Marine Sciences

Jaques Yves Cousteau, 1910-1997

What is Marine Science

- Study of living organisms and their relationship to the chemical, physical and geological nature of the ocean

Marine Biology

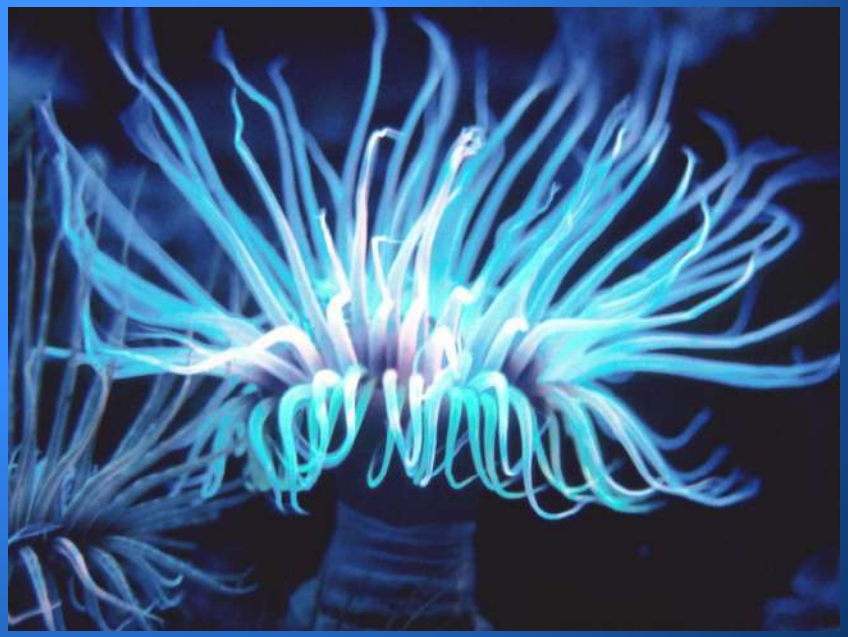
- Study of plants, animals, and other organisms that live in the ocean

Oceanography

- Study of tides, waves, currents, as well as geologic history and characteristics of the ocean

Why Care?!?

- Marine life provides us with food, medicine, and raw materials, in addition to offering recreation and supporting tourism



Why Care!?!

- Marine life helps determine the nature of our planet by producing much of the oxygen we breathe

- Indirectly helps regulate Earth's climate

Why Care?!?!

- Not all interactions are positive…
  - Marine life may harm humans:
    - Disease
    - Attacks
    - Killing or injuring other marine organisms we rely upon
    - Erode piers, walls, other structures
- The reverse is also true….

Portuguese Man-O-War

Commercial Diver Repairing Damaged Structure


AP

http://www.weather.com/news/science/environment/20-cities-most-lose-rising-sea-levels-20130822?pageno=21

Marine Biologists?

- It's really basic science applied to the sea, not the sea applied to science.

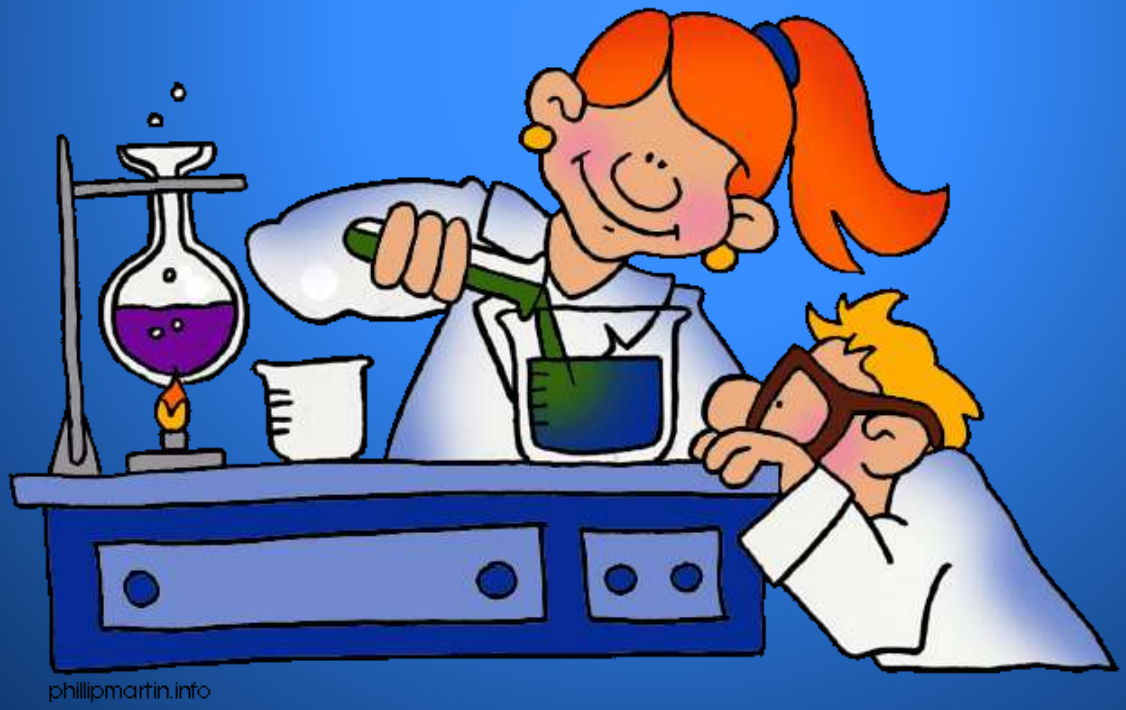
- Nearly *ALL* disciplines are represented in Marine Science (Biology)

- Archaeology
- Biology
- Botany
- Chemistry
- Geology
- Ichthyology
- Oceanography
- Physiology
- Physics
- Seismology
- Medicine
- Welding
- Diving
- Research
- Education
- Recreation

The list goes on and on…

Basic Science?

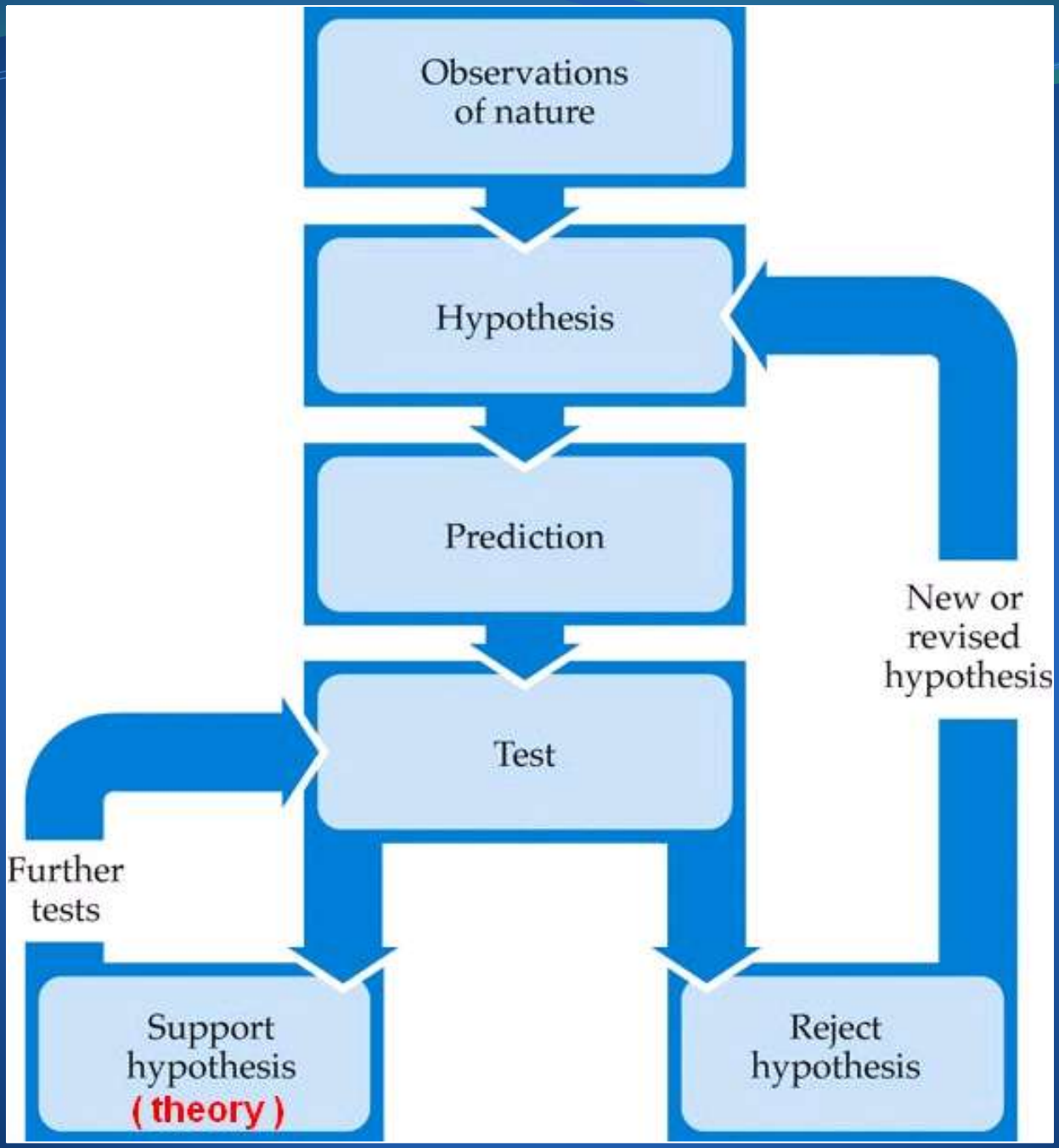
- Scientific Method – series of steps that are used to investigate a ***natural*** occurrence…



Scientific Method

1. Problem/Question
2. [illegible]
3. [illegible]
4. Experi[illegible]
5. Observa[illegible]/Data Analysis
6. Conclude and [illegible]are

s NOT always occur in this or


Observations of nature
Hypothesis
Prediction
Test
New or revised hypothesis
Further tests
Support hypothesis
(theory)
Reject hypothesis

Steps of the Scientific Method

1. Problem/Question:

→ Develop a question or problem that can be solved through experimentation.

Steps of the Scientific Method

2. Observation/Research: Make observations and research your topic of interest.

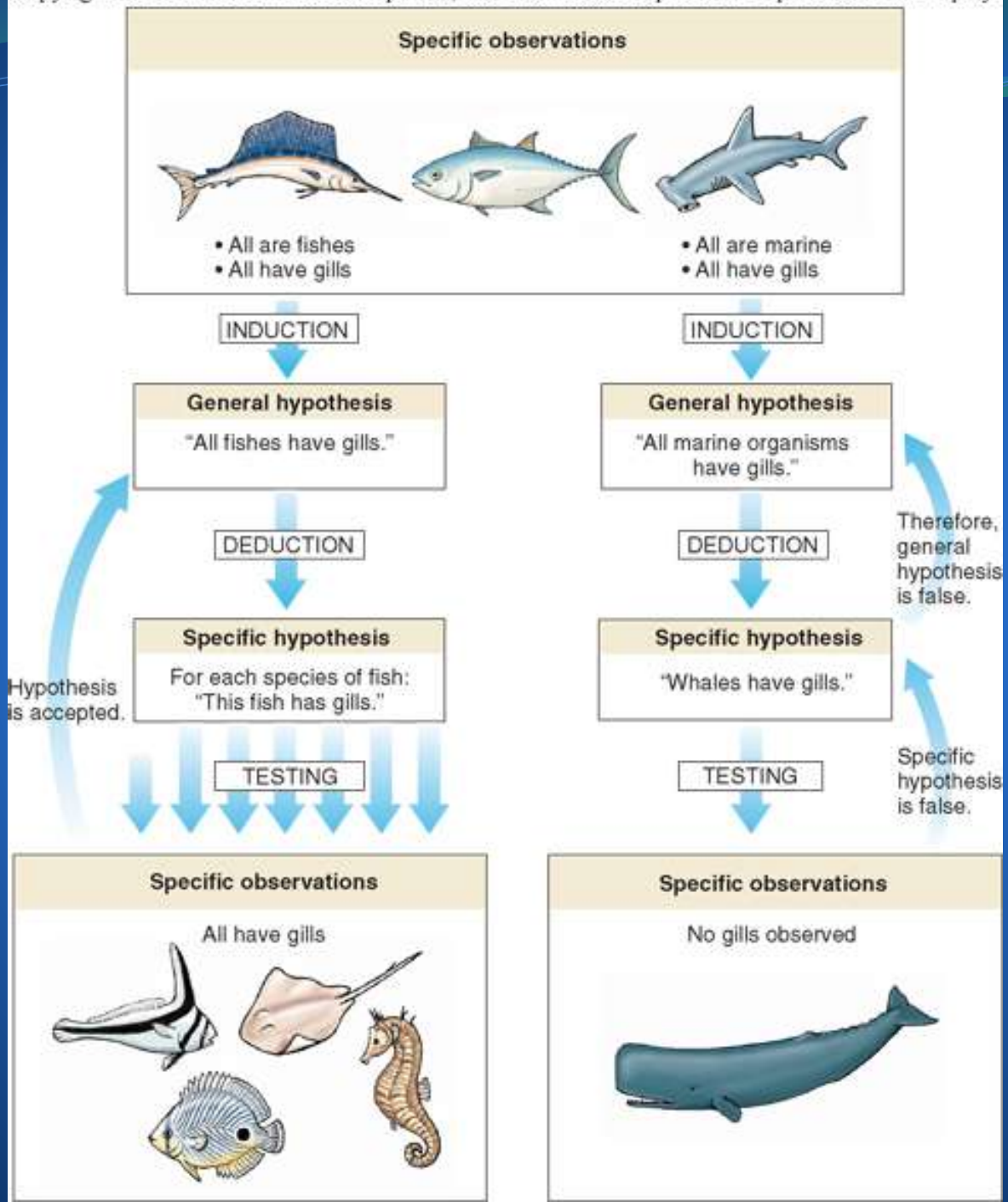
→Collect background info about the problem

Where can you find good information?

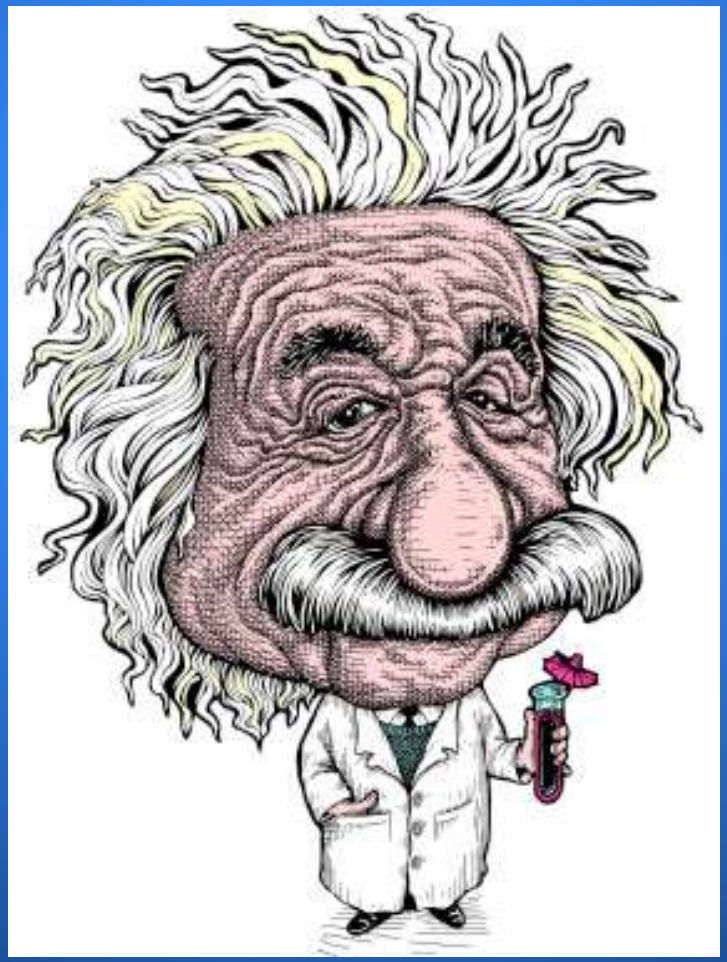
- Books, scientific journals, internet (reliable sites!)

Induction vs Deduction

- Induction – uses separate observations to arrive to general principal
  - All of the fish I have studied so far have gill slits, all fish have gill slits
- Deduction – uses general principal to arrive to specific conclusion
  - All fish have gill slits, trout is a fish, it has gill slits



Do you remember the next "step?"



Steps of the Scientific Method

3. Formulate a Hypothesis:
   Predict a possible answer to the problem or question.

*Must be able to TEST it!**

What is wrong with this hypothesis?

- If a black cat crosses my path, then I will have bad luck.

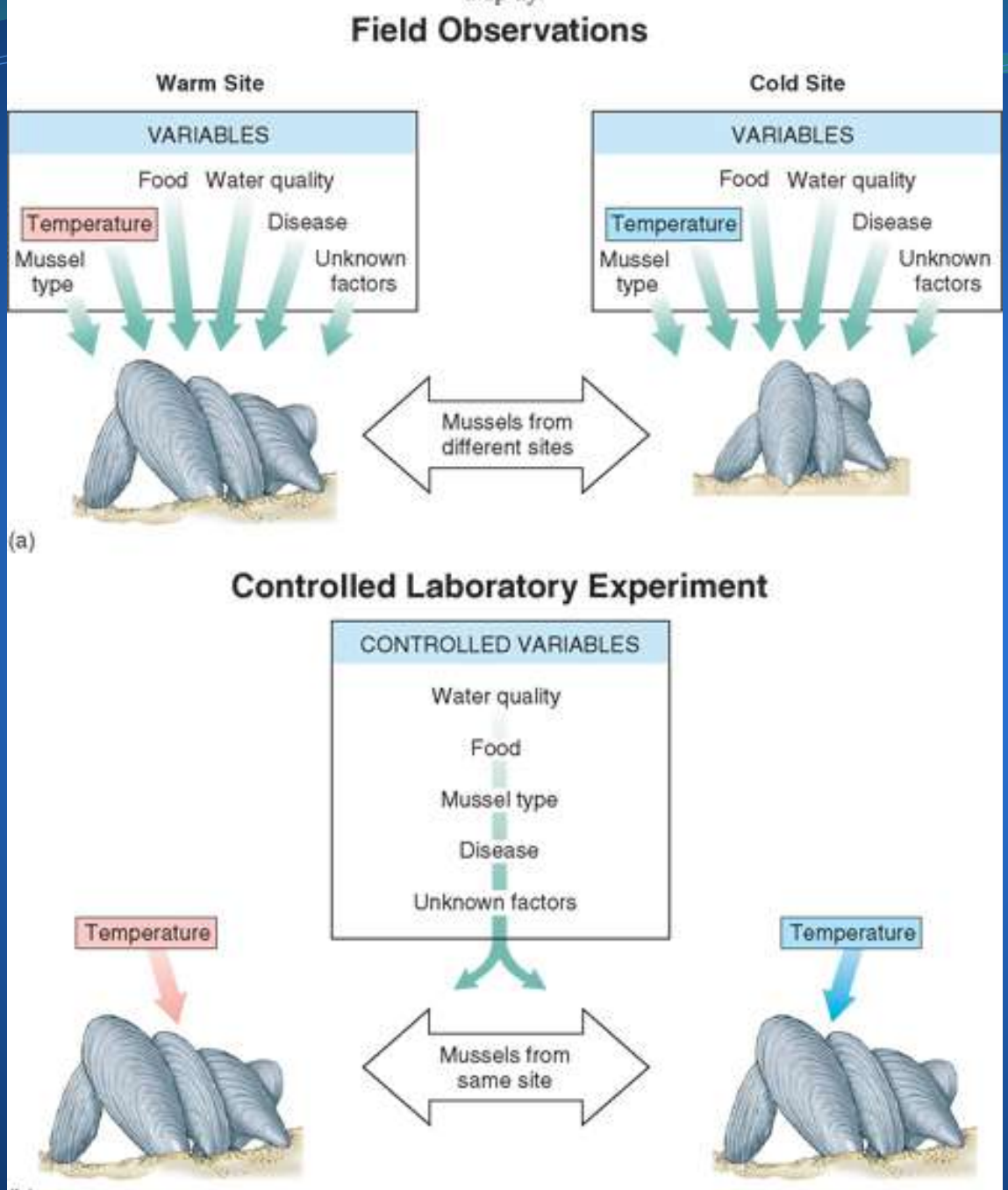
- Not testable because…
  - What is bad luck?
  - What is good luck?
- Not scientifically *measureable!*

How could you *test* this HYPOTHESIS?

- Example: If soil temperatures rise, then plant growth will increase.

Steps of the Scientific Method

4. Experiment= an organized process used to test a hypothesis
   - → Tests only ONE condition (AKA variable)
   - → A controlled experiment tests the effect(s) of this variable



Groups in a controlled experiment…

Control Group

- Used as a standard
- Constant – variable that remains the same

Experimental Group

- Is changed Independent – changed by experimenter
- Dependent – changed by independent

Steps of the Scientific Method

5. Data Collection:
   - Data= observations/measurements collected during experiment

Steps of the Scientific Method

6. Conclusion: judgment based on findings; sums up experiment
   - Was the hypothesis correct?
   - What could you change to better the experiment?

What do we do with the results of experiments…
make Scientific Laws and Scientific Theories!

What is a Scientific Law?

What is a Scientific Theory?

How are they the same?
Different?

How are scientific Laws and Scientific Theories SIMILAR?

- **Both** are based on tested hypotheses;
- **Both** are supported by a large body of empirical data;
- **Both** help unify a particular field;
- **Both** are widely accepted by the vast majority (if not all) scientists within a discipline.
- **Both** scientific laws and scientific theories **could** be shown to be wrong at some time if there are data to suggest so.

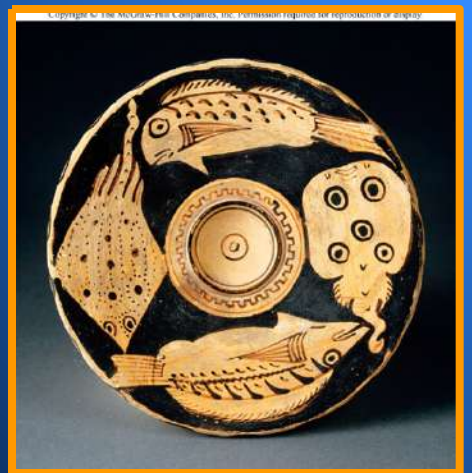
How are scientific Laws and Scientific Theories DIFFERENT?

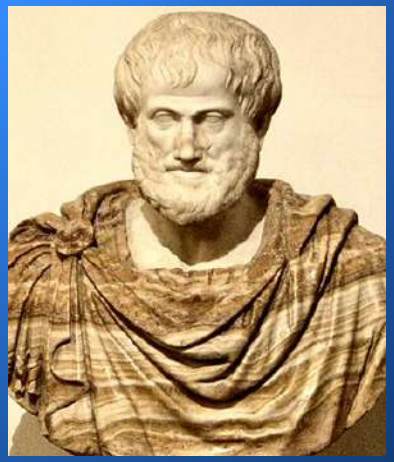
- A law describes ***WHAT*** nature does under certain conditions, and will predict what will happen as long as those conditions are met.
  - Often mathematically defined
  - Common in chemistry and physics
- A theory explains ***HOW*** nature works.
  - often non-mathematical
  - Common in biology

Marine Science History

History of Marine Biology:

- Pacific Islanders—ocean subsistence
- Greeks—Aristotle (described marine life)
- Dark ages stopped scientific inquiry

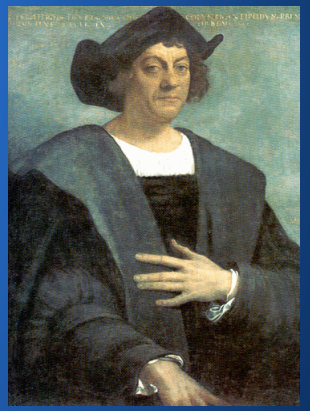




More history…

- A.D. 995 L. Eriksson discovered "Vinland" (N. America).

- A.D. 1492 C. Columbus rediscovered New World.



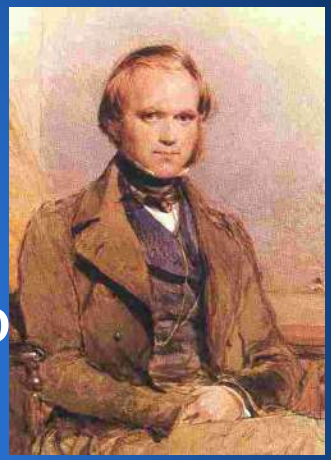
More history…

- A.D. 1519 F. Magellan circumnavigated globe (accurate maps!)

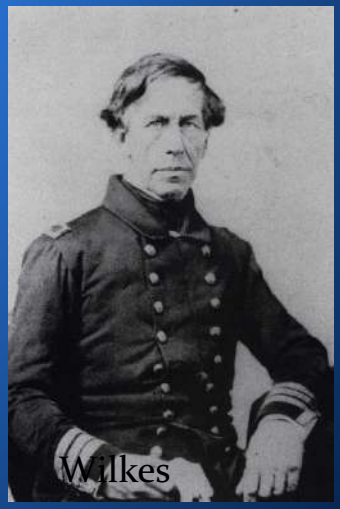
- A.D. 1786 J. Cook first scientific observations (naturalist)

More history…

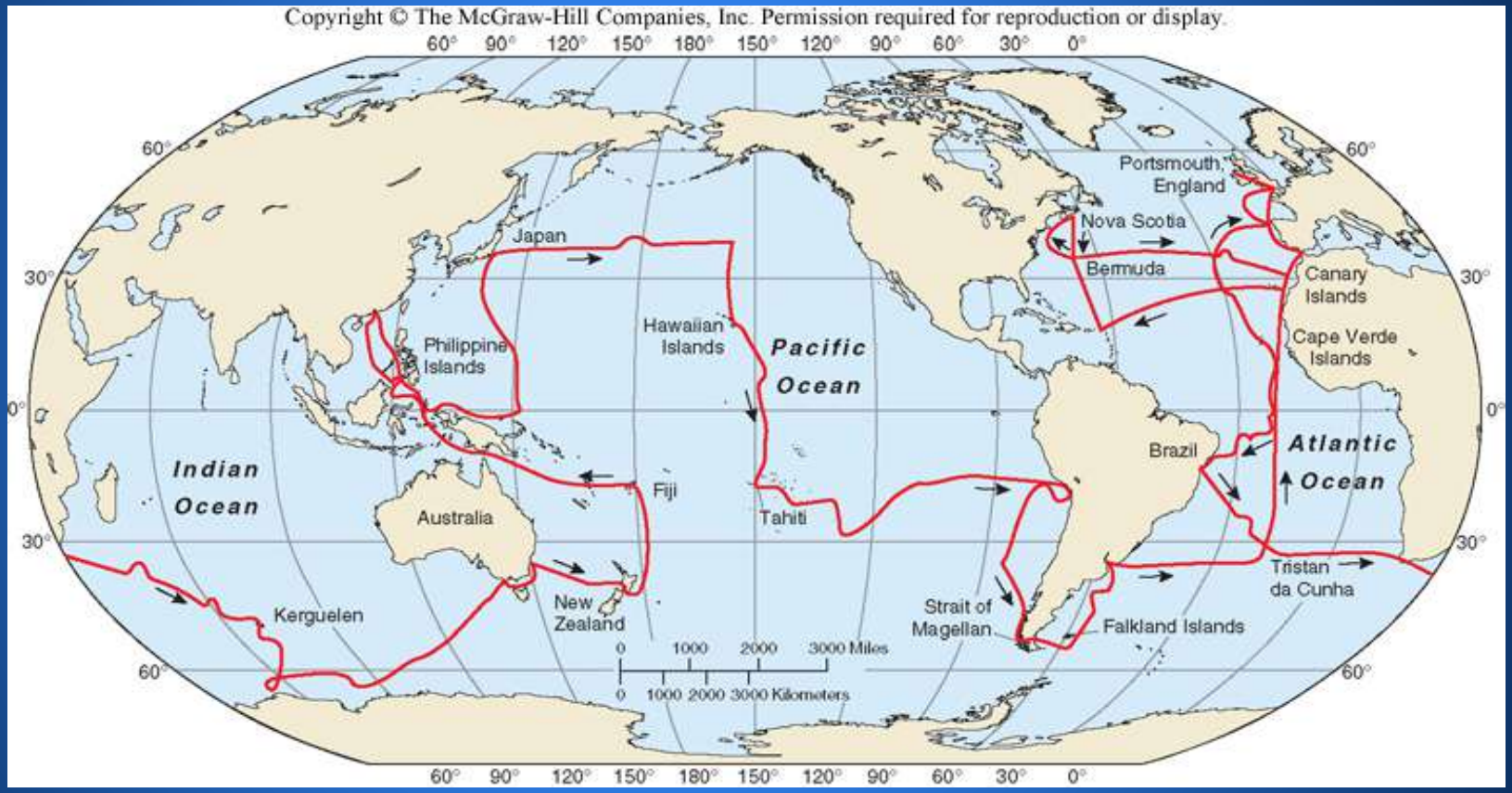
- A.D. 1831 C. Darwin, known for "natural selection," but also described how atolls are formed and did a lot of wo with **barnacles**



- A.D. 1838 C. Wilkes
  Charted 1500 miles of coastline
  Collected 10,000 specimens (2000 new).
  First effort sponsored by U. S. gov't!


Wilkes

- **A.D. 1840 Edward Forbes sea floor dredging (new organisms)**



- **Led the way for *Challenger* Expedition…laid the foundation for modern marine science.**

Marine History…

Challenger

- 3.5 year trip collecting samples

- 19 years to publish all information gathered on voyage, more information than had ever been recorded about the ocean.

- **All this science led to the formation of some pretty cool stuff!!!**

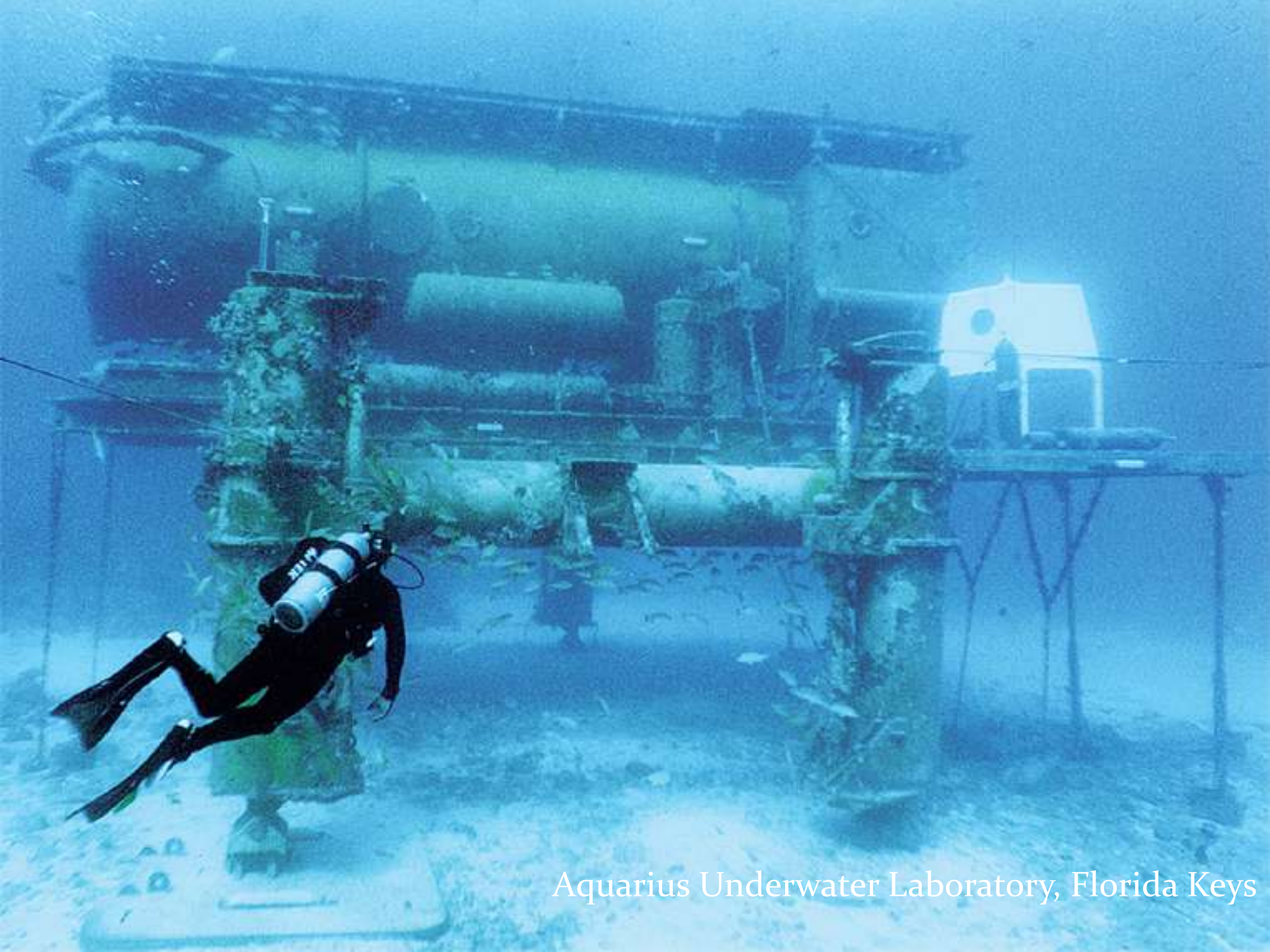
Woods Hole 1888.

Woods Hole, Today

- **Marine Labs boomed!**


RV/Thomsas G. Thompson

Alvin



Aquarius Underwater Laboratory, Florida Keys

R/V *FLIP (floating instrument platform)*