

## **Application of nanoparticles in medicine**

nanomedicine is defined as the application of nanotechnology to health, and hence is virtually synonymous with nanobiotechnology—considering health as applied biology.

quantitative detection devices for early diagnosis and for therapy monitoring will have a wide influence in patient management, in improving patient's quality of life and in lowering mortality rates, in diseases like cancer and Alzheimer's disease.

### **Drug delivery**

Over the last few decades, the applications of nanotechnology in medicine have been extensively explored in many medical areas, especially in drug delivery.

By loading drugs into nanoparticles through physical encapsulation, adsorption, or chemical conjugation.

The aim of drug delivery is to encapsulate a therapeutic agent to disguise its properties until it reaches its target and is released.

The encapsulation must therefore be able to respond to its environment.

### **NanoBiosensor**

An alternative approach is to develop sensors so tiny that they can be semipermanently implanted inside the body, where they can continuously monitor their surroundings.

New fields of nanotechnology is both components of the biosensor are excellent candidates for the application of nanotechnology.

The glucose sensor follows classic biosensing design: a recognition element to capture the analyte (glucose) mounted on a transducer that converts the presence of captured analyte into an electrical signal.

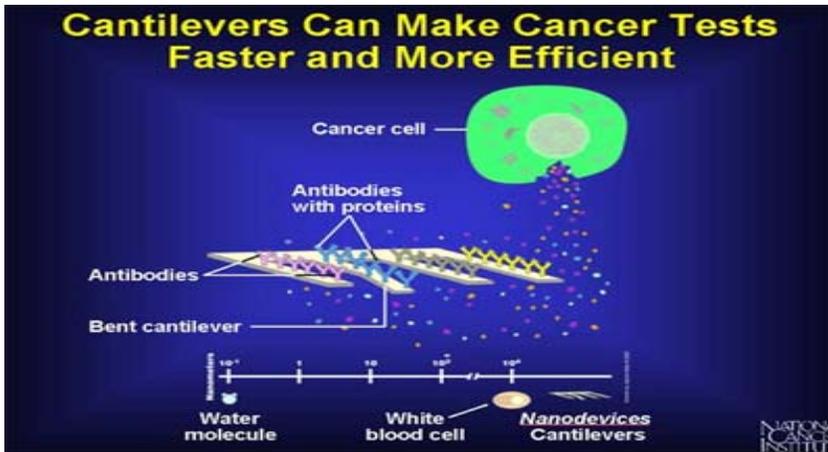
The recognition element is typically a biological molecule, the enzyme glucose oxidase, hence (if small enough) this device can be categorized as both nanobiotechnology and bionanotechnology.

### **Automated diagnosis**

Diagnosis is essentially a problem of pattern recognition: an object (in this case, the disease) must be inferred from a collection of features.

This is an example of indirect nanotechnology:

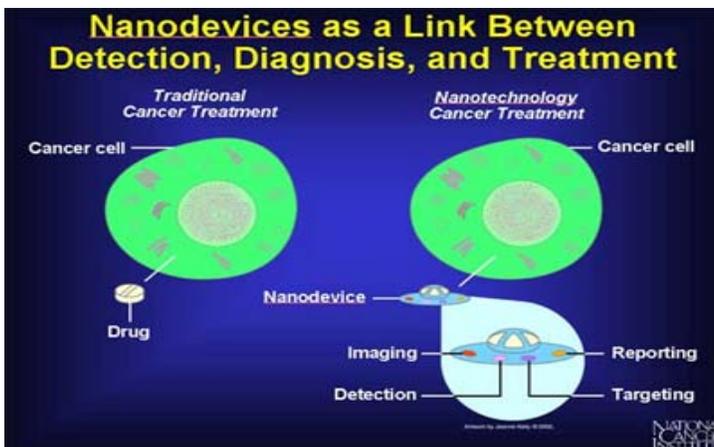
the practical possibility depends on the availability of extremely powerful processors, based on chips having the very high degree of integration enabled by nanoscale components on the chips.



### Custom synthesis

Small modifications to a drug would adapt its efficacy to other haplotype variants. Different drugs will certainly be needed to treat different groups of patients suffering from what is clinically considered to be the same disease.

The development of nanomixers would represent a key step in making custom synthesis of drugs for groups of patients, or even for individual patients, economically viable.



## □ **Nano robot**

Nano robotics is the technology of creating machines of robots at or close to the microscopic scale of a nanometer.

Using special bacterium-sized "assembler" devices, nanotechnology would permit on a programmable basis exact control of molecular structures that are not readily manipulated by natural molecular machines and molecular techniques presently available.

With nanotechnology, atoms will be specifically placed and connected, all at very rapid rates, in a fashion similar to processes found in living organisms.

### **Nanotechnology and Cancer**

Nanotechnology has the potential to enable cancer research and improve molecular imaging, early detection, prevention, and treatment of cancer.

**1-Molecular imaging and early detection:** Nanotechnology can have a clear-changing impact on the ability of clinicians to spot cancer in its earliest stages.

Detection of biomarkers using nanotechnology may help researchers with molecular imaging of malignant lesions and allow doctors to see cells and molecules that are undetectable through conventional imaging.

Additionally, photoluminescent nanoparticles may allow oncologists to discriminate between cancerous and healthy cells.

### **Nanomagnetics for Cancer Detection**

Earlier cancer detection

Development of nanomagnetic sensor

Use magnetic nanoparticles to 'tag' proteins indicative of cancer.

### **2-Prevention and control**

proteomics and bioinformatics will enable researchers to identify markers of cancer susceptibility and precancerous lesions.

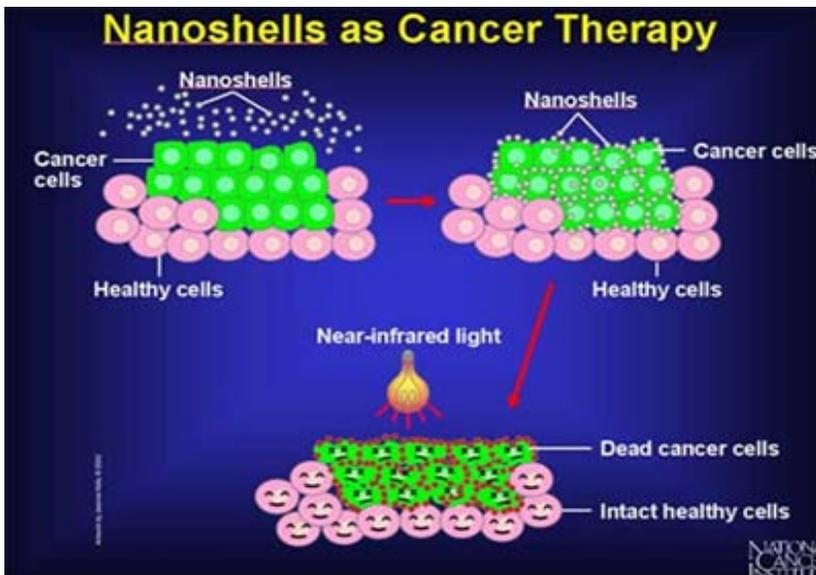
Nanotechnology will then be used to develop devices that indicate when those markers appear in the body and deliver agents to reverse premalignant changes or kill those cells that have the potential to become malignant.

### 3- Cancer treatment

nanoscale devices can contain both targeting agents and therapeutic payloads to produce high local levels of a given anticancer drug, particularly to tumors deep within the body that are difficult to access.

Nanoscale devices also develop new approaches to therapy, to combine a diagnostic or imaging agent with a drug, and to determine whether the drug acted on its target.

“Smart” nanotherapeutics may provide clinicians the ability to time the release of an anticancer drug or to deliver multiple drugs sequentially in a timed manner or at several locations in the body.



### Prostheses and implants

Nanotechnology also has applications in tissue engineering to help a person who needs new bones, teeth, or other tissues.

that techniques based on biological nanostructures are viable.

Biomimetic nanostructures start with a predefined nanochemical or physical structure.

A nanochemical structure may be an array of large reactive molecules attached to a surface, while a nanophysical structure may be a small crystal.

Researchers hope that by using these nanostructures as seed molecules or crystals, a material will keep growing by itself.

Other groups want to apply nanostructured materials in artificial sensory organs such as an electronic eye, ear, or nerve.

