Conceptual Study on Nanoparticles for Cancer Detection using Nanotechnology

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Abstract— Cancer treatment is one of the major challenges in the modern world. Many studies and developments in the field of Nanotechnology have been made and as a result of all these many nanomaterial have been utilized to detect cancer at the early stages itself. Gold nanoparticles, Quantum dots, Carbon Nanotubes are some of the Nanoparticles for the detection of cancer cells due to their special properties.
Key words: Biomarkers, Gold Nanoparticles, Quantum Dots, Carbon Nanotubes

I. INTRODUCTION

Nanotechnology is a field of applied science which performs the engineering of functional systems at the molecular scale. The field nanotechnology can be applicable very effectively and successfully in various fields of science and technology. Cancer is a widespread disease and the treatment becomes a major challenge of modern science. By following traditional cancer treatment 99% of chemotherapy drugs do not reach the target cancer cells, and also it impart lots of toxicity problems to the patients since because they are not selective to Tumor cells. The Survival of a cancer patient depends heavily on the early detection. Nanotechnology has been claimed as a smart and effective technology that produces systems with the capability of targeting drugs to the specific sites in the body. This review refers the different nanoparticles which can be used for cancer detection.

II. NANOPARTICLES FOR CANCER DETECTION

Nanomaterials can have the unique physical, optical and electrical properties that have proven to be very useful in sensing. Nanotechnology involves engineering of multifunctional device which have dimensions of nanoscale, similar to the dimensions as those of large biological vessels or molecules in our body. These devices typically have features of 10's or 100's nm across and they can carry one or two detection signals and/or therapeutic cargos. Nanoparticles have the advantage of targeting cancer by simply being accumulated and get entrapped to tumours, which is known as passive targeting.

Few nanoparticles used for cancer detection are mentioned below.

A. Gold Nanoparticles

Due to the special optical properties of Gold Nanoparticles, they have been in the bio imaging spotlight. Some of their exciting features are given. They have a better absorption and scattering bands than conventional organic dyes. The cross section of their bands going upto 4 to 5 orders of magnitude higher. The gold nanoparticles are proven to be more biocompatible, less cytotoxic and resistant to photo bleaching according to human cell experiments. The Gold nanoparticles can absorb and scatter light from the visible to near-infrared (NIR) region according to their size and shape. It provides deep tissue penetration which is useful for in vivo imaging. Modified gold nanoparticles have developed to improve their contrast properties and their higher affinity to the cancer cells.

B. Quantum Dots

Quantum dots are nanosclae crystals of a semiconductor material which are very stable light emitters and are powerful molecular imaging agent having semiconducting, light emitting nano crystals. Due to their unique optical and electronic properties when compared to the traditional organic fluorescent labels, they are becoming an exciting nanomaterial to work. They have low photo bleaching threshold and broad absorption/emission peak width. They are excellent optical imaging Nano probes for evaluating the specific Tumor-targeting ligands in vireo in cancer cells and in vivo for animal cancer models.

C. Carbon Nanotubes

Carbon nanotubes are in the spotlight which have been emerges as a powerful sensing vehicle due to their excellent properties. The conductance property of the semiconductor carbon nanotube changes when biomolecules are absorbed on the walls, causing changes in local electrostatic environment. They provide high surface to volume ratio, mediate fast electron transfer and they can functionalized with most of the chemical species. They represent potential type of Nano devices for cancer biomarker detection which is being used for the development of DNA biosensors. Carbon nanotubes based biosensors with FET has used for the detection of lung cancer biomarkers for exhaled breath samples.

III. CONCLUSION

The present approaches for cancer treatment are limited to surgical resection, radiation and chemotherapy. Nanotechnology will enable early detection of cancer stages which will greatly improve disease prognostic. The exciting properties of several nanoparticles are explained which can be adapted for cancer cell detection at the early stages.

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