6.2 5.1: Why doesn't a cow quack and why don't puppies look like kittens?

Has anyone ever come up to you and told you that you look just like your parents? You probably have some characteristics or traits in common with each of your parents, aunt, uncle, or other relative.

For a long time people understood that traits are passed down through families. The rules of how this worked were unclear, however. The work of Gregor Mendel was crucial in explaining how traits are passed down to each generation.

Mendel's Experiments

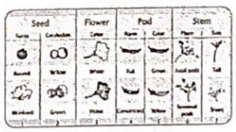
What does the word inherit mean? You may have inherited something of value from a grandparent or another family member. To inherit is to receive something from someone who came before you. You can inherit objects, but you can also inherit traits. For example, you can inherit a parent's eye color, hair color, or even the shape of your nose and ears!

Genetics is the study of inheritance. The field of genetics seeks to explain how traits are passed on from one generation to the next.

In the late 1850s, an Austrian monk named Gregor Mendel performed the first genetics experiments.

To study genetics, Mendel chose to work with pea plants because they have easily identifiable traits. For example, pea plants are either tall or short, which is an easy trait to observe. Furthermore, pea plants grow quickly, so he could complete many experiments in a short period of time.

Mendel studied the inheritance patterns for many different traits in peas, including round seeds versus wrinkled seeds, white flowers versus purple flowers, and tall plants versus short.



In one of Mendel's early experiments, he crossed a short plant and a tall plant. What do you **predict** the offspring of these plants were? Medium-sized plants? Most people during Mendel's time would have said medium-sized. But an unexpected result occurred. Mendel observed that the offspring of this cross were all tall plants!

Next, Mendel let this generation self-pollinate. That means the tall plant offspring were crossed with each other. He found that 75% of their offspring were tall, while 25% were short. Shortness skipped a generation. But why?

In all, Mendel studied seven characteristics, with almost 20,000 plants from the 2ndgeneration. All of his results were similar to the first experiment—about three out of every four plants had one trait, while just one out of every four plants had the other.

For example, he crossed purple flowered-plants and white flowered-plants. Do you think the colors blended? No, they did not. Just like the previous experiment, all offspring in this cross were one color: purple. In the next generation, 75% of plants had purple flowers and 25% had white flowers. There was no blending of traits in any of Mendel's experiments.

Mendel's work provided the basis to understand the passing of traits from one generation to the next.

Traits

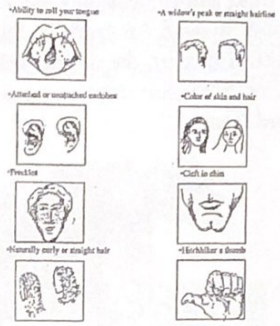
Some trees grow very tall with thick bark while others are very short with thin bark. It all depends on an organism's heredity, the passing of traits from parents to their young. An organism is any living thing that can carry out its life activities on its own. Heredity applies to all organisms including humans, plants, insects and even bacteria.

In a pond, every frog is unique because of varioustraits it inherited from its parents. A trait is a characteristic that determines how an organism looks, acts or functions. Aninherited trait is a characteristic passed from parents to their young. Some examples of inherited traits are fur color, stripes, or spots. The big cats pictured show inherited traits. Can you see similarities and differences between the two cats?

Dogs will always have puppies, just as cats will always have kittens and acorns will always grow into oak trees. That is why people are alike in most ways. We look like people!

All organisms are made up of small building blocks. A person consists of about ten trillion of these building blocks, which come in over 200 varieties. These building blocks give organisms their individual traits and vary from organism to organism. These small differences are enough to keep organisms from looking identical. These differences establish our color of hair or eyes, whether we are tall or short, and whether we have freckles or not. Each of us has inherited his/her own mixture of traits. Within each building block are special instructions that tell an organism how it will grow and what traits it will develop.

Parent organisms, producers of offspring, pass these instructions to theiroffspring, the young of an organism. For example, a puppy may inherit dark hair from its mother; a seedling may develop wide, broad leaves from its parent plant; or human beings may inherit a variety of traits. A few of these inherited traits include: ability to roll your tongue, a widow's peak or straight hairline, attached or unattached earlobes, color of skin and hair, freckles, cleft in chin, naturally curly or straight hair, and a hitchhiker's thumb.



Sometimes, offspring do not look like their parent organism. However, as they go through their **life cycles** they begin to look more like their parents. For example, the legless little tadpole with its large tail looks very different than it will as a full-grown frog.

Compare puppies in a litter. Even though these puppies have had the same two parents, there are **variations**, differences in the appearance of an inherited trait among the members of a group or **species**, in how they look and act. The differences in paw size, tail length, or hair coloring are examples of variations. Some variations do not have much of an effect on an organism. For example, the different colors of hair on puppies may have little effect on whether or not each puppy will survive.

However, for some organisms living in the wild, color can be a matter of life or death. For example, a moth with brightly colored orange and yellow wings will not survive very long if its environment is the dark bark of pine trees. The brightly colored moth can be easily seen and eaten by birds. A moth with similar color patterns to its surroundings may survive longer. These variations give aspecies, a certain group of plants or animals that can only reproduce among themselves, a better chance to live or survive.

Learned Behaviors vs. Instincts

Did you ever see a dog sit on command? Have you ever watched a cat trying to catch a mouse? These are just two examples of the many behaviors of animals. Animal behavior includes all the ways that animals interact with each other and the **environment.** Some animal behaviors are **learned behaviors,** an action that is learned through trial and error or is brought about by the environment. Other behaviors are **instinctual,** meaning animals are born with them. Herding for the dog is both learned and instinctual, the nursing piglet is an instinctual behavior, and blowing dandelion seeds is a learned behavior.

These are examples of animal behavior, can you think of other examples of animal behavior besides these three?

Nature vs. Nurture

Some behaviors seem to be controlled solely bygenes. Others appear to be due to experiences in a given environment. Whether behaviors are controlled mainly by genes or by the environment is often a matter of debate. This is called the nature-nurture debate. Nature refers to the genes an animal inherits and nurture refers to the environment that

the animal experiences. In reality, most animal behaviors are not controlled by nature or nurture. Instead, they are influenced by both nature and nurture. In dogs, for example, the tendency to behave toward other dogs in a certain way is probably controlled by genes. However, the normal behaviors can't develop in an environment that lacks other dogs. A puppy raised in isolation from other dogs may never develop the normal behaviors. It may always fear other dogs or act aggressively toward them.

How Behaviors Evolve

It's easy to see how many common types of behavior evolve. That's because they obviously increase the fitness of the animal performing them. For example, when wolves hunt together in a pack, they are more likely to catch prey. Therefore, hunting with others increases a wolf's fitness. The wolf is more likely to survive and pass its genes to the next generation by behaving this way. Wolves hunt together in packs. This is adaptive because it increases their chances of killing prey and obtaining food.

Inherited Behavior

How do kittens know how to "hunt"? This kitten was probably adopted and separated from its mother at a young age. It never got a lesson in how to stalk and pounce on prey. So how does this kitten know how to attack the ball of yarn? Some behaviors do not need to be learned.

Many animal behaviors are ways that animals act, naturally. They don't have to learn how to behave in these ways. Cats are natural-born hunters. They don't need to learn how to hunt. Spiders spin their complex webs without learning how to do it from other spiders. Birds and wasps know how to build nests without being taught. These behaviors are called inherited.

Aninherited behavior is any behavior that occurs naturally in all animals of a given species. An inherited behavior is also called aninstinct, behaviors that are inherited from the parent organism. The first time an animal performs an inherited behavior, the animal does it well. The animal does not have to practice the behavior in order to get it right or become better at it. Inherited behaviors are also predictable. All members of a species perform an inherited behavior in the same way. From the examples described above, you can probably tell that inherited behaviors usually involve important actions, like eating and caring for the young.

There are many other examples of instincts. Did you know honeybees dance? When a honeybee locates a source of food it will return to the hive and do a dance. This dance is called the waggle dance. The way the bee moves during its dance tells other bees in the hive where to find the food. Honeybees do the waggle dance without learning it from other bees, so it is an instinct.