



Al-Mustaqbal University
College of Science



Scientific Thinking and Research Skills

Third Year Students / 1st Semester

INTRODUCTION TO RESEARCH METHODOLOGY

2025-2026

Biochemistry Department

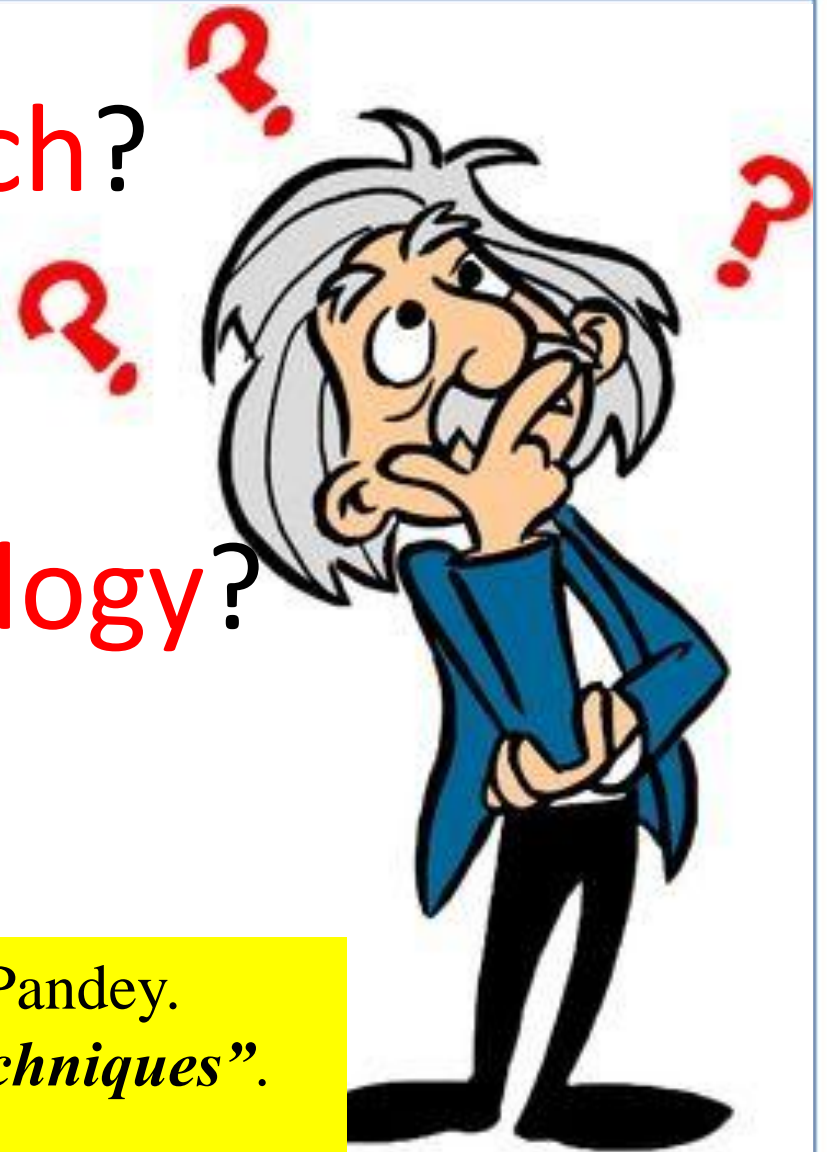
By

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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 systematic₁

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.