**Chapter 1 – The Science of Biology**

**Section 1 – What is Science?**

* \_\_\_\_\_\_\_\_\_\_\_\_\_is an organized way of using evidence to learn about the \_\_\_\_\_\_\_\_\_\_\_\_\_ world.
* What is the \_\_\_\_\_\_\_\_\_\_\_\_\_ of science?
	+ investigate and \_\_\_\_\_\_\_\_\_\_\_\_\_ the natural world.
	+ explain\_\_\_\_\_\_\_\_\_\_\_\_\_ in the natural world.
	+ use those explanations to make useful \_\_\_\_\_\_\_\_\_\_\_\_\_.
* Thinking like a \_\_\_\_\_\_\_\_\_\_ .
	+ Scientific thinking begins with an\_\_\_\_\_\_\_\_\_\_\_\_\_.
		- An\_\_\_\_\_\_\_\_\_\_\_\_\_ is the process of gathering \_\_\_\_\_\_\_\_\_\_ about events or processes in a careful, orderly way.
	+ The information gathered from observations is called \_\_\_\_\_\_\_\_\_\_\_\_\_ .
		- \_\_\_\_\_\_\_\_\_\_\_\_\_data are expressed as \_\_\_\_\_\_\_\_\_\_\_\_\_, obtained by counting or measuring.
			* Examples –
		- \_\_\_\_\_\_\_\_\_\_\_\_\_data are \_\_\_\_\_\_\_\_\_\_\_\_\_ and involve characteristics that can’t easily be measured.
	+ Scientists use data to make an\_\_\_\_\_\_\_\_\_\_\_\_\_.
		- An\_\_\_\_\_\_\_\_\_\_\_\_ is a logical interpretation based on prior knowledge or experience.
* Explaining an interpreting evidence
	+ A \_\_\_\_\_\_\_\_\_\_\_\_\_ is a proposed scientific explanation for a set of observations.
		- They are \_\_\_\_\_\_\_\_\_\_\_\_\_ out or \_\_\_\_\_\_\_\_\_\_\_\_\_.
		- However, they must be designed in a way that can be \_\_\_\_\_\_\_\_\_\_.

**Section 2 – How Scientists Work (Part 1)**

* How do scientists\_\_\_\_\_\_\_\_\_\_\_\_\_ a hypothesis?
	+ Whenever possible, a hypothesis should be tested by an\_\_\_\_\_\_\_\_\_\_\_\_\_ in which only one variable is changed at a time. All other variables should be kept \_\_\_\_\_\_\_\_\_\_\_\_\_, or controlled.
* Parts of an Experiment
	+ The variable that is deliberately changed is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ variable.
	+ The variable that is observed and that changes in response to the manipulated variable is called the responding variable
* The process of designing an experiment to test a hypothesis includes:
	+ Asking a \_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Forming a \_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Setting up a \_\_\_\_\_\_\_\_\_\_\_\_\_experiment
	+ Recording and analyzing \_\_\_\_\_\_\_\_\_\_\_\_
	+ Drawing a \_\_\_\_\_\_\_\_\_\_\_\_
* Historical Example
	+ Asking a Question
		- Many years ago people wanted to know how organisms came into \_\_\_\_\_\_\_\_\_\_\_\_\_, so they asked, “How do \_\_\_\_\_\_\_\_\_\_\_\_\_ come into being?”
	+ Forming a hypothesis
		- One early hypothesis was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or the idea that life could come from nonliving matter. For example, most people thought that maggots spontaneously appeared on meat.
		- In 1668, \_\_\_\_\_\_\_\_\_\_\_\_\_ proposed a different hypothesis: that maggots came from eggs that flies laid on meat.
	+ Redi’s Experiment



* + Redi’s Data and Conclusion



**Section 2 – How Scientists Work (Part 2)**

* Repeating \_\_\_\_\_\_\_\_\_\_\_\_\_ .
	+ Scientists\_\_\_\_\_\_\_\_\_\_\_ experiments to be sure that the results match those already \_\_\_\_\_\_\_\_\_\_\_\_\_.
* \_\_\_\_\_\_\_\_\_\_\_\_\_ Test of Redi's Findings
	+ Needham challenged Redi’s results by claiming that spontaneous generation \_\_\_\_\_\_\_\_\_\_\_\_\_ occur under the right conditions.
* **Needham’s Test of Redi’s Findings**
	+ Needham heated a bottle of \_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Allowed the gravy to \_\_\_\_\_\_\_\_\_\_\_\_\_to room temperature
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_ the bottle
	+ After several days, the gravy was \_\_\_\_\_\_\_\_\_\_\_\_\_ with microorganisms.
	+ Needham concluded that these organisms came from the gravy by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ generation.
* ***What is the problem with this experiment?***
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Spallanzani’s Test of Needham’s
	+ Spallanzani heated \_\_\_\_\_\_\_\_\_\_\_\_\_ bottles of gravy.
	+ He left one open and then \_\_\_\_\_\_\_\_\_\_\_\_\_ the other.
	+ Open flask - \_\_\_\_\_\_\_\_\_\_\_\_ with microorganisms
	+ Closed flask - \_\_\_\_\_\_\_\_\_\_\_\_ of microorganisms.
* Pasteur’s test \_\_\_\_\_\_\_\_\_\_\_\_\_Spallanzani’s results
	+ The key portion of his experiment was the usage of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ neck flask.
	+ Confirmed that spontaneous generation did not occur
* How a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Develops
	+ As evidence from numerous investigations builds up, a hypothesis may become so well supported that scientists consider it a \_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ In science, the word *\_\_\_\_\_\_\_\_\_\_\_\_\_* applies to a well-tested explanation that unifies a broad range of observations.
	+ No theory is considered absolute \_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ As new evidence is uncovered, a theory may be revised or replaced by a more useful explanation.

**Section 3 - Studying Life (Part 1)**

* Characteristics of Living Things
	+ - No \_\_\_\_\_\_\_\_\_\_\_\_\_ characteristic is enough to describe a living thing.
		- Some \_\_\_\_\_\_\_\_\_\_\_\_\_ things share one or more traits with living things.
	+ ***Living things are made up of \_\_\_\_\_\_\_\_\_\_\_\_\_.***
		- A **\_\_\_\_\_\_\_\_\_\_\_\_\_** is the smallest unit of an organism that can be considered alive.
	+ ***Living things \_\_\_\_\_\_\_\_\_\_\_\_\_ and develop.***
		- During an organism’s development, cells differentiate, which means that the cells look different from one another and perform different \_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ ***Living things are based on a universal \_\_\_\_\_\_\_\_\_\_\_\_\_ code.***
		- Organisms store the information they need to live, grow, and reproduce in a genetic code in a molecule called \_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ ***Living things respond to their \_\_\_\_\_\_\_\_\_\_\_\_\_.***
		- A **\_\_\_\_\_\_\_\_\_\_\_\_\_** is a signal to which an organism responds.
	+ ***Taken as a group, livings things change over time. Over many generations, groups of organisms typically \_\_\_\_\_\_\_\_\_\_\_\_\_.***
* ***Living things reproduce***
	+ In \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reproduction, cells from two different parents unite to form the first cell of the new organism.
	+ In \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reproduction, a single parent produces offspring that are identical to itself.
* ***Living things obtain materials and use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.***
	+ The combination of chemical reactions through which an organism builds up or breaks down materials is called **metabolism**.
* ***Living things maintain a stable internal environment.***
	+ Although conditions outside an organism may change, conditions inside an organism tend to remain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ This process is called **homeostasis**.
* \_\_\_\_\_\_\_\_\_\_\_\_\_ of Biology
	+ There a many branches of biology. For example:
		- Zoologists study \_\_\_\_\_\_\_\_\_\_\_\_\_.
		- Botanists study \_\_\_\_\_\_\_\_\_\_\_\_\_.
		- Paleontologists study \_\_\_\_\_\_\_\_\_\_\_\_\_ life.

**Section 3 - Studying Life (Part 2)**

* How can life be studied at different levels?
* Levels of \_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_
		- Groups of \_\_\_\_\_\_\_\_\_\_\_\_\_; smallest unit of most chemical compounds
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_
		- Smallest functional unit of \_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of Cells
		- Tissues, organs, and organ systems
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Individual \_\_\_\_\_\_\_\_\_\_\_\_\_ thing
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Group of organisms of one type that live in the same \_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_
		- Populations that live \_\_\_\_\_\_\_\_\_\_\_\_\_ in a defined area
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_
		- Community and its \_\_\_\_\_\_\_\_\_\_\_\_\_ surroundings
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_
		- The part of \_\_\_\_\_\_\_\_\_\_\_\_\_ that contains all ecosystems

**Section 4 Tools and Procedures**

* A Common Measurement System
	+ Scientists need a common system of measurements in order to \_\_\_\_\_\_\_\_\_\_\_\_ each other’s experiments.
	+ Most scientists use the \_\_\_\_\_\_\_\_\_\_\_\_ system when collecting data and performing experiments.
		- The metric system is a decimal system of measurement whose units are based on certain physical standards and are scaled on multiples of \_\_\_\_\_\_\_\_\_\_\_\_\_.
		- Because the metric system is based on multiples of 10, it is easy to use.



* Microscopes
	+ **Microscopes** are devices that produce \_\_\_\_\_\_\_\_\_\_\_\_\_ images of structures that are too small to see with the unaided eye.
	+ **Light microscopes** produce magnified images by focusing visible light rays.
		- These are the most \_\_\_\_\_\_\_\_\_\_\_\_\_ used microscopes
		- Light microscopes produce clear images of objects at a magnification of about 1000 times.
		- **\_\_\_\_\_\_\_\_\_\_\_\_\_ light microscopes** allow light to pass through the specimen and use two lenses to form an image.
		- **Limitations**
			* Light microscopes cannot produce clear images of objects smaller than 0.2 micrometers, or about one-fiftieth the diameter of a typical \_\_\_\_\_\_\_\_\_\_\_.
	+ **\_\_\_\_\_\_\_\_\_\_\_\_ microscopes** produce magnified images by focusing beams of electrons.
		- The best electron microscopes can produce images almost \_\_\_\_\_\_\_\_\_\_\_\_\_ times more detailed than light microscopes can.
	+ Laboratory Techniques
		- Cell \_\_\_\_\_\_\_\_\_\_\_\_\_
			* To obtain enough material to study, biologists sometimes place a single cell into a dish containing a nutrient solution.
			* The cell is able to reproduce so that a group of cells, called a **cell culture**, develops from the single original cell.
		- Cell \_\_\_\_\_\_\_\_\_\_\_
			* Biologists often use a technique known as **cell fractionation** to separate the different cell parts.
	+ Working Safely in Biology
		- Remember you are responsible for your own safety as well as that of your teacher, classmates, and any live animals you handle.
		- \_\_\_\_\_\_\_\_\_\_\_\_ safe practices.
		- Study the safety rules.
		- Read **ALL** the steps and safety precautions.
		- Follow your teacher’s instructions and textbook directions exactly.
		- If in doubt, ask your \_\_\_\_\_\_\_\_\_\_\_\_\_ for an explanation.
		- Wash your hands thoroughly with soap and warm water after every scientific activity.