Nano Technology Treatment of Cancer- A Future Vision In The Usage of Chemotheraphy Drug

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Abstract— This paperdescribes the theoretical application of nanodevices in the treatment of cancer. The advanced technology for the treatment of cancer is the chemotherapic treatment .In chemotherapic method,drugs of specific composition is given to the patients depending on the biopsy of the tumor from the patient. The main disadvantage of using chemotherapy is that the drug used is not so specific. Hence it causes damage to the surrounding healthy cells. To make the treatment more specific, we use the nanodevices that use nanosensors to sense the cancer cells with biomotors to decrease hypoxia enviroinment and some specific compounds that control the telomerase production, which could serve as a means of controlling cell division.
Key words: Nano sensors, biomotors, nanorobots, chemicalsensor, monoclonal antibody

I. INTRODUCTION

Nano is one billionth of one. At present we have microprocessors and microarray technology that would reach the nano level within a few years.

- Get essentially every atom in the right place.
- Make almost any structure consistent with the laws of physics that we can specify in molecular detail.
- Have manufacturing costs not greatly exceeding the cost of the required raw materials and energy.

II. CONCEPTS INVOLVED IN THE NANOTECHNOLOGY

- Positional assembly.
- Self-replication.

Both positional assembly and self-replication are new in the field of mechanical manufacturing, but are common in our human system. The self-replicating model of a DNA, which arranges the adenine, guanine, cytosine and thiamine with hydrogen bonds in between them, is self-explanatory for both self-replication and positional assembly.

III. BIOLOGICAL ASPECTS ABOUT CANCER

The human body is made up of many cellular units that worn out regularly and replaced by new cells referred to as mitosis. There are certain control systems that control these dividing mechanisms. Cancerous cells are those cells with boundless dividing capabilities that affect the normal body put up. Cancer begins when there is a permanent change in the DNA structure, referred to as the mutation.

IV. 4STEPS FOR CHANGES IN GENE STRUCTURE

A. *Primary steps*

- Immunity fails.
- Cells communicate with each other by receptor organs through the chemotherapic process. During this primary steps the following changes took place in DNA structure of Gene configuration.
  - Proto-Oncogenes Become Oncogenes: Oncogenes which gives message for repeated multiplication of cells, being the main causative of cancerous cell growth.
  - Tumor Suppressor Genes Stop Working: The adjacent cells produce the tumor suppressor activation to inhibit the growth of the cells. At times this might also malfunction.
  - Cell Cycle Clock Malfunctions: The cell nucleus contains a collection of interacting proteins that control cell division, called the cell cycle. If DNA is found damaged then the tumor suppressor gene destroys the cell.

B. *Secondary steps*

- Excessive cell growth.
- Normal cells cannot survive without an extra cellular matrix, which is not the case with the cancerous cells.

1) *Tumor Forms*

- The tumor is a collection of cells without the aid of extra cellular matrix for its survival, which maintains a blood vessel network by angiogenesis.

2) *Benign tumor*

- Prevailing only in one part.
- Surgical removal is possible.

3) *Malignant tumor*

- Serves as the pre-cancer tissue.
- Surgical removal is not possible.

4) *Tumors Spread*

- Malignant tumors spread to the entire region
- Affects the nearby regions to form secondary growth or metastases.
- Adhere to one another thus increasing the danger of spreading the cancer cells.

V. CURRENT TECHNOLOGY IN TREATMENT OF CANCER

The current technology used in the treatment of cancer is chemotherapywhich uses the anticancer (cytotoxic) drugs that reaches the all parts of the body and destroys the cancer cells by stopping their growth or the administration of cancer-fighting drugs, such as ***taxol***, has proven effective in destroying ***breast cancercells***that have spread to other organs. .

Following a healthy analysis of the samples, an Ex-Vivo Apoptotic (EVA) assay taken from the biopsy, the drugs efficiency towards each tumor is identified. The present situation has the following ways for treatment of cancer

- Chemotherapic drugs

- Immunology
- Radiotherapy

VI. GOALS OF CHEMOTHERAPY

- Shrinks primary tumors.
- Slowdown the tumor growth.
- Kill cancer cells that may have spread (metastasized) to other parts of the body from the original, primary tumor.

VII. DISADVANTAGE OF CHEMOTHERAPY

- Kills both cancer and healthy cells.
- Induces anemia that then exacerbates hypoxia in the tumor.
- Treatment is made specific by the use of Nanodevices that use nanosensors to be more specific in application of chemotherapy to the malignant tumors, thereby increasing the safety in the usage of chemotherapic drugs.

VIII. RADIOTHERAPY

Multi-fractionated irradiation and radiotherapy combined with chemotherapy, a radiosensitizer, or hyperthermia have all been used to improve the therapeutic effect of radiotherapy. The radio sensitivity of cancer cells in an aerobic environment is about three times higher than that of hypoxic cells. If artificial blood developed using nanotechnology can change a hypoxic cell into an oxygenated cell, it might improve the radio sensitivity.

IX. IMPLEMENTATION OF NANOTECHNOLOGY

A. Monoclonal Antibody

Monoclonal Antibody (MAb), laboratory-produced protein molecule used in medicine to detect pregnancy; diagnose disease, including acquired immune deficiency syndrome (AIDS), hepatitis, and various kinds of cancer as diagnostic tools and treatment aids.They are also used in laboratories to track proteins in experiments.

B. Mab Production

A monoclonal antibody is created in the laboratory by fusing, or joining together, a normal B cell, which normally dies within a few weeks, and a cancerous B cell, which lives indefinitely. This fusion creates a hybrid cell, called a hybridoma that can live forever and produce an unlimited supply of the antibody secreted by the original, normal B cell. By varying the types of normal B cells used to create hybridomas.

An ingenious technique was developed that combined the myeloma cell's (a type of cancer cell) ability to rapidly produce large quantities of the same antibody with the ability of a normal B cell to produce a useful antibody. Normal mouse B cells and mouse myeloma cells were grown together in a laboratory culture. The growing medium included a chemical that would join the membrane of one normal B cell with the membrane of one myeloma cell, creating a B cell hybridoma.

Each hybridoma from the culture when placed it in its own growing medium grew and multiplied at the rapid rate of the original mouse myeloma cell from which it was derived, but all of its daughter cells (the new cells it produced) secreted only the antibody made by the original, normal B cell used to create the hybridoma.

C. How Mab's Are Used?

- Today scientists use MAbs to identify and measure minute quantities of hormones, infectious substances, toxins, and other molecules in tissues and fluids.
- MAbs can also be used to identify malignant cells (cells with abnormal growth) in tissues.
- In our case to help diagnose cancers hidden in the body, radioactive substances are attached to MAbs that recognize and target cancer cells.
- These MAbs are then injected into a patient's body. The MAbs find cancer cells for which they are targeted and bind to them.
- A special machine that uses film sensitive to radioactivity is used to take an internal picture of the patient's body.
- This image reveals any cells to which the MAbs attached, indicating the presence of cancer.

D. Hypoxia Enviroinment (Low Oxygen Content)

- Induces angiogenesis (blood vessel growth into the tumor).
- Promotes tumor growth.
- Hypoxia leads to Anaemia.

The best way of evaluating blood oxygen-carrying capacity is to measure hematocrit and hemoglobin levels. Since cancer cells thrive in a hypoxic environment, the cancer patient's hematocrit and hemoglobin should be maintained in the upper one-third range of normal prior to the initiation of chemotherapy.

E. Rotary Motor

- For the transportation of chemotherapic drugs biomoleclarnanomotors are used in this method.
- It uses the concept of ATP synthesis that serves for two purposes.

F. Function of ATP

- Increases the oxygen content in the local environment.
- Decreases the possibilities of hypoxia and thereby reducing the spread of cancer tumors and the formation of vascular blood vessels or the so-called angiogenesis.

G. Nanosensors

Theability of medical nanodevices to measure both absolute temperature and changes in temperature is crucial for monitoring in vivo physiological thermoregulatory mechanisms and intracellular energy transactions.

The treatment of cancer using nanotechnology uses the following type of sensors:

- Fluorescence sensor
- Temperature sensor – senses the variation of temperature in the local environment.
- Pressure sensor – senses the variation of pressure in the local environment.
- Chemical sensor- Chemical analysis of local environment.
- Biosensors - Reverse the action of telomerase by proper administration of drugs.

X. PROCESS AND DEVELOPMENT OF NANOSENSORS

The method for the Single Walled Carbon Nanotube (SWNT) is not efficient.By developingnanosensors using nanotube technology or from genetically coding the T4 bacteriophage that is currently being used to develop FET transistors.
Process that follows are

- If we use some kind of nanotube that has the characteristics of being attracted by the radiation components then the couple of nanotubes being used would be attracted by these compounds that there would be some displacement in the nanotube coated with the radiation attracted compound.
- This would change the interseparationdistance of the nano tubes and then it changes the capacitance in between them.
- The variation in distance between the nanotubes directly controls the speed of nanomotor for the administration of chemotherapic drugs to the cancerous cells.

XI. NANOROBOTS FEATURES

The Nanorobot we devised is an integrated system of consists of the following components:

- Nanomotor
- Nanosensors
- Nanopumps

And NanoDevices for the administration of chemotherapic drugs.

XII. 1FEATURES IN A NUT SHELL

- Chemical Elements – Carbon In The Form Of Diamond Or Diamond Fullerene Nano Composites Largely Because Of Tremendous Strength And Chemical Inertness Of Diamond.
- Size-500 Nm To 3000 Nm
- Drug Carrying Capacity (Dcc) - 1cc Injection Of 1µ Nanodevices Has A Capacity Of Carrying 0.5 Cc Of The Drug.
- Powering-By Means Of Explicitly Supplied Acoustic Signals.
- Biocompatablity - Two Protective Layers Used.(A Polymer Coating Of Polyethylglycol With Pecvd Deposition And An Anti-Inflammatory Drug Which Releases Superoxide Dismutuse)
- Integration - Using Biotin-Steptravidin Linkages.
- Tracking - Use Of Navigational Nanorobots.
- Communication With Nanorobot Inside The Body-The Simple Forms Of Broadcasting Messages Into The Body Are Received By Invivonanorobots, Which Involves Acoustic Messaging A Probe That Would Encode Messages On Acoustic Carrier Waves At Frequencies 1 - 10 Mhz

XIII. IMPLEMENTATION OF NANOTECHNOLOGY IN CANCER TREATMENT

The algorithm for the implementation of nanotechnology in cancer treatment using the advanced present day technology are as follows:

- Nanorobots are designed in a way that could carry the chemotherapic drugs for the treatment of cancer cells.
- The use of ATP powered bio-motors used for nanodevices decreases the danger of spreading of tumor to other regions as it creates a low hypoxia environment that
- The present radiation detection method is the use of Monoclonal Antibodies (MAb). In these nanorobots are used for the detection of cancerous areas,
- Administration of drugs in these affected areas that are detected by the nanosensors which show variations in capacitance is directly coupled to the shaft of the nanomotor, through Brownian movements.

XIV. BROWNIAN MOVEMENT OF NANOROBOTS

- The nano sensors are used for the removal of these radiation compounds.
- This Brownian movement will show the cancer affected area for the implementation of the chemotherapic drugs through nanopumps.

XV. FUTURE THRUST

- Bio medical applications.
- Genetic Engineering.
- Research in Avionics.
- Defence(satellite chip).
- Satellite Communciations (NASA).

XVI. CONCLUSION

The latest method in the field of nanotechnology gives the hope of the effective use of this technology in medical field. This is the beginning of nano-era and we could expect many improvements like curing some deadly diseases like AIDS using nanotechnology. In futurenanosensors will be used for fast and accurate diagonostics. Further ahead nanotechnology may be used to build ARTIFICIAL MUSCLE and 'lab on a chip' technology will develop more efficient drug discovery process.

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