DOWNLOAD PDF NANOTECHNOLOGY IN CANCER TREATMENT SEMINAR REPORT

Chapter 1 : Nanotechnology (Seminar) - [DOC Document]

The use of nanotechnology in the treatment of cancer offers some exciting possibilities, including the possibility of destroying cancer tumors with minimal damage to healthy tissues and organs, as well as the detection and removal of cancer cells before they form tumors.

Already, NCI programs have supported research on novel nanodevices capable of one or more clinically important functions, including detecting cancer at its earliest stages, pinpointing its location within the body, delivering anticancer drugs specifically to malignant cells, and determining if these drugs are killing malignant cells. As these nanodevices are evaluated in clinical trials, researchers envision that nanotechnology will serve as multifunctional tools that will not only be used with any number of diagnostic and therapeutic agents, but will change the very foundations of cancer diagnosis, treatment, and prevention. The vast knowledge of cancer genomics and proteomics emerging as a result of the Human Genome Project is providing critically important details of how cancer develops, which, in turn, creates new opportunities to attack the molecular underpinnings of cancer. However, scientists lack the technological innovations to turn promising molecular discoveries into benefits for cancer patients. To harness the potential of nanotechnology in cancer, NCI is seeking broad scientific input to provide direction to research and engineering applications. Drafted with input from experts in both cancer research and nanotechnology, the Plan see pages 4 and 5 will guide NCI in supporting the interdisciplinary efforts needed to turn the promise of nanotechnology and the postgenomics revolution in knowledge into dramatic gains in our ability to diagnose, treat, and prevent cancer. Though this quest is near its beginning, the following pages highlight some of the significant advances that have already occurred from bridging the interface between modern molecular biology and nanotechnology. This latter facility will develop important standards for nanotechnological constructs and devices that will enable researchers to develop cross-functional platforms that will serve multiple purposes. The laboratory will be a centralized characterization laboratory capable of generating technical data that will assist researchers in choosing which of the many promising nanoscale devices they might want to use for a particular clinical or research application. In addition, this new laboratory will facilitate the development of data to support regulatory sciences for the translation of nanotechnology into clinical applications. The six major challenge areas of emphasis include: Nanotechnology refers to the interactions of cellular and molecular components and engineered materialsâ€"typically clusters of atoms, molecules, and molecular fragmentsâ€"at the most elemental level of biology. Such nanoscale objectsâ€"typically, though not exclusively, with dimensions smaller than nanometersâ€"can be useful by themselves or as part of larger devices containing multiple nanoscale objects. At the nanoscale, the physical, chemical, and biological properties of materials differ fundamentally and often unexpectedly from those of the corresponding bulk material because the quantum mechanical properties of atomic interactions are influenced by material variations on the nanometer scale. Nanoscale devices and nanoscale components of larger devices are of the same size as biological entities. They are smaller than human cells 10, to 20, nanometers in diameter and organelles and similar in size to large biological macromolecules such as enzymes and receptorsâ€"hemoglobin, for example, is approximately 5 nm in diameter, while the lipid bilayer surrounding cells is on the order of 6 nm thick. Nanoscale devices smaller than 50 nanometers can easily enter most cells, while those smaller than 20 nanometers can transit out of blood vessels. As a result, nanoscale devices can readily interact with biomolecules on both the cell surface and within the cell, often in ways that do not alter the behavior and biochemical properties of those molecules. From a scientific viewpoint, the actual construction and characterization of nanoscale devices may contribute to understanding carcinogenesis. Noninvasive access to the interior of a living cell affords the opportunity for unprecedented gains on both clinical and basic research frontiers. The ability to simultaneously interact with multiple critical proteins and nucleic acids at the molecular scale should provide better understanding of the complex regulatory and signaling networks that govern the behavior of cells in their normal state and as they undergo malignant transformation. Nanotechnology Noninvasive access to the interior of a living cell affords the opportunity for unprecedented gains on both clinical and basic research frontiers.

Chapter 2 : Nanotechnology in Cancer Treatment

Nano Technology in Cancer Treatment Seminar Abstract. To meet the goal of eliminating death and suffering from cancer, Nanotechnology cancer diagnosis, treatment, and prevention was founded.

Neutron capture therapy of cancer Fig. Eddie Merino is a chemist with research interests at the junction between chemistry and biology. Boron neutron capture therapy BNCT is a high-linear energy transfer LET radiotherapy exploitable for cancer treatment, based on the nuclear capture and fission reactions that occur when 10B is irradiated with thermal neutrons to produce an alpha particle 4He and a 7Li nucleus [74]. Discovery and naming The first mention of boron compounds is found in a book by Persian alchemist Rhazes c. The Department of Materials Science and Engineering is a university-wide, highly-interdisciplinary graduate program with 8 core materials faculty and approximately 25 affiliated faculty spanning from physics and chemistry to electrical, mechanical, aerospace, civil and biomedical engineering. This presentation will discuss the thermodynamics of mercury in hydrocarbons. Radon was used in some hospitals to treat tumours by sealing the gas in minute tubes, and implanting these into the tumour, treating the disease in situ. Nanomaterial Applications in Coatings Prof. Nuclear medicine and radiology are the whole of medical techniques that involve radiation or radioactivity to diagnose, treat and prevent disease. What is the most important technological advance in medicinal chemistry this year? What is the role DNA polymerases plan in maintaining the integrity of genetic information? What are the possibilities of targeting DNA polmerases with pharmaceutical agents in cancer therapies? In recent years, metal nanoparticles have showed great application prospect in the field of biological imaging, cancer diagnosis and treatment due to its unique optical scattering and optical Understanding the chemistry of mercury in hydrocarbons is the first step in its removal and treatment. Significant efforts have recently been made to develop nanoscaled boron-containing delivery systems for improving drug delivery in cancer therapy. This work is an NIH-funded collaboration with Prof. From Atomic Bombs to Cancer Treatments: The Broad Scope of Nuclear Chemistry. Contemporary Aspects of Boron: Chemistry and Biological Applications, He also stated that patients with rheumatoid arthritis commonly experienced a Herxheimer reaction and that this is always a good prognostic sign. In this way, chemical biology is the key bridge at the interface between chemistry, basic biomedical and veterinary research, and therapeutic science. The synthesis and biological evaluation of two ortho-carborane derivatives which contain a 5,6,7-trimethoxyindole TMI unit for use in boron neutron capture therapy is described. Iodine is probably one of the better known radioisotopes for managing thyroid cancer. Isotopes of the same element have different physical properties they may differ in terms of density, relative mass, melting point and so on. At the same time, integration of BODIPY into drug carriers provides the possibility of in vitro and in vivo real time imaging of used drug carriers. However, blood boron concentrations were increased within hr after application of the same amount of boric acid in a water-based jelly, indicating that the vehicle in which boric acid is applied to the skin affects absorption. Information on choosing a doctor or treatment facility, home care, financial help, insurance coverage, end-of-life planning, and resources to help you avoid scams. Please click button to get boron and gadolinium neutron capture therapy for cancer treatment book now. Cranial Alignment Device for use in intracranial stereotactic surgery. Find the list of Chemistry Topics for Seminar Presentation at any school or college level. Excessively high doses of boron tend to increase the blood levels of calcium and oestrogen, lower blood glucose, vitamin B6 and zinc. From chemistry to catalysis, materials, biology, and medicine, from theory to application, the main target of this conference is to gather Researchers and Experts in Phosphorus, Boron and Silicon community in order to provide all participants with the latest progress and inputs recorded in each field. We focus on dynamic kinase-inhibitor complexes cancer treatment and HLA-drug complexes adverse drug reactions. Researchers from the University of Georgia and the Mayo Clinic in Arizona have developed a vaccine that dramatically reduces tumors in a mouse model that mimics 90 percent of human breast and pancreatic cancer casesâ€"including those resistant to common treatments. A new study has shown that adding boron-nitride nanotubes to the surface of cancer cells can double the effectiveness of Irreversible Electroporation, a minimally invasive treatment for soft Undergraduate student seminars CH , Senior Seminar are held in Hand on select Tuesdays and Fridays. Join the community for topics like cancer epigenetics, epigenetic biomarkers, childhood cancer and oncology nursing on November , Cyclic oxonium derivatives of polyhedral boron hydrides are a relatively new class of boron compounds. Chemistry, the science that deals with the properties, composition, and structure of substances defined as elements and compounds , the transformations they undergo, and the energy that is released or absorbed during these processes. The seminar also highlighted The cancer treatment is greatly divided it into, and there are surgery treatment operation , medical therapy including the anticancer agent treatment, hormone therapy , radiation therapy and other including the therapy, thermotherapy of immunity. EPA determined there was no need to develop primary drinking water standards for boron compounds. Which isotope is used in the treatment of a tumor? There are different types of radioisotopes that can be used, depending on the type of cancer. BNCT is a still an experimental cancer treatment, but new boron complexes, especially those that can also bind to DNA, might still be important. In particular, we are interested in the potential application of this class of compounds to boron neutron capture therapy BNCT , a binary cancer therapy proposed for the treatment of brain tumors and metastatic melanoma. I would like to present a seminar on the topic boron and its application in cancer treatment. Seminars Presentations are nice ways of getting students to think about chemistry, especially at introductory levels. Boron nitride nanotubes BNNTs represent an innovative and extremely intriguing class of nanomaterials. I want information about that topic. Alchemists studied the nature of matter before modern chemistry was born. A new study has shown that adding boron-nitride nanotubes to the surface of cancer cells can double the effectiveness of Irreversible Electroporation, a minimally invasive treatment for soft In addition to cancer treatment porphyrins are also under investigation for application in the treatment of a variety of other diseases. Medical Use of Radioisotopes Radioisotopes prove to be useful in the application in medical therapy was first applied to the treatment of thyroid cancer. World Cancer is an international conference on the topics of the future direction of the Cancer Treatment. Boron Chemistry and Applications to Cancer Treatment; New Chemistry of Superelectrophiles; Boron-Pnictogen Multiple boron chemistry and applications to cancer treatment, seminar topic for boron and its application to cancer, I am a chemistry student. Cancer is the most deadly killer in the world over the past decade, and almost all of the developed countries spend millions of dollars for research and treatment of cancer every year. Boronated compounds have been shown to be potent anti-osteoporotic, anti-inflammatory, hypolipemic , anti-coagulant and anti- neoplastic agents both in vitro and in vivo in animals. The talks below are adapted specifically for undergraduate student recruitment; however, we will be glad to work with your department so that the level of the material is appropriate for the audience. A second part of this seminar will present the development of a synthetic triterpenoid derived from olives, "bardoxolone methyl," that possesses extraordinary anti-inflammatory activity and is currently in Phase 3 human clinical trials for the treatment of chronic kidney disease in diabetes patients. Pre-Registration for Luncheon Seminar. The use of advanced optical imaging technology in tandem with new molecular-targeted probes for the optical biopsy of cancer to detect precancerous lesions, to guide targeted therapies, and to monitor the mechanisms of treatment escape by cancer cells related to tumor heterogeneity and drug-resistance at the molecular level. The Track is designed for dedicated students with substantial background in biology and chemistry, and offers a high faculty-to-student ratio with a large, friendly faculty. This technique thus provides a solution to the major problem of radiation therapy, which is the radiation-induced damage to normal tissue. It focuses on the preparation of internally functionalized biodegradable silica nanoparticles with applications in drug delivery, cancer treatment and MRI imaging. A course engaging the topic of nuclear chemistry on the introductory chemistry course level e. The objective of this article is to introduce to the dermatological community an overview of the history of boron integration into drug development and explain the fundamental concepts that support relevant modes of action and clinical applications, including for dermatological disorders. USA , 96 , , Study of the bromination of amine cyanoborane and molecular structures of the amine dibromocyanoboranes. Boron neutron capture therapy; gliomas; melanoma; head and neck cancer; High-grade gliomas, and specifically glioblastoma multiforme, are still extremely resistant to all current forms of therapy, including surgery, chemotherapy, radiotherapy, immunotherapy, and gene therapy, after decades of intensive research 1â€"5. His research program involves the design and application of homogeneous catalysts for applications in the area of carbon management, the development of alternative non-oil based carbon resources for chemical synthesis, in particular alkanes, alkenes, syngas, carbon dioxide and biomass. This work has broad theoretical implications for chemical bonding and organic chemistry and practical applications in hydrocarbon technology. The knowledge accumulated during the past decades on the chemistry and biology of bioorganic and organometallic boron compounds laid the Boron has a wide range of applications in chemistry, material science, energy research, and electronics, as well as in life science. As boron has been shown to have biological activity, research into the chemistry of boronated compounds has increased. From Prokaryotes to Humans Prof. The type of electronic motion in matter determines its properties and its applications. On one hand, borate ester chemistry has shown Abstract. Medicine is clearly a highly important and crucial area of application. Xiaohua Peng Associate Prof. Two naturally occurring isotopes of boron: Photodynamic therapy PDT is an evolving new field of study in the treatment of malignant tumors. The Stanford Cancer Center provides the full spectrum of cancer services, from diagnosis to the newest, most effective treatments and ongoing support for cancer survivors. His recent research interests include 1 synthesis of novel boron composites for boron neutron capture therapy and material chemistry; 2 development of novel catalysts for green chemistry and industry applications. Medicinal chemistry is focused on the discovery and development of biologically active agents with potential therapeutic application. The NRL has supported and contributed to many research projects through the years, such as closed-loop digital control of spacecraft and terrestrial reactors; boron neutron capture therapy for the treatment of cancer; material studies for the next generation of reactors; neutron activation analysis used for the study of environmental contaminants; and the investigation of nanofluids for Boron science features in numerous fields including organic chemistry, organometallic chemistry and medicine. The recent progress in the design and functionalization of BODIPY allows using them for modification of drug micro- and nanocarriers in order to improve their therapeutic effect in cancer treatment. The group of fluorophores on boron dipyrrin platform 4,4- difluorobora3a,4a-diaza-s-indacene, also known as BODIPY has attracted much attention in the field of molecular sensorics, including sensing of biomolecules and bioprocesses. The isotope captures the neutrons Gn , forming radioactive boron, which disintegrates into lithium and alpha particles Ca or He. At that time, boron chemistry was mostly limited to the simple boron hydrides such as diborane B 2 H 6 , pentaborane B 5 H 9 , and decaborane B 10 H 14 , Hawthorne explains. They have great potential for the modification of various types of organic and bioorganic molecules and the synthesis of compounds that could be used in different fields from the treatment of nuclear wastes to the treatment of cancer. It now may serve as a new path for cancer prevention or treatment. Hi am Abhiroop i am pleased to know boron chemistry and application to cancer treatment pdf. The use and production of boron and boron compounds in products such as fiberglass, soaps, detergents, enamels, frits, glazes, and fire retardants, and their use in industries such as agriculture, metallurgy, chemical synthesis, and in nuclear applications may result in their release to the environment through various waste streams SRC. The researchers have some ideas about how medical laboratory researchers could make practical use of the new Georgia Tech method to detect odd biomolecules emitted by cancer Her research interests include the physiochemical and biological properties of new fluorescent porphyrin-based macrocycles and their development of for application in medicine--e. The GRC on Water Disinfection, Byproducts and Health will present frontier research in engineering, chemistry, toxicology, epidemiology and regulation to address emerging issues in the provision of safe drinking water. Women sometimes use capsules containing boric acid, the most common form of boron, inside the vagina to treat yeast infections. The synthesis of the novel unprotected carboranyl C-glycosides 2 and 20â€"24 starting from ethynyl C-glycosides 1, 5â€"8, 10, and 13 is described. One principal motivation in creating boron analogues of amino acids, nucleic acids and other important biomolecules was for possible use in Boron Neutron Capture Therapy BNCT for cancer treatment. General uses Boron has been included in nutritional supplements or natural remedies designed to improve bone and joint health. Synthesis and Evaluation of New Derivatives of Aminoglycosides as Prodrugs for in the discovery, treatment, and prevention of Cancer growth Safer, more consistent, and highly specific nanoparticle production Turning Cancer into a chronic, but manageable disease within the next Then they can reduce treatment from 3 to 1 boron tablet each 3 mg per day as a maintenance dose so that they can avoid any future arthritis. The development of new and improved photothermal contrast agents for the successful treatment of cancer or other diseases via plasmonic photothermal therapy PPTT is a crucial part of the application of nanotechnology in medicine. Boron is used in nuclear medicine and chemistry to absorb neutrons.

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Chapter 3 : nanotechnology and cancer treatment abstract

NANOTECHNOLOGY TREATMENT OF CANCER ÃƒÂ¢Ã¢â€šÂ¬Ã¢â‚¬Å“ A New Perspective,Ask Latest information,Abstract,Report,Presentation (pdf,doc,ppt),NANOTECHNOLOGY TREATMENT OF CANCER ÃƒÂ¢Ã¢â€šÂ¬Ã¢â‚¬Å“ A New Perspective technology discussion,NANOTECHNOLOGY TREATMENT OF CANCER ÃƒÂ¢Ã¢â€šÂ¬Ã¢â‚¬Å“ A New Perspective paper presentation details.

The paper emphasizes on the best and effective utilization of Nanotechnology in the treatment of cancer. The design of nanodevice is based on the constant study of cancer cells and nanotechnology. The nano device is injected to the patient which can travel through blood vessel, identify and destroy cancer cells. The system is fully automated whereby the device manages to move to the affected cells through certain algebraic calculations automatically wherever it might be placed. This would be loaded into a simple microprocessor like and can be embedded along with the nanodevice for automatic discovery of cancer cells. Manual guidance and monitoring is done to control the device explicitly, further more command signals are activated automatically or manually to destroy the affected cells through RF signals. The theme is based on the fact that the cancer cells get destroyed on exposure to RF signals, due to high heat generation. In our paper we design a device that contains sensors, transceivers, motors and a processor which are made up of biodegradable compound. No more destruction of healthy cells due to harmful toxins and radiations generated through chemotherapy and radiation therapy. Electronics and computational techniques are increasingly being used to analyze biological cells to diagnose diseases, and develop methodologies to cure the diseases inside the human body. The main aim of this paper deals with the eradication of cancer cells by providing a steady, possible method of destroying and curing the cancer in an efficient and safe way so that healthy cells are not affected in any manner. This technology also focuses on a main idea that the patient is not affected by cancer again. The purpose of using the RF signal is to save normal cells. Nanotechnology is the art of manipulating materials on the atomic or molecular level and is used to build microscopic devices such as robots and other machines. These miniature devices play an important role in providing safe and efficient analysis and treatment of disease. In addition, when cells divide at an accelerated rate, they form a mass of tissue called a tumour. These cancerous cells that come in excess amounts cause many problems to the bodies of patients. In general, the most common methods used for the cancer treatment are Chemotherapy, a treatment with powerful medicines Radiation therapy, a treatment given through external high-energy rays. Healthy cells are destroyed in the process. As a result, this leaves the patient very weak, causing them to not be able to recover quickly medical treatments. But treatment-using nanotechnology will make a man perfectly normal. A gene is a sequence of DNA. The device would have binding sites sensors, transceiver, and other requirements made up of super carbon. The working parts of these machines would be built around gears no bigger than a protein molecule.

Chapter 4 : Medical Nanotechnology Critical Endeavor in Cancer treatment

nanotechnology in medicine cancer pdf, ppt slides for nanotechnologycritical endeavor in cancer, details about cancer in hindi, ieee seminar report on nanotechnology used for cancer treatment, about cancer, how to do coursework, cancer projects for students.

Today nanotechnology is still in a formative phase--not unlike the condition of computer science in the s or biotechnology in the s. Yet it is maturing rapidly. About two million workers will be employed in nanotech industries, and three times that many will have supporting jobs. Descriptions of nanotech typically characterize it purely in terms of the minute size of the physical features with which it is concerned--assemblies between the size of an atom and about molecular diameters. That depiction makes it sound as though nanotech is merely looking to use infinitely smaller parts than conventional engineering. But at this scale, rearranging the atoms and molecules leads to new properties. One sees a transition between the fixed behavior of individual atoms and molecules and the adjustable behavior of collectives. Thus, nanotechnology might better be viewed as the application of quantum theory and other nanospecific phenomena to fundamentally control the properties and behavior of matter. Over the next couple of decades, nanotech will evolve through four overlapping stages of industrial prototyping and early commercialization. The first one, which began after , 19 involves the development of passive nanostructures: These can be as modest as the particles of zinc oxide in sunscreens, but they can also be reinforcing fibers in new composites or carbon nanotube wires in ultraminiaturized electronics. Rearranging atoms leads to new properties. The second stage, which began in , focuses on active nanostructures that change their size, shape, conductivity or other properties during use. New drug-delivery particles could release therapeutic molecules in the body only after they reached their targeted diseased tissues. Electronic components such as transistors and amplifiers with adaptive functions could be reduced to single, complex molecules. Starting around , workers will cultivate expertise with systems of nanostructures, directing large numbers of intricate components to specified ends. One application could involve the guided self-assembly of nanoelectronic components into three-dimensional circuits and whole devices. Medicine could employ such systems to improve the tissue compatibility of implants, or to create scaffolds for tissue regeneration, or perhaps even to build artificial organs. After , the field will expand to include molecular nanosystems--heterogeneous networks in which molecules and supramolecular structures serve as distinct devices. The proteins inside cells work together this way, but whereas biological systems are water-based and markedly temperature-sensitive, these molecular nanosystems will be able to operate in a far wider range of environments and should be much faster. Computers and robots could be reduced to extraordinarily small sizes. Medical applications might be as ambitious as new types of genetic therapies and antiaging treatments. New interfaces linking people directly to electronics could change telecommunications. Over time, therefore, nanotechnology should benefit every industrial sector and health care field. It should also help the environment through more efficient use of resources and better methods of pollution control. Nanotech does, however, pose new challenges to risk governance as well. Internationally, more needs to be done to collect the scientific information needed to resolve the ambiguities and to install the proper regulatory oversight. Helping the public to 20 perceive nanotech soberly in a big picture that retains human values and quality of life will also be essential for this powerful new discipline to live up to its astonishing potential. In the world of "Star Trek," machines called replicators can produce practically any physical object, from weapons to a steaming cup of Earl Grey tea. Long considered to be exclusively the product of science fiction, today some people believe replicators are a very real possibility. They call it molecular manufacturing, and if it ever does become a reality, it could drastically change the world. Replicator Atoms and molecules stick together because they have complementary shapes that lock together, or charges that attract. Just like with magnets, a positively charged atom will stick to a negatively charged atom. As millions of these atoms are pieced together by nanomachines, a specific product will begin to take shape. The goal of molecular manufacturing is to manipulate atoms individually and place them in a pattern to produce a desired structure. Rice University Professor Richard Smalley points out that it would take a single nanoscopic machine millions of years to assemble a meaningful amount of material. In order for molecular manufacturing to be practical, you would need trillions of assemblers working together simultaneously. Eric Drexler believes that assemblers could first replicate themselves, building other assemblers. Each generation would build another, resulting in exponential growth until there are enough assemblers to produce objects Fig: Assembler Assemblers might have moving parts like the nanogears in this concept drawing. Trillions of assemblers and replicators could fill an area smaller than a cubic millimeter, and could still be too small for us to see with the naked eye. Assemblers and replicators could work together to automatically construct products, and could eventually replace all traditional labor methods. This could vastly decrease manufacturing costs, thereby making consumer goods plentiful, cheaper and stronger. Eventually, we could be able to replicate anything, including diamonds, water and food. Famine could be eradicated by machines that fabricate foods to feed the hungry. Nanotechnology may have its biggest impact on the medical industry. Patients will drink fluids containingnanorobots programmed to attack and reconstruct the molecular structure of cancer cells and viruses. Nanorobots could also be 22 programmed to perform delicate surgeries -- suchnanosurgeons could work at a level a thousand times more precise than the sharpest scalpel [source: International Journal of Surgery]. By working on such a small scale, a nanorobot could operate without leaving the scars that conventional surgery does. Additionally, nanorobots could change your physical appearance. They could be programmed to perform cosmetic surgery, rearranging your atoms to change your ears, nose, eye color or any other physical feature you wish to alter. Micro-Electro-Mechanical Systems, or MEMS, is a technology that in its most general form can be defined as miniaturized mechanical and electro-mechanical elements i. The critical physical dimensions of MEMS devices can vary from well below one micron on the lower end of the dimensional spectrum, all the way to several millimeters. Likewise, the types of MEMS devices can vary from relatively simple structures having no moving elements, to extremely complex electromechanical systems with multiple moving elements under the control of integrated microelectronics. The one main criterion of MEMS is that there are at least some elements having some sort of mechanical functionality whether or not these elements can move. The term used to define MEMS varies in different parts of the world. While the functional elements of MEMS are miniaturized structures, sensors, actuators, and microelectronics, the most notable and perhaps most interesting elements are the microsensors and microactuators. In the case of microsensors, the device typically converts a measured mechanical signal into an electrical signal. Remarkably, many of these micromachined sensors have demonstrated performances exceeding those of their macroscale counterparts. That is, the micromachined version of, for example, a pressure transducer, usually outperforms a pressure sensor made using the most precise macroscale level machining techniques. Not only is the performance of MEMS devices exceptional, but their method of production leverages the same batch fabrication techniques used in the integrated circuit industry â€” which can translate into low per-device production costs, as well as many other benefits. Consequently, it is possible to not only achieve stellar device performance, but to do so at a relatively low cost level. Not surprisingly, silicon based discrete microsensors were quickly commercially exploited and the markets for these devices continue to grow at a rapid rate. A surface micromachined electro-statically-actuated micromotor fabricated by the MNX. This device is an example of a MEMS-based microactuator. The real potential of MEMS starts to become fulfilled when these miniaturized sensors, actuators, and structures can all be merged onto a common silicon substrate along with integrated circuits i. While the electronics are fabricated using integrated circuit IC process sequences e. It is even more interesting if MEMS can be merged not only with microelectronics, but with other technologies such as photonics, nanotechnology, etc. While more complex levels of integration are the future trend of MEMS technology, the present state-of-the-art is more modest and usually involves a single discrete microsensor, a single discrete microactuator, a single microsensor integrated with electronics, a multiplicity of essentially identical microsensors integrated with electronics, a single microactuator integrated with electronics, or a multiplicity of essentially identical microactuators integrated with electronics. Nevertheless, as MEMS fabrication methods advance, the promise is an enormous design freedom wherein any type of microsensor and any type of microactuator can be merged with microelectronics as well as photonics, nanotechnology, etc. A surface micromachined resonator fabricated by the MNX. This device can be used as both a microsensor as well as a microactuator. In terms of liability cover, the insurance industry needs to know which nanoparticles are hazardous to humans, and what levels of concentration are required to cause harm. Can nanoparticles cause chronic health effects similar to asbestosis? The short answer is that we simply do not know. Certain organs in mice have been shown to be adversely affected by some nanoparticles as well as significantly reduced offspring production in some aquatic life. If these effects are caused in other animals they may be possible in humans, though there have been no human studies to confirm this. Studies looking at the chronic effects of nanoparticles are much less common, though some are underway. The UK Council for Science and Technology highlighted that there is insufficient research into the toxicology, health and environmental effects of nanomaterials. This call has been taken seriously and there are now efforts to increase the amount of research into nanotoxicology. There are several ways that nanoparticles can enter the body. These include inhalation, ingestion, absorption through the skin and direct injection for medicinal purposes. Once the 27 particles are in the body they may be transported throughout the body before they are ejected, if at all. Inhalation of nanoparticles Particles breathed into the lungs can cause damage and scarring, which over long periods of exposure can lead to long term breathing difficulties. This is an analogous process by which asbestos fibres cause asbestosis. The fibres lodge deep within the lungs and trigger the local immune system, which sends specialised immune cells that try to digest the fibres and repair any damage by depositing new tissue. As the fibres are highly resistant, the immune cells cannot digest them, die off, cause more immune cells to attack the foreign body, and yet more tissue to be deposited. In some cases this can also cause the cells to become cancerous. Over many years of exposure this leads to thickening of the lung walls and reduces the amount of oxygen that can be absorbed from the air and decreases the amount of carbon dioxide that can be breathed out. This causes a shortness of breath and hence a reduced ability to perform any activities that require exertion and costly oxygen therapy may be required. Carbon nanotubes are potentially toxic to humans. Carbon nanotubes can be very similar to asbestos fibres; they are strong and can have a similar shape to asbestos fibres. There has been much research into the potential applications of nanotubes; however research into their toxicity is currently fragmented. Some studies refute any negative effects of carbon nanotubes, but several of the reviews conclude with statements similar to the following: Julie Muller et al. This statement was from a study that found carbon nanotubes cause inflammation in the lungs and scarring. This is a similar effect to asbestos exposure and gives clear indication that the potential risk from carbon nanotubes should be taken seriously. Titanium dioxide and carbon nanoparticles also show detrimental effects when inhaled.

Chapter 5 : Fighting Cancer with Nanomedicine | The Scientist MagazineÂ®

The use of nanotechnology in cancer treatment offers some exciting possibilities, including the possibility of destroying cancer tumors with minimal damage to healthy tissue and organs, as well as the detection and elimination of cancer cells before they form tumors.

Cancer has been the great killer of our time. While the advance of medical science has made many cancers treatable, the diagnosis of cancer can still often mean a death sentence. But thanks to a new science known as nanotechnology During a visit to the doctor, you get the bad news. Various tests that have been performed on you have uncovered the fact that you have a cancer. It is a very aggressive, malignant form of cancer. The doctor gives you your options, which include surgery, chemotherapy, and radiation. He gives you your chances of survival, which are not good. Nevertheless, you submit to a treatment regime, which involves side effects such as nausea and pain. The progress of your cancer is slowed, but not stopped. Within a few short months of agony and rapidly deteriorating heath, you are dead. Now imagine another visit to the doctor. He gives you the same bad news. However, he is able to give you an injection right there in the office. During a follow up visit about two weeks later, tests indicate that your cancer has been totally eradicated. You have many years of happy, productive life ahead of you. How is the second scenario possible? The answer lays in a new science known as nanotechnology. Materials having very very small size crystallites in the range of nanometers nm are defined as nano materials. Nanomaterials can be natural or man made. For example, some nano particles are produced naturally by plants or even by volcanic activity. Nanotechnology And Cancer ; Most animal cells are about ten thousand to twenty thousand nanometers in diameter. Therefore, it would be easy for nanodevices to enter and interact with the cells DNA and proteins. Nanotechnology can be used to fight cancer in two ways. First, it will be used in detecting the presence of cancer far earlier and with greater precision than with standard diagnostic methods, such as x-rays, MRIs, and biopsies. Second, it will be used in the destruction of the cancer, with greater precision and thoroughness, once it is detected. There are several nanotechnology tools being developed that could detect cancer when it is still at the molecular level. Other nanodevices are being developed that would have the capability to bind to cancer cells and not normal cells, thus making detection easier. The advantages of these methods are that they can detect cancer early, without exploratory surgery, and without physically altering the cells being examined. Modern chemotherapy and radiation can be best described as carpet bombing cancer. That means that healthy cells are attacked along with the cancer cells. The result is that the patient suffers serious side effects, including nausea, hair loss, anemia, and the degradation of his or her immune system. The lack of precision inherent in modern cancer fighting techniques sometimes means that not all of a cancer is eradicated, resulting in a resurgence of the cancer. Nanotechnology provides the potential of a cancer fighting smart bomb. Nanodevices can be built that can precisely deliver drugs to the cancer cells, leaving healthy cells untouched. These devices would enter the previously detected cancer cells and deliver the drug or combination of drugs, destroying the cancer from within. Another potential technique combines nanotechnology with a new form of radiation therapy. Carbon nanotubes are introduced into cancer cells. Then an infrared laser is focused on the affected area. The laser heats the nanotubes, causing the destruction of the cancer cells, leaving healthy cells untouched. The idea would be that these devices would examine the DNA of cancer cells on the atomic level, comparing them to what the DNA of normal cells for the patient should be, and then calling in nanorepair devices to fix the DNA. Drug Administration take a great deal of time to approve new drugs and medical techniques for clinical use. Nevertheless, some nanotechnology therapies are already available. Liposomes, a first generation nanotechnology device, is being used to deliver drugs to treat certain kinds of fungal infections as well as some kinds of cancer. A team at MIT have managed to successfully kill cancer tumors in mice using a nanodevice delivered drug. Another team at Stanford has used carbon nanotubes to heat and destroy cancer cells. Our descendents might well view cancer as we view certain plagues of the past, like small pox, as part of history and no longer as part of everyday life. Scientists are already hard at work on nanobots that can identify and destroy cancer at its growth site so that no trauma is inflicted anywhere else in the body. The burgeoning field of nanotechnology has many useful and direct applications for the medical industry, and nanorobots are no exception to this rule. The medical science wants to create nanobots that can repair damaged tissue without pain and trauma. Many of the medical procedures we employ today are very traumatic to the human body and do not work in harmony with our natural systems. Chemotherapy wreaks havoc on humans and nearly kills them in the quest to kill off their malignant cancer cells. Invasive surgical procedures are also quite common today, with associated traumas that cause many patients to die on the operating table rather than survive and heal. Nanorobots are so small that they actually interact on the same level as bacteria and viruses do, and so they are capable of building with the very particles of our bodies: The ideal nanobot has not yet been fully realized, but when this microscopic robot makes its inevitable debut it will be hailed as a lifesaver by the world of medicine. The fact of the matter is that artificial lifestyles have given rise to all kinds of ailments that absolutely require human interference for lifesaving purposes. Patients may be allergic to anesthetics; their organs may become infected from a variety of surgery-related sources; during an organ transplant their body may mysteriously reject the new organ, leading to death; and in the case of a tumor operation, even a few microscopic missed cells can constitute complete failure to battle the cancer. Simply put, surgeons are peopleâ€”and people are far too large and clumsy to perform the types of fine-scale operations necessary for fixing the human body. Drugs are little better when it comes to finesse. Your bloodstream is an indiscriminate cycle that delivers its contents to many parts of the body. Any drug administered will automatically affect areas of the body that are perfectly healthy, and significant doses will most likely cause unpleasant side effects. This means that the drug which is supposed to cure you may actually leave many parts of your body in worse shape than they were before. Nanorobots, on the other hand, will typically measure only about six atoms wide. It is anticipated that they could be equipped with all sorts of tools and cameras in order to furnish more extensive information about the human body. Not only that, but researchers expect that someday they will have refined the nanobot design to the point where nanobots can be remotely controlled in order to perform millions of useful tasks. Among these is the ability to float neutrally through your bloodstream, identifying problem areas of your body and fixing them. Nanorobots could be used to clear built-up cholesterol from your arteries, thereby saving you from a heart attack. If the heart itself is damaged, they work their way up to the affected area and perform micro-surgery that you would probably not feel or notice, but which would almost certainly save your life.

Chapter 6 : nanotechnology for cancer treatment seminar

nanotechnology n cancer treatment seminar projects, nanotechnology in cancer treatment ppt, new technologies in treatment of cancer, chemotherapy, Title: NANOTECHNOLOGY CRITICAL ENDEAVOR IN CANCER full report.

Through the concerted development of nanoscale devices or devices with nanoscale materials and components, the NCI Alliance for Nanotechnology in Cancer will facilitate their integration within the existing cancer research infrastructure. The Alliance will bring enabling technologies for: Imaging agents and diagnostics that will allow clinicians to detect cancer in its earliest stages Systems that will provide real-time assessments of therapeutic and surgical efficacy for accelerating clinical translation Multifunctional, targeted devices capable of bypassing biological barriers to deliver multiple therapeutic agents directly to cancer cells and those tissues in the microenvironment that play a critical role in the growth and metastasis of cancer Agents that can monitor predictive molecular changes and prevent precancerous cells from becoming malignant Novel methods to manage the symptoms of cancer that adversely impact quality of life Research tools that will enable rapid identification of new targets for clinical development and predict drug resistance Why Nanotechnology in Cancer? Nanoscale devices are somewhere from one hundred to ten thousand times smaller than human cells. They are similar in size to large biological molecules "biomolecules" such as enzymes and receptors. As an example, hemoglobin, the molecule that carries oxygen in red blood cells, is approximately 5 nanometers in diameter. Nanoscale devices smaller than 50 nanometers can easily enter most cells, while those smaller than 20 nanometers can move out of blood vessels as they circulate through the body. Because of their small size, nanoscale devices can readily interact with biomolecules on both the surface of cells and inside of cells. By gaining access to so many areas of the body, they have the potential to detect disease and deliver treatment in ways unimagined before now. And since biological processes, including events that lead to cancer, occur at the nanoscale at and inside cells, nanotechnology offers a wealth of tools that are providing cancer researchers with new and innovative ways to diagnose and treat cancer. Nanotechnologies Work is currently being done to find ways to safely move these new research tools into clinical practice. Today, cancer-related nanotechnology is proceeding on two main fronts: Nanotechnology and Diagnostics Nanodevices can provide rapid and sensitive detection of cancer-related molecules by enabling scientists to detect molecular changes even when they occur only in a small percentage of cells. Nanowires In this diagram, nano sized sensing wires are laid down across a microfluidic channel. These nanowires by nature have incredible properties of selectivity and specificity. As particles flow through the microfluidic channel, the nanowire sensors pick up the molecular signatures of these particles and can immediately relay this information through a connection of electrodes to the outside world. These nanodevices are man-made constructs made with carbon, silicon and other materials that have the capability to monitor the complexity of biological phenomenon and relay the information, as it is monitored, to the medical care provider. They can detect the presence of altered genes associated with cancer and may help researchers pinpoint the exact location of those changes. These can be coated with molecules capable of binding specific substrates-DNA complementary to a specific gene sequence, for example. Such micron-sized devices, comprising many nanometer-sized cantilevers, can detect single molecules of DNA or protein. 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. Researchers can read this change in real time and provide not only information about the presence and the absence but also the concentration of different molecular expressions. Nanoscale cantilevers, constructed as part of a larger diagnostic device, can provide rapid and sensitive detection of cancer-related molecules Nanotechnology and Cancer Therapy Nanoscale devices have the potential to radically change cancer therapy for the better and to dramatically increase the number of highly effective therapeutic agents. Nanoscale constructs can serve as customizable, targeted drug delivery vehicles capable of ferrying large doses of chemotherapeutic agents or therapeutic genes into malignant cells while sparing healthy cells, greatly reducing or eliminating the often unpalatable side effects that accompany many current cancer therapies. Nanoshells Nanoshells have a core of silica and a metallic outer layer. These nanoshells can be injected safely, as demonstrated in animal models. Because of their size, nanoshells will preferentially concentrate in cancer lesion sites. This physical selectivity occurs through a phenomenon called enhanced permeation retention EPR. Scientists can further decorate the nanoshells to carry molecular conjugates to the antigens that are expressed on the cancer cells themselves or in the tumor microenvironment. This second degree of specificity preferentially links the nanoshells to the tumor and not to neighboring healthy cells. As shown in this example, scientists can then externally supply energy to these cells. The specific properties associated with nanoshells allow for the absorption of this directed energy, creating an intense heat that selectively kills the tumor cells. The external energy can be mechanical, radio frequency, optical - the therapeutic action is the same. The result is greater efficacy of the therapeutic treatment and a significantly reduced set of side effects. Nanoparticles Nanoscale devices have the potential to radically change cancer therapy for the better and to dramatically increase the number of highly effective therapeutic agents. In this example, nanoparticles are targeted to cancer cells for use in the molecular imaging of a malignant lesion. Large numbers of nanoparticles are safely injected into the body and preferentially bind to the cancer cell, defining the anatomical contour of the lesion and making it visible. These nanoparticles give us the ability to see cells and molecules that we otherwise cannot detect through conventional imaging. The ability to pick up what happens in the cell - to monitor therapeutic intervention and to see when a cancer cell is mortally wounded or is actually activated - is critical to the successful diagnosis and treatment of the disease. Nanoparticulate technology can prove to be very useful in cancer therapy allowing for effective and targeted drug delivery by overcoming the many biological, biophysical and biomedical barriers that the body stages against a standard intervention such as the administration of drugs or contrast agents.

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Chapter 7 : nanotechnology cancer c

calendrierdelascience.comchnology and Environment: Nano technology has the potential to substantially benefit environment through pollution prevention, treatment and remediation. Auborne nano robots can be programmed to rebuild the removed from water sources and oil spills can be cleaned up instantly.

Engendering an Era of Industrial Revolution Submitted to: Engendering an Era of Industrial Revolution 1. A technology stepping into every aspect of our lines, powerful enough to make things easier and impossible which hitherto was unimaginable. These things include desktop manufacturing cellular repairs, artificial intelligence, inexpensive space travel, abundant energy and environmental restoration, ie radically changing the whole economic and political systems. This is the Nanotechnology. Nanotechnology is the creation of useful materials, devices and systems through manipulation of miniscule matter, manipulation of matter at the atomic or nonoscale i. The shotgun marriage of chemistry and engineering called is ushering in the era of selfreplicating machinery and self-assembling consolatory goods made from cheap raw atoms. Depicts an infrastructure been built by convergent system. In Nanotechnology by controlling molecular structure in material synthesis we have gained inevitable control over the basis material properties such as conductivity, strength, relativity, yielding innovative application ranging from batteries to automotive materials. Talking about applications Nanotechnology will enable us to do radical new things in virtually every technological and scientific areas. The New Era of Nano Computers: Nanotechnology is all about building working mechanisms using components. Computation will then become a property of matter, computers right be morporated in next generation, by we will be aware of our using nanoscale computers. Nanoscale computers will certain hard disks, which have sensors, sensitive enough to detect presence or absence of magnetic field in a microscopic bit of material. This is done as if the magnetic field is strong enough to change a sensors electron flow the bift represents a 1, if not it is 0, the key factor is making sensors that can read and matter bits in increasing the magnetic resistance of sensors. The contact between these wires is only a few hundred atoms wide. The tight squeeze keeps electrons from scattering, allowing the sensor to read the minuscule bits that future, super high-capacity disk drives will depend on. Researchers are aiming to make a spin based computer chip that does all the timing that conventional chip do but with cost power size and were viability advantages that come from magnetic logic with the concept of Spintronics hard disks may be replaced with plastic memories to open up many opportunities for new technologies such as flexible displays and responsive solar cells. We can construct basic logic gates, which carry out computations using the spin electrons. Also because spin states of electrons remain stable even when power goes off, such a computer would not have to boot up every time it is turned on. These are bottle-cap-shaped micro-machines fitted with wireless communication devices - that measure light and temperature, When clustered together, they automatically create highly flexible, low-power networks with applications ranging from climatecontrol systems to entertainment devices that interact with handheld computers. The same idea could be applied to playing the piano or communicating in sign language, with the handheld computer translating hand gestures into music and speech. Experiments on humans are expected to begin as soon as one year from now, with adoption taking place anywhere from three to 10 years, according to Smart Dust researchers 3. Medicinal Era brought by Nanotechnology We can actually say good-bye to cancer diseases; hospitals no longer will plagues of AIDS or Ebola strike the human race. Antibiotics will even decreasing effectiveness, would no longer be staple of medical industry. This is very useful in diagnosis of various diseases. It is also suggested that using NT medical diagnosis will be transformed and use of nano- robots within body could provide a defense against invading viruses. This technology could be used in particular application when considering immune sys. There is also speculation that nano-robots would show on even reverse the aging process and life expectancy could increase significantly. In near future we will be acquainted with notions like: Delivery of drugs by medical nano-machines to exact location in the body. Modifying cellular structures using medical nano-machines.

Bunch of non -replicating nanorobots with a specified medical task such as cleaning and closing a would and many more. A blood borne spherical 1 Micron diamonded atm pressure vessel with active pumping powered by endogenous serum glucose, able to delver times more oxygen to tissues per unit volume than national red cells and to manage carbonic acidity. This will destroy microbiological agent causing disease found in human bloodstream using a digest and discharge protocol. The robots are called Foglets and the substance they form is Utility Fog. The possible applications of Nanotechnology to advanced weaponry are fertile ground for fantasy. It is obvious that 3-D assembly of nano- structures in bulk can yield much better versions of most conventional weapons e. Aerospace hardware would be far lighter and higher performance, built with minimal or no metal, it would be such harder to spot radar. Embedded computer would allow remote activation of any weapon and more compact power handling would allow greatly improved robotics. Nuclear weapons can be credited to prevent major wars since their inventions. Nuclear weapons have high long term cost of use that would be much lower with nanotech weapons. Nuclear weapons require massive research effort and industrial development, which can be tracked more easily than nanotech weapons. Nanotech weapons would be extremely powerful and could lead to a dangerously to an arm race. Also unless nanotech is tightly controlled the number of nanotech nations in the world could be such higher than the number of nuclear nations increasing the chance of a regional conflict blowing. Nano technology has the potential to substantially benefit environment through pollution prevention, treatment and remediation. Auborne nano robots can be programmed to rebuild the removed from water sources and oil spills can be cleaned up instantly. Our dependence an non-renewable sources would diminish with nano-technology. Many resources can be developed by nano-machines. Nanotectnology making transortation easy. However use of NT is scaled up emissions to environment may also increase and perhaps a whole new class of toxins or other environment problems may be created. The purchaser of manufactured product today is paying for its design, raw materials, the labour and capital of manufacturing, transportations storage and sales. If nano-factories can produce a wide variety of product when and where they are wanted most of this efforts will become unnecessary. Thus, what we are seeing is the segment of a revolution caused by our ability to work on same scale as nature, Nano-technology will afford every aspect of our lives from the medicines we use power of our computers the energy supplies we require, the food we eat, the cars we drive, the building we live in, the clothes we wear. Nanotechnology with all its challenges and opportunities is an unavoidable part of our future. The researches are filled with optimums and products are filled with optimum and products based on this technology are beginning to make their mark. The extent to which non-technology will impact our lives only depends on times of human in genuinely. Humanity will be faced with a power accelerated social reduction as a result of nano-technology. More powerful industrial revolution capable of bringing wealth, health and education to every person on this planet is just around the corner. Along with the development of nanotechnology comes the necessary to develop reasonable guidelines procedures and laws in order to protect humanity from new forms of terror, runaway inanities misuse of technologies.

Chapter 8 : Nano Technology in cancer

The paper emphasizes on the best and effective utilization of Nanotechnology in the treatment of cancer. The design of nanodevice is based on the constant study of cancer cells and nanotechnology. The nano device is injected to the patient which can travel through blood vessel, identify and destroy cancer cells.

The aim of clinical diagnosis is the rapid testing and complete diagnosis at an earlier stage to prove the potential of curing, possibly with less damage to the patient. It is possible with points of care diagnosis. Which includes nanobiosensor and nanoscale devices. Bringing the diagnostic technique with patient point care which reduces disadvantages of conventional diagnosis and overall cost and time for health care process for patient is reduced extensively Richard et al. Numerous techniques and assays are available for diagnosis such as immunoassay, genetic based tests, medical imaging and bio sensing. Bioassays commonly used in diagnosis are enzyme linked immunosorbent assay ELISA , polymerase chain reaction PCR based genetic assay and such as giemsa and Gram for viral and bacterial infections diseases Challa, Conventional diagnostic methods suffer from few limitations occurring as a result of low specificity and lack of efficacy. So nanotechnology enhances assays by accomplishing all requirements to provide a platform that is more sensitive than the current gold stand in protein detection and ELISA Gaster et al. Nanotechnology as a diagnostic tool refers to the use of Nano materials for the early detection, prevention treatment and follow up of many life threatening diseases including cancer, cardiovascular diseases, diabetes, Alzheimiers and AIDS as well as infectious disease Tallury, Nanoparticles can attach to biomolecules allowing detection of disease biomarkers in a laboratory sample at a very early stage. These materials are designed to interact with cells and tissues at a molecular i. Nanomaterials possess electrical conductivity catalytic properties, good stability and high loading biomolecules owing to its high surface to volume ratio. Because of their small size, nanomaterials can readily interact with biomolecules and gaining access to so many areas of the human body. Nanomaterials are produced using the top down and bottom up techniques. The top down start with a bulk material and then breaks it into smaller pieces using mechanical, chemical or other form of energy. An additional way is to synthesize the material from atomic or molecular species through chemical reactions allowing for the precursor particles to grow in size which is called bottom up technique. Chapter 6 nanomaterials, springer. Nanomaterials become a platform fabrication of novel diagnostic tool and revolutionized diagnostic processes by increasing relative surface area and emergence of quantum effects and interactions with biological systems present opportunities for scientists. The effect of increased reactivity and the potential to cross cell membranes have positive impacts on healthcare Shao et al. Nanomaterials include; Magnetic nanoparticles, quantum dots, carbon nanotubes, graphene oxide, gold nanoparticles and silver nanoparticle, porous nanomaterial. It commonly consist of magnetic element such as iron, nickel and their derivatives. They are versatile diagnostic tool as they are manipulated using external magnetic field. Its action at a distant phenomenon, combined with intrinsic penetrability of magnetic field into human tissue enables their detection in vivo using magnetic resonance imaging MRI Shao et al. Magnetic nanoparticles for biosensors enhance sensitivity and effectively reduce sample preparation requirements. Magnetic sensors such as magnetic relaxation switch assay sensors, magneto resistive sensors and magnetic particle relaxation sensors have been developed Koh and Josephson, Supra- paramagnetic iron oxide nanoparticles SPION are made of iron oxide core and coated by either inorganic materials like silica or organic materials such as phospholipids and natural polymers such as dextran or chitosan are versatile agent for early diagnosis of cancer, atherosclerosis and other diseases. They are used as contrast agents for magnetic resonance imaging and as an in-vitro application in bioassay by means of a vehicle for the detection of biomarker Hofmann et al. When supra- paramagnetic iron oxide are used in biosensors it improves the sensitivity and selectivity of diagnosis Azzazi et al. They are widely used as alternative to conventional fluorophores and for development of biosensors to detect biomolecules such as proteins, neurotransmitters enzymes and amine acids Azzazi et al. Bio conjugated quantum dots have the potential to b used in cancer diagnosis due to its bright and stable fluorescent light emission and sensitivity of fluorescence imaging Smith et al. They can also be used in the future for locating cancer tumors in patients and in the near term for performing diagnostic tests in biological samples Xing and Rao, These are extensively used nanomaterials in biosensors and diagnosis. They are long hollow cylindrical carbon structures composed of one, two or several concentric graphite layers capped with fullerenes hemisphere which are referred to as single, double and multi- walled. Carbon nanotubes have aspect ratio, unique optical property and small sizes exhibit potentials for variety of biomedical applications including the diagnosis of cancer and infectious diseases. These applications are encouraged by their capability to penetrate biological membranes and relatively low toxicity Zhang et al. For diagnosis carbon nanotubes can help to detect a protein biomarkers of disease when fabricated on the surface of a Nano biosensor. When it binds with a protein, the nanotubes change their electrical resistance which then be measured to determine the presence of a particular protein. Carbon nanotubes also have potential to increase the speed of biological sensors by reducing the biosensor response time. Graphene oxide is a thin layer of sp2 hybridized carbon extensively used for medical diagnosis due to its exciting properties, turn able band gap, high elasticity, high mechanical strength, very high temperature quantum hall effect, high electron mobility and high thermal conductivity Dresselhaus and Araujo, Graphene oxide can also be seen as transparent material with low productivity cost and minimum environmental impact. The sheets of graphene oxide on which antibodies attaches binds to cancer cells which then tag the cancer cells with fluorescent Molecules to make the cancer cells to make the cancer cells stand out in a microscope. It can also detect a very low level of cancer cells as low as 3 to 5 cancer cells in a one milliliter of blood sample Rajashekhar et al. Nano sized gold nanoparticles and silver nanoparticles are precious and in great demand by scientists. Gold nanoparticles are most attractive and extensively studied nanomaterials in bioanalytical field for medical diagnosis owing to its fascinating features such as ease of synthesis, high biocompatibility and Nano cytotoxicity. They have biomedical applications in these areas; labeling and bio sensing. For labeling, certain properties of the particles are exploited to generate contrast. Gold nanoparticles can also be used in biosensors as their optical properties can change upon binding to certain molecules permitting the recognition and quantification of annalites. The silver Nano rods in a diagnostic system are being used to separate viruses, bacteria and other microscopic components of blood samples. This method has been demonstrated to allow identification of viruses and bacteria in less than an hour Shanmukh et al. The porous nanomaterials are particularly promising for fabrication of optical biosensors as it possesses wide range of physical characteristics such as high purity, turn able porosity, Nanoscale structuring, high photochemical, physical rigidity and thermal stability. Porous nanomaterials retain native conformations and reactivity of biomolecules Satvekar et al. They are free standing, cylindrical nanoparticles with specific patterns of sub micro stripes of noble metal ions produced by alternating electrochemical reduction of the appropriate metals Zhou et al. Nano barcode is advantageous in coding multiplexed assays for proteomics, single nucleotide polymorphism SNP mapping and in point of care handheld devices. Nano barcode assays are nanotechnological based technique for detecting proteins which extraordinary sensitivity in detecting certain antigens at extremely low concentrations which is now devoid of the use of polymerase chain reaction PCR. These assay uses disease biomarkers that cannot be used in the conventional assays. Due to the recent progress in biosensor fabrication, diagnosis of life threatening diseases more reliably. Nanotechnology provides great opportunities to improve the sensitivity, stability and anti-interference ability of biosensor system. And with the progress in nanotechnology various novel nanomaterials have been invented and their novel properties are being gradually revealed which greatly enhances the performance of biosensor. Due to small sized nanoparticles the limitations of minimization leading to lower detection limits even getting zepto-molar concentrations are overcome. Nanoparticles can produce a synergic effect between conductivity, catalytic activity, and biocompatibility to enhance the signal transduction. Also nanoscale materials are used in biological sensors in detection of biomolecules. These nanomaterials based nanobiosensing involves in vivo diagnosis with high sensitivity, less cytotoxicity and long term stability for early screening of biomarkers and reliable point of care diagnosis Huangxianju et al. Nano biosensors have made a great impact due to their capacity to sense a wide range of biomolecules and incredibly small concentrations Turner, These biomolecules include antibodies, enzymes nucleic acids, cell and bio mimic component employed as bio recognition element which is highly favourable owing to its specificity and catalytic activity Thevenot et al. These bio recognition element gives rise to signal as the biochemical reaction of interested analyte which is detected by transducer to give electrical signal. This reaction between the biomolecule and the substrates produces a product in the form of electrochemical heat light or sound and then a transducer in form of electrochemical semi-conductor or thermistor which changes the product of the reaction into readable data. The biorecognition element e. The transducer which acts as an interface, measuring the physical change that occurs with the reaction at the biorecognition element and then converting that energy into measuring electrical output. These transducer can be optional, electrochemical, opto-electronic, piezoelectric, thermal and mass. The detector element which passed signals from the transducer to a microprocessor where they are amplified and analyzed Clark and LYONS, Transduction mode depends on the physiochemical change resulting from sensing element. The major types based on transducer mode are discussed below: Amperometric biosensor is based on the electrochemical analysis in which the signal of concern is a current that is linearly dependent upon the concentration of the biomarker. The signal transduction process is accomplished at a fixed potential between the working electrode and a reference electrode, and measuring the current as a function of time which is a direct measure of the rate of electron transfer. In most cases the biorecognition element is immobilized on the working electrode. In potentiometric sensors, the potential difference between the reference electrode and the indicator electrode is measured without polarizing the electrochemical cell. The analytical information is achieved by transforming the biorecognition process into a potential signal. A permselective ion-conductive membrane and high impedance voltmeter is normally utilized to measure the potential signal, which arises when the analyte interacts with the surface. The electrical potential difference or electromotive force EMF measured between two electrodes at near zero current. The indicator electrode or an ion-selective electrode ISE develops a change in potential as a function of analyte concentration in sample zarina et al. These are based on the measurement of electrolyte conductivity, which varies when the cell is exposed to different environments. Conductivity measurements are generally accomplished with AC supply which is a linear function of the ion concentration. Conductometric-based biosensors couple conductance and a biorecognition event in which mostly reactions involve a change in the ionic species concentration and this can lead to a change in the solution electrical conductivity. The major problem with this technique is that the sensitivity is generally lower compared to other electrochemical methods Dey and Goswami, Optical biosensors optodes , have received considerable attention for diagnosis. The optical biosensors involve direct detection of the analyte of interest or indirect detection through optically labeled probes. In general, there are at least four types of biosensors using the principles of optical technology. These are as follows: Optical biosensors are potent alternative to conventional analytical techniques because these are highly sensitive, reproducible, rapid, and simple-to-operate. These biosensors are mass sensitive detectors, which has the principle that an oscillating crystal resonates at the natural resonance frequency. The piezoelectric materials are able to generate and transmit acoustic waves. When a piezoelectric biosensor surface is coated with a biomolecule antibody and placed in a solution containing the pathogen, the attachment of it to the antibody coated surface results in an increase in the crystal mass, and this shows a corresponding frequency shift. This mechanism is relatively simple, inexpensive, and offers direct label-free analysis Cooper, Most chemical and biochemical processes involve the generation of exothermic heat which is used as a basis for measurement of rate of reaction and ultimately analyte concentration. The device is covered with the enzyme and when this interacts with the analyte it generates an exothermic reaction, which is recognized as a heat change. Obvious benefits of this biosensor are that it can be easily miniaturized, can be used in turbid samples, and it is a label-free approach Xie et al. The main types based on are as follows: The DNA nanobiosensor is based on the conversion of the base-pair recognition event or hybridization event the complementarities of adenine-thymine and cytosine-guanosine pairing in DNA into a measurable electrical signal. DNA duplex formation or hybridization event forms the basis of electrochemical detection in which electrochemical signals are generated and enhanced by covalent binding of nanomaterials to the DNA probe.

Chapter 9 : Nanotechnology Applied For Treatment Of Cancer

Cancer nanotechnology (an interdisciplinary area of research in science, engineering and medicine) is an upcoming ï¬•eld with extensive applications. It provides a unique approach and.

Nanotechnology-based therapeutics will revolutionize cancer treatment. COM Short drug circulation times and difficulty localizing therapy to tumor sites are but two of the challenges associated with existing cancer treatments. More troubling are the issues of drug toxicity and tumor resistance. The tissue damage inflicted by some therapies can even be fatal. And evolution of drug resistance by tumors accounts for the vast majority of cases in which treatment fails. Given these and other issues associated with treatment safety and efficacy, scientists are applying tremendous effort toward the utilization of nanomedicine in the fight against cancer. Nanotechnology-based therapeutics have exhibited clear benefits when compared with unmodified drugs, including improved half-lives, retention, and targeting efficiency, and fewer patient side effects. Researchers have already made progress with chemotherapeutic nanomedicines in the clinic. Several compounds that are in various stages of trials or already approved by the U. BIND Biosciences has shown that nanoparticles combining a chemotherapeutic drug with prostate-specific membrane antigen PSMA can reduce lung and tonsillar lesions with greater efficacy compared with the drug alone, and at substantially lower doses Sci Transl Med, doi: Cancer nanomedicine possesses the versatility required to uniquely overcome some of the most challenging impediments to treatment success. On the preclinical front, several nanomaterial formulations have shown promise. Single-agent nanoparticle delivery, both actively and passively targeted, has been demonstrated with a host of platforms using silica, polymer, metal, and carbon-based materials. Delivering a double whammy Researchers recently reported multidrug delivery using nanoparticles to mediate resistance in relapsing cancers and to improve triple-negative breast cancer treatment efficacy. Other recent approaches have included layer-by-layer siRNA and doxorubicin delivery for breast cancer therapy, simultaneous loading of small interfering RNA siRNA and tumor-penetrating peptides against ovarian cancer, as well as sequential administration of multiple types of nanoparticles for pancreatic cancer treatment Adv Funct Mater, doi: These exciting approaches have served as a foundation for the next phase of cancer nanomedicine in the clinicâ€”the rational design of nanomaterial-drug combinations. Until more nanoparticles are validated in the clinic, however, the impact that nanomedicine may have on cancer treatment has yet to be fully realized. In order for chemotherapies modified using nanotechnology to profoundly change hematological and oncological practice, the application of engineered nanomedicines must be paired with emerging strategies to rationally design nanotherapeutic combinations. This is critical because combinatorial therapy is an efficient way to simultaneously address the barriers to treatment success, and it is widely used in treating cancer and infectious diseases. Current clinical methodologies for combinatorial drug design include additive treatments that combine two or more drugs at their highest tolerable but still efficacious dose, although the synergistic effects among drugs cannot be taken into account using this additive approach. As the field gradually embraces the use of nanoparticles to deliver multiple compounds with different targets, a move away from additive dosing is necessary. This raises several important questions. For example, silencing genes to combat resistance, mediating apoptosis, and allowing vascular access are each pathways worth targeting, but what if multiple pathways are targeted at the same time to comprehensively attack the tumor? How will dosing be determined? How will the dosages of each drug be adjusted if efficacy is improved but toxicity is worsened? The next phase of cancer nanomedicine in the clinic is the rational design of nanomaterial-drug combinations. An attempt to optimize any one of these conditions will inevitably affect the others. Furthermore, these conditions vary from patient to patient, so phenotypic personalized medicine will be required. In addition, these issues create a parameter space that is too large to be individually tested and can result in an arbitrary dosing scenario. For example, a combination of six candidate therapeutics with 10 possible concentrations represents a minimum of 1 million possible combinations. Identifying a solution that rapidly converges on a defined set of phenotypic outcomes is a challenge that faces both unmodified drug administration and drug delivery by nanoparticles. To move beyond short-term cancer managementâ€”or single outcomes, like delaying tumor growth using a nanoparticle drug formulationâ€”and to enable long-term or potentially permanent disease management, the field of nanomedicine will inevitably need to be paired with advanced strategies to rapidly determine dosing conditions that can simultaneously optimize for efficacy and safety. One promising route is the field of feedback system control FSC , which relies on phenotypic responses instead of trying to interrogate cellular pathways, their individual protein components, or a spectrum of genotypic responses. One example is the use of a search algorithm in a feedback loop that can guide the formulation of rational drug combinations, both unmodified and nanotherapeutic. Remarkably, this approach can be used for in vitro studies with cell lines and primary cells, and for preclinical and even clinical validation. And because FSC utilizes outcomes to iteratively suggest new possible combinations before rapid convergenceâ€”in tens of trials versus a million or moreâ€—toward an optimal combinatorial dose, pharmacokinetics and pharmacodynamics are inherently accounted for with this approach. Furthermore, because combinations will vary from patient to patient, FSC will help personalized nanomedicine dosing on a case-by-case basis. In sum, cancer nanomedicine possesses the versatility required to uniquely overcome some of the most challenging impediments to treatment success. Rationally designing nanotherapeutic combinations using rapid convergence solutions such as FSC represents a promising pathway from cancer management towards cancer elimination. In December , Ho coauthored a review of the translation of cancer nanomedicine to the clinic E. Ho, Sci Transl Med, doi: