behavior as the independent variable rather than the dependent variable
Example: Bell & Ainsworth (1972)

- Documented relationship between maternal responsiveness and infant crying
  - Mothers who were responsive to infants early in life had babies who cried less at a later time in comparison to unresponsive mothers
- Conclusion: Maternal responsiveness affected infant crying

But...

- Perhaps babies who are difficult to soothe may create mothers who respond to them more slowly
- Beware the correlational conclusion!!!
The Start of Life (Module 1.2)…

- What is our basic genetic endowment and how can human development go off track?
- How environment and genetics work together to determine human characteristics?
- Which human characteristics are significantly influenced by heredity?
- What happens during the prenatal stages of development?
- What are the threats to the fetal environment, and what can be done about them?

Mitosis: Body Cells with 46 chromosomes
Meiosis:
Germ Cells (cell division of gametes)

Each gamete receives only one of the two chromosomes that make up each of a parent’s 23 pairs.

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Beginning of Life

- Gametes from male and female join
  - *Ovum* and *sperm*
- Fused gametes create *zygote*
Mixing and Matching of Genes

- Basics of genetics
  - DOMINANT TRAITS
  - RECESSIVE TRAITS

**GENOTYPE**-underlying combination of genetic material present (but outwardly invisible)
- Homozygous
- Heterozygous

Genetic Information

**Transmission: Phenylketonuria**

- Inherited disorder in which a child is unable to make use of phenylalanine (essential amino acid present in proteins found in milk)
  - Governed by a single allele (single pair of genes)
  - If untreated, PKU allows phenylalanine to build to toxic levels
  - Results in brain damage/mental retardation
  - Occurs in one in 10 to 20 thousand births
Polygenic inheritance

- But...more often that polygenic inheritance (combination of multiple gene pairs) is responsible for production of a particular trait
Cracking the Genetic Code

- Humans have 25K genes
- Not much more genetically complex than some primitive species

See: The Human Genome
National Human Genome Research Institute
(http://www.genome.gov)

When Development Deviates

- Causes
  - Genetics
  - Spontaneous mutation
  - Environmental insult
When Development Deviates

● Examples
  – Down Syndrome
    ● extra chromosome on 21st chromosome pair (1 in 500 births)
  – Fragile X Syndrome
    ● particular gene injured on X chromosome
  – Sickle-cell Anemia
    ● blood disorder named for shape of red blood cells
  – Tay-Sachs Disease
    ● Mainly in Jews of Eastern European heritage
  – Klinefelter’s Syndrome
    ● presence of extra X chromosome (XXY)

Summary

● In humans, the male sex cell (sperm) and the female sex cell (the ovum) provide the developing baby with 23 chromosomes each.

● A genotype is the underlying combination of genetic materials present in an organism, but invisible; a phenotype is the visible trait, the expression of the genotype.

● The field of behavioral genetics, a combination of psychology and genetics, studies the effects of genetics on behavior.
THE INTERACTION OF HEREDITY AND ENVIRONMENT

1/27/2009

Studying Development

- A given behavior is not caused just by genetic factors, nor is it caused solely by environmental factors.
  - Nonhuman animal studies
    - Controlling genetics and environment
  - Human studies
    - Adoption
    - Twin studies
    - Family studies
Do you have your mother’s eyes?

Family resemblances
- More genetic similarity \(\rightarrow\) more likely to share physical characteristics

Nature, Nurture, and Intelligence
- Relative contributions of nature and nurture highly researched
- Closer genetic link = greater correspondence of overall IQ scores
## Genetics and I.Q.

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<th>Relationship</th>
<th>Genetic Overlap</th>
<th>Median Correlation</th>
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<tr>
<td>Foster parent &amp; child</td>
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<td>Siblings reared apart</td>
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<td>Parent &amp; child</td>
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<tr>
<td>Fraternal twins, different sex</td>
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<td>Identical twins, reared apart</td>
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</table>

(Source: Bouchard & McGue, 1991)

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## What about environmental influences?

- Culture
- Parental encouragement
Developmental Diversity

Can a culture’s philosophical outlook be determined by genetics?

Fundamental Principle

- *Within debate about relative influence of nature and nurture*
  - Role of *genetics* is often to produce tendency toward future course of development
  - Role of *environment* affects when and whether a certain behavioral characteristic will actually be displayed
Summary

- Human characteristics and behavior are a joint outcome of genetic and environmental factors.

- Genetic influences have been identified in physical characteristics, intelligence, personality traits and behaviors, and psychological disorders.

- There is some speculation that entire cultures may be predisposed genetically toward certain types of philosophical viewpoints and attitudes.
Fertilization

- Moment of conception
  - Joining of sperm and ovum = zygote

Stages of Prenatal Development

- Germinal
- Embryonic
- Fetal
Germinal Stage

- **Fertilization → two weeks**
  - Shortest stage
  - Fertilized egg now called blastocyst
  - Travels to and implants in uterus
  - Characterized by methodical cell division
  - With division comes cell specialization

Embryonic Stage

- **2 weeks → 8 weeks**
  - Organism firmly secures to uterus and called an embryo
  - Development of major organs and basic anatomy
- **Three distinct layers that ultimately form different set of structures:**
  - Ectoderm
  - Endoderm
  - Mesoderm
Embryonic Stage

- Every part of body formed with these layers

Fetal Stage

- 8 weeks → Birth
  - Formally starts when differentiation of major organs has occurred
  - Organism now called fetus
  - Characterized by rapid development
    - Organs become more differentiated and begin working
    - Interconnections between body parents become more complex and integrated
    - Brain becomes more sophisticated
Pregnancy Problems

- Infertility
- Miscarriage
- Abortion

Threats to Development

- Prenatal environment
  - Teratogens...
### Mother’s Prenatal Influence

- **Mother’s**
  - Diet
  - Age
  - Prenatal support
  - Health
  - Drug use
  - Alcohol use
  - Tobacco use
Father’s Prenatal Influence

- Relatively little research
- Tobacco use
- Drug use
- Alcohol use
- Treatment of mother

Becoming an Informed Consumer (or: Optimizing the Prenatal Environment)

- Avoid X-rays and birth control pills; get rubella vaccination
- Eat well and take prenatal vitamins
- Avoid alcohol use and other drugs
- Monitor caffeine intake.
- Avoid smoking and exposure to secondhand smoke
- Exercise regularly
Summary

- Fertilization joins the sperm and ovum to start the journey of prenatal development. The prenatal period consists of three stages: germinal, embryonic, and fetal.

- The prenatal environment significantly influences the development of the baby. The diet, age, prenatal support, and illnesses of mothers can affect their babies’ health and growth.