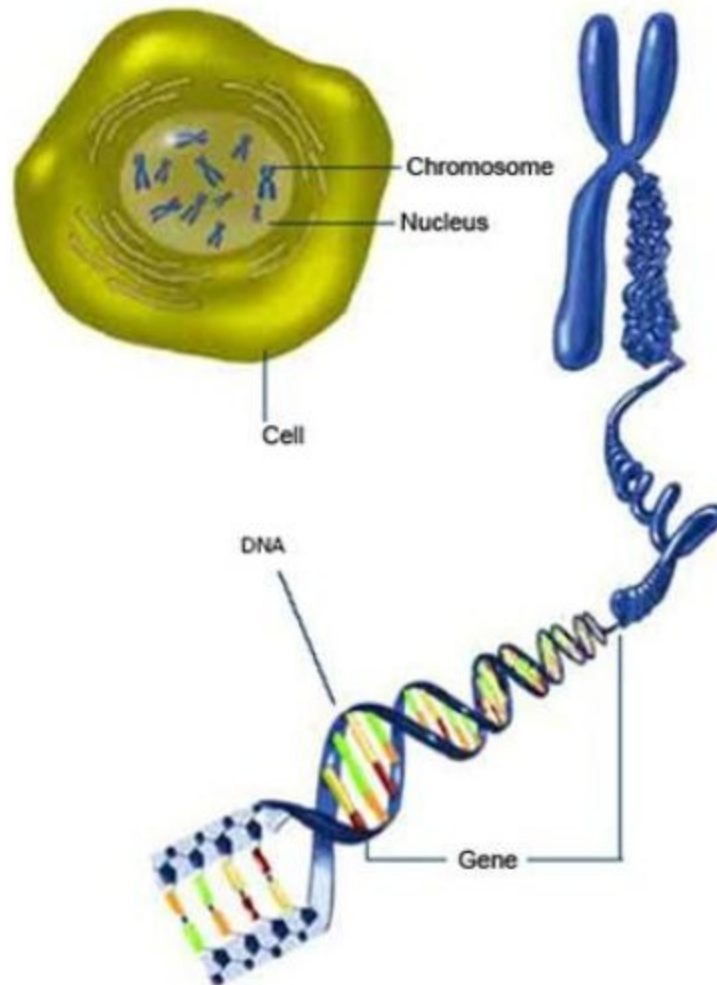


Variation of Traits

by ReadWorks



When two organisms create a third organism through reproduction, a number of variables come into play. It's a sort of complex lottery in which the third organism—the offspring of the first two—inherits a combination of the parent organisms' genetic material. The possible variations inherent in recombining the parents' DNA are very, very broad and infinitely larger than the pool of entries in the state lotto jackpot! That's why we get so much variation even within the population of a particular sexually reproducing species.

Each new organism receives two of each chromosome, and within those chromosomes, two versions of each parents' set of genes. These genes contain instructions for protein production within the body of the offspring, and the way those proteins are prescribed determines the traits of the offspring. So, although your unique collection of traits, the combination of characteristics, physical and otherwise, that make you uniquely yourself are originally the product of chance, there are machinations going on behind the scenes to which every freckle, hair and character trait can be traced.

Personality traits are another story altogether. When we think about how our personalities are formed,

we can certainly think about genes we acquired from our parents-but we also have to think about other complexly intertwined factors like environment and upbringing. For now, we'll simplify things by just focusing on the physical aspect of inherited traits. For example, if both parents exhibit the trait of red hair, their offspring have a greater chance of acquiring the genes that code for red hair. Certain traits are characteristically dominant or recessive, depending on the makeup of their alleles. This can make predicting traits tricky, but it is still very possible to estimate the likelihood, even the mathematic probability, that certain traits will manifest in the offspring of partners who exhibit those traits.

Red hair happens to be a kind of gene called incomplete dominant, which means it will blend with other genes, rather than dominate or be dominated. Since this is the case, the likeliest candidate to be coded for red hair is offspring with two red-headed parents.

It would be very, very unlikely for two parents with identically coded chromosomes to sexually reproduce. Even in the case of intrafamilial (or consanguine) pairings, which are discouraged in our society, the chromosome pairings would never be perfectly identical-that's a good thing for us as a civilization! As you will see, the absolute worst thing for our survival is for like to be paired with likes. It's in the best interests of our population that lots of different genes get mixed together in an evolutionary soup, so that many new variations on living organisms can be exposed to the environment, develop new adaptations to changing conditions, and promote the survival of the species.

Another variable that lets organism populations adapt to changing environments is mutation in genes. Sometimes, unpredictable changes in genetic code will appear within a new generation, not traceable back to a parental source.

Creators of superheroes like the X-Men and Teenage Mutant Ninja Turtles have used the idea of extreme mutation as a narrative device to invent colorful characters, bizarre scenarios, and literary metaphors. *Mutant* and *mutation* have exciting, exotic connotations to us, but actually, mutation is simply a necessary part of a species' evolution. Mutation can be something as mundane as two parents with brown eyes giving birth to a child with hazel eyes; or a type of moth whose wings are a different color from all the other moths in that species. Mutations are where new adaptations to existing or dynamic conditions are field tested in competition to whatever has worked for a population in the past. If a mutation pops up that happens to be advantageous for a particular organism within a population, that organism is more likely to survive, and therefore, more likely to procreate. Eventually, that chance mutation is reflected more widely in the community, and is passed on further to later generations. Once new challenges appear in the environment, new adaptations are likely to crop up for a fortunate few.

This is not to say that mutations are always helpful. Sometimes they are simply inconvenient, odd or unsupportable. They can even be indicative of a disruption in the environment.

Human interference in genetic coding is a pretty common practice these days. By deliberately engineering mutations in plants, most often food crops, humans can create larger, more resilient food sources. Since these "superfoods" are synthetically equipped with attributes that make them disproportionately competitive in the ecosystem they share with naturally grown food crops, they pose a threat to those populations. This is a controversial practice many food activists are working to curb.

Whether the mutation occurs naturally or is forced upon a population by biogenetic scientists, mutations are essential to the system by which ecosystems change and grow.

inherit in · her · it

Definition

verb

1. to receive from a person who has died.

James inherited land and money from his grandfather.

Advanced Definition

transitive verb

1. to receive (money, property, or the like) through a will made by, or legal succession to, a person who has died; be heir to.

I inherited this watch from my uncle.

She inherited several million dollars upon her father's death.

2. to receive (a characteristic) by genetic transmission through a parent.

He inherited the disease from his father.

She inherited her blue eyes from her mother's side of the family.

3. to receive (something) from or as if from a predecessor.

She inherited the previous tenant's dreadful wallpaper.

The new president inherited the problems that arose under the former administration.

intransitive verb

1. to receive property or succeed to a position or title as an heir, or have the right to do so.

He inherits when he becomes twenty.

2. to receive characteristics, authority, duties, or the like from a forebear or predecessor.

Spanish cognate

heredar. The Spanish word *heredar* means inherit.

These are some examples of how the word or forms of the word are used:

1. The newly settled population bred. The individuals among subsequent generations that were fitter or better adapted to certain conditions of the population's new home, continued the breeding process, and thus, new species evolved. Those individuals that **inherited** disadvantageous traits, given environmental stressors, stood a greater chance of dying off before they could reproduce and pass the traits on to their offspring.
2. At the time, France was a monarchy, which means a king or queen ruled the country. The king or queen **inherited** this position from birth. Members of the royal family and other privileged-by-birth aristocrats controlled power and wealth within the country, while peasants and other poor people paid extremely high taxes, which were levied in order to support the extravagant lifestyles of the rich.
3. Schweitzer said that new techniques might make it possible for scientists to one day extract a dinosaur's genetic material. Genetic material determines an animal's **inherited** characteristics, such as eye color and hair color.
4. When two organisms-in this case, those organisms would be Alice and Jake's parents: Pete and Rachel-create a third organism through reproduction, many variables come into play. It's a complex lottery in which an offspring of the first two organisms **inherits** a combination of their genetic material.
5. Your genes determine how tall you grow, what color hair you have, and how quickly your skin gets sunburnt. Our genes are **inherited** from our parents, which is why you see family resemblance between parents, children and siblings. These genes are passed on through generations by either artificial or natural selection.
6. **Inherited** genetic information explains why certain species look different from others. Monarch butterflies, orange butterflies with black markings and white spots on their wings, are most common in Mexico and the United States. Their bright color makes them easily noticeable to predators, but also acts as a warning that they are poisonous if eaten.
7. So many of our most defining traits have been learned, rather than **inherited**. For instance, if you're really great at video games, it's not because one or both of your parents passed down skills in some video game mastery gene. It's because you practiced, played a lot of video games, and developed those skills yourself.

reproduction

re · pro · duc · tion

Advanced Definition

noun

1. the act or process of reproducing or state of being reproduced.
2. a copy or duplication, as of a document or work of art.
3. the process by which new plants or animals of the same kind are created.

Reproduction is necessary for a species to survive.

Spanish cognate

reproducción: The Spanish word *reproducción* means reproduction.

These are some examples of how the word or forms of the word are used:

1. The populations were small and perhaps most importantly, isolated from mainland South America. This allowed sexual **reproduction** and individual cases of mutation to introduce advantageous traits and disadvantageous traits that would not be diffused across a very large population.
2. As the bee flies around looking for even more nectar, it distributes pollen along its flight pattern, almost accidentally, and ensures that the pollen from the first plant is distributed to the second plant, thereby acting as a middleman in flower **reproduction**.
3. Two scientists, who conducted research on the impact of bumblebee loss on plant **reproduction**, found that when a particular species of bumblebee was removed from the pool of pollinators, other bees did not completely take over the pollinating duties.
4. When two organisms-in this case, those organisms would be Alice and Jake's parents: Pete and Rachel-create a third organism through **reproduction**, many variables come into play. It's a complex lottery in which an offspring of the first two organisms inherits a combination of their genetic material.
5. Our Earth is alive with organisms carrying through their life cycle of birth, **reproduction** and death. All plants, animals and other living things reproduce, resulting in new offspring or organisms. Sometimes this reproduction is unassisted, such as within bacteria, and sometimes it requires the assistance of others.

variation

var · i · a · tion

Advanced Definition

noun

1. the act or process of changing, or the condition of being changeable.

During the spring, there is a great deal of variation in the temperature.

2. a slightly different form or version of something, such as an artistic work.

This story is a variation of a well-known folk tale.

3. the degree to which something varies; amount of change or difference.

Spanish cognate

variación: The Spanish word *variación* means variation.

These are some examples of how the word or forms of the word are used:

1. This combination of two incomplete sets of genetic materials accounts for trait **variation** and change (or evolution) across a sexually reproducing population.
2. The animals of our world have been shaped by millions and millions of years of evolution. Everything about them, their fur, their feet, and the shape of their beaks, has been determined by natural selection. Nature has tried many **variations**.
3. "What struck me was how much **variation** there is in tissue color and other internal features," she said. "Everyone looks different on the inside as well as the outside."

Name: _____ Date: _____

1. What determines the traits of offspring?

- A. food sources that have been genetically engineered
- B. literary metaphors and exciting connotations
- C. the pool of entries in the state lotto jackpot
- D. genes received from the offspring's parents

2. Mutation in the genes of an organism is a cause. What is a possible effect?

- A. The organism is less likely to be studied by scientists.
- B. The organism is more likely to find a sexual partner identical to it.
- C. The organism is more likely to resemble its parents.
- D. The organism is more likely to survive and procreate.

3. Reproduction is "a sort of complex lottery in which the third organism-the offspring of the first two-inherits a combination of the parent organisms' genetic material."

What evidence from the passage supports this statement?

- A. "The likeliest candidate to be coded for red hair is offspring with two red-headed parents."
- B. "It would be very, very unlikely for two parents with identically coded chromosomes to sexually reproduce."
- C. "*Mutant* and *mutation* have exciting, exotic connotations to us, but actually, mutation is simply a necessary part of a species' evolution."
- D. "Human interference in genetic coding is a pretty common practice these days."

4. What is a difference between physical traits and personality traits?

- A. Physical traits are mainly determined by a person's environment; personality traits are determined by both a person's genes and environment.
- B. Physical traits are mainly determined by a person's genes; personality traits are determined by both a person's genes and environment.
- C. Physical traits are mainly determined by a person's genes and environment; personality traits not determined by either a person's genes or environment.
- D. Physical traits are mainly determined by a person's genes; personality traits are determined by genetically engineered food that a person eats.

5. What is this passage mostly about?

- A. genes
- B. ecosystems
- C. the lottery
- D. personality traits

6. Read these sentences: "Red hair happens to be a kind of gene called incomplete dominant, which means it will blend with other genes, rather than **dominate** or be dominated. Since this is the case, the likeliest candidate to be coded for red hair is offspring with two red-headed parents."

What does the word "**dominate**" mean?

- A. protect or defend something from attack
- B. consume or eat a large amount
- C. overpower or be in control
- D. give up or be in the control of another

7. Choose the answer that best completes the sentence below.

A mutation may be passed down from one generation to the next, _____ when the mutation is advantageous.

- A. before
- B. never
- C. particularly
- D. on the contrary

8. Define "mutation."

9. What can people create by engineering mutations in food crops?

10. Why might genetically engineered "superfoods" be a threat to naturally grown food? Support your answer with information from the passage.

1. What determines the traits of offspring?

- A. food sources that have been genetically engineered
- B. literary metaphors and exciting connotations
- C. the pool of entries in the state lotto jackpot
- D. genes received from the offspring's parents**

2. Mutation in the genes of an organism is a cause. What is a possible effect?

- A. The organism is less likely to be studied by scientists.
- B. The organism is more likely to find a sexual partner identical to it.
- C. The organism is more likely to resemble its parents.
- D. The organism is more likely to survive and procreate.**

3. Reproduction is "a sort of complex lottery in which the third organism-the offspring of the first two-inherits a combination of the parent organisms' genetic material."

What evidence from the passage supports this statement?

A. "The likeliest candidate to be coded for red hair is offspring with two red-headed parents."

B. "It would be very, very unlikely for two parents with identically coded chromosomes to sexually reproduce."

C. *Mutant* and *mutation* have exciting, exotic connotations to us, but actually, mutation is simply a necessary part of a species' evolution."

D. "Human interference in genetic coding is a pretty common practice these days."

4. What is a difference between physical traits and personality traits?

A. Physical traits are mainly determined by a person's environment; personality traits are determined by both a person's genes and environment.

B. Physical traits are mainly determined by a person's genes; personality traits are determined by both a person's genes and environment.

C. Physical traits are mainly determined by a person's genes and environment; personality traits not determined by either a person's genes or environment.

D. Physical traits are mainly determined by a person's genes; personality traits are determined by genetically engineered food that a person eats.

5. What is this passage mostly about?

- A. **genes**
- B. ecosystems
- C. the lottery
- D. personality traits

6. Read these sentences: "Red hair happens to be a kind of gene called incomplete dominant, which means it will blend with other genes, rather than **dominate** or be dominated. Since this is the case, the likeliest candidate to be coded for red hair is offspring with two red-headed parents."

What does the word "**dominate**" mean?

- A. protect or defend something from attack
- B. consume or eat a large amount
- C. **overpower or be in control**
- D. give up or be in the control of another

7. Choose the answer that best completes the sentence below.

A mutation may be passed down from one generation to the next, _____ when the mutation is advantageous.

- A. before
- B. never
- C. **particularly**
- D. on the contrary

8. Define "mutation."

Answers may vary in wording. A mutation is an unpredictable genetic change in an organism that cannot be traced to the organism's parents.

9. What can people create by engineering mutations in food crops?

People can create larger, more resilient food sources.

10. Why might genetically engineered "superfoods" be a threat to naturally grown food? Support your answer with information from the passage.

Answers may vary, as long as they are supported by the passage. For instance, students may respond that engineering food crops to be more resilient makes those crops likelier to survive and produce offspring. Crops without this advantage are less likely to survive and produce offspring. They face the threat of eventually going extinct because they are at a competitive disadvantage against "superfoods."