What is Science? – Tutorial Script

What is **Science**?

Science is a method of inquiry to learn more about the hows and whys of phenomena at work in the world around us. At its heart lies a natural **skepticism** that requires explanations be supported by **sufficient evidence** and be **repeatable or applicable across a wide range of phenomena**. Credentialed, career scientists aren't the only ones who use the methods of scientific inquiry. We all do! We observe that a friend is excited, and we puzzle over why. We **observe** behaviors. We ask questions. We research the puzzle and **gather data**. We make an educated guess, otherwise known as a **hypothesis**, and then we refine that hypothesis as we continually make observations and gather more data. If **new observations and data** contradict our original hypothesis, we **modify it** to fit the new data. We may **consult others**, but we also do our own research and make our own observations. We look for **objective** data and are skeptical of subjective data (such as what our friend claims is the source of the excitement).

Natural skepticism is something that we apply throughout our day to a variety of puzzles. *What happened to the peanut butter I left in the refrigerator last night half full? If I complete this set of exercises daily, will my back really get stronger?* We may be tempted to rely on the opinions and pronouncements of others, but when faced with the loss of time, money, or health, we research the issue ourselves – testing the claims and analyzinq the results. *We complete the exercises for 2 weeks and assess our resulting back strength. We look for evidence of an empty peanut butter jar in the garbage can (and maybe even dust for fingerprints).* These processes of inquiry and problem solving that are such an integral part of our lives are science. We don't ALWAYS apply these techniques to all our decisions, opinions, and puzzles, but we know how to!

Embedded in our daily scientific inquiries are a few fundamental characteristics of good science and skepticism.

At the heart of the puzzles we solve daily is **curiosity**. We like to know why and how things happen. *An unaddressed envelope sits on the counter bulging with papers. Whose is it? What's in it? What's it about?*

We make hypotheses about what is causing what we are seeing, and we apply these to **predict future occurrences under similar circumstances**. *We surmise that an episode of heartburn is caused by drinking soda on an empty stomach, so we avoid drinking soda under similar circumstances or prepare for the now-expected consequences if we do.*

When past inquiries have resulted in satisfactory hypotheses over and over, we begin to rely on them as truth, and **we build upon them to learn even more** in our future investigations.

When new data and results contradict our original hypothesis, we might be skeptical of the new data and results and try to repeat them, but **we don't throw them out**. *If we've previously learned that our garbage gets picked up on Tuesday mornings, and then one Tuesday it doesn't get picked up, we don't throw that data out – we look for an explanation, which might eventually lead us to learn our garbage bill hasn't been paid for 3 months or that the pick-up day has changed.*

How can we get better at thinking scientifically? One place to start is by distinguishing between observation and evaluation. Observations are measurable items, usually objective facts. Evaluation includes some kind of judgment or explanation of the facts.

When I go outside after sitting indoors in front of a computer for hours, I might evaluate the conditions as cold. However, the data show that it's 65 degrees Fahrenheit outside. That's the observation. Someone who was just running up a mountain might evaluate that same data point as warm. Opinions are evalutions, not observations.

Another way to mix up observations and evaluations is to jump to conclusions about why things are happening. *It's cold because it's winter*. That sentence is an evaluation. It might even be a true one. But linking the two into a causation is an evaluation, and there might be another explanation entirely!

Why is it important to separate observation or fact from evaluation or opinion? Evaluations and opinions we can throw out when they no longer satisfactorily explain the observations and facts. They can be argued and discussed. They can evolve. They can be expanded. But observations and facts are golden. We can't just throw them away! And when we engage in critical thinking and discussions with our friends and colleagues, we're best served if we can start with the facts and observations and measurements and then be skeptical and creative with our evaluations and hypotheses and open to new ideas that better explain the facts we will continue to gather. For some of the big puzzles we're solving today, our future depends on all of us applying skeptical and consistent scientific thinking and inquiry.

[end credits]

What is Science?
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