Inheritance and Variation of Traits | Science

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Inheritance and Variation of Traits

If you've been using our blog to help you study for the TASC Test Assessing Secondary Completion™ Science subtest, you might already have some insight into what heredity is and why it is important to Life Science.

The Next Generation Science Standards ask students to have a deeper understanding of heredity – they want students to be able to discuss how traits are inherited and how they vary from generation to generation. As you prepare for your Science subtest, be sure you're able to discuss what scientists know generally about traits and analyze specific examples.

Overview

Members of any given species, from tiny organisms like ants to human beings, are almost never exactly the same. Organisms differ in size, coloration, health and wellness, and many other traits. For example, you do not look exactly like either of your parents. You may have your dad's hair color but your mom's eye colors. Or you might not have either of your parents' eye colors – even if they are your biological parents.

According to the American Museum of Natural History's "Variation and Inheritance" overview, these variations are "often the results of random mutations, or "**copying errors**," that arise when cells divide as new organisms develop. The scientists at AMNH explain that when organisms reproduce, they pass on their DNA to their offspring. **DNA** acts as a "set of instructions encoded in living cells for building bodies." Because of DNA, dogs with long hair tend to have puppies with long hair.

Natural Selection

As we noted in our earlier post on heredity, Charles Darwin and Alfred Russell Wallace were the first scientists to announce the theory of natural selection. Darwin speculated that members of individual species competed against one another for resources and for mates, especially as their populations grow. Because of variations in traits, some organisms are better able to compete. Consequently, they get the resources they need. The less-competitive organisms, and their less-competitive traits, die out over time.

If this is true, how do less-competitive traits keep arising in species? If only dominant traits are passed on over time, shouldn't there only be competitive organisms left?

The simple answer is: no, there cannot only be competitive organisms left at this point. Though scientists argue that evolution has always been going on (because through evolution, we get the species we have on earth today rather than the ancient creatures we know used to live on this planet), the process of evolving has not completely eradicated undesirable traits. This is primarily because what is desirable and what is not desirable changes over time depending on the organism's habitat, needs, and many other factors.

For example, as Richard W. Young explains in the *Journal of Anatomy*, scientists have proposed that early humans began as chimpanzee-like apes. They developed the need to throw rocks and swing clubs at their enemies and their prey, and these skills became essential to survival. These skills "yielded reproductive advantages for millions of years, driving natural selection for improved throwing and clubbing" which caused the human hand to adapt to these skills. Because the hand evolved, and early humans developed the use of opposable thumbs, they were eventually able to develop hunting and gathering skills. Early humans without opposable thumbs died off. If they hadn't needed thumbs to compete against enemies and hunt prey, they probably wouldn't have developed them – and the human race today would look much different.

At early points in our history as a species, our needs changed – which meant that what was desirable to mates and to compete changed. Opposable thumbs began to be inherited as those individuals became more and more competitive.

This is not to say that after one generation there were no more early humans without opposable thumbs. It's important to note that because traits vary, and because some organisms inherit recessive traits, it can take many generations for traits to be removed from a species. It could be a few generations, or thousands. **Evolution is a long-term process.** In fact, we are currently undergoing evolution – we just can't see the impact of it in the short term.

It is also important to note that variations in traits can be tiny. AMNH, in its discussion of "Selection: Survival and Reproduction," points out, "small variations can influence whether or not an individual lives and reproduces. Differences in color, for instance, aid some individuals in camouflaging themselves from predators. Sharper eyes and claws help an eagle catch its dinner. And brighter coloration improves a male peacock's chances of attracting a mate." The sharpness of an eye or a claw can be only a fractional difference. A peacock's coloration can be less than a shade different than its male competitor. Nevertheless, these fractional differences determine inheritance and variation.

Looking for a helpful way to sum up what you've just learned about inheritance and variation? Remember the acronym **VISTA**, which stands for Variation, Inheritance, Selection, Time and Adaptation. These are the five basic steps described here, and these five steps are essential to understanding heredity.

Test out your understanding with these helpful resources from the Next Generation Science Standards' website, or leave your questions below for a TASC test team member.