Christopher Schneider, Boston University:
*Take a look at this mantis here. This thing is almost perfectly disguised as a leaf, but you can see if you look at the underside that it’s a praying mantis just like you would find in a garden in North America.*

How does a leaflike mantis come about? The answer lies in Charles Darwin’s major contribution to science—his theory of evolution by natural selection. Natural selection is the process by which populations of living things change, adapt and evolve. The aspects of nature that contribute to the process are *variation, inheritance, selection* and *time*, which together lead to *adaptation*.

Within any given population, individuals can vary in many different ways. Variation between individuals is the result of differences in their DNA—the sets of genetic instructions encoded in all living cells. New variations are the result of mutations—random DNA copying errors that occur as cells divide.

But while variations make individuals unique, organisms also resemble their parents because they inherit their parents’ DNA.

Nature interacts with variation through selection, which refers to the fact that many living things are born but not all of them survive and reproduce. Some individuals may possess variations that help them survive and reproduce better than others.

Over sufficient time, those helpful variations will become more common in the population, since only the individuals who survive and reproduce can pass on their DNA.

In this way, an entire population will become modified, with all members sharing a particular adaptation.

Biologists study this process of change to better understand the natural world and to address problems facing humanity. Without Darwin’s theory, they would have trouble linking and explaining the facts they uncover.

Informed by natural selection, two biologists studying the rough-skinned newt can explain this newt’s incredibly high toxicity.

Edmund D. Brodie, Jr., Utah State University:
*This is probably the most poisonous animal in the world, with enough skin toxin to kill tens of thousands of mice or perhaps 100 people.*
The two Brodie’s sync:
Brodie III: Yeah, I can smell the secretion.
Brodie, Jr.: Don’t lick your hands.

Edmund D. Brodie, Jr., Utah State University:
The question was, Why should a salamander evolve that much toxin?

Edmund D. Brodie III, Indiana University:
This species of garter snake is the predator that we think is the driving the evolution of the high toxin levels in the newts. This is the only thing that can survive an encounter with a newt. It’s the only thing that can therefore represent a selective pressure for increasing toxicity. As the snakes get better at resisting the effects of the toxin, the prey has to evolve higher levels of toxin.

The garter snakes can eat some newts, but they reject others that are too toxic. These more toxic newts have greater success in surviving and reproducing. And because they pass on traits to their offspring, higher toxicity becomes more common in the population.

Understanding natural selection also helps researchers address how the human body interacts with other organisms. It was once thought that infectious diseases would become a thing of the past. But viruses evolve like any other organism.

Here, in the body of an HIV-infected patient, some individual HIV viruses vary slightly from the rest of the population.

When a patient takes medicine, the environment in his body changes, and most HIV viruses die or are disabled. But some of the mutant varieties may be able to resist the effects of the drugs. These drug-resistant varieties reproduce freely and quickly become dominant.

Michael Saag, University of Alabama at Birmingham
Center for AIDS Research:
Imagine we didn’t have the concept of evolution, and we started giving drugs to patients that in the test tube looked great. And all of a sudden the virus starts coming back—and it's not susceptible to the drugs anymore. What a mystery! How in the world did that happen? There's only one way that it happened—through evolution.

The end result of variation, inheritance, selection and time is biological change—organisms becoming better adapted to their environments. Natural selection explains how all living things can share a common ancestor and yet be so different from one another. Throughout Earth’s history, this process has led to an amazing diversity of life.