How Scientists Work

When scientists come up with ideas or guesses called hypotheses, they often think of many different possibilities. Many of these ideas will turn out to be wrong, even if they are published in scientific journals. This is part of the process of exploring new things in science. What's important is that scientists discuss their results and data with each other. They can agree or disagree, but they reach a consensus based on observations and experiments, not just personal opinions. Once they reach a consensus, they have a new objective truth that is true whether we believe in it or not.

A theory is an explanation that has been well-established through the scientific method. It has been tested and confirmed repeatedly through experiments. Based on a theory, scientists can make predictions and solve other mysteries.

When scientists have a result from an experiment that has been verified and checked, it cannot later be proven false. However, what they can find is a deeper understanding of the world that builds upon what they already know.

Let's take an example to understand better. Newton and Einstein are famous scientists who made important discoveries. Newton came up with laws of motion and gravity that explained how things move on Earth and in space. His laws could explain the Moon orbiting around Earth, the Earth orbiting around the Sun, and even the moons of Jupiter orbiting around Jupiter.

Then, William Herschel accidentally discovered the planet Uranus. When astronomers tracked its orbit, they found that it didn't follow Newton's laws exactly. This led to the idea that Newton's laws might not apply universally and that there might be a limit to how far they can be used. However, instead of saying that Newton's laws were wrong, some scientists proposed that there might be another planet out there that hadn't been discovered yet, and its gravity was affecting Uranus. Astronomers in Germany eventually found the new planet, Pluto, almost exactly where its position was predicted by calculations. This precise prediction confirmed the power of Newton's theory of gravity.

As scientists made more detailed calculations, they realized that any deviations from expected behavior in the orbits of planets indicated the presence of unseen masses in the Solar System. However, when they observed anomalies in the orbit of Mercury, these couldn't be explained by the gravitational influence of another planet (a planet named Vulcan was suggested). It was Einstein's theory of motion and gravity that provided an explanation for this deviation. Einstein's theory showed that near the Sun, where gravity is very strong, Newton's laws start to fail. By applying Einstein's theory, scientists were able to calculate Mercury's orbit correctly.

Sometimes people say that scientists change their minds about what is true. But that's not how science works since the 17th century. Once scientists have a result from an experiment that has been verified and checked many times, it will not be proven false

later. Einstein's theory encompasses Newton's laws and includes them as a special case for situations with low speeds and weak gravity. Newton's laws are still accurate for everyday situations, but Einstein's theory is needed to understand extreme conditions like near the Sun or at very high speeds.