Unit 1 "Basic Biological Principles"

Lesson 1: What is Science ? How is Science Performed ? and the Unifying Characteristics of Life
Text Sections: 1.1,1.3, 7.1, 7.2

I. **What is Science? (1.1)**
- A. What Science Is and Is Not
  1. Science **is not** just a collection of unchanging facts or beliefs
     a. scientific ideas are open to testing, discussion and revision
  2. Science **is** an organized way of gathering and analyzing evidence about the natural world
     a. science **is** a process
  3. The Goals of Science
     a. provide natural explanations for natural events
     b. use these explanations to understand patterns in nature
     c. make useful predictions about natural events
  4. Science rarely proves anything in absolute terms
     a. scientific explanations are based on the best evidence available
     b. evidence is collected through observation, investigation and experimentation

II. Scientific Methodology (1.1):
- A. The Procedures involved in doing Science
  1. **Observing and asking questions**
     a. observation: using your senses to gather information
  2. **Making Inferences and forming hypotheses**
     a. inference: a logical interpretation based on prior knowledge
     b. hypothesis: a possible explanation or answer (formal)
  3. **Conducting Controlled Experiments**
     a.only one variable is tested, all other variables are controlled
  4. **Collecting and Analyzing Data**.
     a. data: important information related to the experiment
     b. Two types of data:
        Quantitative data: numbers obtained by counting or measuring
        Qualitative data: is descriptive and not easily measured using numbers
     c. data is recorded in a journal, table or graph
     d. Analyze data to **determine if the data supports or rejects the hypothesis**
     e. large samples and proper equipment help to reduce error
  5. **Forming a Conclusion**.
     a. the conclusion will state your findings from analyzing the data
     b. "the data supports" or "the data rejects" the hypothesis
     c. The data may also be inconclusive

B. **The Salt Marsh Study** (pages 6-7 in text)

1. **Observation**: noticing and describing events or processes in a careful, orderly way
   a. Question: Why do marsh grasses grow to different heights in different places?

2. **Inferring and forming a hypothesis**
   a. Inference: Something is limiting the grass growth in some places.
      Could be any environmental factor (variable)
   b. Hypothesis: Marsh grass growth is limited by available Nitrogen.

3. **Designing a Controlled Experiment** (one variable tested against a control group)
   a. Independent Variable (Tested Variable) = Nitrogen in soil
   b. Dependent Variable (Responds to the Independent Variable) = height of the grass

4. **Control Group**: used as a standard of comparison. All other experimental groups are compared to the control group to determine the effects of the IV
   a. **No Treatment Control**: does not receive any treatment (No I.V.)
   b. **Experimenter Selected Control**: the group used as the control is purposely selected by the experimenter

5. **Experimental Group**: gets the IV: this is where the test takes place

C. **Variables:** are factors that can have an impact on the experiment

1. **Independent Variable:** the factor that is tested.
   a. AKA the 'manipulated variable'
   b. Only one IV is used
   c. IV comes directly from the hypothesis
2. **Dependent Variable:** the factor that is measured
   a. responds to or changes because of the IV.
   b. AKA the 'responding variable'
3. **Constants**: the factors that are kept the same in an experiment.
   a. there are usually several constants in a given experiment
4. **Measurements**: we can measure length, width, height, time, temperature etc. Counting is also measuring.
   a. measurements need a number and a unit **(Metric System)**
5. **Repeated Trials**: the number of times each level of the IV is tested.
   a. reduce error in measurements by relying on averages
   b. reduce the effects of hidden variables
6. **Graphing Data**: line, pie or bar graphs are excellent ways to visualize your data.
   a. line graphs: show changes over time and can compare two or more groups.
   b. Creating line graphs: Y-axis= measurement
      X-axis= time or subject
   c. Pie graph: shows percentages
   d. Bar graphs: compare several trials or groups

END Lesson 1.1