

CHAPTER 3: THE EVOLVING MIND- NATURE AND NURTURE INTERWINED

Genes can be turned on and off.

The genes that are not turned off are free to produce the proteins needed to build a particular kind of cell.

Genes do not just turn on and off as they build a body during development.

Your ongoing interaction with the environment can turn genes on or off.

Food

Smoking/drinking

Stress levels

Identical twins become less similar as they age.

Why do we say nature and nurture are intertwined?

Nature- the contributions of heredity to our physical structure and behaviors

Nurture- the contributions of environmental factors and experience to our physical structure and behaviors.

Francis Galton- described the contrast between heredity and environment as “nature vs. nurture”; Darwin’s cousin; believed that intelligence was largely the result of inheritance

What are the building blocks of behavior?

Genotype- an individual’s profile of alleles

Phenotype- Observable characteristics

Each parent contributes a set of 23 chromosomes

Gene- Small segment of DNA located in a particular place on a chromosome.

Gene expression- The process in which genetic instructions are converted into a feature of a living cell

Allele- one of several different versions of a gene, as in having A, B, or O blood type allele

Homozygous- having two of the same alleles for a gene

Heterozygous- having two different alleles for a gene

Recessiveness- a feature of an allele that will only produce a phenotype in the homozygous condition

Dominance- a feature of an allele that will determine a phenotype in either the homozygous or heterozygous condition

Genetic Variation

A single human can produce eggs or sperm with 2^{23} different combinations of his or her chromosomes

Relatedness- the probability that two people share the same allele from a common ancestor

The chance that you share an allele with one of your parents is one half, as is the chance that you share an allele with a sibling

First cousins have 1/8 likelihood of sharing an allele

Sex chromosomes

22 out of the 23 pairs of chromosomes from each parent are perfectly matched

The X and Y sex chromosomes do not carry the same genes

Most of the genes located on the Y chromosome are involved with male fertility

Sex linked characteristics

The X chromosome contains genes that influence a wide variety of characteristics like blood clotting and the ability to see the colors red and green.

Genes responsible for hemophilia, or the failure of blood to clot, and the red-green colorblindness are found on the X chromosome.

These are recessive so when women get them they are just carriers and do not experience it

A male receiving this X chromosome gene will have the condition

So, these are much more frequent among males

Epigenetics

Different phenotypes can result from the same genotype due to interactions between the organism and the environment

Epigenetics- the study of gene-environment interactions in the production of phenotypes

The environment can determine if and when a particular gene is activated

What is the field of behavioral genetics?

Behavioral genetics- the scientific field that attempts to identify and understand links between genetics and behavior

Heritability- the statistical likelihood that variations observed in a population are due to genetics

Usually presented as a ratio of the amount of variation observed in a population due to genetics relative to the total amount of variation due to both genetic and environmental influences

If genes play no part in producing phenotypical differences between individuals, heritability is 0.0

Ex. Having a heart

If genes are totally responsible for all phenotypical differences between individuals, heritability is 1.0.

Heritability of most human traits is usually between .3 and .6

Genes encode for proteins, not behaviors

Genes build proteins that are used to construct brains, and brains may or may not initiate the behavior of drinking alcohol.

Genes do not cause but “contribute” to the development and functioning of the nervous system

How does evolution occur?

Evolution- descent with modification from a common ancestor

Charles Darwin- proposed that species evolve or change from one form to the next in an orderly manner.

Natural selection- the process by which survival and reproduction pressures act to change the frequency of alleles in subsequent generations

Gregor Mendel- discovered ways to outline and predict the inheritance of particular traits, like the color of flowers, in his research on pea plants.

Mechanisms of Evolution

Evolution can be caused by natural selection but also mutation migration and genetic drift.

Mutation- errors that occur when DNA is replicated

Migration- movement to a new location

Phenotypical traits that are advantageous in one environment might be less so in another

Genetic drift- change in a population's genes from one generation to the next due to chance or accident

When a person has a choice of mates of equal value, he or she will select the one that "stands out from the crowd"

Individuals with blonde hair color, which was different and more rare, might have enjoyed more reproductive success than those with more common, darker hair colors.

Rare things tend to be viewed as valuable

Fitness- the ability of one genotype to reproduce more successfully relative to other genotypes

- Survival to adulthood

- Ability to find a mate

- Reproduction

Natural selection favors the organism with the highest degree of fitness.

Adaptation-a change due to a natural selection

- Behaviors, such as jumping higher to better avoid a predator

- Anatomical features, such as eyes that can see color

Any adaptation that is 'good enough' to contribute to the fitness of an organism will carry forward into future generations

Adult human males have about 10 times as much testosterone as adult human females.

Men with higher testosterone report having more sex partners and earlier age at intercourse.

High testosterone levels are correlated with lower immune system functioning, making them more vulnerable to disease.

Evolution of the Human Brain

Hominin- species that walked on two feet, had large brains, and are assumed to be related to modern humans

Brains grew rapidly, suggesting that improved intelligence was quickly translated into substantial advantages in survival

Australopithecines- early tool-using hominins, had brains like modern chimps 400 cubic cm.

Homo erectus- a hominin with a brain 700 cubic cm

Homo sapiens- modern humans 1400 cubic cm brains

Primates, elephants, and whales' brains also grew fast.

The major factor distinguishing human intelligence from the intelligence of other species is the richness and complexity of the social behavior supported by the human brain.

- Humans can

- Distinguish friend vs. foe

- Imitate others behavior

- Use language to communicate