Salahaddin University – Erbil
Education College
Physics Department

Medical Physics

Lecture One

Introduction

Fourth Stage

Prepared By :
Assist. Prof. Dr. Haidar J. Ismail
Biophysics (Medical image processing)
Web address: https://academics.su.edu.krd/haidar.ismail

1. Introduction

Lect.	Subject
1	Introduction
2	Force on and in the body
3	Physics of the Skeleton
4	Heat and cold in medicine
5	Energy, Work and Power of the Body
6	Pressure in the body
7	The Physics of the Lungs
8	Physics of the Cardiovascular System

Lect.	Subject
9	Electricity in human body
10	Sound in medicine
11	Physics of hearing and ear
12	Light in medicine
13	Physics of eye and vision
14	x-ray in medicine
15	Nuclear medicine

Reference Books

1. Medical Physics, by John R. Cameron, 1978.
2. Physics of the Human Body, Irving P. Herman, 2007
3. Websites

1. Introduction

- **Biophysics** is the science of the application of the laws of physics to biological phenomena.
- In principle, the field of biophysics should include medical physics as an important subspecialty.
- **Medical Physics** is the application of physics to medicine. It uses physics concepts and procedures in the prevention, diagnosis, and treatment of disease(IAEA def.).
- There are two important area of medical physics:
  1. Physics of Physiology: Contain application of physics to function of human bodies in health and diseases(eyes, ears, lung, heart, circulatory system).
  2. Application of physics principle in practice of medicine (mechanics, heat, light, ultrasound, electricity magnetism, lasers, radiations).

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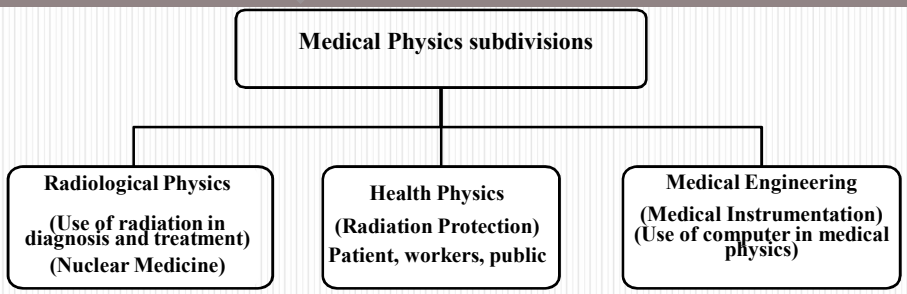

- **Modeling:** understand a physical phenomena- select major features- ignore small features (as we believed) – analogies (employ model) partially correct (not perfect).
- Example: eyes analogs as camera (retina–film incomparable).
- The real situation is always more complex than the one we describe.

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- **Some models** involve physical phenomena that appears to be completely unrelated to the subject being studied.
- Example: a model(electric circuit) in which blood flow is represented by the flow of electricity is often used in study of the body's circulatory system(it simulate very well many phenomena of the cardiovascular system).
- **Mathematical Models**(equations): such HR=f(P), heart rate is a function of power produced by the body. The f convert to an equation, the hard step.
- **Homeostasis**: Many functions of the body are controlled by Homeostasis, which is analogous to feedback control in engineering.
- Some of the output is fed back to source to regulate the production.

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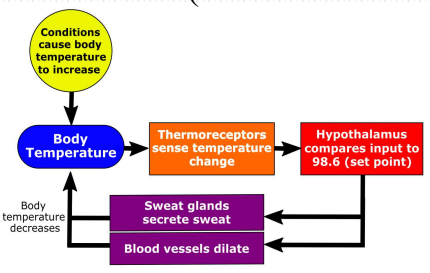
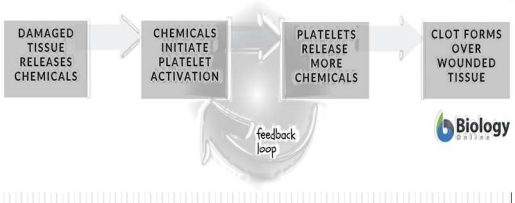
- Typically, we divide feedback loops into two main types:
  1. **Positive feedback loops(stable control)**, in which a change in a given direction causes additional change in the same direction(rare in the body).
  2. **Negative feedback loops(unstable control)**, in which a change in a given direction causes change in the opposite direction(common in the body).





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- **Various diseases** found related to failure of feedback control (body grows through increasing number of cells until adult size, body remains constant size under some type of feedback control. Sometimes, some cells do not respond to this control and become tumors.

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Table of important physical properties of the human body

Distinctive systems in the body	11
Average cell size	20 μm
Range of cell sizes	4 μm to 1 mm
Total number of cells (rough estimate)	3×10^{13}
Number of genes (estimate)	25 000
Number of proteins (estimate)	2×10^{4}
Cell types	210
Outer skin area	~2 m^2
Senses of the body	More than 8