



## ADVANCEMENT OF NANOTECHNOLOGY AND NANOPARTICLES IN DIAGNOSIS AND DRUG DELIVERY SYSTEM FOR CANCER TREATMENT

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### ABSTRACT

Imagine the chips embedded in the human body reporting every body movement and just waiting to strike at those nasty bacterial invaders, clothing smart enough to monitor out health and save us from environmental hazards, huge buildings and machines having the capability to repair and adjust themselves to the vagaries of the environment, or a regular wristwatch doubling up as a supercomputer. Thanks to nanotechnology, all of these wonders, and many more, are possible. Scientific discoveries and inventions have in fact propelled man to challenge new frontiers. And with his superior brain, man has been able to deliver most of these goodies. Nanotechnology is one such technological wonders that we are experiencing now. Scientists and engineers are working round the clock to achieve breakthroughs that could possibly be the answer to human misery. This paper mainly contains about Nanotechnology and its 'various' applications. And this tells about the history of Nanotechnology and its necessity. This also discusses how it will improve our lives and about the applications in wide range.

**KEY WORDS:** Nanotechnology, Nanotubes, Quantum dots, Cantilevers.

### INTRODUCTION

The design, characterization, production, and application of structures, devices, and systems by controlled manipulation of size and shape at the nanometer scale

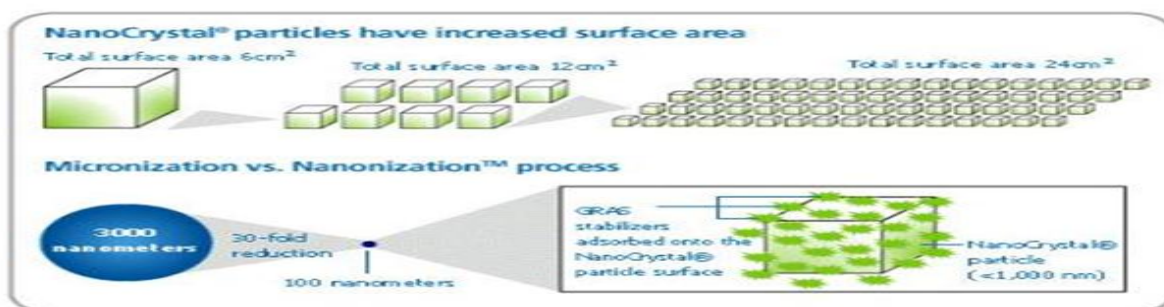
(atomic, molecular, and macromolecular scale) that produces structures, devices, and systems with at least one novel/superior characteristic or property.



### CHALLENGES

- ✓ Formulation stability and shelf life
- ✓ Prevention of drug from biological degradation
- ✓ Effective targeting
- ✓ Patient compliance
- ✓ Cost effectiveness
- ✓ Product life extension

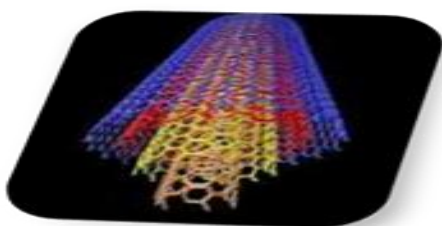
## PROPERTIES OF NANOMATERIAL



## NANODEVICES FOR DRUG DELIVERY

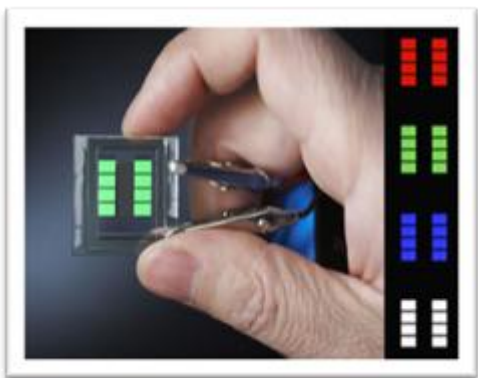
### Nanotubes

It helps to exactly pinpoint location of the changes at mutated regions associated with cancer.



### Quantum dots

These are tiny crystals that glow when these are stimulated by ultraviolet light. The latex beads filled with these crystals when stimulated by light, emit the color that lights up the sequence of interest.



### Cantilevers

Tiny bars anchored at one end can be engineered to bind to molecules associated with cancer. It would be possible to tell whether the cancer molecules are present and hence detect early events in the development of cancer cells.

### Nanorobots

Nanorobots could be used to tag the cancerous cells, so that the surgeon could efficiently and precisely remove the tumor.

**Liposomes:** Liposomes are self-assembling spherical closed colloidal structures composed of lipid bilayers that surround a central aqueous space.

**Nanoshells(NS):** Absorption of light by nanoshells creates an intense heat that is lethal to cells.

**Dendrimer:** Dendrimers have a tree-like structure with many branches where a variety of molecules, including drugs can be attached.

**Micelles:** They have a nano size, easy manipulation of surface chemistry, core functionalities, as well as ease of fabrication, making them suitable as carriers for encapsulation and delivery of water insoluble agents.

**Nanowire:** Nanowires can be coated with a probe such as an antibody that binds to a target protein. Proteins that bind to the antibody will change the nanowire's electrical conductance and this can be measured by a detector.

## ADVANTAGES

- Smaller Size
- Higher surface area
- Higher bioavailability
- Low dose required
- Uniform delivery of drug
- Can be administered via different routes
- Ability to incorporate hydrophilic and hydrophobic drug molecules
- Longer shelf-stability
- High Carrier Capacity
- Targeted delivery of drugs at cellular and nuclear level
- Longer clearance time
- Ability to sustain the release of drug

## DISADVANTAGE

It is very hard to determine dosage

## CONCLUSION

Different types of Cancer cells have unique properties that can be exploited by nanoparticles to target the Cancer cells. Nanoparticles can be used to detect/monitor (by utilizing or adding optic, magnetic, and fluorescent properties) and to treat Cancer (by Heat ablation, chemotherapy, gene therapy).

No human trials have been performed yet and human trials are still at least a few years away. (Unknown side effects, toxicity, difficulty in manufacturing and harmful byproducts, need for highly specific nanoparticles.

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