إعداد البحوث العلمية
الشروط و الضوابط

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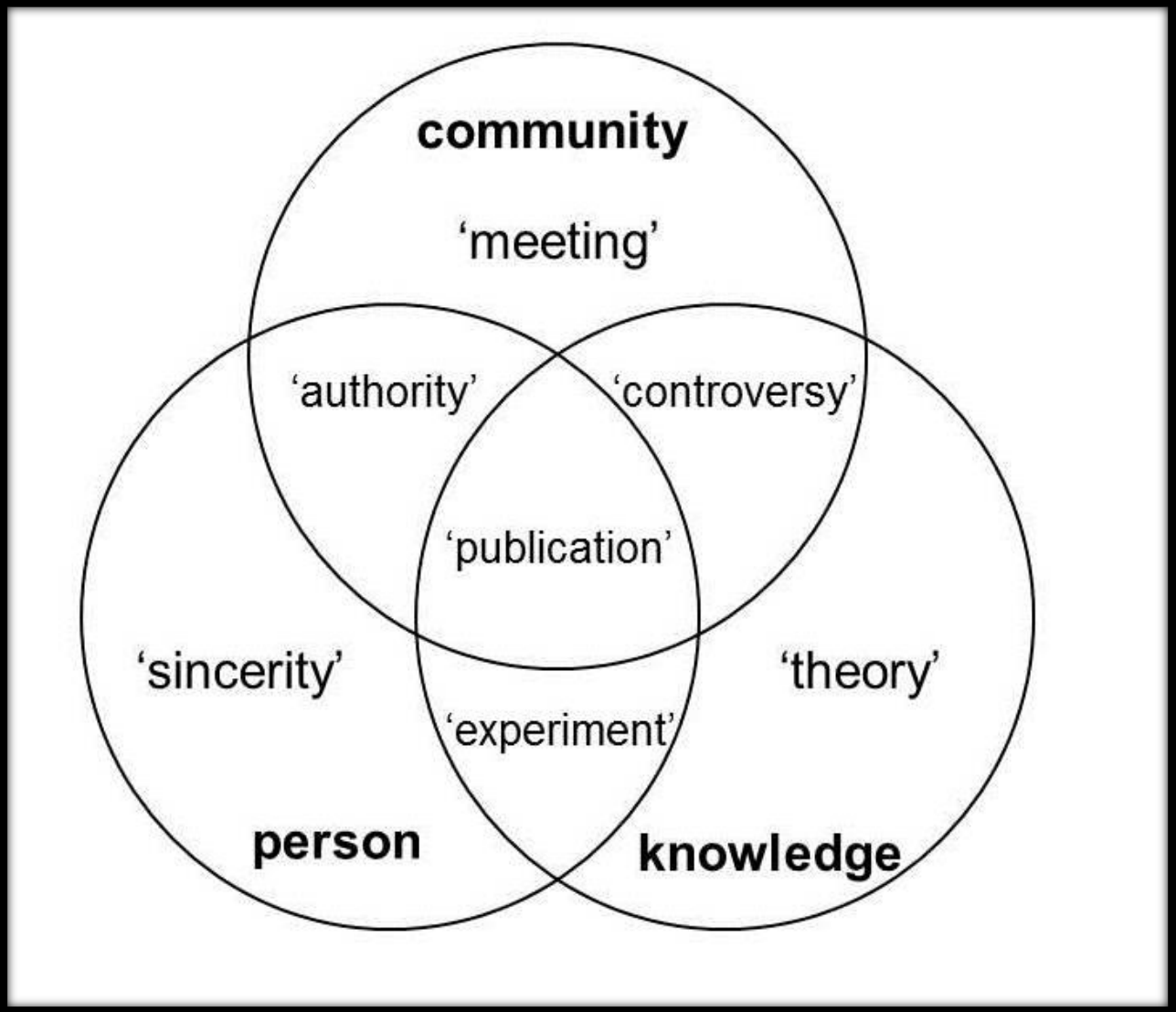
The scientific method is a tool that helps scientists & the researchers to solve problems and determine answers to questions in a logical format.

It provides step-by-step, general directions to help us work through problems.


community
'meeting'
'authority'
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person
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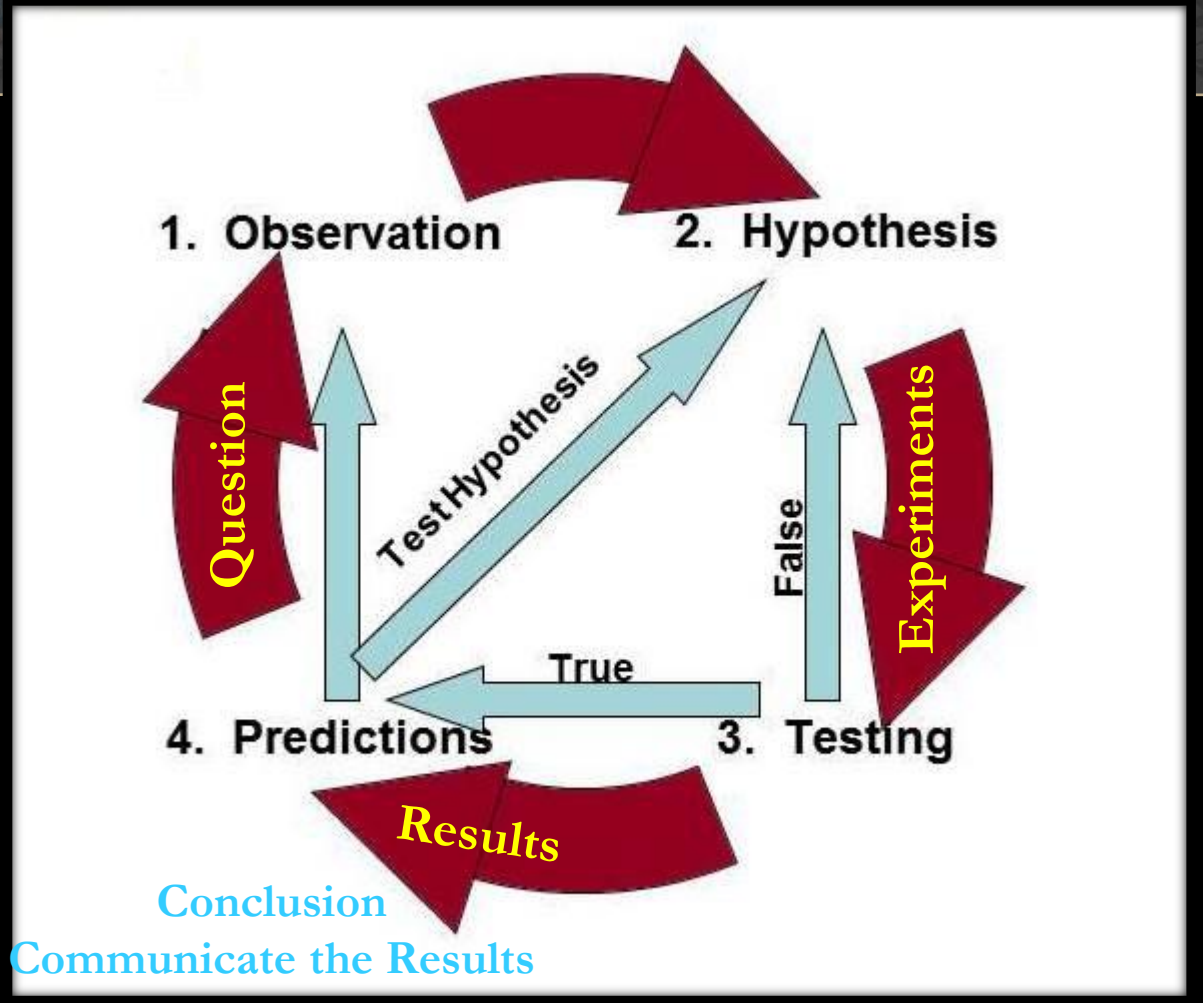
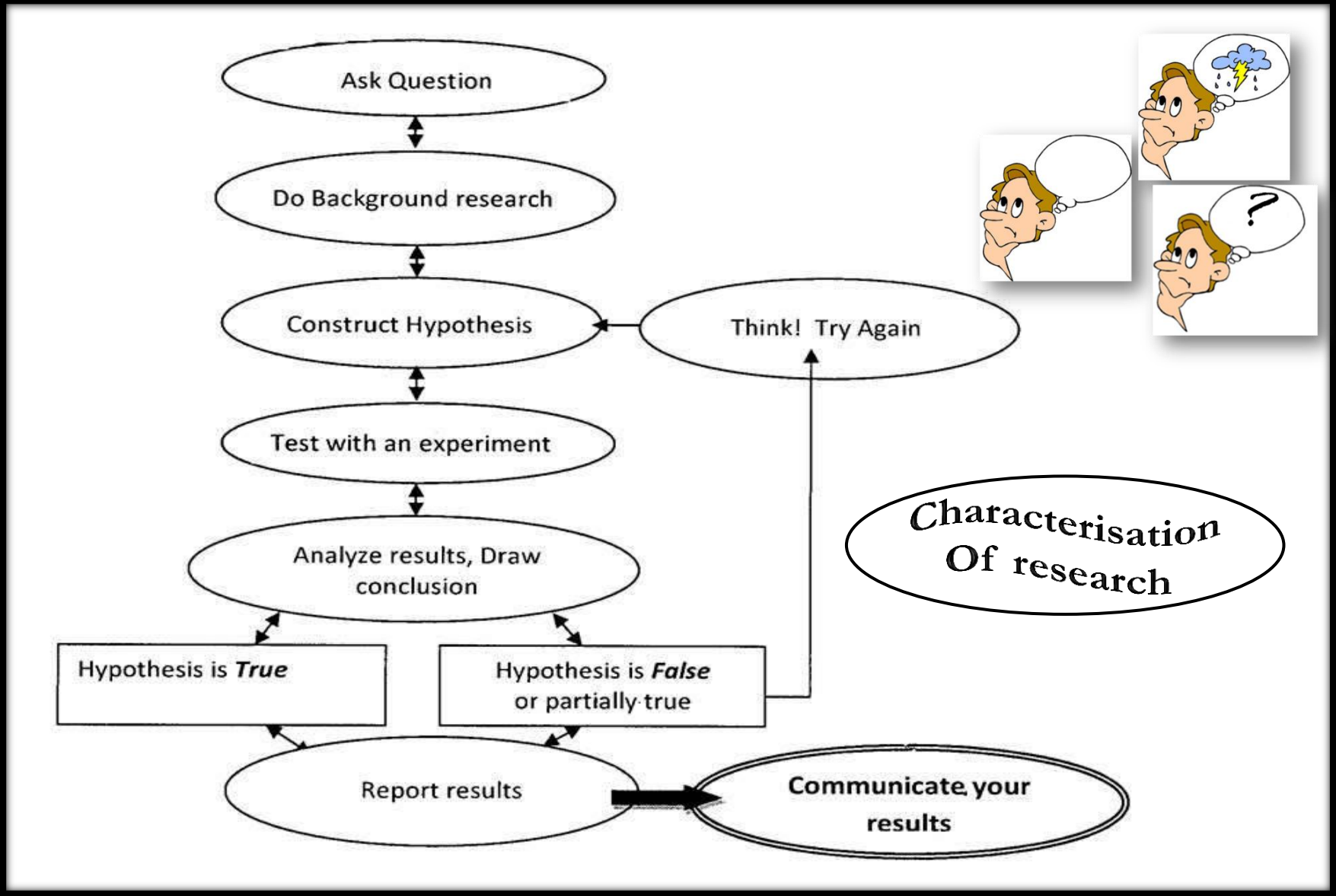
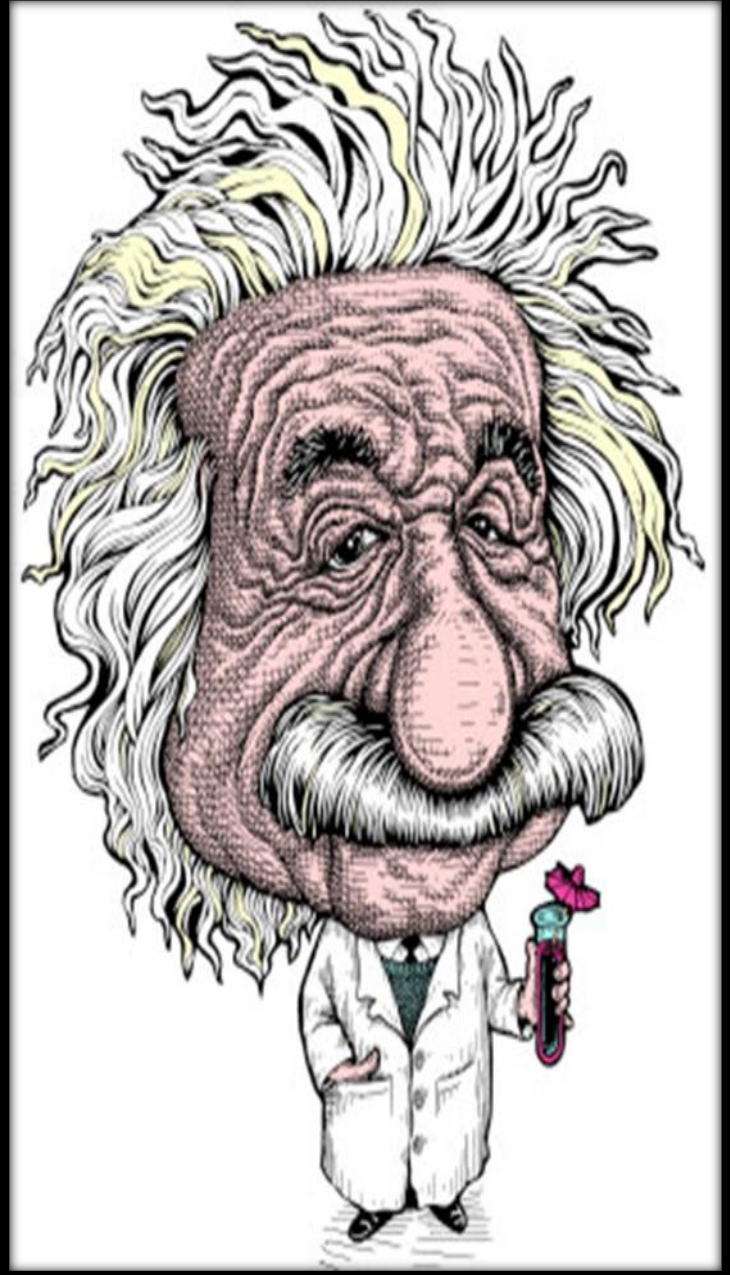
DATA
EXPERIMENT
RESEARCH
KNOWLEDGE


1. Observation
2. Hypothesis
Question
Test Hypothesis
False
Experiments
True
4. Predictions
3. Testing
Results
Conclusion
Communicate the Results





STEPS

1- Problem/Question: Develop a question or problem that can be solved through experimentation.

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

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

4- Experiment: Develop and follow a procedure. Include a detailed materials list. .

5- Collect and Analyze Results: Modify the procedure if needed. Confirm the results by retesting. Include tables, graphs, and photographs. The outcome must be measurable (quantifiable).

6- Conclusion: Include a statement that accepts or rejects the hypothesis.

7- Make recommendations for further study and possible improvements to the procedure.

8- Communicate the Results: Be prepared to present the project to an audience. Expect questions from the audience.

HYPOTHESIS

The hypothesis is an educated guess about the relationship between independent & dependent variables.

1- The independent, or manipulated variable, is a factor that's intentionally varied by the experimenter

2- The dependent, or responding variable, is the factor that may change as a result of changes made in the independent variable.

HYPOTHESIS FRAMING

H_0: There is no association between the exposure.

H_1: There is an association between the exposure and this of beyond what might be expected from random error alone.

IP

- Identification: of the hypotheses in a research study.
- Planning: protocol (the study design);
  - Study designs direct how the investigation is conducted and allows for the translation of a hypothesis into an operational one.

CONTROL GROUP

In a scientific experiment, the control is the group that serves as the standard of comparison.

The control group is exposed to the same conditions as the experimental group, except for the variable being tested.

All experiments should have a control group.

CONSTANT

The constants in an experiment are all the factors that the experimenter attempts to keep the same.

They might include:
Other ingredients to the bread recipe, oven used, rise time, brand of ingredients, cooking time, type of pan used, air temperature and humidity where the bread was rising, oven temperature, age of the yeast…

TRIALS

Trials refer to replicate groups that are exposed to the same conditions in an experiment.

COLLECT AND ANALYZE RESULTS

Can negative results be important?
Are they publishable?
Would journals full of negative results sell?
If they are not published are they doomed to be repeated wastefully?
How can positive results be validated without knowing about negative ones?

CONCLUSION

Hypothesis might be either prove or rejected , but a decision to re-test the experiments should be mansions.

"Disappointment is when a hypothesis is destroyed by an ugly fact … Newton".

COMMUNALISM

One of the principles issues in research of science is communalism that the results of research are public knowledge, freely available to all
Research to provide public knowledge, freely available to all
But what about
secret government research?
secret commercial research?
However the participants in research have a right to privacy
Alternatively much research is private, owned by the funder of the research either the government or a commercial concern.
The conflict between privacy, confidentiality and the public access to knowledge creates an ethical arena for "Who owns the information?".

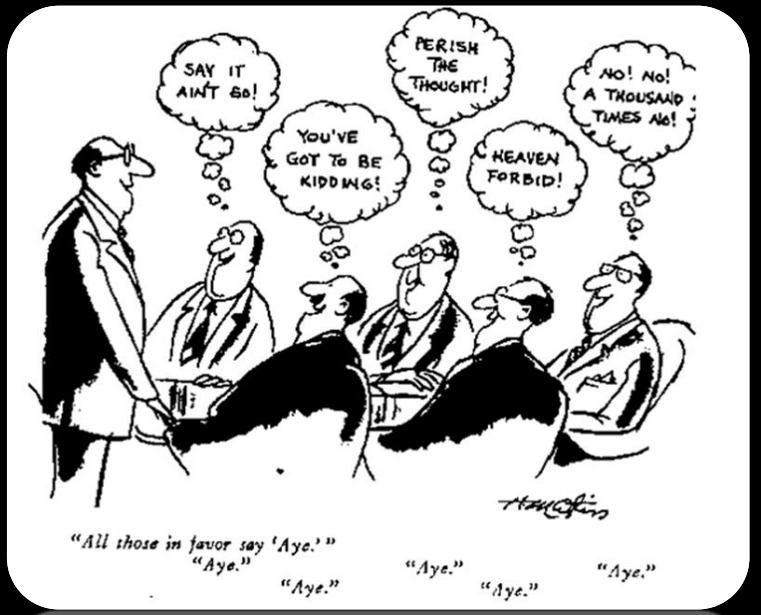
Research is not just a method and a system of organised knowledge

It is a social activity carried out by groups of competing/co-operating/communicating scientists

A key consideration concerns the status/rank/class of not just subjects but all participants including colleagues

This will influence the ethical relationship/responsibility of the researcher. Not all people are equal.

Colleagues may vary from superiors such as project leaders, "equals" but with varying degrees of experiences and status, to technicians and support staff. There is a special responsibility to colleagues with less experience or of a lower rank who may find it more difficult to refuse to participate.



What Makes a Good Science Fair Project Question?	For a Good Science Fair Project Question, You Should Answer "Yes" to Every Question
Is the topic interesting enough to read about ?	Yes / No
Can you find at least 3 sources of written information on the subject?	Yes / No
Can you measure changes to the important factors (variables) using a number that represents a quantity such as a count, percentage, length, width, weight, voltage, velocity, energy, time, etc.? Or, just as good, are you measuring a factor (variable) that is simply present or not present? For example, •Lights **ON** in one trial, then lights **OFF** in another trial, •**USE** fertilizer in one trial, then **DON'T USE** fertilizer in another trial.	Yes / No
Can you design a "fair test" to answer your question? In other words, can you change only one factor (variable) at a time, and control other factors that might influence your experiment, so that they do not interfere?	Yes / No
Is your experiment safe to perform?	Yes / No
Do you have all the materials and equipment you need for your science project, or will you be able to obtain them quickly and at a very low cost?	Yes / No
Do you have enough time to do your experiment more than once before the science project closing date?	Yes / No

What Makes a Good Hypothesis?	For a Good Hypothesis, You Should Answer "Yes" to Every Question
Is the hypothesis based on information contained in the Research Proposal?	Yes / No
Does the hypothesis include the independent and dependent variables?	Yes / No
Have you worded the hypothesis clearly so that it can be tested in an experiment?	Yes / No

What Makes for Good Variables?	For Good Variables, You Should Answer "Yes" to Every Question
Is the independent variable measurable?	Yes / No
Can you change the independent variable during the experiment?	Yes / No
Have you identified all relevant dependent variables, and are they all caused by and dependent on the independent variable?	Yes / No
Are all dependent variable(s) measurable?	Yes / No
Have you identified all relevant controlled variables?	Yes / No
Can all controlled variables be held at a steady value during the experiment?	Yes / No

What Makes a Good Experimental Procedure?	For a Good Experimental Procedure, You Should Answer "Yes" to Every Question
Have you included a description and size for all experimental and control groups?	Yes / No
Have you included a step-by-step list of all procedures?	Yes / No
Have you described how to the change independent variable and how to measure that change?	Yes / No
Have you explained how to measure the resulting change in the dependent variable or variables?	Yes / No
Have you explained how the controlled variables will be maintained at a constant value?	Yes / No
Have you specified how many times you intend to repeat the experiment (should be at least three times), and is that number of repetitions sufficient to give you reliable data?	Yes / No
The ultimate test: Can another individual duplicate the experiment based on the experimental procedure you have written?	Yes / No

What Makes a Good Science Experiment?	For a Good Science Experiment, You Should Answer "Yes" to Every Question
Did you take detailed notes about your observations and record them in your laboratory notebook?	Yes / No
Did you collect your data using a data table?	Yes / No
Were you consistent, careful, and accurate when you made your measurements?	Yes / No
Were you careful to insure that your controlled variables remained constant so as not to affect your results?	Yes / No
If you ran into any unexpected problems, did you adjust your experimental procedure accordingly?	Yes / No

What Makes for a Good Data Analysis Chart?

	For a Good Chart, You Should Answer "Yes" to Every Question
Is there sufficient data to know whether your hypothesis is correct?	Yes / No
Is your data accurate?	Yes / No
Does your chart specify units of measurement for all data?	Yes / No
Have you verified that all calculations (if any) are correct?	Yes / No

What Makes for a Good Graph?	For a Good Graph, You Should Answer "Yes" to Every Question
Have you selected the appropriate graph type for the data you are displaying?	Yes / No
Does your graph have a title?	Yes / No
Have you placed the independent variable on the x-axis and the dependent variable on the y-axis?	Yes / No
Have you labeled the axes correctly and specified the units of measurement?	Yes / No
Does your graph have the proper scale (the appropriate high and low values on the axes)?	Yes / No
Is your data plotted correctly and clearly?	Yes / No

What Makes for Good Conclusions?	For Good Conclusions, You Should Answer "Yes" to Every Question
Do you summarize your results and use it to support the findings?	Yes / No
Do your conclusions state that you proved or disproved your hypothesis?	Yes / No
If appropriate, do you state the relationship between the independent and dependent variable?	Yes / No
Do you summarize and evaluate your experimental procedure, making comments about its success and effectiveness?	Yes / No
Do you suggest changes in the experimental procedure and/or possibilities for further study?	Yes / No

What Makes a Good Reference?

For a Good Reference, You Should Answer "Yes" to Every Question

Does your reference come from a credible source?	Yes / No
Is your reference current?	Yes / No
Is your reference objectively written, not biased towards one point of view?	Yes / No
Is your reference free of errors?	Yes / No
Does your reference properly cite its original sources?	Yes / No
Is the reference easy for other people to find or obtain?	Yes / No

RESEARCH ETHICS

Ethics is a way of understanding and examining what is "right" & what is "wrong"

Bioethics is a way of understanding and examining what is "right" and what is "wrong" in biomedical research & practice.

ORIGINALITY

Science is the discovery of the unknown

Plagiarism ?
Publication of the same results in multiple journals ?
Routine “stamp-collecting” surveys ?

PLAGIARISM

Plagiarism is the theft of other people's words and ideas. Plagiarism happens when you claim (or appear to claim) that an idea, or the expression of it, is your own when in fact it is someone else's.

Deliberate Plagiarism, usually takes the form of either getting someone else to write your essay for you and saying it's yours or copying chunks of text out of a book with the deliberate intent of deceiving the reader into thinking they are in your own words.

Accidental Plagiarism, which most institution are obliged to penalize equally heavily, is achieved by oversight and/or lack of skill in manipulating information.

Johns Hopkins “Plagiarism, the most common form of academic dishonesty occurs when students use the work, research, ideas, or words of any other person or source without proper credit.”

Observe UR
world & come
UP with question
2 answer using a
SCIENTIFIC METHOD
THANQ