

**Salahaddin University-  
Erbil College of Science  
Physics Department**



**1<sup>st</sup> Lecture after  
course book**

**1<sup>st</sup> Weak**

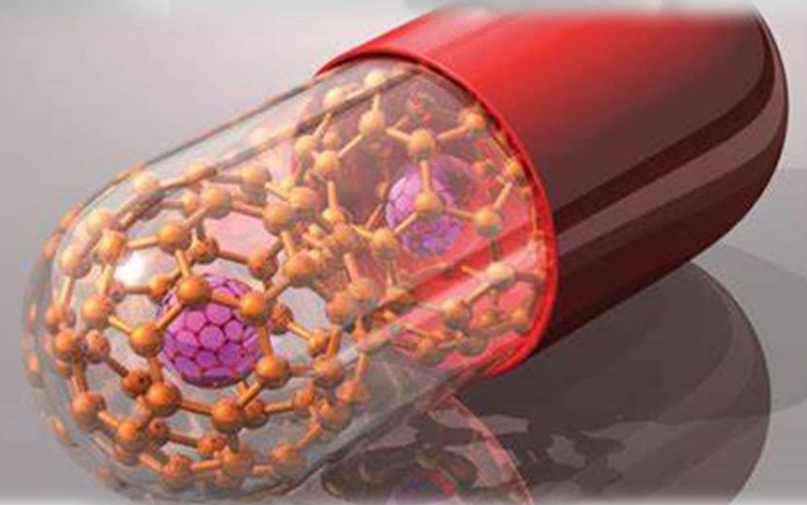
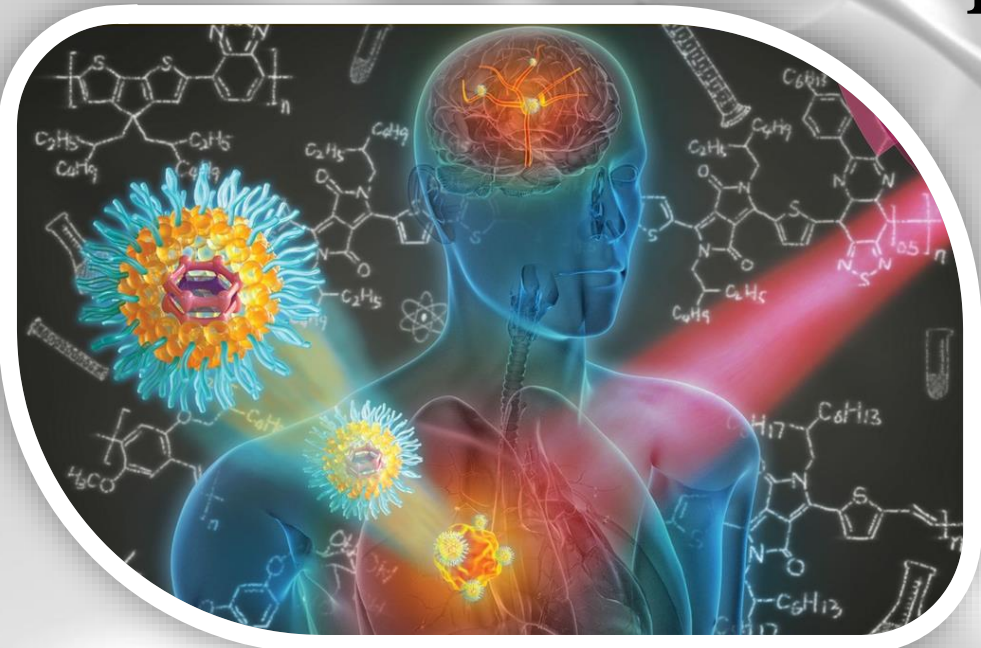
**Date 29-9-2022**

**Nanomedicine. 4<sup>th</sup> stage  
Medical branch**

**Nanomedicine: An Introduction**

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# Content

1

**Learning Outcomes**

2

**Nanomedicine: An Introduction**

3

**Synthesis Of Nano Materials Methods: Advantages And Dis  
Advantages**

4

**Properties and functions of objects at the nanometer scale**

5

**Types of nanomaterial used in nanomedicine**

**At the end of today's lecture you would be able to:**

- ❖ Understand the following terminologies: nanomaterial, nanotechnology, nanomedicine and Quantum confinement .
- ❖ understand the fabrication, characterization, and manipulation of nanomaterials
- ❖ Explain :Where Physical and Biological Sciences Meet
- Understand Size and shape of nanomaterials effect on properties of nanomaterials
- Understand The **bottom-up** approach used in nanofabrication is more advantageous than the **top-down** approach approaches

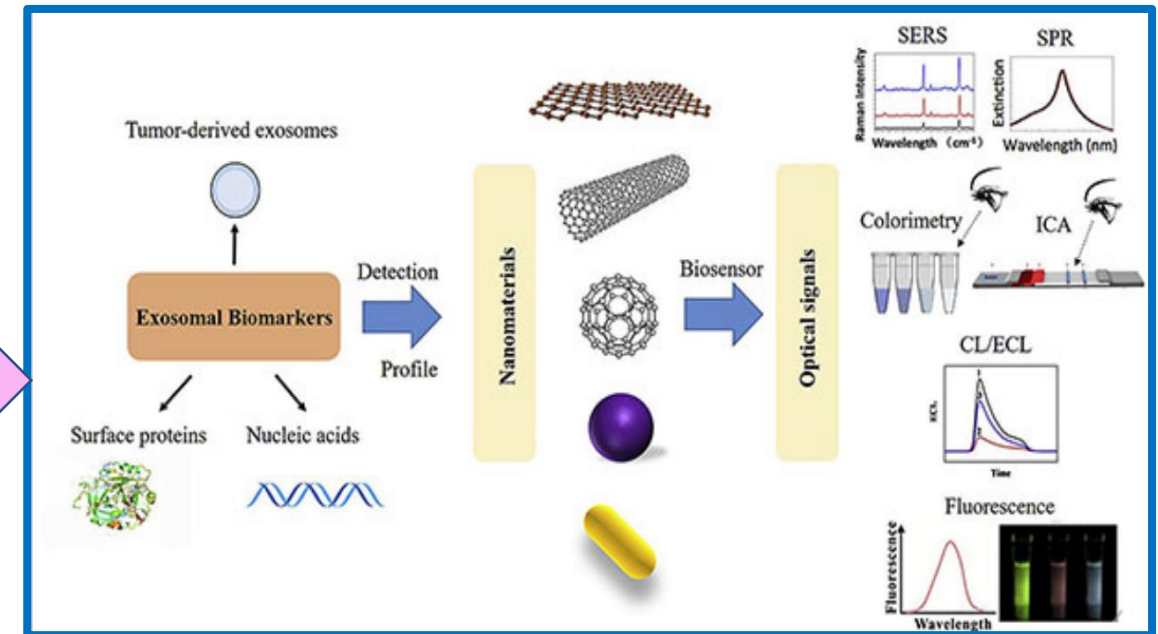
# Nanomedicine: An Introduction

- Nanomedicine refers to the use of **Nanotechnology** in health care. Nanomedicine can include a wide range of applications, including Biosensors, tissue engineering, diagnostic devices, **Biomarkers** and many others

## Biomarkers

A biomarker (short for biological marker) is an objective measure that captures what is happening in a cell or an organism at a given moment

Exosomal biomarkers including tumor-derived exosomes, exosomal surface proteins and exosomal nucleic acids have emerged as one of the most important and general cancer biomarkers in modern biomedical science. These indicators can provide momentous biological information for early diagnosis and treatment of cancer.. Among these biosensors, nanomaterial-based optical biosensors are prospective future platforms for rapid and cost-effective detection of exosomal biomarkers.



exosomal biomarkers detection by nanomaterials-based optical biosensors



# Nanotechnology

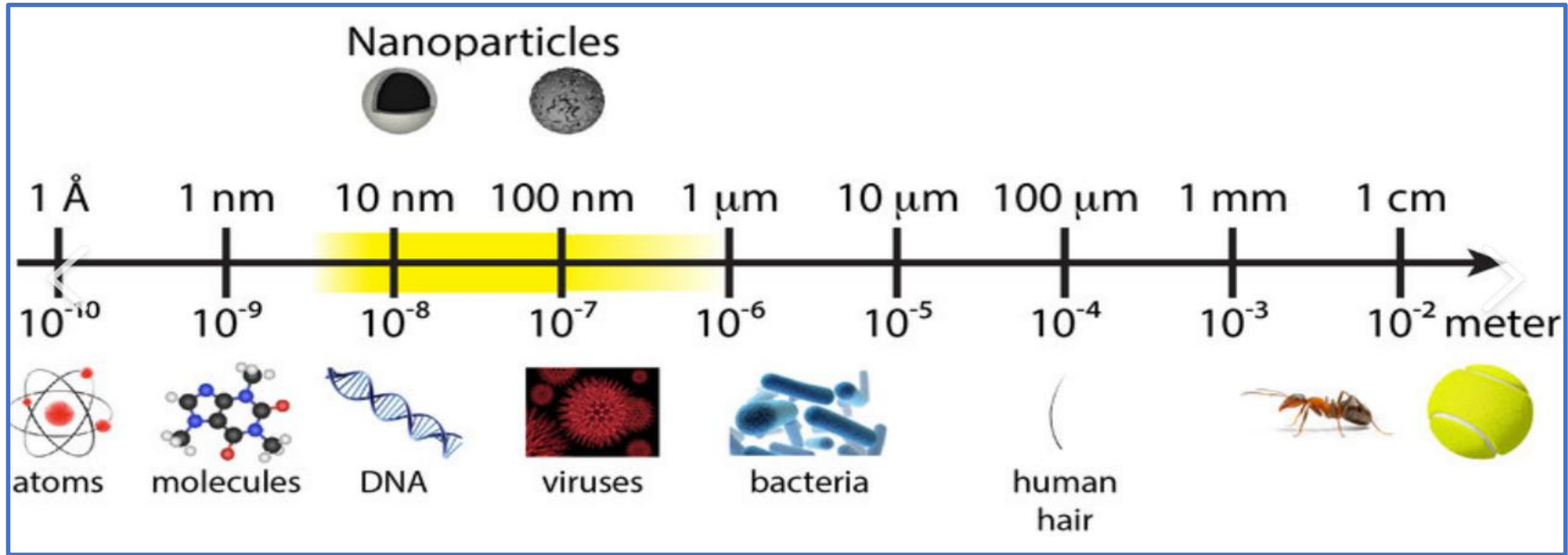
**Nanotechnology** means working with materials at the nano level -- a scale too small to be seen with a regular lab microscope or Nanoscience and nanotechnology deal with the objects at the nanometer scale .

## Nanoscale: Where Physical and Biological Sciences Meet?

- The biological and physical sciences share a common interest in nanoscale, and the integration of biology and materials at the nanoscale has the potential to revolutionize many fields of science and technology.
- The advances in physical sciences offer materials useful in cell and molecular biology, and provide tools for characterizing cells and sub-cellular components; meanwhile the progress in biology provides a window for researchers to understand the most sophisticated functional nanostructures that have ever existed



# Length Scale of Nanomedicine

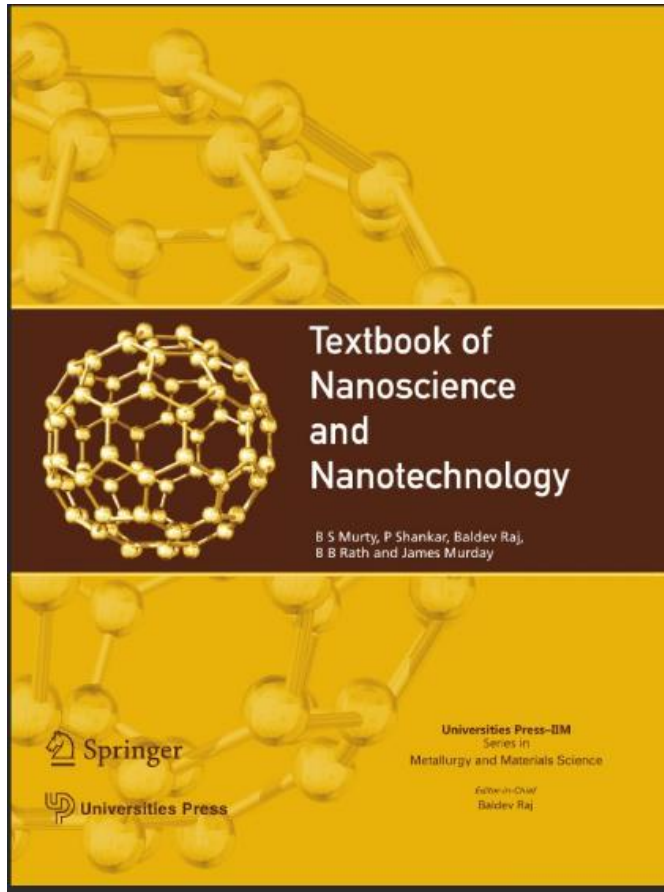


Angstrom ( $\text{\AA}$ , 0.1 nm)	Viruses (10~100+nm)	Red Blood Cells (10 $\mu$ m)	Fly (10 mm)
Atoms (0.1~0.5 nm)	Antibodies (10 nm)	Bacteria (100 nm~10 $\mu$ m)	Insects (1 mm~1 cm)
Molecules (0.3~23 nm)	Proteins (1~10 nm)	Hair (50 $\mu$ m)	Human Egg (100 $\mu$ m)
X-rays (0.1~10 nm)	UV (100 nm)	Visible light (1 $\mu$ m)	Infrared (10 $\mu$ m)
			Microwave (1 cm)

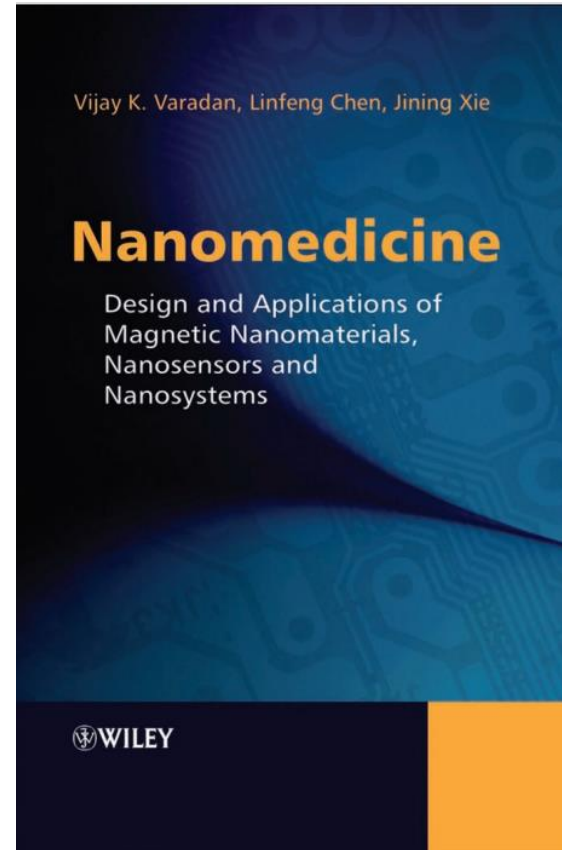
# Length Scale of Nanomedicine

- a lot of biological entities are within the range of nanoscale, such as proteins, antibodies, viruses and bacteria, and they are usually called **biological nanomaterials**.
- The special functions and properties of **biological nanomaterials** provide much inspiration for the design of **non-biological nanomaterials**; to access or manipulate biological nanomaterial meanwhile, due to their suitable sizes, non-biological nanomaterials can be used to access to or manipulate biological nanomaterials. Nanomaterials with sizes smaller than 50 nm can get inside most cells without difficulty. When nanomaterials with sizes smaller than 20 nm travel around the circulatory system of the body, they can move out of blood vessels. Therefore, after special treatments, nanomaterials are widely used as targeted drug delivery vehicles, which carry chemotherapeutic agents or therapeutic genes into the desired malignant cells while saving healthy cells.

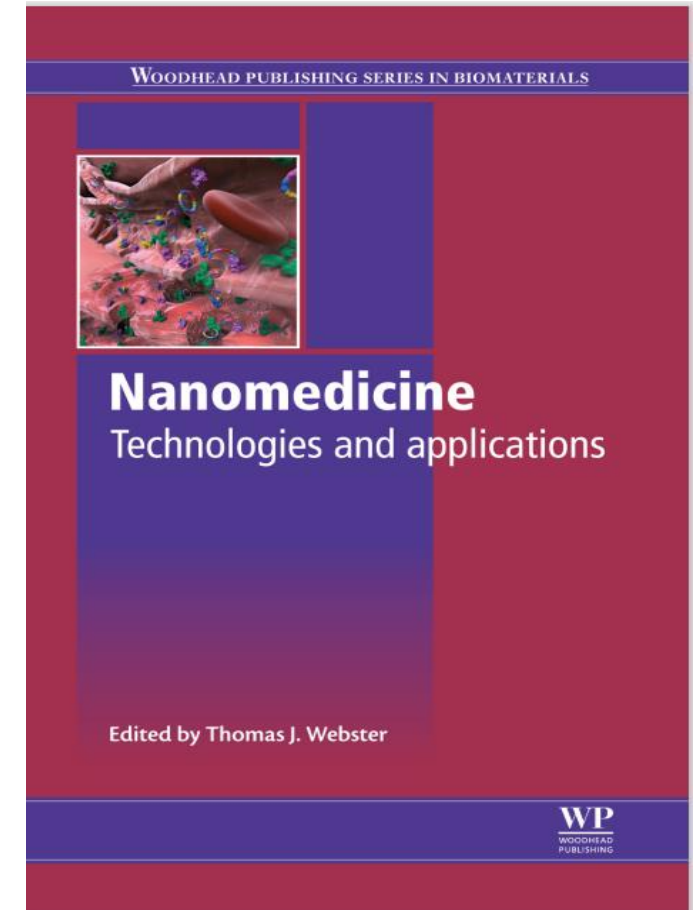
# Reference



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[Nanomedicine: Technologies and Applications \(Woodhead Publishing Series in Biomaterials\): Webster, Thomas J.: 9780857092335: Amazon.com: Books](#)



[Nanomedicine: Design and Applications of Magnetic Nanomaterials, Nanosensors and Nanosystems: Varadan, Vijay K., Chen, LinFeng, Xie, Jining: 9780470033517: Amazon.com: Books](#)