

# GLOSSARY/INDEX

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The numbers after each term represent the chapter in which it first appears.

## additive 2

When an allele's contribution to the variation in a phenotype is separately measurable; the independent effects of alleles "add up." Antonym of nonadditive.

## ADHD/ADD 6

Attention Deficit Hyperactivity Disorder/Attention Deficit Disorder. Neurobehavioral disorders characterized by an attention span or ability to concentrate that is less than expected for a person's age. With ADHD, there also is age-inappropriate hyperactivity, impulsive behavior or lack of inhibition. There are several types of ADHD: a predominantly inattentive subtype, a predominantly hyperactive-impulsive subtype, and a combined subtype. The condition can be cognitive alone or both cognitive and behavioral.

## adoption study 4

A type of research focused on families that include one or more children raised by persons other than their biological parents. In an adoption study, adoptees, their biological parents, their adoptive parents, and/or other members of the biological and adoptive families are assessed for resemblance on a trait. The objective is to determine the relative importance of genetic and environmental influences.

## aggression 6

Behavior manifested by destructive and attacking actions, by covert attitudes of hostility and obstructionism, or by a healthy self-expressive drive to mastery. Aggression may arise from innate drives and/or in response to frustration.

## allele 2

One of two or more alternative forms of a gene; a single allele for each gene is inherited separately from each parent.

## Alzheimer's disease 5

A medical disorder causing the loss of memory, reasoning, and language abilities. Protein residues called plaques and tangles build up and interfere with brain function. This disorder usually first appears in persons over age sixty-five. Compare to early-onset Alzheimer's.

## amino acids 2

Molecules that are combined to form proteins. The sequence of amino acids in a protein, and hence protein function, is determined by the genetic code.

## amnesia 5

Loss of memory, temporary or permanent, that can result from brain injury, illness, or trauma.

## antibodies 2

Proteins produced by immune system cells that bind to microorganisms, such as viruses and bacteria, and inactivate them.

## antisocial behavior 6

Acting in a manner that is hostile or harmful to organized society; especially deviating sharply from the social norm.

## antisocial personality disorder 6

Medical diagnosis of having a pattern of behaving against the norm or in hostile and harmful ways.

#### association study 4

Form of molecular research that seeks to test whether the variation in specific DNA sequences might be statistically correlated with the variation in a particular trait. This approach is used to detect genes with relatively small effect on a trait.

#### autism 5

A complex developmental disability that emerges in early childhood and interferes with the normal development of social skills and communication.

#### base 2

See nucleotide.

#### behavior 1

The response of an individual or group to its environment or within the context of its environment. The term can refer generally to the way in which someone behaves or to an instance of such behavior.

#### behavioral genetics 1

The study of the relationship between genetic and environmental factors in accounting for individual differences of behavior.

#### bipolar disorder 5

A mood disorder characterized by swings from mania (exaggerated feeling of well-being) to depression, with a tendency to recur and subside spontaneously. Either the manic or the depressive episodes can predominate and produce mood swings, or the patterns of mood swings may be cyclical. The manic phase is characterized by elation, hyperactivity, over-involvement in activities, inflated self-esteem, a tendency to be easily distracted, and little need for sleep. The manic episodes may last from several days to months. In the depressive phase

there is sluggishness (inertia), loss of self-esteem, withdrawal, sadness, and a risk of suicide.

#### candidate gene 2

A gene that has been hypothesized (often on the basis of animal studies) to have a causative effect on a phenotype.

#### causal pathway 6

The chain of events from cause to effect, such as from genotype and environments to phenotype.

#### chromosomes 2

The structures in an organism that contain an individual's genes. Humans typically have 46 chromosomes in every cell of their body, inheriting one of each chromosome in a pair from each parent. If a chromosome is missing, duplicated, or damaged, an individual can develop health problems.

#### cloning 4

A laboratory technique by which embryos are created using the complete DNA from the cell of one individual (as opposed to embryos that are created when a sperm and egg cell combine).

#### CODIS (Combined DNA Index System) 6

A searchable database of DNA profiles from convicted felons, operated by the Federal Bureau of Investigation (FBI).

#### cognition 1

The act or process of knowing, which includes awareness, judgment, perception, reasoning, and conceiving.

#### complex 5

Resulting from the expression of many different genes and the influence of many environmental factors.

**concordance rate 4**

The proportion of a sample of twin pairs that both have a particular trait.

**consciousness 3**

A sense of existence within a surrounding; a sense of being able to take action.

**continuous trait 2**

A trait that is measured on a continuous scale, for example, height. Synonym of quantitative trait. Antonym of discontinuous trait.

**control group 4**

A group of subjects in an experiment who do not have the trait under study or who are not given the experimental treatment under study.

**correlation 2**

An index of resemblance between two variables. Correlation also indicates resemblance between pairs of subjects such as twins, ranging from .0 for no resemblance to 1.0 for complete resemblance.

**correlation coefficient 4**

A number reflecting the extent to which scores on one variable can predict scores on a second variable.

**criminality 6**

The tendency to break the law, to be arrested, and/or to be convicted of a crime.

**crossing over 4**

See recombination.

**cystic fibrosis 2**

A disorder affecting the mucous lining of the lungs, leading to breathing problems and other health difficulties.

**depression 1**

A mental state characterized by low mood, low energy, and low enjoyment.

**developmental noise 3**

The variation introduced by minute, random events that occur during development and have a significant cumulative effect on the phenotype.

**developmental pathway 3**

The chain of events that occur over the course of an organism's development to produce its phenotype.

**diploid 2**

Having each chromosome in two copies per cell.

**discontinuous trait 2**

A trait that is either present or is not present. For example, a diagnosis of diabetes. Antonym of continuous trait.

**DZ (dizygotic) 4**

Resulting from two fertilized eggs occurring in the same womb at the same time, producing embryos that are roughly half identical (fraternal twins).

**DNA (deoxyribonucleic acid) 2**

The double-stranded molecule encoding the total genetic information of most organisms.

**dominance 2**

When one allele at a loci has overriding influence on the genotype relative to another allele at the loci.

**dominant disorder 5**

A disorder that can occur when either one or both of the alleles at a locus are mutations that improperly code for protein. Contrast with recessive disorder.

### dopamine 6

A type of neurotransmitter.

### early-onset Alzheimer's 2

A form of Alzheimer's disease that usually first appears in persons less than sixty-five years of age.

### endophenotype 6

An intermediate trait that contributes to a phenotype. For example, capacity of working memory is an endophenotype of intelligence.

### enhancement 6

The altering of a trait or set of traits to more desired forms.

### envirome 3

The sum of all environmental influences surrounding and affecting a genome.

### environment 1

The sum of circumstances, objects, and conditions that surround an individual. The aggregate of social, cultural, and physical environmental conditions that influence the life of an individual or community. For the gene, the environment encompasses all conditions external to the gene, including the influence of other genes.

### environmentability 3

The phenotypic variation in a population that is due to environmental variation.

### enzymes 2

Proteins that facilitate a biochemical reaction, usually speeding it up. Enzymes are essential for all forms of life.

### epigenetic 2

When the action of a gene is affected without its DNA being altered.

### epistasis 2

When an allele at one location in the genome affects the expression of another allele at another location.

### equal environments assumption 4

The hypothesis that the environment of an identical twin pair does not work to make those two alike to any greater degree than the environment of a fraternal twin pair works to make those two alike.

### ethnic 7

Describing a population of people that are related by blood and/or have common characteristics in terms of physical appearance, culture, religion, language, or nationality.

### ethnicity

Common qualities or affiliation with large groups of people classed according to common racial, national, tribal, religious, linguistic, or cultural origin or background.

### etiology 5

The pathway from initial cause to effects; the study of the origins of a phenomenon such as a disorder or behavioral trait.

### eugenics 6

Philosophy and practice based on the belief that information about heredity can and should be used to improve the human race.

### evolution 2

The process by which forms of life change over time because of variations in the DNA so that descendants differ from their predecessors.

### factor analysis 7

Statistical methods that are used to reduce a large set of variables to the smallest number of factors that can account for individual differences in a trait.

### family study 4

A type of research focusing on the phenotypic resemblance between genetically related members of a family. Through family studies, researchers estimate the extent to which resemblance is due to genetic or environmental factors.

### first-degree relative 4

Parent, sibling, or child.

### fragile X syndrome 5

The most commonly inherited form of mental retardation, which occurs in persons who have a gap (a “fragile site”) on their X chromosome.

### free will 6

The ability to make choices without undue influences present.

### gamete 2

A sperm or egg cell, involved in reproduction.

### gene/environment correlation 3

When individuals with a genetic propensity for a trait are in environments, or choose environments, that support expression of the trait.

### gene/environment interaction 3

A situation in which the effect of a gene or genes depends on the type of environment to which it is exposed, or in which the effect of an environment depends on the presence of particular genes.

### gene frequencies 4

The frequency of a particular allele at a locus in different population groups.

### general cognitive ability (*g*) 6

A basic, core ability to make use of information. *g* is theorized to exist based on the observation that an individual’s scores on different types of intelligence tests tend to correlate positively. A synonym is general intelligence factor.

### genes 1

The hereditary units of life in chromosomes. Genes contain unique segments of DNA that provide the complete instructions for making the many proteins that are needed to create a unique individual.

### gene therapy 5

An experimental procedure used to correct the harmful effects of a gene, sometimes by inserting a normal gene.

### genetic determinism 2

The view that the development of an organism is determined solely by genetic factors. This view is not supported by science.

### genetic drift 2

The change in allele frequencies within a species population over time due to chance.

#### genetic heterogeneity 5

When a trait or disorder can result from a mutated allele at any one of two or more loci. Also, when a trait or disorder can result from different mutations at the same locus (a synonym for this second definition is “allelic heterogeneity”). The term also is used to describe a population for which there are substantial differences among members with regard to their DNA sequences.

#### genetic marker 4

A DNA sequence at a known chromosomal site that shows variation in a population and is used in an association or linkage study.

#### genome 2

All the genetic material in the chromosome needed to create and maintain an organism.

#### genotype 2

Genetic makeup of an individual, or the combination of alleles relevant for a specific trait.

#### geotaxis 4

The tendency to move with or against gravity.

#### heredity 1

The sum of the qualities and potentialities genetically derived from one's ancestors, or the transmission of such qualities.

#### heritability 3

A term that describes the proportion of phenotypic variation among individuals in a specific population that can be attributed to genetic effects. Heritability is a characteristic of a population, not of an individual, and is an estimate of the relative importance of genetic influences on a trait (as opposed to environmental influences).

#### heterozygous 2

Having two alleles of a gene at a specific locus that are different.

#### homozygous 2

Having two alleles of a gene at a specific locus that are identical.

#### hormone 1

A blood-borne substance produced by glands that affects the metabolism or activity of certain other cells.

#### Human Genome Project 2

An international scientific collaboration that has resulted in the essentially complete sequencing (determining the order of all the bases) of the genome of humans and several other organisms.

#### Huntington's disease 2

A medical disorder resulting in progressive loss of cells in areas of the brain. It is caused by DNA changes on Chromosome 4. The disease typically appears in adulthood and leads to premature death.

#### imprinting 2

When an allele is expressed differently depending on whether it has been inherited from the mother (maternal imprinting) or the father (paternal imprinting).

#### impulsive behavior 4

An act performed in response to a stimulus without delay, reflection, voluntary direction, or obvious control.

#### impulsivity 6

The tendency to act without premeditation and forethought.

#### inbred strain 4

A population of a species in which all of its members are genetically alike. Inbred strains can be created by breeding siblings together over many generations until they are virtually alike genetically. This also can be accomplished through cloning.

#### injustice 6

Wrongful act or omission that denies an individual or group the benefits to which they have a rightful claim, or failure to distribute burdens in a fair manner.

#### insanity 6

A legal term indicating that a person committing a criminal act is unaware (due to a mental disorder) that the act is illegal.

#### intelligence 1

The ability to learn or understand, to deal with new or trying situations, or to use reason skillfully. Abilities associated with intelligence, such as application of knowledge to manipulate one's environment or thinking abstractly, are often measured by "objective" criteria (such as tests).

#### in vitro fertilization 7

The mixing of eggs with sperm in a laboratory dish in order to achieve conception. "In vitro" means "in glass."

#### IQ (intelligence quotient) tests 3

Assessments that require the completion of tasks designed to measure the trait of intelligence. Test scores are divided by chronological age to assign a numerical value (IQ) to the test-taker.

#### knockout study 4

A study of organisms (such as mice) whose genomes have been artificially manipulated to inactivate a particular gene. Any function that is subsequently altered usually may be assigned to the knocked-out gene.

#### linkage analysis 4

A procedure for determining the frequency with which two or more different genes are inherited together due to their proximity on a chromosome. This procedure is used to narrow down the location of a gene that contributes to a particular trait.

#### lobotomy 6

A surgical procedure in which an incision is made in the brain to reduce the transmission of nerve messages from one part of the brain to another and thus alter behavior.

#### locus 2

The position in a chromosome of a particular gene or allele.

#### lod score 4

The calculation of likelihood that a gene involved in one trait is close by on the same chromosome to a gene involved in another trait. Lod stands for "logarithm of the odds" or "likelihood of odds." A lod score above 3 indicates a likelihood by chance of 1/1000 and usually is considered "significant."

#### major gene 4

A gene for which allelic variations by themselves (apart from other genes and/or environmental influences) may be sufficient to trigger significant and easily observable differences in a trait.

#### manic-depressive illness 5

See bipolar disorder.

#### Mendelian 5

Based on the inheritance theories of Gregor Mendel, who discovered that certain simple traits are passed from generation to generation in dominant and recessive patterns.

#### mental illness 1

Refers collectively to diagnosable disorders of the brain. Mental disorders are characterized by abnormalities in cognition, emotion, or mood, or the highest integrative aspects of behavior, such as social interactions or planning of future activities.

#### meta-analysis 4

The pooling together of data from multiple independent studies in order to draw more broadly based findings.

#### microarray analysis 4

A technique to scan the activity of thousands of genes simultaneously.

#### microdeletion 5

A short sequence of an individual's DNA that is missing.

#### modifier gene 3

A gene that affects another gene, thereby altering the latter gene's effect on the phenotype.

#### molecular research 4

Studies at the biochemical level. In behavioral genetics, molecular research is typically directed at DNA and proteins and their interactions. For example, a molecular researcher may compare sections of the DNA sequences from multiple subjects and/or compare subjects' genotypes with observations of their phenotypes.

#### MZ (monozygotic) 4

Resulting from a single early embryo that splits to create two embryos (identical twins).

#### model fitting 4

An analytic process in which several mathematical models estimating the relative contributions of genetic and environmental factors to a trait are proposed. The models are compared, using standard statistical methods, to find the one that best explains the data.

#### mood disorders 1

Emotional behavior inappropriate for one's age or circumstances, characterized by, for example, unusual excitability or loss of energy, guilt, anxiety, or hostility.

#### multigenic 5

Resulting from the expression of many different genes. A synonym of polygenic.

#### multifactorial 5

Resulting from the expression of many different genes and the influence of many environmental factors.

#### multiple intelligences 6

The view that humans have several distinct kinds of abilities that enable them to solve problems; for example, linguistic ability, logical-mathematical ability, and more.

#### multiple locus gene of small effect 4

A gene whose alleles, operating in synchrony with alleles of other genes, contribute to variation in a trait.

#### mutation 2

A change, deletion, or rearrangement in an organism's DNA sequence when the mutation occurs in a gene, the protein-encoding message of that gene may be altered.

#### natural selection 2

The process by which members of a species have traits that enable them to take better advantage of their environment. Those with the advantageous traits leave more descendants for the next generation, so the trait itself may become more prevalent in the species.

#### nature v. nurture 3

The controversy over whether genetic inheritance (our innate nature) or environment (upbringing) determines behavior. Since both nature and nurture undoubtedly contribute to behavior, this 'either-or' thinking is not an accepted dichotomy by scientists.

#### negative eugenics 7

Practices (including, but not limited to, sterilization, incarceration, and killing) to discourage reproduction by persons whose characteristics are not desired in the next generation. Compare to positive eugenics.

#### nervous system 2

The brain, spine, and network of nerves. Information is communicated throughout the body via electrical and chemical transmission along the nervous system.

#### neurotransmitter 6

A chemical released by nerve endings to carry messages between nerve cells.

#### nonadditive 2

When an allele's contribution to the variation in a phenotype is affected by the presence of other alleles at the same locus or at a different loci. Antonym of additive.

#### nonshared environment 3

Environmental factors that contribute to differences among family members. Antonym of shared environment.

#### norm of reaction 6

The variety of phenotypes that result from a given genotype in each possible environment.

#### normal 5

Conforming to an expected, typical, or healthy behavior, pattern, or type. Antonym of pathological.

#### normal curve of distribution 6

Scores for a trait value that cluster around the middle of the distribution and are less frequent as the extremes are approached. This creates a "bell curve" when plotted on a graph. Most behavioral phenotypes show a normal curve of distribution.

#### novelty seeking 6

The tendency to seek out and enjoy novel, and sometimes risky, experiences.

#### nucleotide 2

A building block of DNA and RNA.

#### pathological 5

Not conforming to an expected, typical, or healthy behavior, pattern, or type. Also, compulsive or diseased. Antonym of normal.

#### pedigree 4

A family tree that indicates those who show a particular health or behavioral condition.

#### phenotype 2

The visible properties of an organism that are produced by the interaction of the genotype and the environment; also, any one trait or any group of traits.

#### PKU (phenylketonuria) 3

A medical disorder that, if untreated, often results in severe mental retardation. The body does not produce enough of a particular enzyme, leading to an excess of a compound that damages the brain.

#### pleiotropy 2

The ability of a gene to have multiple phenotypic effects, such as simultaneous effects on hair color, brain function, and motor control.

#### polygenic 5

Resulting from the expression of many different genes. A synonym of multigenic.

#### polypeptide chain 2

A series of hundreds or thousands of amino acids linked together. Proteins are formed when polypeptide chains (and sometimes shorter “peptide chains”) join together into a three-dimensional structure.

#### population genetics 7

The study of those forces that affect gene frequencies.

#### positive eugenics 7

Practices (such as propaganda campaigns and rewards) to encourage reproduction by persons whose characteristics are desired in the next generation. Compare to negative

eugenics.

#### pre-implantation diagnosis and selection 6

A medical procedure by which the DNA of embryos created through in vitro fertilization is analyzed for one or more disorders and/or traits; those without mutant alleles can be selected for implantation.

#### prenatal diagnosis 6

A medical procedure to determine the prospective health of a baby before it is born.

#### proband 4

The person that is the first subject to be identified in a study.

#### protein 2

Substances that consist of amino-acid residues joined by peptide bonds. Many essential biological compounds such as enzymes, hormones, or immunoglobulins are proteins.

#### QTL (quantitative trait locus) 2

One locus (gene) among many in the genome that affects a continuous trait.

#### QTL analysis 4

A type of molecular research that seeks the locations of the many genes whose alleles contribute to a variable trait.

#### quantitative genetic trait 2

A trait for which the observable phenotype associated with an underlying genotype varies across a population by measurable quantities or degrees, for example, height.

#### quantitative research 4

Studies of traits that vary quantitatively (that vary by degree in individuals in a population). Such studies are done by observing the phenotypes of subjects.

#### race 7

A classification of people on the basis of their phenotypic characteristics that are presumed to be inheritable. The notion of race as based on specific biological traits is not embraced by most scientists; however, race as a social variable is viewed as a topic meriting scientific investigation.

#### reaction range 6

See norm of reaction.

#### recessive disorder 5

A disorder that can occur only when both alleles at a locus are mutations that do not properly encode for protein. Contrast with dominant disorder.

#### recombination 4

When a section of one chromosome switches places with the same section from the other chromosome of a pair or with a section from another chromosome.

#### replication 5

A scientific research study that repeats or is very similar to an earlier study in order to confirm or disconfirm the earlier findings.

#### responsibility 6

The term has several meanings. To be “causally responsible” is to cause something to happen, either directly or indirectly. To be “legally responsible” is to be held accountable under the law and be subject to legal consequences for one's actions. To be “morally responsible” is to have a moral obligation, for which the fulfillment or failure to fulfill is deserving of praise or blame. In both morality and law, one's responsibility is judged in the context of the ability to understand the nature and consequences of one's actions and to control one's behavior.

#### RNA (ribonucleic acid) 2

A single-stranded nucleic acid that plays a central role in protein synthesis and gene regulation. RNA contains ribose, in contrast to the deoxyribose in DNA.

#### schizophrenia 1

A mental disorder characterized by disturbances in thought, personality, conscious awareness, sensation, and behavior.

#### second-degree relative 4

Aunt, uncle, grandchild, grandparent, niece, or nephew.

#### shared environment 3

Environmental factors that contribute to similarities among family members. Antonym of nonshared environment.

#### sickle cell disease 6

A disorder in which red blood cells take on an unusual shape, leading to other blood and circulation problems.

#### SNP (single nucleotide polymorphism) 4

A single bit of DNA in a genome's sequence that varies among members of a species. Each bit is one base (nucleotide): either adenine (A), cytosine (C), thymine (T) or guanine (G).

#### stem cell 4

An undifferentiated cell. Those found in early embryos can mature into many different cell types, such as blood, bone, or neurons.

#### susceptibility gene 5

A gene whose alleles may increase or decrease one's probability of having or acquiring a trait or disorder.

#### tandem repeats 5

Multiple copies of the same base sequence that appear one after another in the genome.

#### thalassemia 6

A blood disease, occurring chiefly among people of Mediterranean descent, characterized by the production of abnormal hemoglobin. The word means "anemia of the sea."

#### twin study 4

A type of research in which the subjects are pairs of twins, identical or fraternal or both. In the study, each twin is identified as having or not having the trait/disorder under study; this information is used to establish a concordance rate for the trait. Often in such a study, concordance rates for fraternal and identical twins are obtained and compared.

#### violence 6

Rough, injurious or abusive physical force, action, or treatment, or an instance of such behavior.

#### whole genome scan 4

The search of a subject's entire genome that uses many genetic markers selected to sample segments of all the chromosomes. The markers may be segments of DNA and/or SNPs.

#### X-linked disorder or trait 5

A phenotype that results in part or whole from alleles at a locus on the X (sex) chromosome.

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## AAAS / HASTINGS CENTER BEHAVIORAL GENETICS PROJECT

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ADVANCING SCIENCE. SERVING SOCIETY

The American Association for the Advancement of Science (AAAS), was founded in 1848 and is today the world's largest general science and engineering organization, with nearly 140,000 individual and institutional members, and 272 affiliated organizations in more than 130 countries. It is the publisher of the weekly journal, *Science*.

The AAAS Scientific Freedom, Responsibility and Law Program (SFRL) focuses on the ethical, legal, and social issues associated with the conduct of research and with advances in science and technology.

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This book is one of several resources resulting from a project on behavioral genetics conducted by the American Association for the Advancement of Science (AAAS) and The Hastings Center. It is an introduction for non-scientists to the science of behavioral genetics and its broader ethical and social implications. Among the issues covered are how behavioral genetics challenges our understanding of human nature, personal responsibility, and equality.

Each chapter begins with a fictional, yet plausible, vignette about an individual seeking answers to a question about behavior. The text then provides enough scientific background for the reader to address the question thoughtfully. A glossary indexed according to the chapters explains key words and concepts. For more information about the larger project, visit the project's website at <http://www.aaas.org/spp/bgenes>.