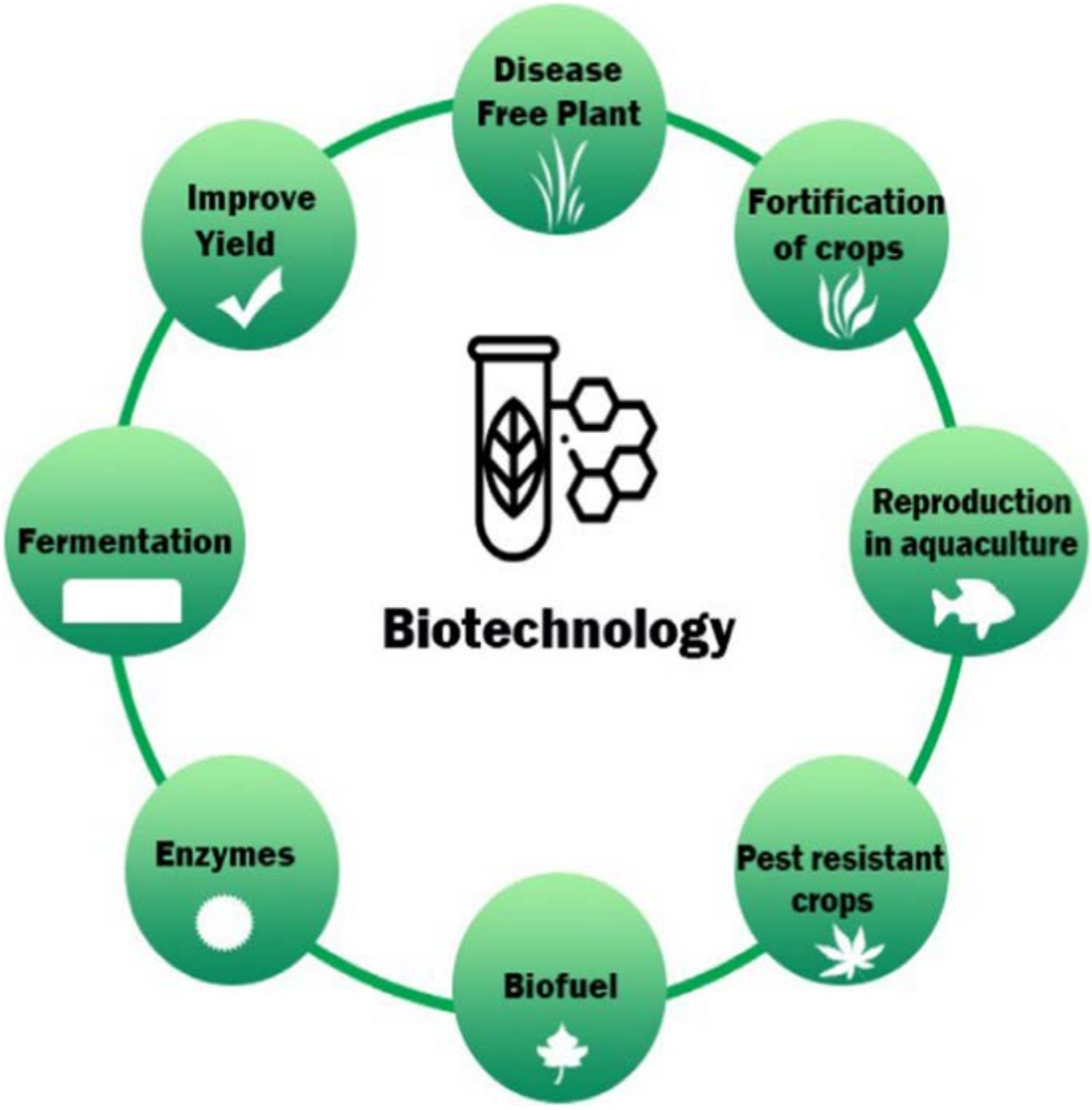
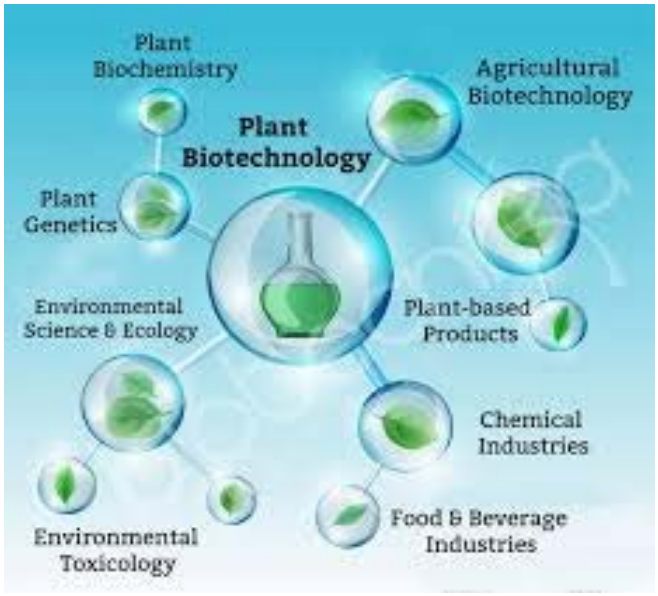
Introduction to Biotechnology:

Biotechnology is a technology that utilizes biological systems, living organisms or parts of this to develop or create different products. It a process to produce a genetically modified organism by removing genetic information from an organism, manipulating it in the laboratory and then transferring it into another organism to change certain of its characteristics.



Plant Biotechnology is a rapidly expanding field within Biotechnology.



It is mainly involving in the introduction of foreign genes into economically important plant species, resulting in crop improvement and the production of novel products in plants.

Today, biotechnology is being used as a tool to give plants new traits that benefit agricultural production, the environment, and human nutrition and health. The goal of plant breeding is to combine desirable traits from different varieties of plants to produce plants of superior quality.

This approach is being used to improve crop production which has been very successful over the years. For example, it would be beneficial to cross a tomato plant that bears sweeter fruit with conventional traits. Also, the red juicy tomatoes on shelves are results of genetic engineering.

For hundreds of years plant breeders have cross fertilized related plant, selecting combinations from the offspring that provide the plant with new characteristics beneficial to men. Currently, plant biotechnology includes two major areas, plant tissues culture and plant genetic engineering.

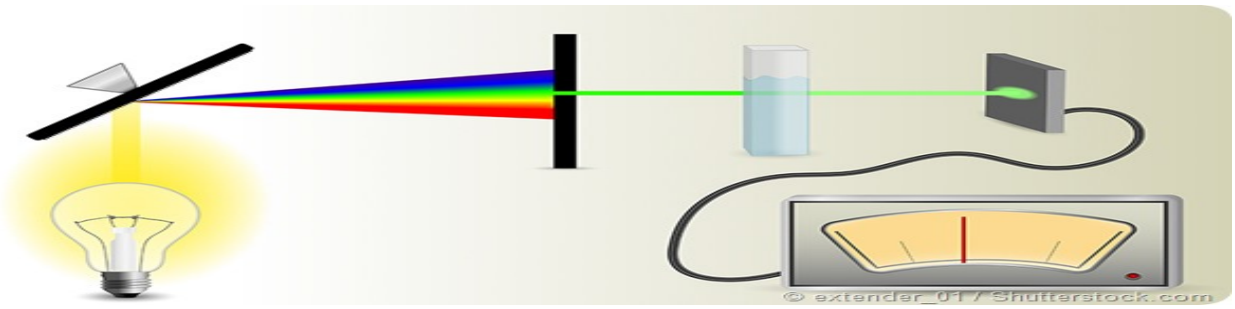
The transgenic Bt corn, for example, which produces its own insecticide, contains a gene from a bacterium.

Plants containing transgenes are often called genetically modified or GM crops. Desirable genes may provide features such as higher yield or improved quality, pest or disease resistance, or tolerance to heat, cold and drought.

Lab 3: Measuring Protein Concentration through Absorption Spectrophotometry

Absorption Spectrophotometry

Spectrophotometers is a mean for determining the concentration of a substance in a solution. Spectrophotometric techniques are used to measure the concentration of solutes in solution by measuring the amount of light that is absorbed by the solution in a cuvette placed in the spectrophotometer.



Spectrophotometry is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution.

The basic principle is that each compound absorbs or transmits light over a certain range of wavelength. This measurement can also be used to measure the amount of a known chemical substance.

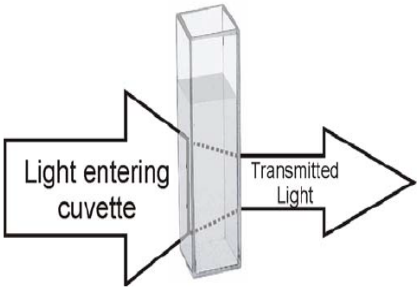


Figure 1. Absorption of light as it passes through a solution.

It is used to measure the difference in the amount of light entering and leaving the sample. The light that passes through the sample (not absorbed) is called transmitted light.
This difference in the original and transmitted light is called the absorbance.

Spectrophotometry is one of the most useful methods of quantitative analysis that most commonly used in biomedical and life science research, which includes both academic and industrial research. For instance, spectrophotometry can quantify

nucleic acids, proteins and bacterial density, but it also can measure bitterness compounds (IBUs, international bitterness units) in brewed beer.

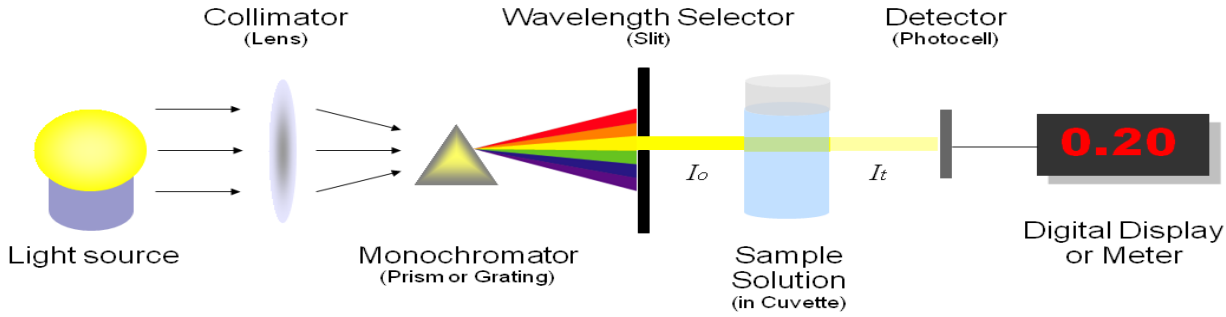
Spectrophotometry Specified Applications:

- It can be used to study the properties of many types of biological molecules
  - Pigments
  - Enzymes
  - DNA
  - And many small organic molecules.

- It can also be used to measure biological activities of living cells
  - Enzyme activities
  - Rates of photosynthesis.

Device and Mechanism:

It consists of a light source, a collimator, a monochromator, a wavelength selector, a cuvette for sample solution, a photoelectric detector, and a digital display or a meter.



A spectrophotometer, in general, consists of two devices; a spectrometer and a photometer. A spectrometer is a device that produces, typically disperses and measures light. A photometer indicates the photoelectric detector that measures the intensity of light.

What are some potential sources of error in absorbance measurements?

1. Spectrophotometric measurements are affected by many factors
   i. The type of solvent used
   ii. Temperature
   iii. Wavelength of light at which the measurements are made

iv.Presence of impurities in the sample being studied.

To eliminate absorbance due to the solvent, the spectrophotometer is always zeroed against the solvent.

2. Another potential problem is light scattering which caused by suspended particles. As shown below in Figure 2, the particulates will deflect light rays and cause an artificial increase in absorbance.

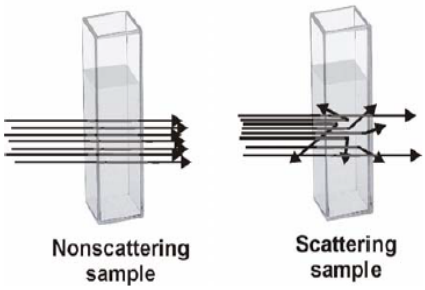


Figure 2. Light scattering by suspended particles will lead to erroneous absorbance measurements.

To avoid light scattering, it is common practice to centrifuge the sample before measuring absorbance in order to remove particulates.

Nano-drop

NanoDrop is the trade name for one of the several micro-volume spectrophotometers that are commercially available. Laboratories use spectrophotometers to determine the density of a solution, for instance the concentration of proteins, DNA and RNA.

The Nanodrop ND-1000 spectrophotometer is able to perform full spectrum UV-Vis absorbance analyses (220-750nm).

Only 1µL is required by the NanoDrop to quantify nucleic acid samples, Since the NanoDrop ND-1000 has a large dynamic range (2-3700 ng/µL for dsDNA), dilutions are not necessary for most samples. Unlike traditional spectrophotometers, the Nanodrop does not require cuvettes or capillaries. Instead, the sample is pipetted directly onto the measurement pedestal. When the apparatus is closed, the sample arm compresses the droplet and a sample column is drawn (to a controlled path length of 1mm) and surface tension holds the sample in place. After the 10 second measurement, the sample is simply wiped off and the instrument is ready for the next sample. The sample cannot be collected following its measurement.