

CHEMISTRY!

Studying all things
that “matter”:
teeny tiny atoms,
and how they
interact

BIOLOGY!

All living things:
plants, animals,
bacteria, brain
eating amoeba,
YOU!

What is **SCIENCE**?

EARTH & SPACE!

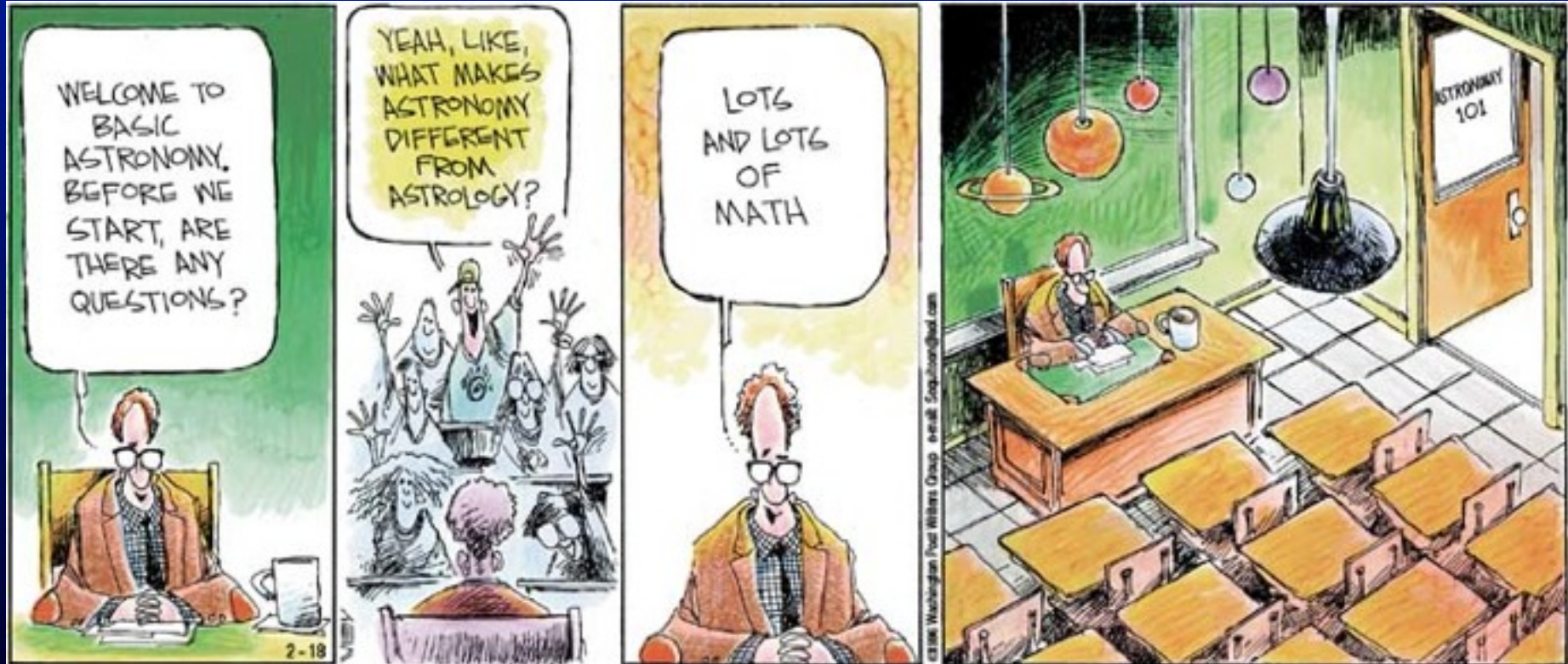
Our earth, our solar
system, our universe
and beyond!

PHYSICS!

The science of
how and why
things move the
way they do



How does Science work?

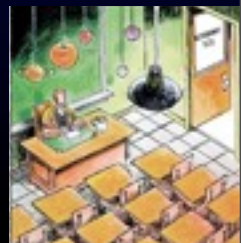


2/18/1996

Is that it? Lot and lots of math?

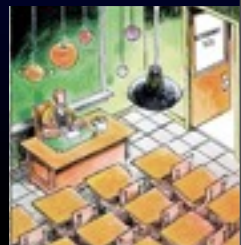
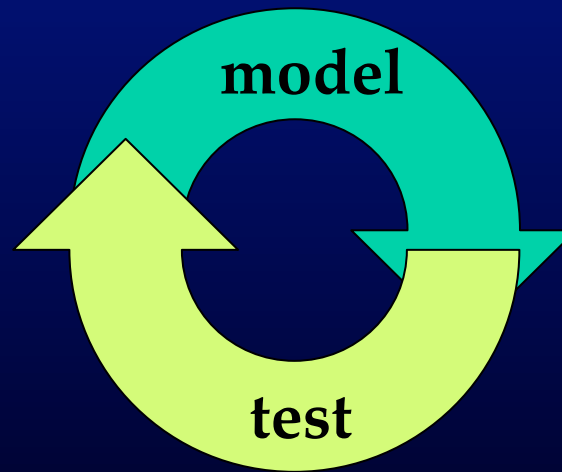
The Scientific Method

- What is the scientific method?
- What does the scientific method **assume**?
- Does the scientific method work?
- What is not a scientific argument?
- Does astrology follow the scientific method?



The Scientific Method

1. **Observe** an event.
2. Develop a **model** (or **hypothesis**) which makes a **prediction**.
3. **Test** the prediction.
4. **Observe** the result.
5. **Revise** the hypothesis.
6. **Repeat** as needed.
7. A successful hypothesis becomes a **Scientific Theory**.



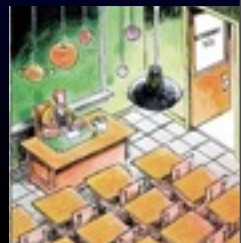
How do we test a prediction?

Design an experiment
using **VARIABLES**

Independent - the factor that you manipulate or change

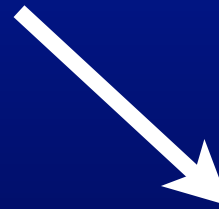
Dependent - the factor that changes as a result of the independent

Control - all other variables should remain consistent



How do we make Observations?

- Two different types:



QUALITATIVE

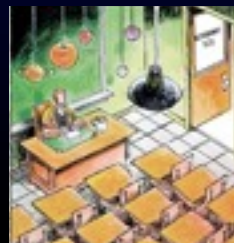
Observations that
don't involve any
numbers

- ie) her hair is black
- ie) he smells bad

QUANTITATIVE

Observations that
involve numbers

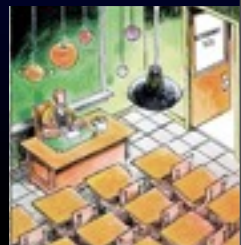
- ie) her hair is 20cm long
- ie) he smells like 50
monkeys



What makes a hypothesis successful?

If it continues to make accurate predictions.

If a hypothesis frequently makes accurate predictions it becomes a scientific theory.



Medical Science

| Scientific Method | High Cholesterol |
|------------------------------------|---|
| Observation | Patient has high cholesterol |
| Hypothesis (prediction) | Certain chemicals may dissolve cholesterol deposits. |
| Test | Give 100 patients these chemicals, give 100 patients placebo. |
| Observe result | Same number lower their cholesterol as placebo patients. |
| Revise hypothesis? | Try different combo of chemicals. |
| New test? | Re-run medical test. Observe results. |
| Scientific Theory | Lipitor reduces cholesterol. |



Everyday Science

| Scientific Method | Car Repair |
|-------------------------|--|
| Observation | Engine won't turn over. |
| Hypothesis (prediction) | Predict battery is dead. |
| Test | Replace battery. |
| Observe result | Engine now turns over. |
| Revise hypothesis? | Not needed. |
| New test? | Not needed. |
| Scientific Theory | Cars won't work without a fully charged battery. |



Everyday Science

| Scientific Method | Making Spaghetti Sauce |
|--------------------------------|-----------------------------------|
| Observation | Spaghetti sauce should be red. |
| Hypothesis (prediction) | Try a tomato sauce. |
| Test | Heat pot of tomato sauce. |
| Observe result | Taste the sauce - bland. |
| Revise hypothesis? | Use tomato sauce and garlic! |
| New test? | Add garlic, taste - not so bland. |
| Scientific Theory | The Final Recipe. |

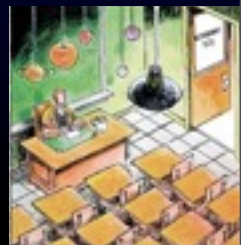


Repeatability

A successful theory is repeatable.

– By you.

– By anyone.



Example: Cold Fusion (1989)

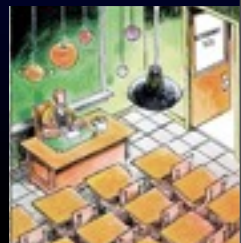


And then ...



Requirements

- Objective reality
 - We all see the same world.
- Constant Laws of Nature
 - What happens here, happens there.
 - What happened yesterday will happen tomorrow.
- The Universe is knowable.

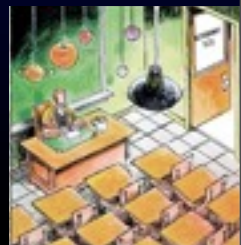


Does it work?

- Scientific Method is a tool.
- Does this tool work?

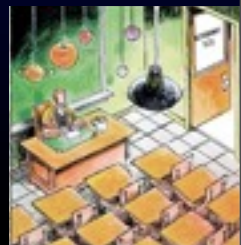
The scientific method has helped increase life expectancy, decrease mortality rates and build new technologies. A lot of our modern conveniences owe their discovery to the scientific method.

- Are there better tools?



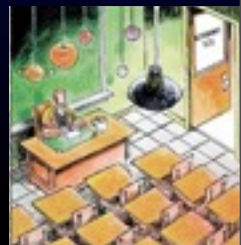
Theories

- So: a theory is a highly successful hypothesis.
- All hypotheses make predictions.
- All theories make predictions.
- All theories can be tested.
- **Result: Any scientific theory is subject to change as our ability to make tests, or make observations of a test's results, improves with time.**



Falsification

- A real Scientific Theory tells you what observations are necessary to falsify it.



Is Astrology a Science?

Think about it with a partner...

Then, complete the worksheet

