

The Human Genome

Chapter 6

Genetics and Personality

- Genome refers to the complete set of genes that an organism possesses
- Human genome contains 30,000–80,000 genes on 23 pairs of chromosomes

The Human Genome

- Human Genome Project is designed to sequence the entire human genome—i.e., identify the particular sequence of DNA molecules in human species
- But identifying sequence of DNA molecules does not mean identifying the function of each molecule

The Human Genome

- Most genes in a human genome are the same for all humans
- Small number of genes are different for different individuals, including genes that indirectly code for physical traits and for personality traits

Controversy About Genes and Personality

- Behavioral geneticists attempt to determine the degree to which individual differences in personality (for example) are caused by genetic and environmental differences
- Highly controversial
 - Ideological concerns
 - Concerns about renewed interest in eugenics

Controversy About Genes and Personality

- Modern behavioral geneticists who study personality are typically very careful about addressing implications of work and are sensitive to ideological concerns
- Knowledge is better than ignorance

Controversy About Genes and Personality

- In addition, finding that a personality trait has a genetic component does not mean the environment is powerless to modify trait

Goals of Behavioral Genetics

- Determine the percentage of individual differences in a trait that can be attributed to genetic differences and percentage that can be attributed to environmental differences
- Determine the ways in which genes and environment interact and correlate with each other to produce individual differences

Goals of Behavioral Genetics

- Determine precisely where in the “environment” environmental effects exist— e.g., parental socialization, different teachers to which children are

What Is Heritability?

- Proportion of observed variance in group of individuals that can be explained or accounted for by genetic variance
- OR
- Proportion of phenotypic variance that is attributable to genetic variance

What Is Heritability?

- Environmental = proportion of observed variance in group of individuals attributable to environmental variance

Misconceptions About Heritability

- Heritability CANNOT be applied to single individual
- Heritability is NOT constant or immutable
- Heritability is NOT a precise statistic

Behavioral Genetics Methods

- Selective Breeding—Studies of Humans' Best Friend
- Family Studies
- Twin Studies
- Adoption Studies

Selective Breeding

- Can only occur if a desired trait is heritable
- Selective breeding studies of dogs
- Cannot be ethically conducted with humans

Family Studies

- Correlates the degree of genetic overlap among family members with the degree of similarity in personality trait
- If a trait is highly heritable, family members with greater genetic relatedness should be more similar to one another on the trait than family members who are less closely genetically related

Family Studies

- Problem: Members of a family who share the same genes also usually share the same environment—confounds genetic with environmental influences
- Thus, family studies are never definitive

Twin Studies

- Estimates heritability by gauging whether identical (monozygotic or MZ) twins, who share 100 percent of genes, are more similar than fraternal (dizygotic or DZ) twins, who share only 50 percent of genes

Twin Studies

- If MZ twins are more similar than DZ twins, this provides evidence of heritability
- Calculating heritability—many formulas, simple one: Two times difference between correlation (“r”) for MZ twins and DZ twins, or $2(r_{mz} - r_{dz})$

Twin Studies

- Two assumptions of the twins method
 - Equal environments assumption
 - Representativeness assumption

Adoption Studies

- Positive correlations on traits between adopted children and adoptive parents provide evidence of environmental influence
- Positive correlations between adopted children and genetic parents provide evidence of genetic influence

Adoption Studies

- Adoption studies are powerful because they get around the equal environments assumption
- Assumption that adopted children and their adoptive and genetic parents are representative of the general population—questionable

Adoption Studies

- Problem of selective placement of adopted children
- Design that combines strengths of twin and adoption studies = twins reared apart

Major Findings from Behavioral Genetic Research

- Personality Traits
- Attitudes and Preferences
- Drinking and Smoking

Personality Traits

- Summaries of behavioral genetic data yield heritability estimates for major personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience) of about 20-45 percent

Personality Traits

- Sexual orientation
 - Controversial and developing area
 - Current evidence suggests that genes provide modest and indirect influence (via childhood gender nonconformity) on adult sexual orientation

Attitudes and Preferences

- Wide variance in heritability of attitudes
- Some attitudes (e.g., traditionalism) show high heritability (about .60), whereas others show low or no heritability (e.g., beliefs in God)
- Not clear why only some attitudes appear to be heritable

Drinking and Smoking

- Behavioral manifestations of personality traits such as sensation seeking, extraversion, neuroticism
- Drinking alcohol and smoking cigarettes are stable over time
- Both show evidence of heritability

Shared Versus Nonshared Environmental Influences: A Riddle

- Same studies that suggest moderate heritability also provide good evidence of the importance of environmental influences
- Personality characteristics show heritabilities in 30–50 percent range; hence, showing substantial degree of environmentality—50–70 percent

Shared Versus Nonshared Environmental Influences: A Riddle

- Two key types of environmental influences
 - Shared: In family environment, features of the environment shared by siblings (e.g., number of books in home)
 - Nonshared: In family environment, features of the environment that differ across siblings (e.g., different friends, different teachers)

Shared Versus Nonshared Environmental Influences: A Riddle

- For most personality traits, the environment has major influence, but this influence is primarily in the form of nonshared and not shared variables
- For most personality traits, the shared environment has little impact
- We do not know which nonshared experiences have a key impact on personality

Genes and the Environment: Two Issues

- Genotype-Environment Interaction
- Genotype-Environment Correlation

Genotype-Environment Interaction

- Differential response of individuals with different genotypes to the same environments
- For example, task performance of introverts versus extraverts in loud versus noisy conditions
- Individual differences interact with environment to affect performance

Genotype-Environment Correlation

- Differential exposure of individuals with different genotypes to different environments
- Three types of genotype-environment correlations
 - Passive
 - Reactive
 - Active

Genotype-Environment Correlation

Passive

- Parents provide both genes and environment to children, yet children do nothing to obtain that environment
 - Child's verbal ability and the number of books in home

Genotype-Environment Correlation

Reactive

- Parents (or others) respond to children differently depending on the child's genotype
 - Baby's liking for cuddling and the mother's cuddling behavior

Genotype-Environment Correlation

- Person with particular genotype seeks out a particular environment
 - High sensation seekers expose themselves to risky environments
- Genotype-environment correlations can be positive or negative

Behavior Genetics, Science, Politics, and Values

- Findings that some personality traits are heritable seemed to violate prevailing environmentalist view that personality is determined by socialization practices, such as parenting style
- People also worried about political and ideological misuse of behavioral genetics findings

Behavior Genetics, Science, Politics, and Values

- Much controversy surrounding individual differences in intelligence
- In past decade, attitudes shifted somewhat so that behavioral genetics are fairly mainstream (recent exception is sexual orientation studies)

Behavior Genetics, Science, Politics, and Values

- Because scientific research can be misused for political and ideological goals, scientists bear special responsibility, but
- Science can be separate from values
- Knowledge is better than operating in ignorance

Summary and Evaluation

- Most compelling evidence for heritability and environmentality of personality comes from findings generated across methods that do not share the same problems and limitations

Summary and Evaluation

- Personality variables such as extraversion and neuroticism have moderate heritability, as do drinking, smoking attitudes, and sexual orientation
- These studies suggest that these same variables have moderate to strong environmentality

Summary and Evaluation

- Much of the environmental influence is due to nonshared variables—experiences unique to siblings
- Genotype-environment interaction and correlations, as well as the new field of molecular behavior genetic analysis, are promising areas for future work