

Lec8\ Biomedical applications of nanomaterials

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What is NANOTECHNOLOGY?

Nanotechnology has several application on many fields such as :

- Medicine
- Electronics
- Energy production
- water processing

Nanomedicine

- **Nanotechnology applied medically**
- **New break throughs in medicine:**
 - Advanced biomedical research tools
 - Labels to experiments
 - Study of DNA and its component genes
 - Diagnostic tests
 - In bone implants etc...

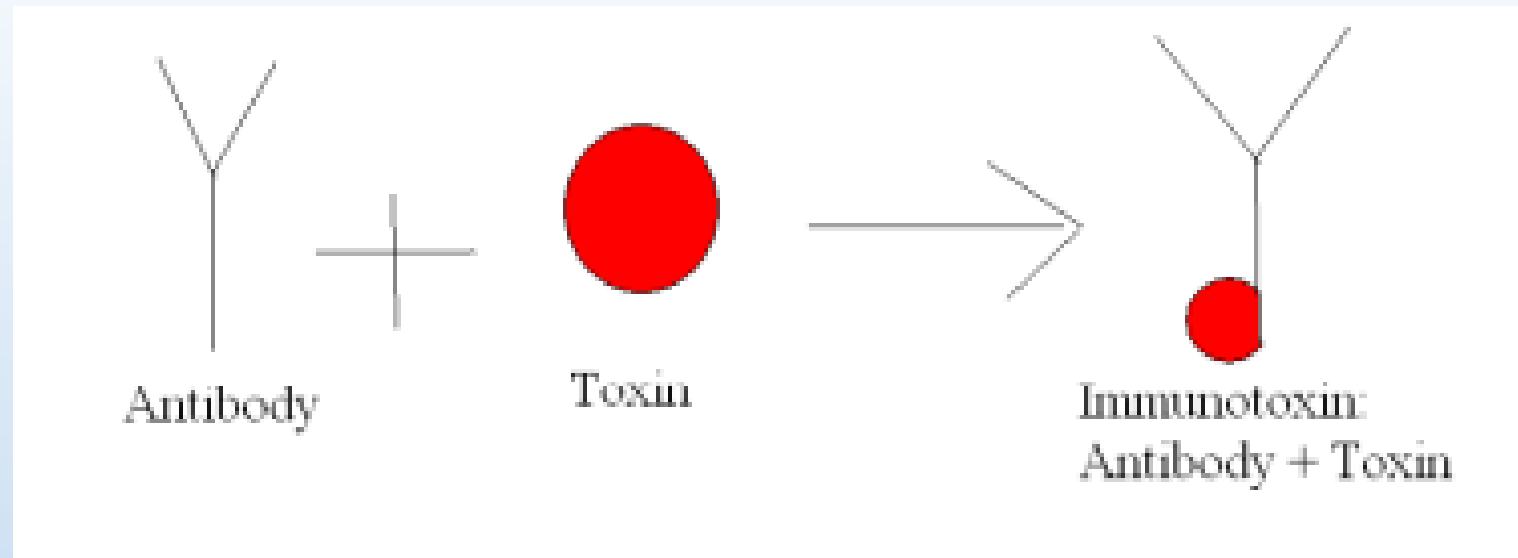
Drug Delivery Methods

- **Systems that deliver drugs to specific sites**
- **Sample Methods:**
 - Smart Drugs
 - Nanocomposite hydrogel systems
 - Magnetic Nanoparticles

Drug Delivery Methods

1• Smart drugs

- Attack specific antigens
- Immunotoxins that are protein in nature
- Consist of an antibody part and toxic part



1) Immunotoxin reaches a cell

The diagram shows a Y-shaped antibody structure with a red circle attached to its stem, positioned next to a red oval representing a cell.

2) Antibody part attaches to protein on cell membrane

The diagram shows a yellow circle representing a cell. A Y-shaped antibody structure with a red circle attached to its stem is shown attached to a small red dot on the cell's surface, representing a protein.

3) Immunotoxin enters cell by endocytosis and toxin destroys the cell

The diagram shows a cell membrane pinching off to form a vesicle. Inside the vesicle is the Y-shaped antibody structure with the red circle attached to its stem. The red circle is shown with a small dot, indicating it is the toxic part of the immunotoxin.

Drug Delivery Methods

2• Nanocomposite hydrogel systems

- Thermo therapeutic process العلاج الحراري
- Releases drugs that are encapsulated on heating يتحرر العلاج من داخل الغلاف بالحراره
- Gold nanoshells/nanoparticles can be used استخدام قشور النانوية الذهبية
- Ideal **wavelengths** of light are infra red i.e 800-1200nm

Drug Delivery Methods

3• Magnetic Nanoparticles

- Drugs are **bound** to magnetic nanoparticles
- Carry drugs to malignant sites with **magnetic fields**
- Release** the drugs by **enzymatic activity**

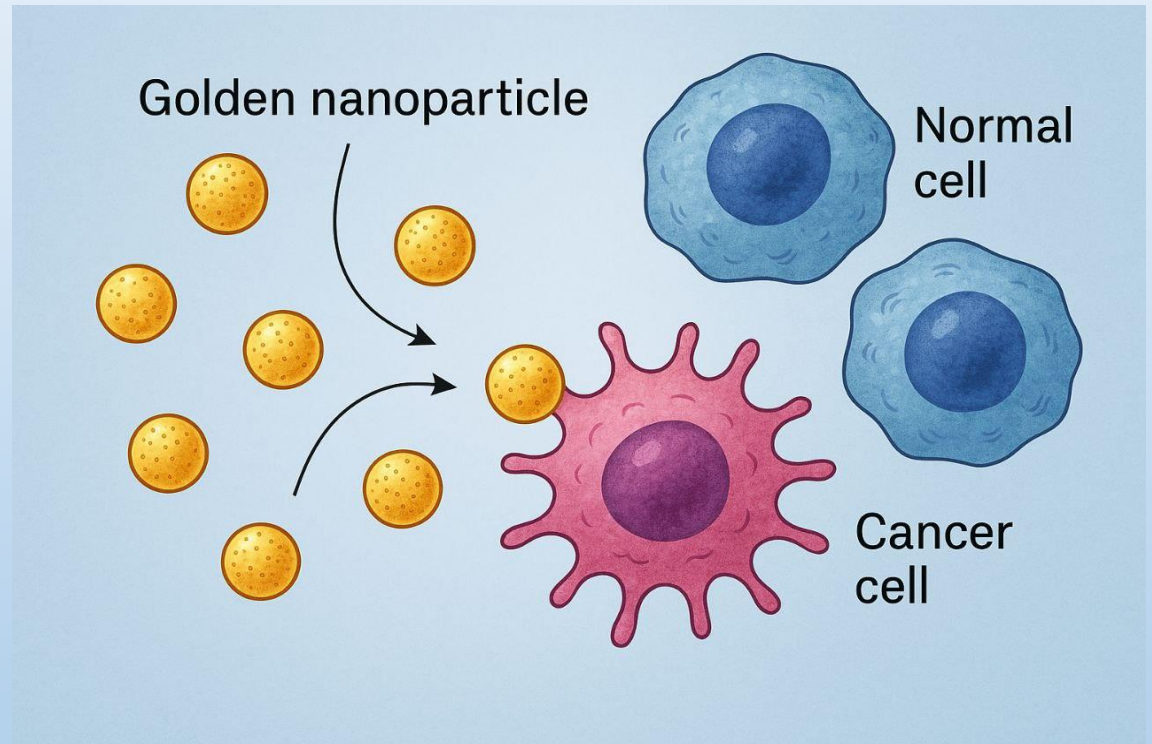
Disease Detection

- **Cancer/Virus Detection**

- Carbon Nanotubes
- Gold nanoparticles and Nanodots
- Nanowires

- **Gene Detection**

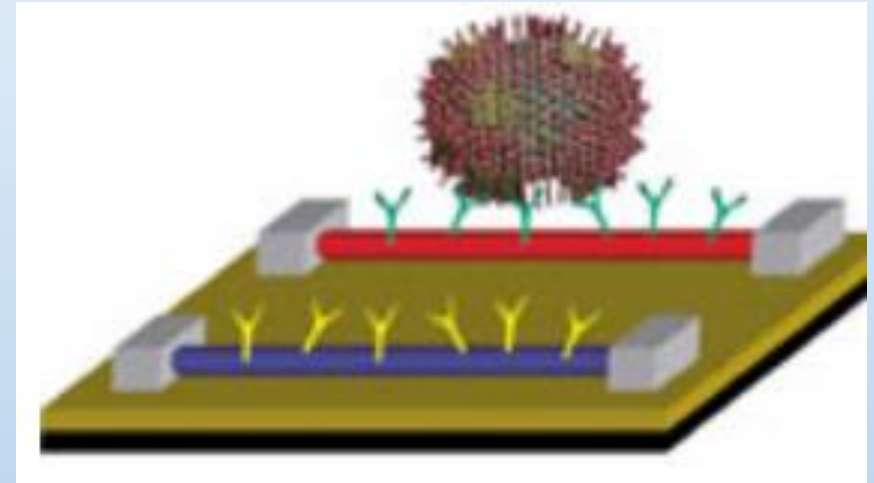
- Silicon nanowires



Cancer / Virus Detection

- **Silicon Nanowires**

- Similar in use to nanotubes
- Antibodies attached to wire
- Current changes measured
- Can be applied to cancer cells and viruses

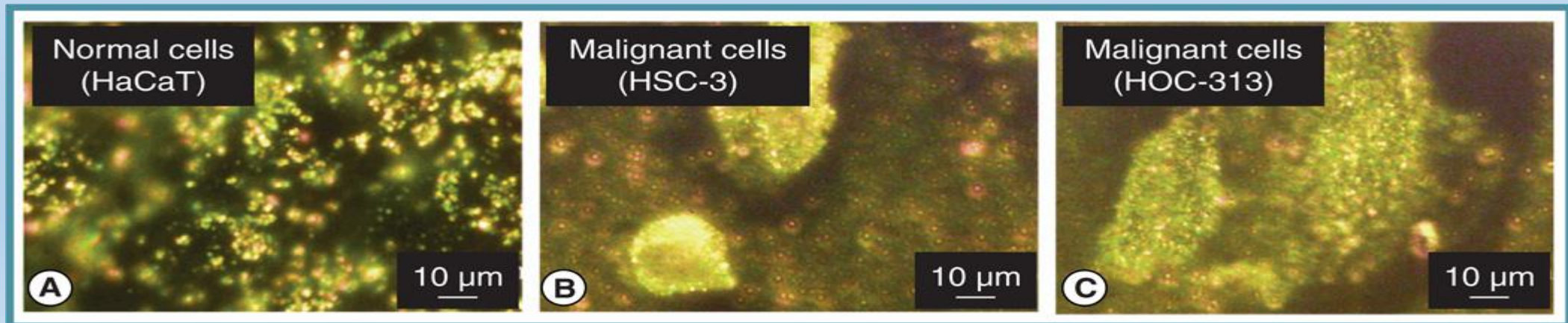
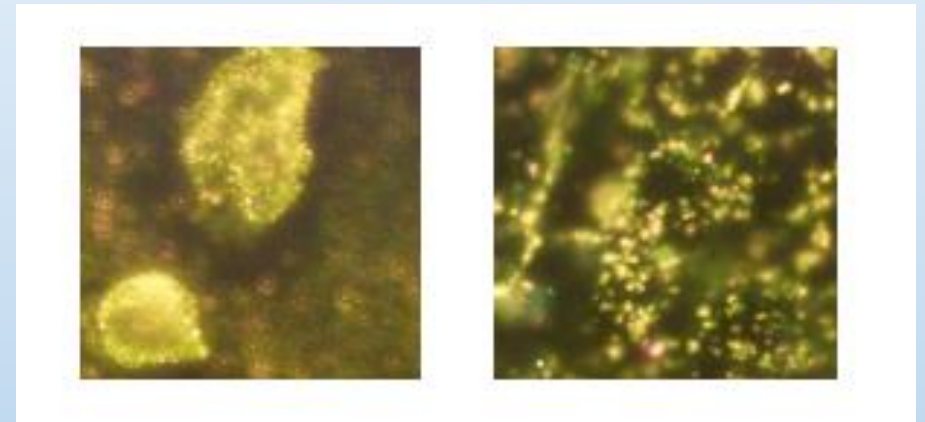


Cancer / Virus Detection

Q\ Explain the method of detecting cancer using nanoparticles ?

- Gold Nanoparticles and Nanodots

- Antibodies attached to nanoparticles
- Nanoparticle antibodies bind to cancer cells
- Colors reflected when light hits particles
- Shapes and sizes affect color



Imaging Techniques

- **Conventional Techniques:**
 - X-ray, MRI, Fluoroscopy
 - CAT scan
- **Limitations**
 - Limited detail
 - Difficult to track movement

