University of Al-Mustaqbal
College of Science
Department of Medical Physics

Name of subject : Medical physics 3

Number stage : fourth

Lecture name : Modeling

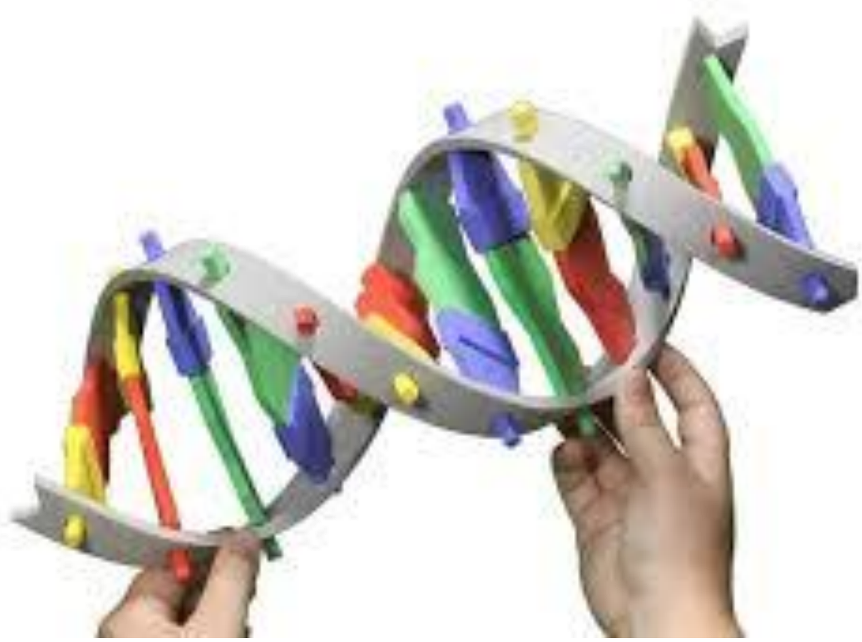
Lecture number : 3

Name of lecturer : M.Sc Murtadha Kadhim Salman

Modeling

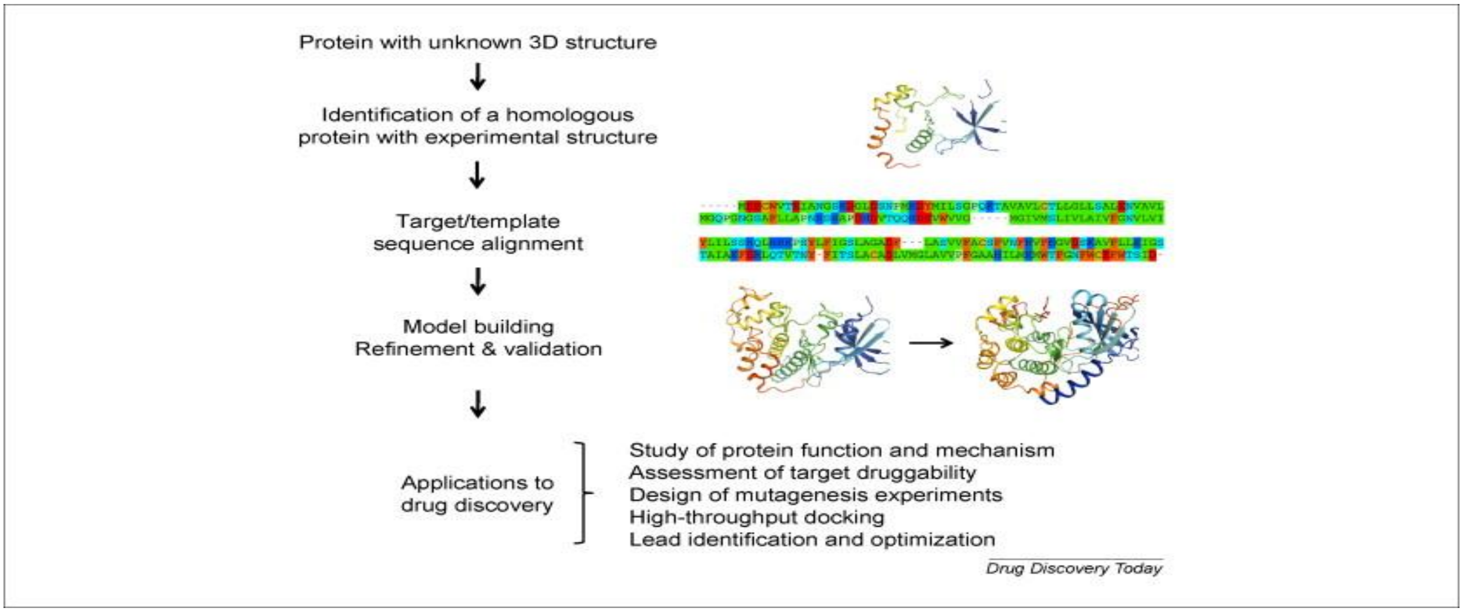
Scientific modeling, the generation of a physical or mathematical representation of a real phenomenon that is difficult to observe directly. Scientific models are used to explain and predict the behavior of real objects or systems and are used in a variety of scientific disciplines, ranging from medicine, physics and chemistry to ecology and the Earth sciences.

- **The purpose of scientific modeling varies. Some models, such as the three-dimensional double-helix model of DNA, are used primarily to visualize an object or system, often being created from experimental data. Other models are intended to describe an abstract or hypothetical behavior or phenomenon.**



For Example: -

Three- dimensional models of proteins are used to gain insight into protein function and to assist with drug design.



❖ **Even though physicists believe that the physical world obeys the laws of physics, they are also aware that the mathematical descriptions of some physical situations are too complex to permit solutions.**

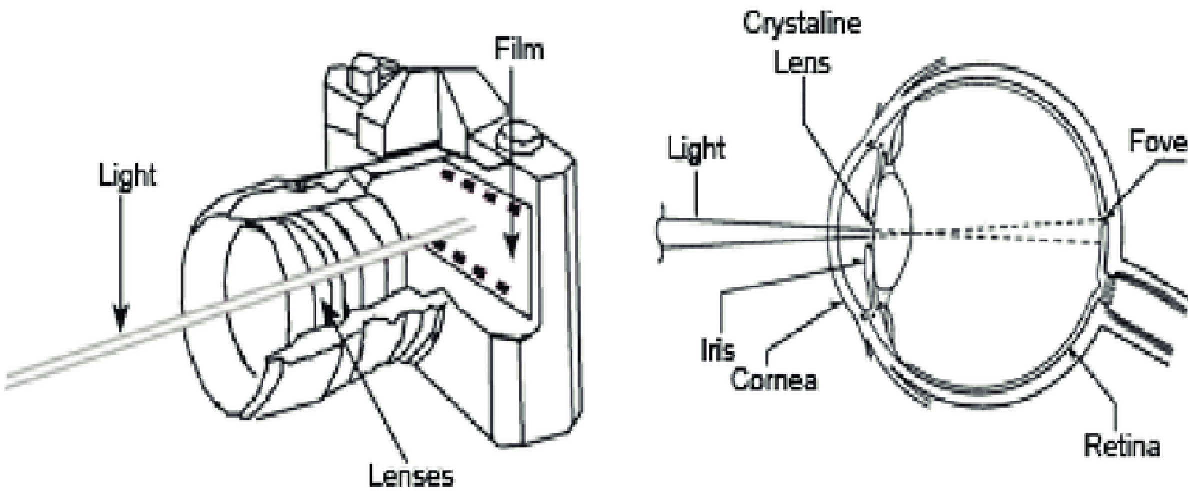
For Example: -

If you tore a small corner off this page and let it fall to the floor, it would go through various gyrations. Its path would be determined by the laws of physics, but it would be almost impossible to write the equation describing this path. Physicists would agree that the force of gravity would cause it to go in the general direction of the floor if some other force did not interfere. Air currents and static electricity would affect its path.

- **In trying to understand the physical aspects of the body, we often resort to analogies; physicists often teach and think by analogy. Keep in mind that analogies are never perfect.**

For Example: -

In many ways the eye is analogous to a camera; however, the analogy is poor when the film, which must be developed and replaced, is compared to the retina, the light detector of the eye.

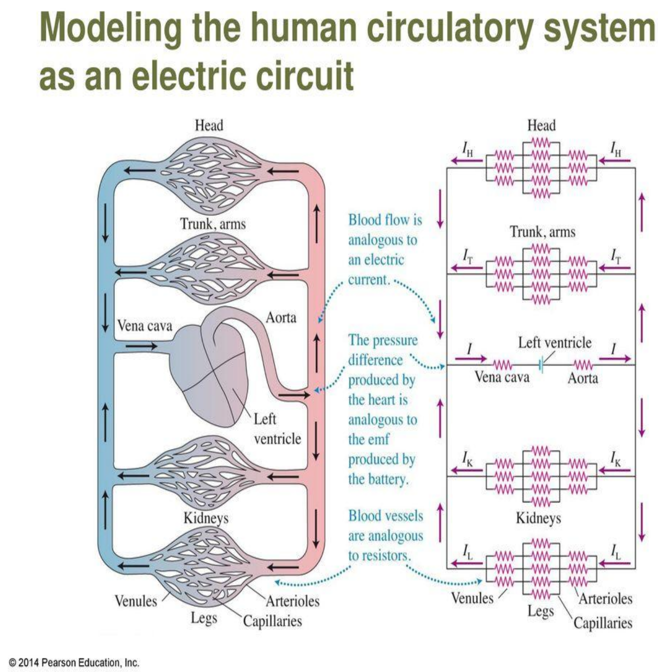


- **Some models involve physical phenomena that appear to be completely unrelated to the subject being studied.**

For Example: -

A model in which the flow of blood is represented by the flow of electricity is often used in the study of the body's circulatory system. This electrical model can simulate very well many phenomena of the cardiovascular system. Of course, if you do not understand electrical phenomena the model does not help much. Also, as mentioned before, all analogies have their limitations.

Blood is made up of red blood cells and plasma, and the percentage of the blood occupied by the red blood cells (**the hematocrit**) changes as the blood flows toward the extremities. This phenomenon is difficult to simulate with the electrical model.



- ❖ **Other models are mathematical; equations are mathematical models that can be used to describe and predict the physical behavior of some systems. In the everyday world of physics we have many such equations. Some are of such general use that they are referred to as laws.**

<u>For Example: -</u>

The relationship between force ***F***, mass ***m***, and acceleration ***a***, usually written as ***F=ma***, is known as **Newton's second law**. There are other mathematical expressions of this law that may look quite different to a lay person but are recognized by a physicist as other ways of saying the same thing. **Newton's second law** is used in the form $F=\Delta mv/\Delta t$, where ***v*** is the velocity, ***t*** is the time, and Δ indicates a small change of the quantity. The quantity ***mv*** is the momentum, and the part of the equation ***P*/Δ*t*** means rate of the change (**of momentum**) with time.