Thomas Kuhn (1922 — 1996) was an American historian and philosopher of science. He began his career in theoretical physics before switching career paths. His book, *The Structure of Scientific Revolutions*, was first published in 1962. It is one of the most cited scholarly books of all time and made Kuhn perhaps the most influential philosopher of science in the twentieth century.

People often think of science as a steady increase in accepted facts and theories. This is what Kuhn calls “normal science.” But Kuhn argued that this was not always how things worked.

He said that sometimes discoveries build on each other, but sometimes there is a sudden burst of revolutionary science. In revolutionary science, a new “paradigm” changes the rules and direction of scientific research. A paradigm is a way of thinking about the world.

His analysis said that science was not always strictly fact-based, but could affected by people’s views. This caused a lot of controversy. His work continues to spark reaction and debate among scientists and others.

The following selections have been adapted from his book to provide a simplified view of Kuhn’s arguments. Consider the questions that follow each section.
I. A role for science

Normal science is what most scientists do most of the time. Normal science assumes that we know what the world is like. This is a necessary assumption.

Normal science often holds back new information that goes against the basic view of what the world is like. Still, as long as scientists are willing to be proved wrong, this new information will eventually come out.

Sometimes a normal problem that should be solvable by normal procedures stumps the experts. Other times, a piece of equipment made for normal research gives results that don’t seem to make sense.

In these and other ways, normal science can go off track. Scientists must face anomalies — results that are different from what is expected — that they can’t explain. This is when they begin new investigations that lead scientists to a new way of thinking.

These are scientific revolutions. Science must accept new realities. These include the major turning points in science associated with Copernicus, Newton, Lavoisier, and Einstein.

These episodes are great examples of scientific revolutions. Each of them caused the community to reject one scientific theory for another. Each brought a new set of questions for scientists to answer. Each brought new problems and new ways to solve these problems. Finally, each transformed the scientific imagination. Each transformed the world where scientific work was done.

These changes and the controversy they cause are what define scientific revolutions.

II. The route to normal science

In this essay, “normal science” means research firmly based on past scientific achievements. These past achievements form the base for further study.

Today, these achievements are described in science textbooks. The textbooks provide the core of accepted theory. They give examples of successful uses of the achievements, and compare these uses with observations and experiments.
Before textbooks became popular, the famous classics of science served a similar purpose. Aristotle’s *Physica*, Ptolemy’s *Almagest*, Newton’s *Principia and Opticks*, Franklin’s *Electricity*, Lavoisier’s *Chemistry*, and Lyell’s *Geology* — these and many other works defined the problems and methods of research for future scientists. They were able to do so because they shared essential characteristics:

First, the discoveries they presented were completely new. This attracted people from all fields to study them more. Also, these discoveries were open-ended enough to leave more questions for future researchers to answer.

I’ll call achievements that share these two characteristics “paradigms.” These paradigms provide models that produce traditions of scientific research.

These are traditions that historians call “Copernican astronomy” or “Newtonian dynamics,” for example. A beginning scientist must study all the paradigms in her field before starting research. Scientists in a field rarely disagree over fundamentals, since they all have accepted the same paradigm. They share the same rules and standards. That agreement it produces is necessary for normal science — for the creation and continuation of a research tradition.

History shows that coming to such an agreement is quite difficult. History also shows some reasons that it is so difficult.

Without a paradigm, all facts that a scientists comes across seem worth considering equally. Fact-gathering can seem random.

Furthermore, without a reason for seeking out more hard-to-find information, early fact-gathering tends to find the data that is convenient to find. Technology has often played a very important role in the emergence of new sciences because it can uncover information that is not convenient to find.

We can’t study and interpret the world without a system of theories and methods that permits selection, evaluation and criticism. If that system is not in place, we have just “facts.”

It’s not surprising that in the early stages of any science, different scientists seeing roughly the same things describe and interpret them in different ways. What is surprising, and maybe even unique in science, is that such differences can disappear.
To be accepted as a paradigm, a theory must seem better than its competitors. But it doesn’t have to, and never does, explain all the facts it may face.

When a new scientific paradigm arrives on the scene, the older systems gradually disappear because members accept the new paradigm.

Scientists who cling to older views are often ignored by the rest of the community. The new paradigm gives a stricter definition of what is acceptable. Those who don’t agree with it must work alone or attach themselves to some other group.

When an individual scientist can take a paradigm for granted, she doesn’t have to explain the basic system in her works. She can assume that other scientists know the basic paradigm.

It is textbooks, then, that still have to explain things step by step, from the beginning.

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