

## **Behavioral Genetics**

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Behavioral genetics is a field of scientific research that aims to understand how much genetic and environmental factors contribute to variability in behavior. From a genetics standpoint, numerous genes are influenced by the environment, which results in complex behaviors. Additionally, the physiology and developmental history of an individual, along with its environment, can modify genes and neuronal circuits of the brain. Furthermore, evolution and natural selection shape behaviors to optimize survival of the individual. Behavioral genetics is an evolving field that involves a combination of experimental psychology, genetics, neuroscience, and ethology.

Behavioral genetics is progressing as our scientific knowledge increases. The first research that examined animal behaviors was conducted by the forerunners of experimental psychology: Pavlov, Skinner, and Thorndike. Additionally, Darwin's concept of natural selection laid the foundation of biology, and led to an understanding of the genetic origin of behaviors. Also, Mendel's rules of inheritance were rediscovered in the early twentieth century. This provided the scientific community with the understanding that genes were the targets of natural selection during the evolution process.

Later in the twentieth century, Watson and Crick discovered the structure of DNA, and clarified the understanding of the genetic code. At the same time, major advances in neuroscience were taking place. During this time, the experimental psychologists and ecologists were developing an understanding of the fundamental aspects of behavior. Advances in genetics,

especially the development of methods for gene targeting and whole genome sequencing, as well as advances in neuroscience, are allowing for the integration of disciplines.

One of the main goals of behavioral genetics is to understand how changes in allele frequencies result in an evolution of behaviors, and how the regulation of gene expression allows the nervous system to change and drive behaviors. Therefore, behavioral genetics examines genetic and environmental factors that may contribute to individual differences in behavior. Quantitative research methods examine heritability, as well as shared and non-shared environmental variance. Heritability is thought of as the genetic effect size. It is the proportion of phenotypic variance that is attributed to genetic factors. The leftover variance is attributed to environmental factors. Environmental variance is broken down into shared and non-shared environmental variance. Shared environmental variance is defined as the familial resemblance that is attributable to environmental influences that are shared with family members, but are not explained by genetic variance. Non-shared environmental variance, on the other hand, is made up of environmental influences and measurement error that are unique to each individual. Non-shared environmental variance is what makes each member of the same family different from one another. There are a variety of methodological approaches that are used in this field of research to examine the above factors.

The sequence of human DNA nucleotides can now be genotyped. Scientists can then test for an association between genetic variants and behavioral phenotypes. Examples of behavioral phenotypes include cognitive ability, mental disorder, and personality. A popular approach of measuring genetic variants is testing candidate genes. During this process, a gene, typically referred to as a 'candidate gene' is selected based on a hypothesized association between the candidate gene and a behavioral phenotype. However, this research has been deemed to lead to

high false positive rates. Another popular approach of measuring genetic variants is through genome-wide association studies. During these studies, scientists test associations between millions of genetic polymorphisms and behavioral phenotypes. This research is not based on an a priori hypothesis. However, this type of research has concluded that psychiatric disorders often involve many small genetic effects. Single nucleotide polymorphisms (SNPs) heritability is another method of examining genetic variants.

Two other common approaches include animal studies, and twin studies. Twin studies are common in developmental behavioral genetics, which is an interdisciplinary field that is beginning to emerge. Developmental behavioral genetics examines the relationship between development, as well as genetic and environmental sources of variance. One common questions asked by developmental researchers is, why do children differ in personality features? Developmental behavioral genetics offers empirical methodology to test this type of question, as well as a theoretical framework to study the etiology of individual differences.

At this time, behavioral genetic research suggests that the influence of genetic factors increases in importance as an individual gets older. Additionally, research suggests that environmental factors have a tendency to create more differences between family members, rather than more similarities. Lastly, behavior genetics research concludes that genes influence all disorders and behavioral traits.

### **Further Reading**

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Plomin, R. (1983). Introduction: Developmental behavioral genetics. *Child Development*, 253-259.

Saudino, K. J. (2005). Behavioral genetics and child temperament. *Journal of developmental and behavioral pediatrics: JDBP*, 26(3), 214.