International Journal of Computer Science and Software Engineering (IJCSSE), Volume 5, Issue 9, September 2016
ISSN (Online): 2409-4285 www.IJCSSE.org Page: 218-222

Nanomedicine: Overview, Problem, Solution and Future

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ABSTRACT

Over the years the field of nanotechnology has gained tremendous ground, it has really begun developing into more progressive forms in medical research. It is expected that nanotechnology can have an vast optimistic impact on human health. Pertinent processes of living organisms take place essentially at nanoscale, basic biological divisions like DNA, proteins or cell membranes are of this aspect Nanomedicine benefits greatly from expansions in nanotechnology and because of this a wide variety of medicines and medical procedures have become accessible predicting that the future holds more advancement in this field. Mononuclear phagocytes, dendritic cells, endothelial cells, and cancers (tumor cells, as well as tumor neovasculature) are key targets.
The use of nanoscale technology in medicine is one of the latest and most exhilarating forms of science that is still in its infancy. From the name, it is obvious that nanotechnology focuses on very small things including atoms and molecular objects. The assumption is that once we know the littlest parts of life we will have the capacity to comprehend everything that is going on the globe, yet it has been involved towards enhancing mechanical development and, sadly, the potential dangers of nanomedicine have remained inadequately evaluated. Research into the balanced delivery and targeting of pharmaceutical, medical, and diagnostic agents is at the front line of projects in nanomedicine. These involve the recognition of the cells and receptor connected to precise medical circumstances and selection of the suitable nanocarriers to attain the necessary responses while minimizing the side effects. The prospective and the dangers of nanomedicine need to be amenably researched, analyzed, disputed and delimited. This paper is focused on the problems, precautions, as well as the future of nanomedicine. However, it is important to note that nanotechnology also raises important social issues and ethical challenges. Proponents suggest that a nanomedicine-enabled “revolution” will bring far-reaching changes to economic, social and environmental relations. Yet to date, there has been a shortage of life-threatening discussion about civic interest issues associated with the predicted nanomedicine “revolution” and in specific what role civil society should have in decision making. This research was conducted using information provided by textbooks on nanomedicine, nanotechnology journals and books, journals on how nanotechnology in medicine work and its history and web pages about nanotechnology and nanomedicine.

Keywords: *Nanotechnology, Nanomedicine, Atoms, Molecules, Risks, Revolution.*

1. INTRODUCTION

Nanotechnology ("nanotech") is the exploitation of matter on an atomic, molecular, and super molecular scale. The most primitive, widespread depiction of nanotechnology referred to the particular technological goal of precisely manipulating atoms and molecules for fabrication of macroscale products, also now referred to as molecular nanotechnology [1]. Nanomedicines have been contributed to the targeted delivery of drugs to cure a great diversity of diseases. Nanomedicine ranges from the therapeutic exploitations of nanomaterials and biological devices, to nanoelectronic biosensors, and even conceivable future uses of sub-atomic nanotechnology, for example, organic machines. Current issues for nanomedicine include understanding the issues identified with lethality and biological effect of nanoscale (materials whose structure is on the size of nanometers, i.e. billionths of a meter). A significant advantage of some nanomedicines is the capability to devise a drug without using dose-limiting toxic recipients present in current marketed formulations, often improving acceptability and allowing more drugs to be given to patients to cure infections or diseases.
Nanomedicine tries to convey a profitable arrangement of examination instruments and clinically valuable gadgets sooner rather than later. The National Nanotechnology Initiative expects new ad applications in the pharmaceutical business that may incorporate propelled drug conveyance frameworks, new treatments, and in vivo imaging. Nanomedicine examination is getting subsidizing from the US National Institutes of Health, incorporating the financing in 2005 of a five-year plan to mainly on nanomedicine.

2. LITERATURE REVIEW

Richard P. Feynman in his remarkably prescient 1959 talk ‘‘There’s Plenty of Room at the Bottom” proposed employing machine tools to make smaller machine tools, these are to be used in turn to make still smaller machine tools, and so on all the way down little knife to perform medical operations. His remarks were followed a decade later by Drexler who recommended that it may be conceivable to build, from organic parts, nanodevices that could examine the cells of individual and portable repairs inside them. This was taken after 10 years by Drexler's fundamental specialized book establishing the frameworks for atomic machine frameworks also, sub-atomic assembling, and subsequently by freitas’ technical books on medical nanorobotics.

Robert A. Freitas, Jr. (2005) in his article “Current Status of Nanomedicine and Medical Nanorobotics” suggested that the idea of placing autonomous self-powered nanorobots within the human body may appear somewhat odd, but actually the human body already abounds with such nanodevices. He posited that our bodies likewise keep up a populace of more than a trillion motile organic nanodevices called fibroblasts and white cells, such as, neutrophils and lymphocytes, every measuring maybe 10 microns in size. These useful normal nanorobots are always slithering around within us, repairing damaged tissues, attacking invading microorganisms, and getting together alien particles and transporting them to different organs for removal from the body” projected the Daniel Branton’s team research work at Harvard University whose research is directed toward reliably fabricating pores with specific diameters and repeatable geometries at high precision, understanding the unzipping of double-stranded DNA as one strand is pulled through the pore and the recognition of folded DNA molecules passing through the pore, experiments with new 3 10 nm silicon-nitride nanopores, and investigating the benefits of adding electrically conducting electrodes to pores to improve longitudinal resolution "possibly to the single-base level for DNA".

Günter Oberdörster (2005) in his paper on “Biokinetics and the effect of nanoparticles” suggested that there is a lot of hype surrounding the promises of nanomedicine. He opined that many things look very promising, but until now there are only animal studies to show a proof of principle, but even though he was apprehensive concerning security issues related to nanomedicine, he has self-assurance in the regulatory process. But, he cautioned, that testing must be comprehensive. He added that if toxicity testing is only done in healthy organisms (animal data or controlled clinical studies), adverse effects may still occur in susceptible parts of the population which would require more specific testing.

Other than the obvious potential risks to patients, there are other toxicological risks associated with nanomedicine. Concerns over the disposal of nanowaste and environmental contamination from the manufacture of nanomedical devices and materials are valid. This study examines in detail, the different methodologies that have been used to investigate this nanotechnology.

3. MEDICAL APPLICATIONS OF NANOTECHNOLOGY

Nanotechnology offers fundamental novel tools with a huge impact on various areas in medical technology. The impending medical applications are mainly in Surgery (Wound dressings and textiles with antibacterial and fungicidal activity), Tissue Engineering and in diagnostics (disease diagnosis and imaging), monitoring, the accessibility of more robust and improved prosthetics, and new drug-delivery systems for potentially harmful drugs. Nanomedicine is being utilized in developing nations to help treat disease, infections and anticipate wellbeing issues. Nanomedicine additionally has a vital part in the quick creating field of Tissue Engineering. At the point when outlining platforms, scientists endeavor to emulate the nanoscale components of a Cell's microenvironment to direct its separation down an appropriate genealogy. In the comprehensive sake of aggregate knowledge of the human bodyy and in Medical Robotics (medical nanorobots are nano devices that are very small in nanodimentions, to repair or detect targeted damages, infections and disease cells).

4. PROBLEMS OR ISSUES WITH NANOMEDICINE

The major ways through which an individual may be inadvertently exposed to nanomaterials are through inhalation, ingestion and dermal exposure, with possibility for further translocation to secondary organs. For instance, dental procedures may involve the milling, drilling, grinding and polishing of applied medical materials containing nanomaterials, which may then be inhaled inadvertently, make contact with skin or be ingested.

Workers exposure to nanomaterials in manufacturing industries or factories is of explicit fret as specialists might be uncovered at much more elevated amounts than the overall population and on an extra reliable assertion. Personnel may experience nanoexposure in the invention, manufacturing, packaging or transport of products that contain nanomaterials, or in cleaning and maintenance work. Environmental exposure to nanomaterials is liable to rise as the industry expands.

Every waste product that has nanomaterials will be highly open into the environment from households and industry, and goods containing nanomaterials will disposed of in landfill. Even nanomaterials that are "fixed" in products, for example lights, car parts or building equipment, may enter waste streams as "free" nanomaterials following product disposal or recycling. Large quantities of nanomaterials may also be released into the environment purposely, for example in a nanomedicine industrial unit. There is absolute lack of data intended for existing human and exposure to manufactured Nanomaterials in the environment.

The harmful effect of inhaling ultrafine particles is well recognized. For instance, the industrialized pollutant carbon black is acknowledged to cause cancer in the course of breathing in rats and under positive conditions in humans.

Related concerns have been questioned in relation to definite carbon nanotubes. The most important apprehension is whether nanoparticles can cross the air-blood barrier in the lungs and expand to the rest of the body. There is evidence that nanomaterials can progress from the lung into the liver, spleen, heart and probably other organs. Entrée through the olfactory bulb has also been reported. An additional possible exposure way in humans is through contact with the skin. Entrance by fullerenes and quantum dots has been reported, dependent on size and surface coatings. Gastrointestinal absorption as well as movement from there into the blood stream has also been verified. Nanomaterials have been seen to mount up in stumpy concentrations in the liver, spleen, heart and the brain.

Long ago, aside produced nano-sized particles, there have been a by-product of forest fires and volcanoes, and high-temperature industrial processes including combustion, welding, and harsh sounding and instrument combustion. The widespread evaluate of incredible nanomaterials in regular shopper, scientific and concerning plants products will dramatically rebound our discovery to particles in this scope range. learning of the nix brute force impacts of confession to as a matter of fact close to the ground particles in air pollution, clouded and silica planet, welding fumes and concrete is informing the rising employment of nanotoxicology, but much more research is desirable to appreciate the health risks of nanomaterials previously used in hundreds of products globally. The toxicity of nanomaterials is periodic linked to their extremely small size. Smaller particles have a preferably reactive surface area than larger particles, are more chemically reactive and serve greater numbers of reactive oxygen place that include off the top of head radicals. Reactive oxygen species concept has been found in a varied series of Nanomaterials including imitates fullerenes; imitate nanotubes and native mineral libelous earth oxides. This is one of the head mechanisms of nanoparticle toxicity; it may consequently lead to oxidative uphold, milk crust, and resulting to damage in protein structure, membranes and DNA.

During the life cycle of nanoparticles there are different ways in which an individual can be exposed to them, including those during production, processing and distribution, use and application, storage, and waste disposal and recycling. If extended term stability of a nanoparticle is verified, this aim within one area has consequences: for the community and for potentially vulnerable subpopulations, including the newborn, the adolescent, and the very old, too that connected by all of the acknowledgment of personnel. Also the role of predisposition factors of an individual, for example their genetic background and pre-existing allergies such as asthma, cardiovascular disease and invulnerable diseases needs to be taken into account.

The tremendously little size of nanomaterials also means that they are much more willingly in use separately human body than larger sized particles. Nanomaterials are able to cross biological membranes and win cells, tissues and organs that micro particles normally cannot. Nanomaterials can gain entrée to the blood stream through ingesting and inhaling. At least some nanomaterials can break in the raw, especially if skin is broken.

Nanoparticles of titanium dioxide and silver are utilized in rich numbers of toothpastes, soaps, sunscreens, cosmetics, personal care and cuisine products. Titanium dioxide is a recognized photo catalyst. But even in the lack of UV light and at small doses, in a test tube experiment 20nm nanoparticles of titanium dioxide caused total obliteration of super coiled DNA. Furthermore in the lack of UV in another test tube experiment titanium dioxide created reactive oxygen species in know-it-all immune cells. Pilot word from confirm tube experiments disclose nanoparticle titanium dioxide exposure negatively up to one neck in cellular function and caused death of brain immune cells after 24 hours exposure. The possible way for nanomaterials in sunscreens and cosmetics to demonstrate in besiege is made better as work of reactive oxygen position and automatic radicals rises with exposure to UV light. Photo-activated nanoparticle titanium dioxide has been established to cause oxidative impairment to DNA in cultured cro magnums man fibroblasts. In test tube experiments, photo-activated titanium dioxide nanoparticles were lethal to skin fibroblasts and nucleic acids and to human colon carcinoma cells.

Carbon fullerenes ("buckyballs"), presently used in the production of some face creams and moisturizers, have been demonstrated to cause brain dent in fish, exterminate water fleas and have bactericidal properties. Experiments have been able establish that even low

levels of exposure to water soluble fullerenes are poisonous to human liver cells, carcinoma cells and skin connective tissue. This is cause for serious concerns given the capacity of Fullerene-
based amino acid to enter human cells and to localize within cell nuclei and harm human skin cells.
These are possible risks which need to be cautiously looked into, which has not been completed.

5. PRECAUTIONARY APPROACH TO MANAGE NANOMEDICINE

It would be appropriate to create 'Good Clinical Practice' (GCP) guiding principle that may be useful to the clinical development of explicit families of drug delivery systems or therapeutics. The precautionary guidelines to manage nanomedicine are as follows:

- Regular evaluation of nanomaterials as new chemicals.
- Public participation in decision-making regarding nanomedicine's overture.
- Restriction of the medical use of nano-silver to crucial applications and patients.
- Create networks of superiority in the sub-disciplines of Nanomedicine by means of organization of familiar principal edge researchers and companies
- Compulsory safety testing of nanomaterials proceeding to their inclusion in mercantile products i.e. the call for safety testing of nanoproducts before discharging these products into the market.
- Treatment of nanomaterials in factories and research laboratories as hazardous requirement for product labels to specify the presence of contrived nano materials/particles i.e. obligatory labelling of all nanomedicine products, so patients and healthcare workers can be conversant about the use of such products.
- The complete lifecycle (including the manufacture, transport, use, environmental impacts and end-of-life management) of nanomaterials needs to be addressed when considering the potential hazard of nanomedicine. For instance it is important to:
  Develop guiding principle to consider end-of-life management options for nanomaterials that include:
    – The possible inherent toxicity of nanomedicine waste and the dangerous effects of ignition emissions.
    – Prediction of the fate and transport of nanowastes in the environment upon disposal.
  – Put off the exploit of nano-based cleaners and disinfectants in hospitals. Nano-based cleaners may act as strong antiseptic but may also worsen antibacterial conflict. They should be utilized as a part of the connection of treating genuine health conditions.
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6. THE FUTURE OF NANOMEDICINE

Nanorobots: They have the capability to perform the following functions:

- Repair cells, tissue, and even organs.
- Enter cells and correct DNA or a deficiency.
- Break up blood clots or even kidney stones.
- Carry minuscule cameras and be powered from the electrolytes in the blood.

The future of Nanomedicine beyond doubt is one of the most thrilling aspects of research and has the prospect to deliver much compensation for the diagnosis and cure of many health troubles. Theranostics may feasibly later on predict dangers of getting an illness, analyze infection, help in stratifying patients, and direct remedial reactions and henceforth encourage prior and more productive treatment. Extensive exploitation of a system in which all medical data of a person, such as medical history, test results, and prescribed medications, are stored on a single chip and general use of early diagnosis methods based on blood tests for roughly all cancers and development of treatment methods capable of completely curing infections, diseases and allergies such as asthma. But this method also raises moral and ethical issues surrounding the initial point of "disease" and the administration of treatments before "sickness" begins. A number of the resources used are also extremely very toxic and there are risks of environmental pollution.
In the coming years and decades nanomedicine will conceivably turn into the beginning stage for all medical projects. Nanomedicine still in its infancy now so no one truly knows to what extent the development and improvement is going to take, the uplifting news is that there are a large number of specialists, organizations, and financial specialists out there prepared and willing to propel the exploration at whatever point they have the open door so it truly is just a short time before nanomedicine truly takes off.

7. CONCLUSION

As of now, an assortment of examination is being performed on nanomedical gadgets, a few modern items exist at this moment. The conceivable outcomes are everlasting, however will require some investment to create. So, there is essentially no limit to what should be possible with nanomedicine, yet it is just a short time before most important revolutionary research is accomplished. A few experts just have next to zero clues what to foresee as the potential verifiably are continuous and that is precisely what makes nanotechnology so fantastically energizing. Nanotechnology may have the capability to make present medical applications economical and simple; the vision is to improve health by enhancing the safety of nanosystems and nanodevices to use in places like the general practitioner's office and residential area. In addition, early diagnosis, monitoring, cancer treatment and smallest invasive treatments for heart disease, diabetes and other diseases are expected

On the other hand, there are various reasons to think about that new risk may arise to affect human health and the environs. The foundation for these concerns lies with the diverse properties and components of nanomaterials, the many gaps in facts and information, the lack of methodologies and tools for evaluation and administration of any risks, and the conclusion is that the preventative measure protects human health and the environs.

Hence, in examination of the possible risks of nanomaterials to human health and the atmosphere and the lack of awareness, defensive action should be taken and the deterrent principle must be functional. Without a comprehensible knowledge of the risks concerned with human health and the environs, nanoproducts should not be endorsed into the marketplace. This is predominantly vital for dispersive applications like disinfectants, which do not have a visibly established medical benefit over and above other products.

The risks will of course be dependent on the specific materials in use and on the exposure Routes, but cannot be dismissed while they are not clearly identified. Thus, Because of this Law makers have a vital role to play in shielding human health and the environment from the danger of exposure to nanomedicine.

8. RECOMMENDATION FOR FURTHER STUDIES

This paper has been able give a concise overview about the problems, precautions, as well as the future of nanomedicine. Nanomedicine is a large industry, as it continues to develop; it is anticipated to have an important impact on the economy and has done more good than harm in recent years. However, there should be further research into the effect of nano-robots in the human body, further studies could widen the scope and even the existing treatment, handling, stockpiling and transfer hones for bulk materials and their suitability for the relevant nano-form and also evaluation of whether nano-waste should be scheduled as hazardous waste and prioritise investigation to tackle security measures as regards the risks of nanomedicine products in human health and the environment.

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