

Welcome to the *Natural Inquirer* Monograph— **Time Warp Series!**

Photo by Carlos Rodriguez,
USDA Forest Service.

Glossary words are in **bold**
and are defined on page 24.

A monograph is a single research article organized into a booklet. This monograph presents the fourth article in the Time Warp Monograph Series. Have you ever thought about time warps? A time warp is a **hypothetical** state that involves a feeling or place in which time seems to stop or go backward. In this Time Warp Monograph Series, every article presents a research topic that has been under scientific investigation for a long time. Each monograph features a recent research study, while highlighting a similar research study from the past.



When you see the **Time Warp icon**, get ready to read about the historic research study related to the **“Standing on the Shoulders of Giants”** research!

Time Warp section begins on page 28.

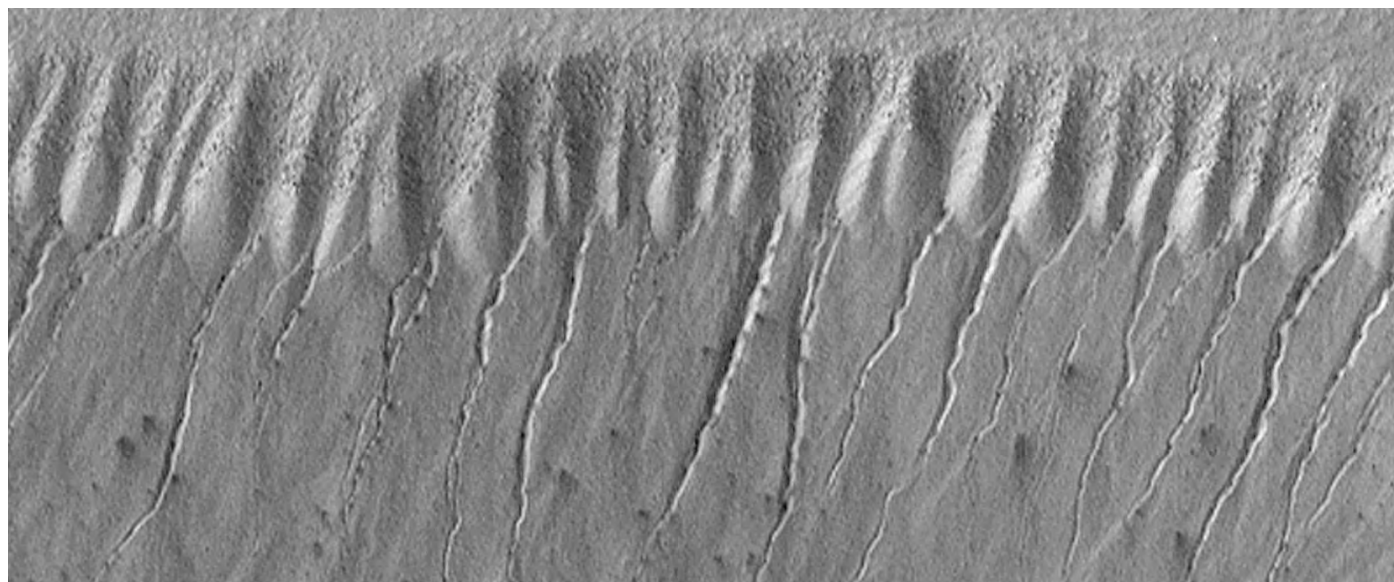
To learn more about monographs, read **“About *Natural Inquirer* Monographs!”** on page 6.

Scientists **accumulate** knowledge over time. But sometimes they discover that what they thought was true may not be true. For example, the National Aeronautics and Space Administration (NASA) thought for years that the surface of Mars was completely dry. But recently, NASA announced the discovery of liquid water on Mars. Jim Green, the Director of Planetary Science, said that Mars is “not the dry, arid planet that we thought of in the past.”

With new research, scientists can create a more accurate understanding. Often, new technology is the key. New technology provides new ways of collecting and **analyzing** data.

New scientific studies may be like previous ones in different ways. In the past, for example, scientists might have studied how rainbow trout respond to water temperature changes in the Western United States. Years later, other scientists might ask the same question about rainbow trout in the Eastern United States.

Scientists might study the same ecosystem or species that was studied in the past. These scientists might ask new questions that help them to better understand the ecosystem or species. In this case, scientists are working to build a more accurate understanding. A direct link between the previous and current research may not exist.



Although Mars may look dry and arid, National Aeronautics and Space Administration scientists discovered areas on the planet with evidence of water. Streaks on the land are one piece of evidence that scientists believe shows water on Mars. In this photo, the streaks start on the left side, and they stretch down and toward the middle of the photo.

National Aeronautics and Space Administration photo.

Research on wildland fire is one example of how research can change human understanding over time. Forest Service scientists began studying wildland fire in the 1920s. Research at that time focused on how fire impacted wood production. Scientists and managers thought that wildland fire harmed forests. Later research, however, showed that either wildland fires or **prescribed fires** actually keep some forests healthy.

Some scientific studies focus on one thing over a period of years. These studies may answer one or more questions. Called **longitudinal** studies, the research produces results that occur over a long time. Let's say that a team of scientists wants to know whether reading *Natural Inquirer* as a middle school student influences students' choice of careers. The scientists would have to follow the same students through middle school, high school, college, and until the students' first jobs.

Two studies are presented in this monograph. In the *historic* research, the scientists were interested in learning how to most effectively grow three different types of mahogany trees. The scientists were interested in trying to grow the best wood for human use. One of the types of mahogany trees the scientists studied was big-leaf mahogany. Scientists with the *current* research wanted to examine how big-leaf mahogany responds to different amounts of rainfall and availability of nutrients in the soil.

Science always proceeds across time. Sometimes historic research can, at first glance, look similar to recent research. Carefully reading and thinking about historic and recent research will bring their similarities and differences to light. Whenever you read historic or recent research findings, think about the past and future. One day, you might be the scientist advancing the knowledge about that topic!