

## Chapter 3: The Steps of the Scientific Investigation Process

### 1- Some Definitions:

**-The scientific method:** it is the set of rules and procedures to follow in order to achieve objectives and conduct scientific research. Therefore, the method is defined as the set of intellectual operations that allow for the analysis, understanding, and explanation of the studied reality.

**-The scientific approach:** it is the set of steps to follow in order to conduct scientific research (it is the way to progress towards the defined goal or subject).

**-Methodology:** it is the science of method. Methodology is the set of methods and approaches in a particular field, adopted by specialists such as researchers, linguists, editors, teachers, etc., to conduct scientific research.

**-Technique:** it is the set of tools, instruments, and means specific to an activity or research.

### 2-Les étapes de la démarche scientifique D'investigation

#### 1-Observation :

Scientists are individuals who observe the world in which they live. They can observe it with the naked eye or use tools such as magnifying glasses, microscopes, telescopes, or other measuring devices.

#### 2. State the problem to be solved:

The problem is always stated in the form of a question.

#### 3. Propose hypotheses:

A hypothesis is a possible answer to the problem, but an answer that is uncertain and needs to be tested to verify its validity. The hypothesis is always stated in the affirmative form.

#### 4. Stating the verifiable consequence of the hypothesis

To state a verifiable consequence, two important points must be respected.

a) It is assumed that the hypothesis is correct.

b) In this case: IF we vary a parameter, THEN we will observe a certain phenomenon.

The verifiable consequence allows:

- i. to anticipate the experiment or research that will need to be conducted to test the hypothesis
- ii. to predict the results to be obtained for the experiment to validate its hypothesis

The verifiable consequence is always stated in the form: "If ..., so ... ."

### **5- Designing the experiment to test the hypothesis**

To state a verifiable consequence, one must adhere to the following important points:

1. An experiment should test only a single hypothesis.
2. Only one parameter/factor (that of the hypothesis) should be varied.
3. The necessity of having a control to compare the results.
4. If reagents are used, they should be presented.
5. Always consider the required duration to highlight the phenomenon to be observed.

The experiment should be presented in the form of a rigorous, comprehensive, and neat diagram.

### **6-Communicating the obtained results**

Various means of communication include:

- Diagrams.
- Result tables.
- Observation drawings.
- Graphs.
- Digital images.

The results should be annotated (captions, titles, different stages...).

### **7-Analyzing the results**

This is a phase of reasoning where the obtained results are compared with the verifiable consequence. The purpose of analyzing the results is to validate or invalidate the initial hypothesis. The reasoning in the analysis should be structured and may rely on knowledge to interpret (understand) the results effectively.

### **8-Conclusion**

To conclude the work, the scientist must formulate a clear and precise answer to the problem they posed.