

Small particles big wonders-Nanotechnology- A Review

Abstract

Man makes technology, but technology create wonders. Small ideas create big wonders, small things make world bigger. The background of the article is about the small particles-called Nano particles. The technology for these articles called- Nanotechnology. Coming into existence this technology deals with particles at atomic level. Nanotechnology have been into all fields, likewise it is into medicine, dentistry giving newer dimensions to the fields. The science and technology of diagnosing, treating and preventing of disease and traumatic injury, of relieving pain and of preserving and improving human health, using nano scaled- structured materials, biotechnology and genetic engineering and eventually complex molecular machine systems and nano robots.

Key Words

Nanotechnology, Nano Particles, Nanodentistry, Technology

Introduction

Nanotechnology is the science and technology of miniaturization. It primarily acts one billionth of a meter or one tenth thousandth the width of a human hair involving each individual atoms or molecules. The word NANO is derived from the greek word-meaning DWARF. It is basically engineering sense at a atomic or molecular level or scale. Thus extracting atomic or molecular scale of any material, and resulting with newer nano materials which are better in properties^[1].

Nanoproducts are basically created with sophisticated equipments that are capable of making materials into newer materials of nanoscale. i.e. each individual atoms combines with molecules or atoms done using equipments creating mechanical nanoscale objects with extraordinary properties.

Nano materials are capable of giving out light at different length depending on the size of the material. These materials at the miniature scale exhibit different property. i.e iron at nanodimension are no more magnetic, below 200 atoms of gold no more a metal and glistening. Taking advantage materials of high value properties like strength, lightness, flexibility are exhibited.

Mechanisms of nanotechnology, complies of three basic steps

1. Scientist must be able to manipulate individual atoms
2. Next step is to develop nanoscopic assemblers, that can be programmed

to manipulate atoms and molecules at will.

3. In order to create enough assemblers to build functional structure, some nanomachines called replicators, will be programmed to build more assemblers. Assemblers and replicators will work together like hands, to automatically construct products. Thus nanotechnology stands for the technology to program and manipulate matter with molecular precision and to scale it to 3-d product of arbitrary size^[2].

Many fields like electronics, information technologies, optics, now recently with medicine, dentistry etc have been introduced. Nanomedicine, the science and technology of diagnosing, treating and preventing of disease and traumatic injury, relieving pain and of preserving and improving human health.

History

1959 The late Nobel Prize winner Physicist Richard P. Feynman envisioned and speculated the potential of nano sized devices. He said at the annual meeting of the American Physical Society presenting a talk entitled "There is plenty of room at the bottom". Feynman suggested that these small nanomachines, nanorobots and nanodevices could be used to develop a wide range of atomically precise microscopic instrumentation and manufacturing tools. He concluded, "This is a development which I think cannot be avoided". Forty years ago, this talk astonished and created

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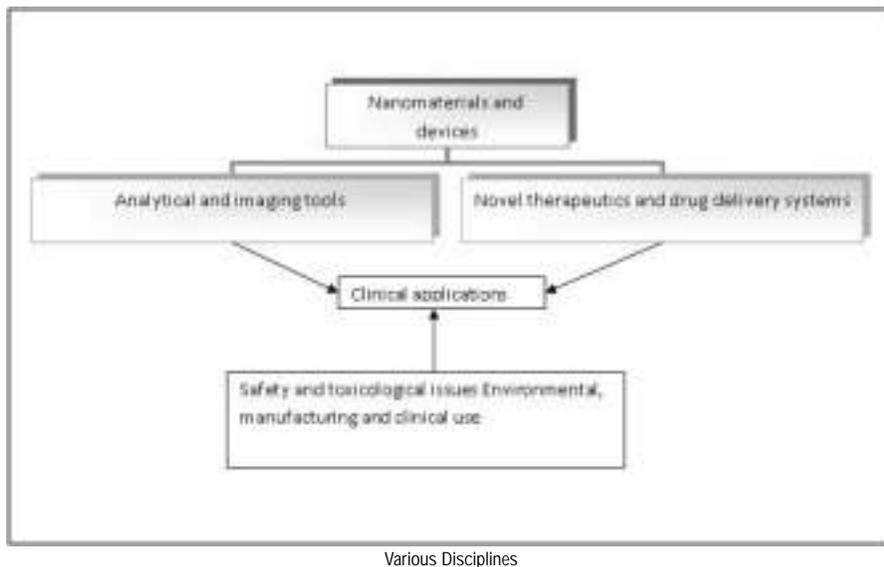
skepticism. However, since then, we have made remarkable progress towards realizing Feynman's vision. His vision remained undiscussed until the mid 80's, when the MIT educated engineer K Eric Drexler published 'Engines of creation' to popularize potentiality of molecular nanotechnology.

Chris Papadopoulos, nanotechie claimed that a carbon nanotube which is a poster boy of nanotechnology, which along with graphite tube can be used for applications for constructing high performance air crafts.

Ted Sergent Author of 'The dance of the molecules' elaborated that every matter are when tuned to a nanoscale can change enormously the function also. Eg: Guitar string when length and width changed the sound quality also changed.

Nanotechnology In Medicine

The science and technology of diagnosing, treating and preventing of disease and traumatic injury, of relieving pain and of preserving and improving human health, using nano scaled-structured materials, biotechnology and genetic engineering and eventually complex molecular machine systems and nano robots. This nanomedicine



perceived of five main sub disciplines with many overlapping common technical issues **Fig1**.

Regenerative Medicine

The tissue engineering methods and cell therapy and along with nanotechnology can manipulate cell proliferation and differentiation and the production and organization of extracellular matrices. Programmable nanorobotic devices would allow physicians to perform precise interventions at the cellular level, technology can mechanically reversing arteriosclerosis, improving respiratory capacity, enabling near instantaneous haemostasis, supplementing immune system, rewriting or replacing DNA sequences in cells, repairing brain damage and resolving gross cellular insults

Feynman offered the first known proposal for a nanorobotic surgical procedure to cure heart disease, "A friend of mine (Albert R. Hibbs) suggests a very interesting possibility for relatively small machines. He says that, although it is a very wild idea, it would be interesting in surgery if you could swallow the surgeon inside the blood vessel and it goes into the heart and looks around. It finds out which valve is the faulty and takes a little knife and slices it out, that we can manufacture an object that maneuvers at that level, other small machines might be permanently incorporated in the body to assist some inadequately functioning organs."

We know bacteria and viruses are very small and not visible through naked eyes, the nanoparticles are still smaller than these bacteria and viruses, then the action

by these nano particles are very effective than any particles on these infection causing organisms, because they can penetrate at very lower level, thus proving their ability and potentiality^[1]. Regular antibiotics coated with nanoparticles are still effective in its action. Genomics and proteomics are powerful diagnostic tool for detecting genetic predisposition of certain diseases, thus used in preventive medication for the individual for preventive measures. Lab-on-chip developed by Chris Backous analyses the genetic material in individual cells and can be done quickly for sequencing using blood, bone marrow etc^[3]. Nanocoatings also offer for slow release of asthma medication.

Nanosensors help in recognizing airborne rogue agents drugs exhaled through breath. Drugs like marijuana, concentration of alcohol, can be checked where in future totally replacing with urine testing.

Nanotechnology also in field of orthopaedics for osteogenesis and biomineralization showing its presence. There is ongoing attempts where nanoparticles are intend to use as medical robots for carrying drugs/drug delivery system. Respiratory cells, medical nanorobot is artificial red blood cell made of 18 billion precisely arranged atoms.

Nanogenerators, self powered implantable medical devices, sensors, and portable electronics by converting mechanical energy from body movement, muscle stretching, or water flow into electricity.

Nanodentistry, potential treatment opportunities may include in diagnostics, inducing local anesthesia, dentition

renaturalization, permanent hypersensitivity cure, complete orthodontic alignments, and not least continuous oral health maintenance^[4].

Inducing local anesthesia, a common procedure in dental practice. Dental professional will instill a colloidal suspension containing millions of active analgesic micron sized dental nanorobot particles on the patient gingivae. Soon after contact with the tissues they migrate into gingival sulcus and passing painlessly through lamina propria or the the 1-3 micron thick layer of loose tissue at the cementodintinal junction, then enters dentinal tubules to proceed further to reach the dental pulp, all guided by a combination of chemical gradients, temperature differentials, and even positional navigation, all under the control of the onboard nano computer as directed by the dentist^[5].

This impulse traffic supervised by dentist once installed in the pulp can shutdown all sensory at region and at any level that requires treatment, the selected tooth on imparting nanorobots is anaesthetized at the stage. After the procedures sensation all restored by retrieving the nanorobots from the same as it was instilled again under supervision by the dentist, thus controlling the nerve traffic. Thus new era of painless, no needles, selectivity and controllability of the analgesic effect, fast and reversible action, and most important side effects and complications are avoided.

Dental Applications And Research

Tooth Repair

A one step in the dental research is the whole replacement of biological analogous of the tooth called dentition replacement therapy. The therapy should be feasible with the economic and time constraints.

Dentin Hypersensitivity

Reconstructive dental nanorobots using native biological materials could selectively and precisely occlude specific tubules within minutes, offering patients a quick and permanent cure.

Tooth Repositioning

Orthodontic nanorobots could directly manipulate the periodontal tissues, allowing rapid and painless tooth straightening, rotating and vertical repositioning within minutes to hours.

Tooth Renaturalization

This procedure may become popular, providing perfect treatment methods for esthetic dentistry.

This trend may begin with patients who desire to have their 1) Old dental amalgams excavated and their teeth remanufactured with native biological materials, and 2) Full coronal renaturalisation procedures in which all fillings, crowns, and other 20th century modifications to the visible dentition are removed with the affected teeth remanufactured to become indistinguishable from original teeth^[5].

Dental Durability And Cosmetics

Both can be tremendously improved with replacing upper layers with covalently bonded artificial materials such as sapphire or diamond which have 20-100 times the hardness and failure strength of natural enamel or contemporary ceramic veneers and good biocompatibility. Nanorobotic dentifrice

delivered by mouthwash or toothpaste could patrol all supragingival and subgingival surfaces at least once a day metabolizing trapped organic mater into harmless and odorless vapors and performing continuous calculus debridement. These nanorobots for dentifrice called dentifrobots are also capable of identify and destroy pathogenic bacteria residing in plaque. These robots are also can be employed for halitosis prevention. Thus with this kind of protection at an early age will lead complete disappearance of dental caries and gingival diseases in near future.

Conclusion

Nanotechnology ,its just not a technology,it is the backbone for all reserach.Nano technology make its presence in medicine, dentistry,drug sciences adding more to the diagnosis,treatment, preventing diseases is more encouraging, The technology in pharmaceuticles also proved its importance.hence the research related to

this field will be always rewarding.

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