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NANO PARTICLES: A NEW PROMISING THERAPY FOR CANCER

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ABSTRACT

Nanotechnology promises a very wide variety of solutions to many aspects of cancer detection and treatment. The technology is new, with most research currently in the animal trial phase, but very promising. In the field of tumor detection, nano-scale transistors can detect marker proteins at concentrations of only .025 pg/ml, nano-pore gene sequencers can read 1,000 base pairs per second, and super paramagnetic nanoparticles can be used to measure levels of enzymes that signal malignant forms of cancer. In the treatment category, nanoparticles can be engineered which contain payloads of drugs surrounded by proteins which bind predominantly to cancerous cells, thereby targeting the medicine to just the areas where it is required. Also, microchips with reservoirs for drugs have been engineered which can deliver specific dosages for specific lengths of time from within the body, when remotely triggered.

Key words: Nanotechnology, Tumor, Transistors, Enzymes, Cancer, Microchips.

INTRODUCTION

Nanoparticles are the simplest form of structures with sizes in the nm range. In principle any collection of atoms bonded together with a structural radius of < 100 nm can be considered a nanoparticle. These can include, e.g., fullerenes, metal clusters (agglomerates of metal atoms), large molecules, such as proteins, and even hydrogen-bonded assemblies of water molecules, which exist in water at ambient temperatures. Nanoparticles are very commonplace in nature - for instance proteins exist in almost all biological systems, metal-oxide nanoparticles are easily produced, etc.. When studying nano particles a distinction must necessarily be made between condensed "hard "matter nanoparticles, generally termed nanoclusters, and "soft" bio-organic nanoparticles and large molecules. Coarse particles cover a range between 10,000 and 2,500 nanometers. Fine particles are sized between 2,500 and 100 nanometers. Ultrafine particles or nanoparticles are sized between 1 and 100 nanometers

Properties of Nanoparticle

Nanoparticles often have unique physical and chemical properties. For example, the electronic, optical, and chemical properties of nanoparticles may be very different from those of each component in the bulk. At the nanoscale, materials behave very differently compared to larger scales and it is still very difficult to predict the physical and chemical properties of particles of such a very small size. The principal parameters of nanoparticles are their shape, size, surface characteristics and inner structure. Nanoparticles can be encountered as aerosols (solids or liquids in air), suspensions (solids in liquids) or as emulsions (liquids in liquids). In the presence of certain chemicals, properties of nanoparticles may be modified

Characteristics of Nanoparticle

Due to smallest size of nano particles it penetrates deeper in to skin and is able to detect the cells which is easily prone to cancer. It plays an important role in transporting energy, carrying oxygen to cells. Property of nano particle can be changed by changing its shape i.e. Nano rods etc... It promotes the growth of skin cells by replacing the aging for revitalization. It plays an important role in oxygen transport for smooth skin metabolism and elasticity. By changing the shape of nano particle it can be made in such way which can detect malignant tumors, It is specially in case of breast cancer and they selectively destroy them with lasers only half as powerful as before without harming the healthy cells.

Therapeutic Applications of Nano Particle: Nano particles has various therapeutic effects as mentioned below

1. Nano crystalline paliperidone-used in Schizophrenia

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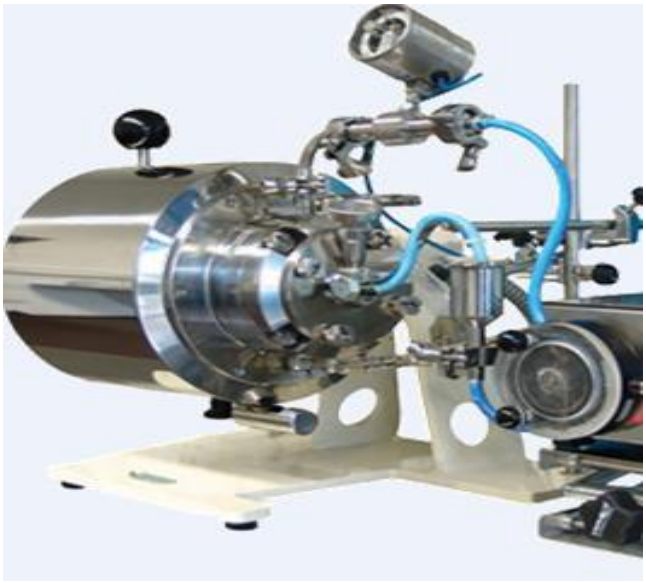
2. Nanoemulsion- Onychomycosis, Herpes labialis.
3. Nanocrystalline 2-methoxyestradiol- Used in various cancers.
4. Polyglutamate paclitaxel- Used in treating Lung cancer, ovarian cancer.
5. Albumin bound nanoparticles-Doxorubicin-used in treating cancer

There are many other diseases which are curable or controllable with nano technology. For e.g. in cancer, chemotherapy is used where all the drugs cannot reach the cancerous cells like Tamoxifen citrate which is used in treating breast cancer. In chemotherapy there are many side effects like hair fall, weight loss, the person will become very thin there will be change in there in immunity levels and they are easily prone or susceptible to any other disease. The greatest achievement of nano particles is that it can be used cancer detection and some extent to treat the cancer. Nano particles being of nano size can be conjugated with DNA. Gold nano particles can be used in the photo thermal therapy. It can be used in targeting drug delivery for cancer. All these applications have made nano particle an interesting molecule for research.

Synthesis of Nanoparticle

These are the methods usually used to prepared particles of nano size. They are as follows

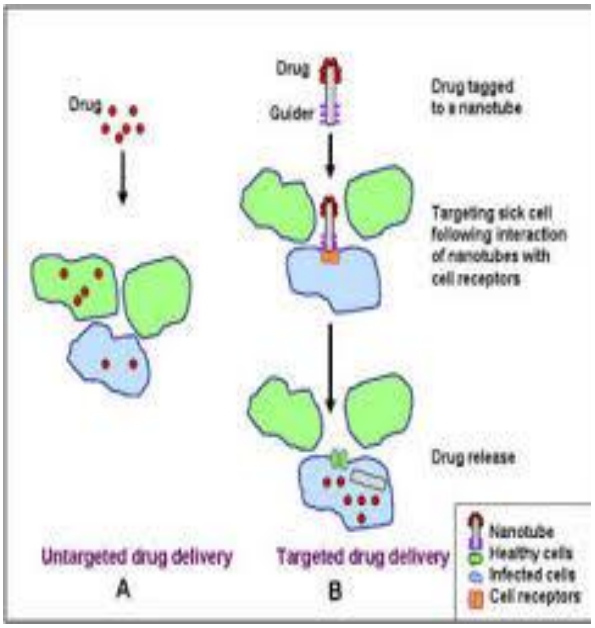
- Homogenizer
- Ultrasonicator
- Nano Mills
- Spray milling
- Supercritical Fluid technology
- Electrospray
- Ultracentrifugation
- Nanofiltration



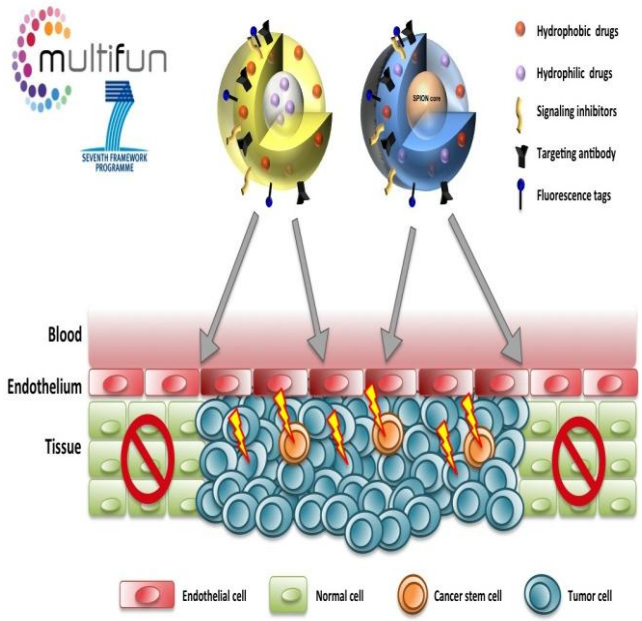
Nano Mill

Nanotechnology-Based Targeted Drug Delivery System

Dexamethasone is chemotherapeutic agent that has anti-proliferative and anti-inflammatory activity.



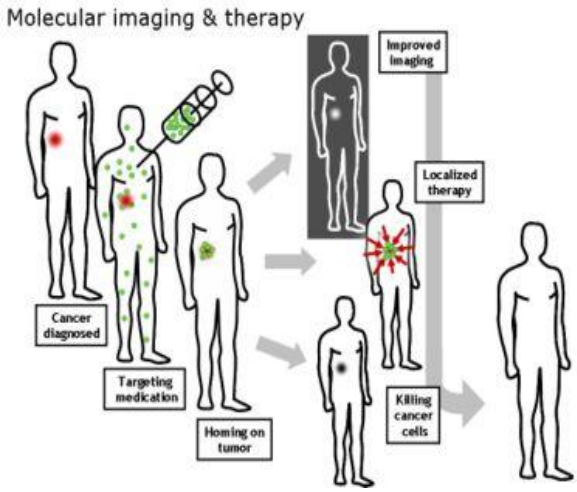
Targeted drug delivery



Targeted drug delivery

Nanoparticles in Cancer Detection and Treatment

Nanoparticles (gold nanoparticles) are very good in light scattering and absorption. Many cancer cells have a protein, Known as epidermal growth factor (EFGR), all over the surface, while healthy cells do not show this type of behavior. By conjugating or Binding, The nanoparticles to an antibody of EFGR, suitably named anti-EFGR, It was possible to get the nanoparticles to attach themselves to the cancer cells. When this conjugated nanoparticles solution is added to healthy cells as well as to cancer cells it is shown that cancer cells exhibits high shining. With this technique, If a well-defined cell is glowing is seen glowing, that's cancer.



Detection of cancer using nanoparticles

In a study it was known that nanoparticles have 600 percent greater affinity towards cancerous cells. It is not widely known but radioactive gold was used in the treatment of cancer many years ago. Gold is used in the treatment of prostate cancer. Using small grains of nanoparticles (Gold), doctors can identify position of the patient's prostate during treatment. In terms of drugs used for treating cancer, the use of platinum in the form of cisplatin is under development. It has been discovered that that phospine supported nanoparticles (gold) complexes have excellent anti-tumor activity. A nanoparticle has a major advantage being a biocompatible particle. Chemists have used the principle to load the dozens of molecules of anti-cancer drug paclitaxel onto a nano carrier. Paclitaxel which is being sold by the brand name of Taxol prevents cancerous cells from dividing or proliferation. The disadvantage is that this drug works on all cells, including healthy cells. This is why the patients undergo chemotherapy sometimes suffering like hair loss and suppressed immune function. The aim is to deliver more of the drug directly to the cancer cells and reduce the side effects of chemotherapy. The new delivery system is based on nanoparticles.

OTHER APPLICATIONS OF NANOPARTICLE:

A list of some of the applications of nanomaterials to biology or medicine is given below:

- Drug and gene delivery
- Bio detection of pathogens
- Detection of proteins
- Tissue engineering
- Tumor destruction via heating (hyperthermia)
- Separation and purification of biological molecules and cells
- Probing of DNA structure
- In targeting drug delivery
- Nanomedicnes: nanodrugs, medical devices, tissue engineering, etc.
- Increased bioavailability
- Dose proportionality
- Decreased toxicity
- Smaller dosage form (i.e., smaller tablet)
- Nanoparticles are being invested as carriers of drugs such as paclitaxel.
- Nanorods (GOLD) are being investigated as photo thermal agents for in-vivo applications.

CONCLUSION

This promising new therapy will serve effective in the treatment where there is no adequate control of proliferation of cancerous cells like Paclitaxel, Mitoxantrone, Cisplatin, and Altretamine.

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