

Thinking and acting as a scientist

US 275 Scientific Ethics
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How do children learn about the world?

- observe situations.
- generalize to form rules
- apply these rules to new situations.
- ask do these rules work
 - if yes, keep rules
 - if no, adjust rules



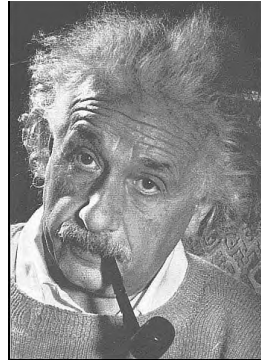
How do scientists learn about the world?

- observe situations.
- generalize to form a hypothesis
- apply these hypothesis to new situations.
- ask does this hypothesis work
 - if yes, keep hypothesis
 - if no, adjust hypothesis



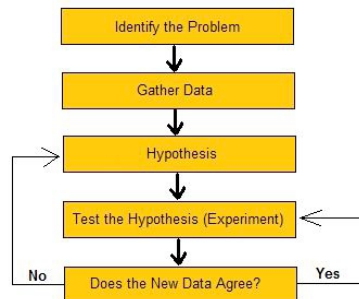
“Imagination is more important than knowledge.”

- *“The whole of science is nothing more than a refinement of everyday thinking.”*
~Albert Einstein



No one, distinct scientific method

1. Observation of natural phenomena
2. Question what caused the event
3. Hypothesis is a testable “guess” about how world works
4. Prediction of what will happen in the future
5. Was hypothesis supported or falsified?
6. Repeat



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Hypothesis must be testable

- *“Science must disregard all hypotheses that cannot be subject to experimental verification, not because they are wrong but because they are useless.”*
~Thomas Hunt Morgan



Keep it simple: Occam's Razor

- “*Pluralitas non est ponenda sine neccesitate - Entities must not be multiplied without necessity.*”
- When more than one possibility exists, choose the simplest one.
- Builders of Stonehenge?
 - ancient extraterrestrial astronauts
 - humans



William of Ockham

Science is hypothesis testing

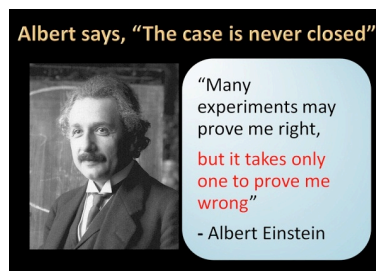
- Observation
 - observe nature without manipulating it
- Hypothesis
 - explanation of observation
- Experimentation
 - perform experiments in which we manipulate nature and observe the outcome



<http://forums2.gardenweb.com/forums/load/seed/msg0414330728717.html>

Science is hypothesis testing

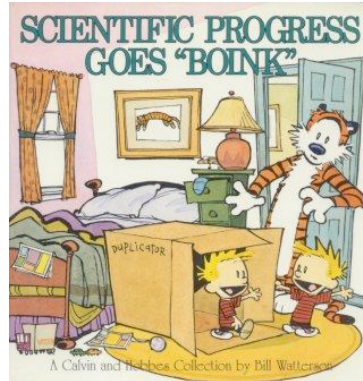
- If observations hold true
 - support, but not prove hypothesis
 - test hypothesis some more
- If observations refute hypothesis:
 - revise hypothesis
 - or develop a new hypothesis



<http://climateclash.com/files/2010/10/ScientificMethod6.jpg>

Scientific Progress

- Science progresses by eliminating “wrong” hypotheses
- New hypotheses must
 - explain the phenomena of old hypotheses
 - predict new phenomena
 - provide support for new observations (until they are falsified and replaced)



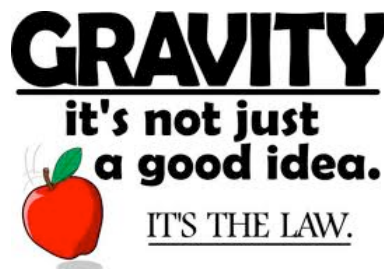
Scientific Theories

- hypothesis that has been extensively tested and supported.
- often incorrectly used interchangeably with “hypothesis”
- e.g. Theory of Relativity



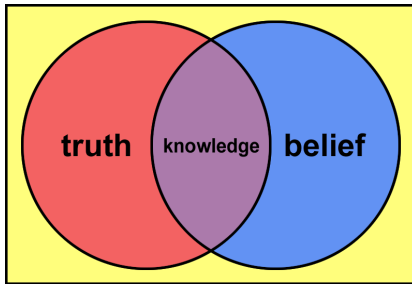
Scientific Laws

- supported by extensive experimentation
- accurately predicts results in all situations.
- frequently expressed mathematically



Science differs from other ways of knowing

- Science is
 - self-testing
 - self-correcting
 - objective
 - reproducible

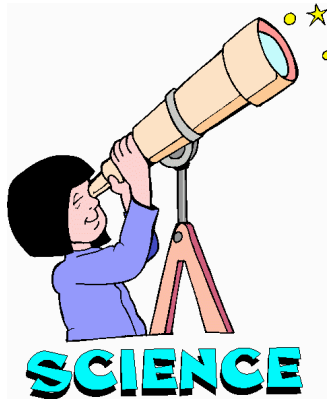


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Hypothesis must be testable:
make predictions that can be observed.

- Did God create the world?
 - Creationism - metaphysics
- Is a sunset beautiful?
 - beauty - value theory
- Is war immoral?
 - moral judgement - value theory

Text



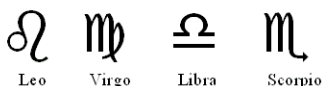
<http://www.cameronmckinley.com/science.gif>

Pseudoscience

- claim presented as based on science
 - but lacks scientific method
 - testable hypothesis
 - data supporting hypothesis



Aries Taurus Gemini Cancer



Leo Virgo Libra Scorpio



Sagittarius Capricorn Aquarius Pisces

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Readings

Understanding Science: How science really works.
http://undsci.berkeley.edu/article/0_0_0/us101contents_01

Sections:

III. How science works

IV. The core of science

VII. What has science done for you lately

VIII. A scientific approach to life



Actor Reading a Scroll
Utagawa Kunisada, 1855
Wikimedia Commons

Assignment

Scientific Controversies

What constitutes a scientific controversy...

In your discussion group:

Each member of the group should find an example of online news article where scientific controversies are mentioned (include the link to the article in your post).

Other members of the group should find and post examples of reliable and unreliable resources related to each controversy.

Discuss the validity of the claim of controversy.



Any Questions?

Email me at:
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<http://www.vipitbullkennels.com/images/animated-question-mark.gif>