USES OF NANOROBOTICS TECHNOLOGY

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ABSTRACT

Nanorobotics is the technology of creating machines or robots at or close to the microscopic scale of a nanometer (10−9 meters). More specifically, nanorobotics refers to the still largely hypothetical nanotechnology engineering discipline of designing and building nanorobots, devices ranging in size from 0.1-10 micrometers and constructed of nanoscale or molecular components. As no artificial non-biological nanorobots have yet been created, they remain a hypothetical concept. The names nanobots, nanoids, nanites or nanomites also have been used to describe these hypothetical devices.

KEY WORDS

Nanorobot, approaches and Applications

INTRODUCTION

There are pressing needs in biological research today: the cost of getting new drugs to market is estimated to be 1$ billion by 2015, time to market has increased and failure rates remain shockingly high. Illnesses such as cancer, neurodegenerative diseases and cardiovascular diseases continue to ravage people around the world.

NANOROBOTICS THEORY:-

Since nanorobots would be microscopic in size, it would probably be necessary for very large numbers of them to work together to perform microscopic and macroscopic tasks. These nanorobot swarms, both those which are incapable of replication (as in utility fog) and those which are capable of unconstrained replication in the natural environment (as in grey goo and its less common variants), are found in many science fiction stories, such as the Borg nanoprobes in *Star Trek*. The word "nanobot" (also "nanite", "nanogene", or "nanoant") is often used to indicate this fictional context and is an informal or even pejorative term to refer to the engineering concept of nanorobots. The word nanorobot is the correct technical term in the nonfictional context of serious engineering studies.

APPROACHES

_ Biochip

The joint use of nanoelectronics, photolithography, and new biomaterials, can be considered as a possible way to enable the required manufacturing technology towards nanorobots for common medical applications, such as for surgical instrumentation, diagnosis and drug delivery. Indeed, this feasible approach towards manufacturing on nanotechnology is a practice currently in use from the electronics industry.[4] So, practical nanorobots should be integrated as nanoelectronics devices, which will allow tele-operation and advanced capabilities for medical instrumentation.

_ Nubots

Nubot is an abbreviation for "nucleic acid robots." Nubots are synthetic robotics devices at the nanoscale. Representative nubots include the several DNA walkers reported by Ned Seeman's group at NYU, Niles Pierce's group at Caltech, John Reif's group at Duke University, Chengde Mao's group at Purdue, and Andrew Turberfield's group at the University of Oxford.

_ Positional nanoassembly

Nanofactory Collaboration[6], founded by Robert Freitas and Ralph Merkle in 2000, is a focused ongoing effort involving 23 researchers from 10 organizations and 4 countries that is developing a practical research agenda specifically aimed at developing positionally-controlled diamond mechanosynthesis and a diamondoid nanofactory that would be capable of building diamondoid medical nanorobots.

_ Bacteria based

This approach proposes the use biological microorganisms, like Escherichia coli bacteria.Hence, the model uses a flagellum for propulsion purposes. The use of electromagnetic fields are normally applied to control the motion of this kind of biological integrated device, although his limited applications.

Open Technology

A document with a proposal on nanobiotech Development using open technology approaches has been addressed to the United Nations General Assembly. According to the document sent to UN, in the same way Linux and Open Source has in recent years accelerated the development of computer systems, a similar approach should benefit the society at large and accelerate nanorobotics development. The use of nanobiotechnology should be established as a human heritage for the coming generations, and developed as an open technology based on ethical practices for peaceful purposes. Open technology is stated as a fundamental key for such aim.

POTENTIAL APPLICATIONS

_ NANOROBOTICS IN DENTISTRY

The growing interest in the future of dental applications of nanotechnology is leading to the emergence of a new field called Nanodentistry. Nanorobots induce oral analgesia, Desensitize tooth, manipulate the tissue to re-align and straighten irregular set of teeth and to improve durability of teeth. Further it is explained that how nanorobots areused to do preventive, restorative, curative procedures.

Major tooth repair

Nanodental techniques involve many tissue engineering procedures for major tooth repair.

Mainly nanorobotics manufacture and installation of a biologically autologous whole replacement tooth that includes both mineral and cellular components which leads to complete dentition replacement therapy.

Tooth Durability and Appearance

Nanodentistry has given material that is nanostructured composite material, sapphire which increases tooth durability and appearance. Upper enamel layers are replaced by covalently bonded artificial material such as sapphire. This material has 100 to 200 times the hardness and failure strength than ceramic. Like enamel, sapphire is a some what susceptible to acid corrosion. Sapphire has best standard whitening sealant, cosmetic alternative. New restorative nano material to increase tooth durability is Nanocomposites. This is manufactured by nanoagglomerated discrete nanoparticles that are homogeneously distributed in resins or coatings to produce nanocomposites. The nanofiller include an aluminosilicate powder having a mean particle sizeof about 80nm and a 1:4ratio of alumina to silica. The nanofiller has a refractive index of 1.503, it has superior hardness, modulous of elasticity, translucency, esthetic appeal, excellent color density, high polish and 50% reduction in filling shrinkage. They are superior to conventional composites and blend with a natural tooth structure much better.

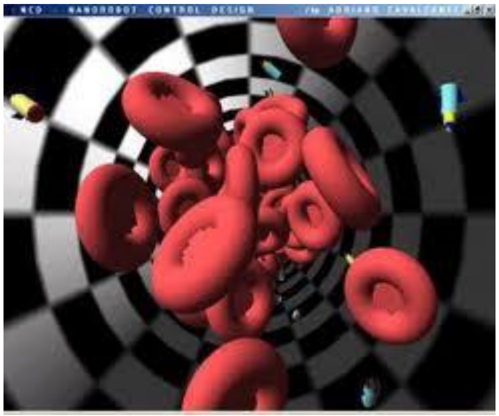
Nano Impression

Impression material is available with nanotechnology application. Nanofiller are integrated in the vinylpolysiloxanes, producing a unique addition siloxane impression material. The main advantage of material is it has better flow, improved hydrophilic properties hence fewer voids at margin and better model pouring, enhanced detail precision.

_ NANOMEDICINE

Potential applications for nanorobotics in medicine include early diagnosis and targeted drug delivery for cancer biomedical instrumentation, surgery, pharmacokinetics, monitoring of diabetes, and health care[9].In such plans, future medical nanotechnology is expected to employ nanorobots injected into the patient to perform treatment on a cellular level. Such nanorobots intended for use in medicine should be non-replicating, as replication would needlessly increase device complexity, reduce reliability, and interfere with the medical mission. Instead, medical nanorobots are posited to be manufactured in hypothetical, carefully controlled nanofactories in which nanoscale machines would be solidly integrated into a supposed desktop-scale machine that would build macroscopic products. The most detailed theoretical discussion of nanorobotics, including specific design issues such as sensing, power communication, navigation, manipulation, locomotion, and onboard computation, has been presented in the medical context of nanomedicine by Robert Freitas. Some of these discussions remain at the level of unbuildable generality and do not approach the level of detailed engineering.

NANOROBOTS IN CANCER DETECTION AND TREATMENT



Cancer can be successfully treated with current stages of medical technologies and therapy tools. However, a decisive factor to determine the chances for a patient with cancer to survive is: how earlier it was diagnosed; what means, if possible, a cancer should be detected at least before the metastasis has began. Another important aspect to achieve a successful treatment for patients, is thedevelopment of efficient targeted drug delivery to decrease the side effects from chemotherapy. Considering the properties of nanorobots to navigate as bloodborne devices, they can help on such extremely important aspects of cancer therapy. Nanorobots with embedded chemical biosensors can be used to perform detection of tumor cells in early
stages of development inside the patient's body. Integrated nanosensors can be utilized for such a task in order to find intensity of E-cadherin signals.Therefore a hardware architecture based on nanobioelectronics is described for the application of nanorobots for cancer therapy. Analyses and conclusions for the proposed model is obtained through real time 3D simulation.

ADVANTAGES

- The microscopic size of nanomachines translates into high operational speed
- Individual units require only a tiny amount of energy to operate
- Durability is another potential asset
- Nanites might last for centuries before breaking down

DISADVANTAGES

·The initial design cost is very high.
·The design of the nanorobot is a very complicated one.
·Electrical systems can create stray fields which may activate bioelectric-based molecular recognition systems in biology.
·Electrical nanorobots are susceptible to electrical interference from external sources such as rf or electric fields, EMP pulses, and stray fields from other in vivo electrical devices.
·Hard to Interface, Customize and Design, Complex
·Nanorobots can cause a brutal risk in thefield of terrorism. The terrorism and antigroups can make use of nanorobots as a new form of torturing the communities as nanotechnology also has the capability of destructing the human body at the molecular level.
·Privacy is the other potential risk involved with Nanorobots. As Nanorobots deals with the designing of compact and minute devices, there are chances for more eavesdropping than that already exists.

CONCLUSION

Nanotechnology as a diagnostic and treatment tool for patients with cancer and diabetes showed how actual developments innew manufacturing technologies are enabling innovative works which may help in constructing and employing nanorobots most effectively for biomedical problems. Nanorobots applied to medicine hold a wealth of promise from eradicating disease to reversing the aging process (wrinkles, loss of bone mass and age-related conditions are all treatable at the cellular level); nanorobots are also candidates for industrial applications. They will provide personalised treatments with improved efficacy and reduced side effects that are not available today. They will provide combined action – drugs marketed with diagnostics, imaging agents acting as drugs, surgery with instant diagnostic feedback.The advent of molecular nanotechnology will again expand enormously the effectiveness, comfort and speed of future medical treatments while at the same time significantly reducing their risk, cost, and invasiveness. This science might sound like a fiction now, but Nanorobotics has strong potential to revolutionize healthcare, to treat disease in future. It opens up new ways for vast, abundant research work. Nanotechnology will change health care and human life more profoundly than other developments. Consequently they will change the shape of the industry, broadening the product development and marketing interactions between Pharma, Biotech, Diagnostic and Healthcare industries. Future healthcare will make use of sensitive new diagnostics for an improved personal risk assessment.

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