



Al-Mustaql University

College of Science



Scientific Thinking and Research Skills

Third Year Students / 1st Semester

INTRODUCTION TO RESEARCH METHODOLOGY

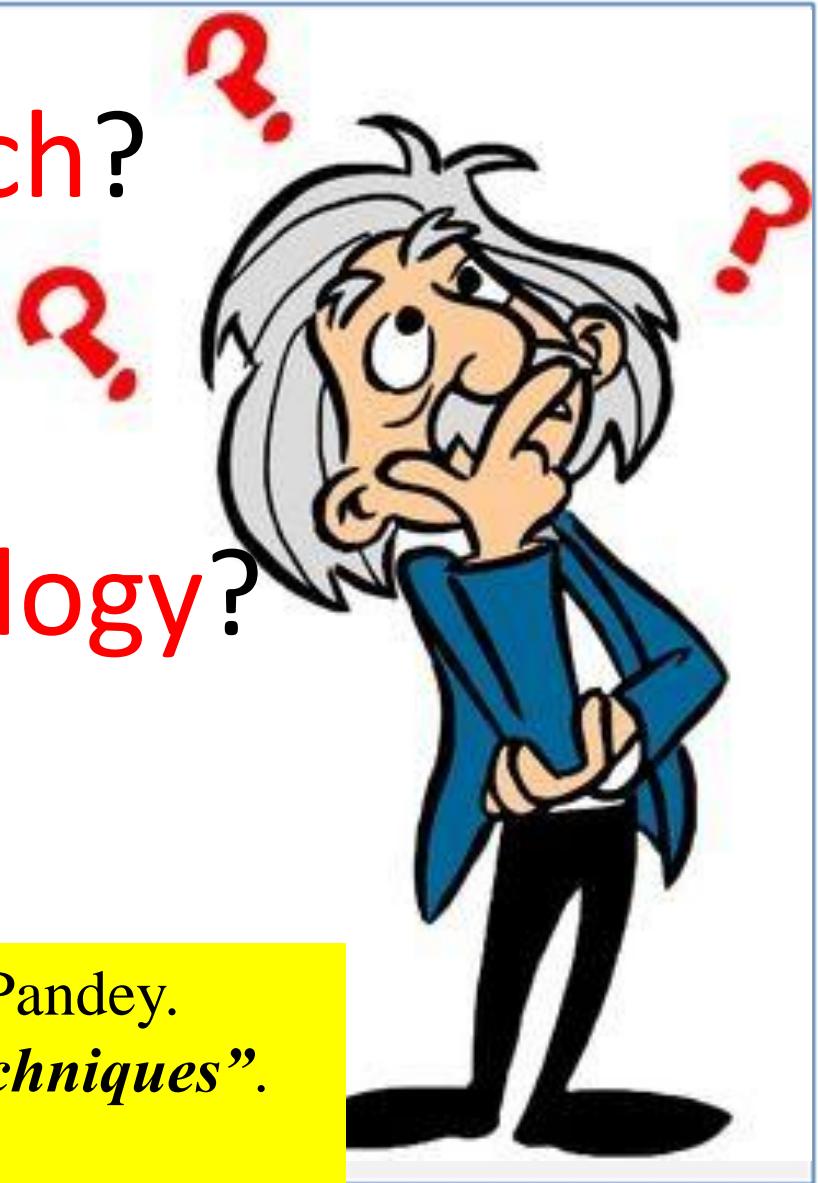
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Biochemistry Department

By

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What is Research?



What is Methodology?

Pandey, Prabhat, and Meenu Mishra Pandey.

“Research methodology tools and techniques”.

Bridge Center, 2021.



Meaning of Research ?

Word ‘Research’ is includes of two words = Re + Search.

It means to search *again*

“ Arranged effort to gain knowledge”

Research is a process of “ *manipulation of* things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge.

Scientific Research Definition

Hunting for facts or truth about a subject?

Organized scientific investigation to :

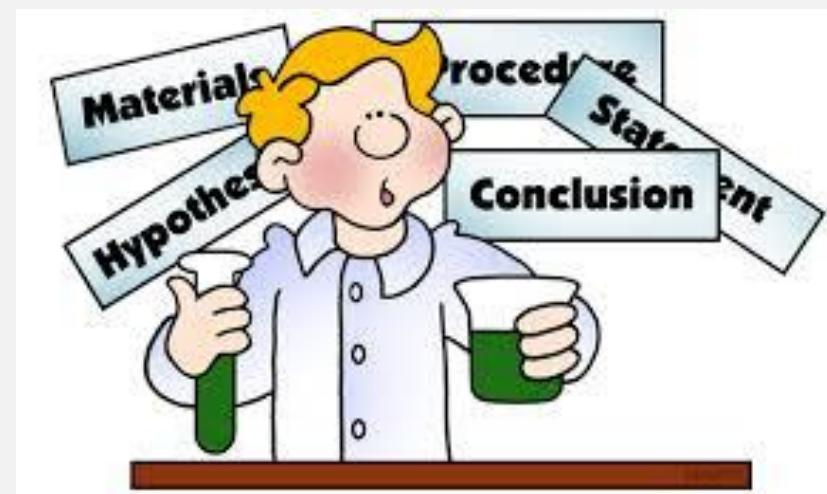
- Solve problems.
- Test hypotheses.
- Develop or discover new products.



Start with Scientific Research

Scientific research is a systematic, controlled, experimental, and critical investigation of natural or social phenomena using a commonly accepted methodology to (in general):

- ✓ Identify the problems?
- ✓ Collect data?
- ✓ Analyze and draw valid conclusions?





**Scientific Research is systematic,
because it follows certain steps that are logical in order, i.e.**

- Understanding the nature of the **problem** to be studied and identifying the related area of knowledge.
- Reviewing **literature** to understand how others have approached or dealt with the problem.
- Collecting **data** in an organized and controlled manner so as to arrive at valid decisions.
- **Analyzing data** appropriate to the problem.
- Drawing **conclusions** and making generalizations.



Important Characteristics of Scientific Research

- Aim
- Rigor
- Testability
- Reliability
- Accuracy and Confidence
- Objectivity
- Generalizability
- Thrift (cost-effective)



Characteristics of Scientific Research - **Aim**

- The aim/purpose of scientific research must be written clearly for example:
 - to increase the performance of a gas sensor?
 - to reduce the interaction between iron and oxygen?
 - to characterize the optical properties of glass?

Characteristics of Scientific Research - **Rigor**



- Based on a good theoretical base and sound methodology
- Careful /or Scrupulous:
 - e.g. all design parameters concerning the gain in transformer power must be considered; geometrical length, temperature, input signal power and wavelength.
 - e.g. stability of current source for the pump laser system.



Characteristics of Scientific Research-**Testability**

1. Test theoretical model by **Simulation or Experiment.**
2. Analysis of performance parameters against the design parameters.
 - e. g. Diode theoretical model shows low current with low input signal power.
 - Experiment to test this relationship while other design parameters are fixed can be carried out.
 - Gain is measured against input signal power.



Characteristics of Scientific Research - **Reliability**

- The **same relationship achieves** repeatedly under the same design parameters.
- e.g. **linear current-voltage relationship** for electrical resistivity of copper rods of different sizes.