AN END FOR CANCER BY NANOTECHNOLOGY

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ABSTRACT:

Electronics and computational techniques are increasingly being used to analyze biological cells to diagnose diseases and develop methodologies to cure diseases inside the body. One such technology is 'Nanotechnology'. 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 8085 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.

INTRODUCTION:

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:

A nanometer is one billionth of a meter - 1/80,000 the width of a human hair, or about the combined diameter of ten hydrogen atoms. 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.

CANCER:

Cancer cells are different from healthy cells because they divide more rapidly than healthy cells. 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.

The nanodevices can be programmed to destroy affected cells and kill only them, thus ending the problem of destroying any normally functioning cells which are essential to one's well-being.

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

PROBLEM:

Both of these types of treatment are harmful. 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. Research has proved that any individual who had cancer can survive on deadly chemotherapy up to a maximum of five years and after that it's anybody's guess. But treatment using nanotechnology will make a man perfectly normal. This paper deals on the treatment of the most wide spread 'CANCER' using nanotechnology.

WHY GENES?

DNA, the genetic material of living organisms, is a large helical molecule held together by weak bonds between base pairs of nucleotides. Human genome consists of approximately 30000 genes, containing approximately 3 billion base pairs. A gene is a sequence of DNA. Sequence is the order of nucleotides in a DNA or ribonucleic acid (RNA).

SUPER CARBON:

With the help of nano-molecular tools, we could design the nano device. 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.

PROCESS:

The initial step of identifying the cancer and the location can be done by scanning. Once the location has been identified through scanning, the task is to position the nanodevice to the exact location. We focus on the positioning of the nanodevice into the required location by itself. The nanodevice is allowed to be placed into any part of the body (or) the nano device is injected through the blood vessel. The positioning is done with the help of mathematical calculations. External Control signals could be used to avoid mishap or any other errors. The nanodevice is loaded with a microchip. The device is also provided with the compounds concealed so that it is initiated externally through a computer. The nano device contains sensors, motor, gene reader, processor, transceiver, camera and power supply. The location of the cancer cells is given as co-ordinates in a 3-dimensional point of view. This point is considered as the reference and referred as (0,0,0).

POSITIONING:

The nanodevice performs an internal calculation based on the difference between its current position and the reference. Mathematical computations involve such that only one axis is compared between the nano device and the reference at a time. The motor fan is placed in a particular direction for a particular reference comparison. After one of the axis is completed and comparison is done, then the next axis is being compared followed by the third.Thus the three co-ordinate comparison of the nano-device results in any 3-dimensional orientation of the nano-device and results in exact positioning.

NAVIGATION:

The output of the mathematical operation is given to a driver circuit (motor).The driver helps the device to navigate through the blood with precision in direction and with the required speed. The device thus should sample its new position with the reference at a sampling rate. The sampling rate is made such that their value is less than the velocity of blood flow.

The cancer killer could thus determine that it was located in (say) the big toe. If the objective was to kill a colon cancer, the cancer killer in the big toe would move to the colon and destroy the cancer cells. Very precise control over location of the cancer killer's activities could thus be achieved. The cancer killer could readily be reprogrammed to attack different targets using acoustic signals while it was in the body.

ALGORITHM FOR NAVIGATION:

Step1: Marking the co-ordinates.
Step2: Initialize the start command.
Step3: Feed the axis.
Step4: Send command to emit ultrasound.
Step5: Wait for T seconds.
Step6: If there is no signal reflected back (or) if the reflected signal is less than the threshold

value, then activates the stepper motor to rotate through a certain distance. (Note: the distance is proportional to one axis)

Step7: Subtract the axis value by one.

Step8: Continue from step4 to step7 for both coordinates.

Step9: If the signal reflected back is greater than the threshold value then the motor is de-activated.

Step10: The motor (perpendicular to motor1) is activated. The motor2 moves through one step thus making the motor1 to change the axis.

Step11: The motor1 is allowed to travel until next change is required.

Step12: Once the nanodevice reaches the required spot, the motor is deactivated through external command.

Step13: Receives the RF radiation for T seconds that has been already calculated depending upon the intensity of tumour.

IMAGING:

With the available technology, a camera is inserted which helps us to monitor the internal process. Whenever multiple directions are there in the blood vessel, the device is made to stop through the external control signal and another signal is given to activate in the right direction.

Current clinical ultrasound scanners form images by transmitting pulses of ultrasonic energy along various beam lines in a scanning plane and detecting and displaying the subsequent echo signals. Our imaging is based on the absolute scattering properties and in the frequency dependence of scattering in tissues, which will help to differentiate between normal and abnormal cells.

IDENTIFICATION:

The nano device identifies the cancer cells using a gene reader. A gene reader is a sensor which contains ten to fifty DNA probes or samples of cancer cells that are complementary. The DNA detection system generates an electronic signal whenever a DNA match occurs or when a virus causing cancer is present. Motorola's e-Sensor DNA detection system is currently available. Whenever we get a signal indicating the presence of cancer cells we go for further process. Once the device has been originally located, the next step is the destruction of the cancer cells.

DESTRUCTION:

Researchers at MIT (Massachusetts Institute of Technology) have proved that, we can remotely control the behavior of DNA using RF energy.

An electronic interface to the bimolecular (DNA) can be created. RF magnetic field should be inductively coupled to nanocrystal antenna linked covalently to a DNA molecule. The inductive coupling results to the increase in the local temperature of the bound DNA, allowing the change of state to take place, while leaving molecules surrounding the DNA relatively unaffected. The switching is fully reversible, as dissolved molecules dissipate the heat in less time duration. Thus RF signal generated outside the body can destroy the affected DNA.

RF HEATING:

The treatment tip contains the essential technology components that transform RF to a volumetric tissue heating source. The heat delivery surface transmits RF energy to the cells.

Tumors that have little or no oxygen content (i.e. hypoxia) also have increased resistance to radio-frequency radiation. Thus, due to high resistance to radio frequency radiation the affected cells get heated and hence destroyed.

BIOTELEMETRY SYSTEM:

The biotelemetry system monitors pressure and temperature and consists of major building blocks like implantable pressure/temperature transmitter, receiver, data acquisition card, and digital signal processing system.

The transmitter uses Pulse Interval Modulation (PIM) to send temperature and pressure information out of the biological environment. The RF carrier frequency is in the biomedical range (174 - 216MHz). A pair of RF pulses is transmitted at a frequency of about 1-2Hz.

How nano device escapes from immune system?

Generally our immune system attacks all the foreign particles entering any part of our body. The problem has been that such nano particles are similar in size to viruses and bacteria, and the body has developed very efficient mechanisms to deal with these invaders. It is known that bacteria with hydrophilic surfaces can avoid being destroyed by immune system and remain circulating in the body for longer periods. To emulate this effect, our nano device can be coated with a polymer such as polyethylene glycol (PEG), which is proved after the research.

CONCLUSION:

As per our aim we have proposed the usage of nanotechnology and the RF signal for the destruction of cancer cells. This method doesn't affect the healthy cells such that the cancer affected person is healthy after the treatment. This treatment doesn't involve critical operations. This treatment will not take longer time as in any other treatments. Surely one day or the other cancer treated patient will be affected again in treatments other than nanotechnology treatment. This can be very well used for other dangerous diseases.

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