

1.3 Scientific Thinking and Processes

KEY CONCEPT

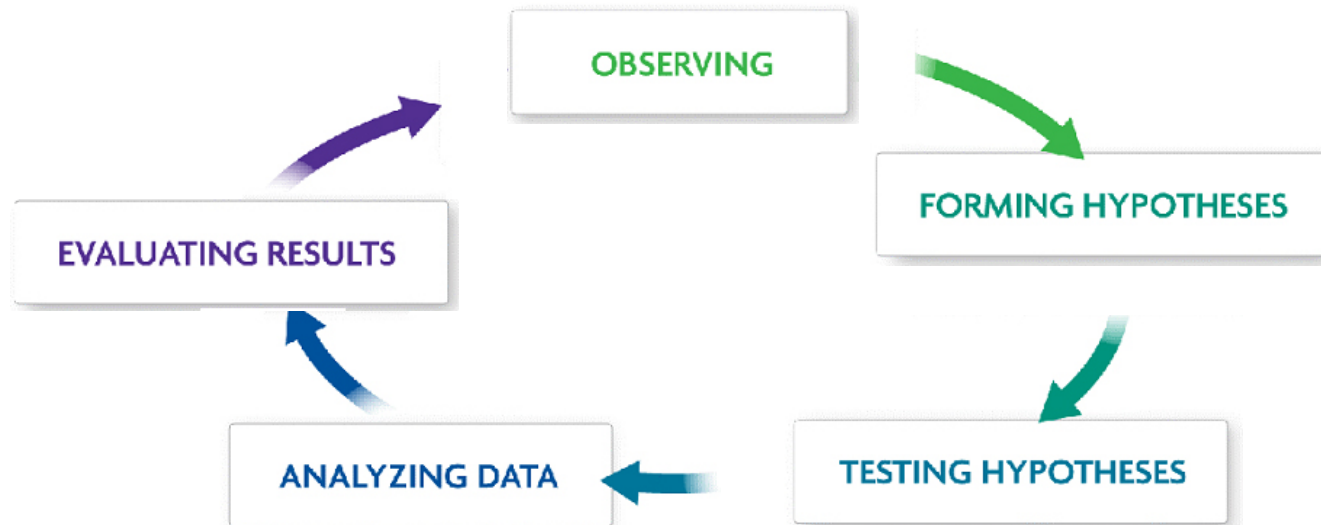
Science is a way of thinking, questioning, and gathering evidence.



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▶ Like all science, biology is a process of inquiry.

- Scientists make careful and systematic observations.
- Scientists record observations as data.
- Scientists form a hypothesis as a possible answer to a question.
- Scientists test their hypotheses and analyze their data.



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► Biologists use experiments to test hypotheses.

- **Observation** – using the senses or tools to gather information
 - Observational studies allow scientists to describe a phenomenon.



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- **Forming hypothesis** – Ask a question and try to explain observation
- **Testing hypothesis** – Collecting data to support or reject a hypothesis
 - Experimentals allow scientists to determine what causes a phenomenon.



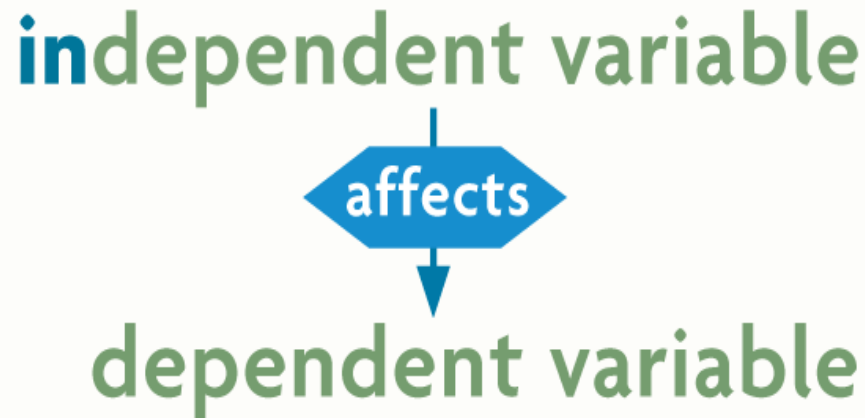
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- **Analyzing Data** – statistical analysis of data to draw conclusions
- **Evaluating results** – Data and conclusions are studied to determine whether they are valid
 - Experimental methods and results are evaluated by other scientists in *peer review*.



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- **Experiment** – using independent and dependent variables to find cause-and-effect relationships
 - **Independent variable** is the condition that is *manipulated* in an experiment; the “**cause**”
 - **Dependent variable** is the factor that is *measured* in an experiment; the “**effect**”



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- **Constant** – any condition that is kept the same during an experiment. It is necessary for determining whether the independent variable produces any change in the dependent variable.
 - Example: blood pressure medication experiment
 - How often the medication is given
 - How the medication is taken

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- ▶ **A theory explains a wide range of observations.**
 - Theories are proposed explanation for a wide range of observations and experimental results supported by a wide range of scientific evidence.
 - Theories can change based on new evidence.

