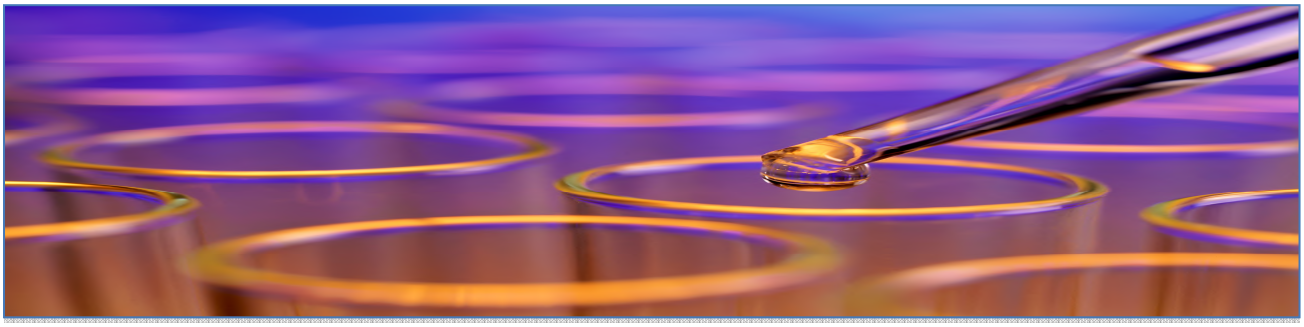


Researchable questions & getting to a 'right' answer!

Activity: What is a 'good' research question?

- **Discussion question:** *what represents a bad research question*?

Consider the following six research questions and classify them good or bad questions.

A. How does the temperature of sea water affect the amount of calcium carbonate that can be dissolved in it?

B. What can be done to stop the pH of the ocean changing?

C. How does the amount of light influence the rate of algal growth?

D. Do paper bags biodegrade faster than plastic grocery bags?

E. What type of packaging preserves antioxidant activity in food the best?

F. How can chemicals be used to reduce the spread of bacteria?

Characteristics of a good research question:

- Focuses on only 2 or 3 variables.
- Is defined with respect to current knowledge.
- Can be investigated within available time/resources/ ethical constraints.
- Can use comparative terms (e.g. "faster", "higher", "improved").
- Must use clear concepts.
- Include cause and effect relationships

Adapted from the following sources:
1. Chin, C., and Osborne, J., (2008) Students' questions: a potential resource for teaching and learning science. *Studies in Science Education* 44:1-39.
2. Filippo Silestri's Wiki: http://deseng.ryerson.ca/xiki/Research/Main:Conducting_research

Types of research questions:

Category	Feature
Factual	simply look for causal relationships and describe them eg. *What buffer is required to separate proteins on a gel?*
Comparative	these identify (usually) two alternatives to a situation and compare the alternatives in actual practice eg. *Does bioethanol produce less greenhouse gas than diesel fuel?*
Predictive	constructing "scenarios" of how things might be in the future eg. *Will a lower pH of seawater increase the rate of ice melting*?
Problem-solving	Propose solutions to existing problems eg. *Does the use of a cover reduce evaporation from swimming pools*?
Paradoxical	explore an apparently contradictory situation to make a suggestion for resolving the contradiction eg. *How can we fertilize crops without creating algal blooms?*

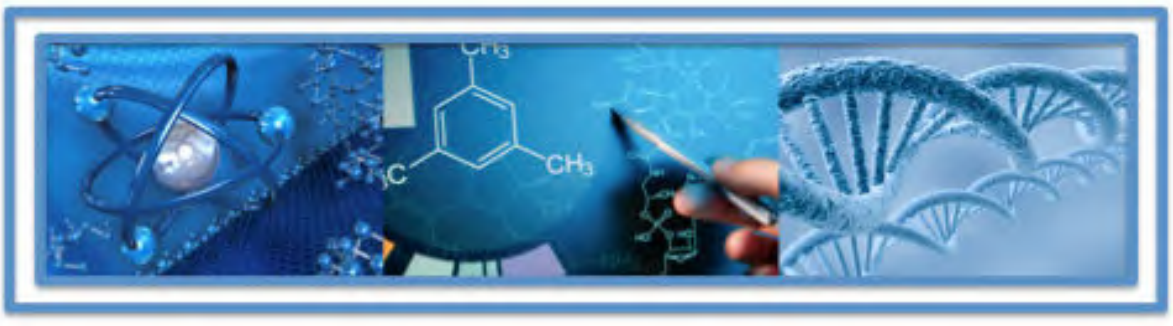
Developing a hypothesis from a research question:

A *hypothesis* predicts the nature and direction of the relationship between two or more variables. A good research question should lead almost directly to at a single hypothesis.

For example:
Research question
Will a lower pH of seawater increase the rate of ice melting?
Hypothesis
An increase in the number of ions in solution will increase the rate that water molecules move from a solid into a liquid state.

A good hypothesis has certain characteristics, including:

- Gives *insight* into the research question;
- Are *testable* and *measurable* by the proposed experiments; and
- A clearly *proposed* relationship between only 2 variables for which experimental data can be collected and used as evidence in response to the esearch question.



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