BIOL200

Chapter 1

WHAT is BIOLOGY

Biology is the science that deals with life. What is science? It is the process used to solve problems and develop an understanding of natural events and testing possible answers.

This process is known as the Scientific method.

Scientific method is a way to gain information about the world by forming possible solution to questions followed by testing to check if proposed solutions are supported.

This method include:

1. Careful observation
2. Constructing a hypothesis and testing it
3. Accepting new information and ideas
4. Accepting that our ideas may be defeated by others.

1.Observation:

Use of our senses and instrument to record like microscope thermometer recorder…

2. Ask a question and explore:

How,what cause, when,…

Once the question is decided, as a student you start exploring to gain ansers to your question. Then you start constructing a hypothesis.

3. Constructing a hypothesis:

What is a hypothesis? It is a statement that provides a possible answer to our question or an explanation for an observation that can be tested.

Hypothesis should be:

1. Logical
2. Account for the variable info we gather
3. Should allow to predict future events relating to the question being asked
4. It should be testable.

And if a scientist put different competing hypothesis, he should use the simplest hypothesis and neutral explanation.

Collecting relevant data

There are different forms.

1. Colleting relevant information
2. Making additional observation
3. Devise an experiment
4. Experiment

Experiments may involve different factors called variable. And all experiment should have a control.

**4.Development of theories and laws:**

 When observations are made and hypothesis are tested, we can see patterns that can lead to general conclusions or theories or laws or principles.

The process of developing general principles from examining sets of facts is called **inductive reasoning or induction**. (example: Laying eggs is a characteristics of birds).

If you use a principle or theory to predict additional observations, you would be using deductive reasoning or deduction (example: new discovered birds should lay eggs)

**Definition of a theory:**

It is a widely accepted general statement about a concept in science that explain **why** things happen. There are few theories.

**Scientific Law:**

It is a uniform or constant fact of nature that describes **what** happens in nature.

Both laws and theories have been examined repeatedly and predict how nature behaves.

1. **Communication:**

Scientific methods should be communicated with other scientist by publishing in scientific journals or in conferences etc…

**1.4 Science of BIOLOGY:**

What are the characteristics of living things that are not found in non-living things?

1. Metabolic processes
2. Generative processes
3. Responsive processes
4. Control processes
5. Unique structural organization.

These 5 characteristics may not be all found at the same time in a living thing.

1. **Metabolic processes:**

They describe all the reactions and associated changes in energy in an organism and include **nutrient uptake, nutrient processing and waste elimination.**

1. **Generative processes:**

They include all activities that result in an increase in size (that is **growth** of an organism) or increase in population (**reproduction**). Growth and reproduction are related to metabolism.

Reproduction can happen either **sexually or asexually**.

Sexually requires 2 individuals each contribute to a sex cells that lead to creation of a new organism.

Asexually occurs when an organism make identical copies of itself (yeast, some plants,…)

1. **Responsiveness:**

It is how an organism reacts to changes in its surrounding and they classified as:

1. Irritability
2. Adaptation for individuals
3. Evolution for populations

**Irritability** is a fast response to a stimulus.

**Adaptation** results from an individual reaction to a stimulus but is slower because it needs growth or other changes in the organism.

**Evolution** involves changes in the characteristics displayed within a population. It is a slow change in their genetic make-up over generations. It enables a species to adapt to a long term change in its environment.

1. **Control Process:**

They are all the mechanisms that ensure an organism will carry out all metabolic activities in the proper sequence and rate that is coordination and regulation.

Coordination happens at different levels. At the metabolic level, all reactions are linked together in specific pathway controlled by enzymes. Enzymes are molecules that control rate at which chemical reactions occur.

1. **Unique Structural organization**

This is seen at the molecular level, cellular and organism level. See Fig 1.18 to summarize characteristics of living things.

**Levels of Biological organization:**

See table 1.2.