

# Term Paper

Roll no:201030068

Title of paper :- Nanoscience in diagnostics

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Year of publication:January,2011

Volume : Internet Journal of medical update,6

No. of Pages:15

Paper link :

<http://www.ajol.info/index.php/ijmu/article/viewFile/63971/51777>

Nanoscience is the science which deals with the study of atoms, molecules, and objects whose size is on the nanometer scale .Generally nanotechnology deals with size of the range 1-100 nm by convention.Nanoscience has wide range of applications in the areas of biotechnology,Disease detection,biosensors, data storage,nanofibres,carbontubes etc..This science integrates different areas like physics,chemistry,materialengineering,biology,computer Science.Quantum mechanical effects are important when dealing at such nano scales.

Quantam dots: quantum dots are semiconductors whose electronic characteristics are closely related to the size and shape of the individual crystal. Its applications are in single electron transistor, as quantam bits in quantam information processing.<sup>[2]</sup>

The invention of scanning tunneling microscope whose resolution can deal with individual atoms in matter. The imagery can be manipulated and redefined with the required characteristics.

Nano crystalline silver:

Burns are one of the most common and devastating forms of trauma. Patients with serious thermal injury require immediate specialized care in order to minimize morbidity and mortality.

Acticoat (with nano crystalline silver) dressing is an effective antimicrobial barrier dressing. The nanocrystalline coating of silver rapidly kills a broad spectrum of bacteria in as little as 30 minutes.<sup>[3]</sup>

The application of nanotechnology to biosensor design and fabrication promises to revolutionize diagnostics and therapy at the molecular and cellular level. The biosensor effectively works on the analyte with increased sensitivity and performance.

Single nucleotide polymorphism: It is a DNA sequence variation occurring when a single nucleotide – A, T, C or G in the genome differs between members of a biological species or paired chromosomes in an individual.<sup>[4]</sup>

Studying such variations in DNA sequences helps us to understand how humans are infected by pathogens, drugs, vaccines.

Nano science diagnostics fall into one of the following category.

- \* Diagnostic assay development
- \* Specialized reagent development
- \* Lab-on-chip diagnostic platforms
- \* Medical Electronics for Diagnostic devices
- \* Specialized Microbiology testing
- \* Anti-microbial testing
- \* Setup of diagnostic infrastructure<sup>[5]</sup>

## Cancer diagnosis:

Cancer cannot be confirmed by any single test. The patient usually undergoes predetermined tests and requires a thorough history and physical examination along with diagnostic testing. Many tests are needed to determine whether a person has cancer, or if another condition (such as an infection) is mimicking the symptoms of cancer. Nanoscale cantilevers microscopic, flexible beams resembling a row of diving boards - are built using semiconductor lithographic techniques. As a cancer cell secretes its molecular products, the antibodies coated on the cantilever fingers selectively bind to these secreted proteins. These antibodies have been designed to pick up one or more different, specific molecular expressions from a cancer cell. The physical properties of the cantilevers change as a result of the binding event. Nanoscale cantilevers can provide rapid and sensitive detection of cancer-related molecules.<sup>[6]</sup>

Gold nanoparticles:

Certain diseases can be diagnosed based on the interaction of colloidal gold and spinal fluids. The main advantage of gold nanoparticles is that they can be detected by following methods.

1) Fluorescence: It is illumination observed when a substance emits light when it absorbs electromagnetic radiation.

2) Raman Scattering: The incident photons can excite the vibrational modes of polarizable molecules. The emitted photons lower their energy by vibrational transition energies.

Gold and silver based nanoparticles DNA detection system is ten times more sensitive and 100,000-times more specific than current genomic detection systems.

Nano wires: The periodic arrays of magnetic nanowire arrays have the capacity of storing  $10^{12}$  Bits of information in a square inch area. They have rectifying properties similar to semiconductor junctions. Nanowires are the future hope for different nanoscale electrical, thermoelectrical, optical, magnetic, bio-medical and sensor device applications.

## References:

- 1) <http://en.wikipedia.org/wiki/Nanotechnology>
- 2) [http://en.wikipedia.org/wiki/Scanning tunneling microscope](http://en.wikipedia.org/wiki/Scanning_tunneling_microscope)
- 3) <http://www.health.wa.gov.au/circularsnew/attachments/446.pdf>
- 4) [http://en.wikipedia.org/wiki/Single-nucleotide polymorphism](http://en.wikipedia.org/wiki/Single-nucleotide_polymorphism)
- 5) <http://nanosciencediagnostics.com/Services.html>
- 6) [http://nano.cancer.gov/learn/understanding/nanotech\\_cantilevers.asp](http://nano.cancer.gov/learn/understanding/nanotech_cantilevers.asp)

Conclusion: The nanoscience is a more challenging field of science which submerges various disciplines and requires a collaborate research for a significant advancement in diagnosing dreadful diseases. Synthesizing such complex Nano particles to diagnose point of Care may glow up life on the earth.