AST 101

Lecture 3:
What is Science
“In the space of one hundred and seventy-six years the Lower Mississippi has shortened itself two hundred and forty-two miles. That is an average of a trifle over one mile and a third per year. Therefore, any calm person, who is not blind or idiotic, can see that in the Old Silurian Period, just a million years ago next November, the Lower Mississippi River was upwards of one million three hundred thousand miles long, and stuck out over the Gulf of Mexico like a fishing rod. And by the same token any person can see that seven hundred and forty-two years from now the Lower Mississippi will be only a mile and three quarters long, and Cairo and New Orleans will have joined their streets together, and be plodding comfortably along under a single mayor and a mutual board of aldermen.

There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact.”

from Life on the Mississippi, by Mark Twain
Question Authority
Question Authority
They Don’t Know Either
What Science Is

Science is a process by which we investigate our world.

• Science is not a litany of facts.
• Science employs the technique of objective materialism. This means that science is limited to seeking natural laws and processes to explain the world.
Thales (c. 600 BCE) is considered the first scientist. He postulated that there must be an underlying order to the universe, subject to rational inquiry, accessible by observation.
What Science Is Not

Science is not
• Dogmatic
• Authoritative
• Mysterious

Supernatural explanations are not science.
What Science Is

Scientific explanations must be
• **Testable**, and
• **Falsifiable**

• Science is **self-correcting**
• Knowledge is cumulative

• Science is an evolving process.

• We recognize that we do not know everything, but that we are learning.

• As we learn, facts or observations that we cannot now explain may become explicable.
Definitions

• **Fact:** what we observe.

• **Law:** a descriptive generalization of facts, such as the law of gravity.

• **Theory:** An explanation for the laws and facts.
  – Must have predictive power
  – The theory is the pinnacle of science.
A Rube Goldberg Device
Occam’s Razor

• Pluralitas non est ponenda sine necesseitate (Entities should not be multiplied unnecessarily)
• Nature operates in the shortest way possible (Aristotle)
• We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances (I. Newton)
• Everything should be made as simple as possible, but not simpler (A. Einstein)
• If two theories explain the data equally well, the simpler theory is generally preferable

Or: never attribute to malice that which can be attributed to stupidity

The KISS principle: Keep it simple, stupid!