IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 3, March 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.488

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 3, March 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0903190 |

Nanobots for Cancer Immuno-therapy

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ABSTRACT: Cancer immunotherapy orchestrates the system of the physical body to fight against cancer cells. By doing this, it has revolutionized cancer treatment. Some decades ago, the nano-scale robots were only in science fiction but today, they are expected to be the next generation to change the technology related to medical diagnosis and drug delivery. Many challenges have to be faced to develop this technology not only from technical, biological, physio-chemical point of view but also the concern of using this new technology to interact with the human environment. **According to Robert Wood, an American robotist, "Nanobots are devices that detect friends and enemies; undergoing through a conformational change when they sense an enemy, catalyzing the the release of a substance that can act against it"**. This nano-biomolecular technology will definitely rule the world and we will get a lot of benefits in terms of saving time, accurate diagnosis and fast treatment without side-effects.

KEYWORDS: Nanobots, Nanomedicine, Nano particles, Cancer, Immunotherapy.

I. INTRODUCTION

Cancer is an alarming virus that independent attack of peoples from children to elders. Due to the human habitual cultivation, the cancer is wide spread in and around the world [3-4]. The global statistics of cancer growth shown in Figure.1. The doctors and engineers are coined to control, quick diagnosis and treat the cancer. The paper is proposed that the nanobots are identify the cancer cells, accumulate the cancer cells and remove the overgrowth of the cancer cells shown in Figure 2. In human body, many healing sages are available as nature and it constructed through anticancer characteristics already identified in current research articles. Nano particles are used to trigger the healing herbs in the form of cancer medicines and assures have no side effects [8-10]. Nanomedicines overcome interference of nanoparticles to develop immune system. The nanoparticles delivery focus to build the strong immune system. Cancer immunotherapy accumulates nanoparticles to synchronous the response of immune system. Nano particles may chance to toxic, quick concern in particular selection of pathways for the immune response. Nanobots are developed in which it is blocked unwanted foreign bodies [5-7].

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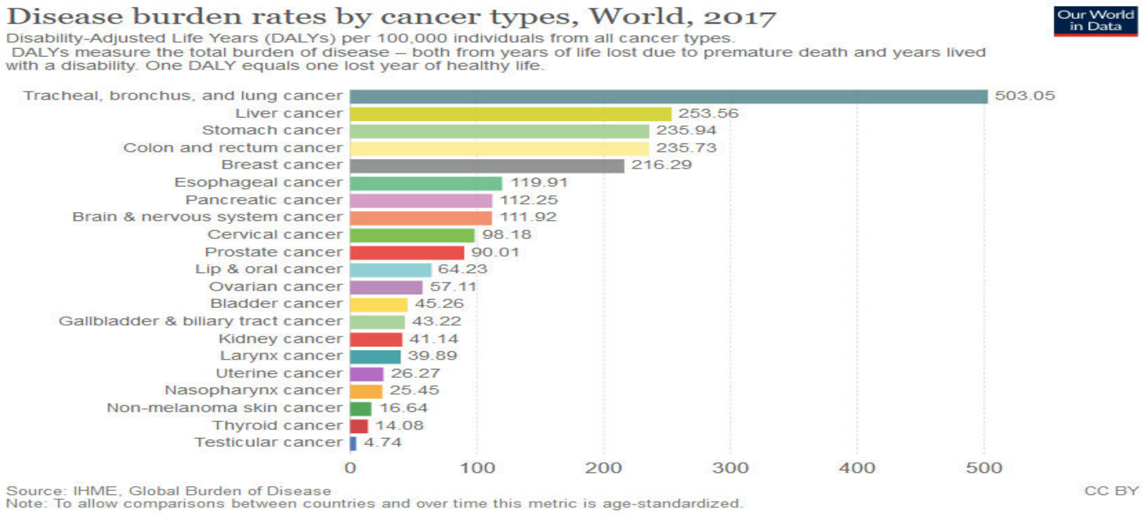

Fig. 1 . Statistical growth of Cancer

II. HISTORY OF NANOBOTS

Richard Feyman was mentioned as “nanobots” in 1959 for therapy of heart diseases. Later, Eric Drexler published a book named ‘Engines of Creation’ about genetically programmed molecular machines shown in Figure 2. The study related to nanobots was made by Robert Freitas about respirocytes, nanobots resembling the red blood cells [1].

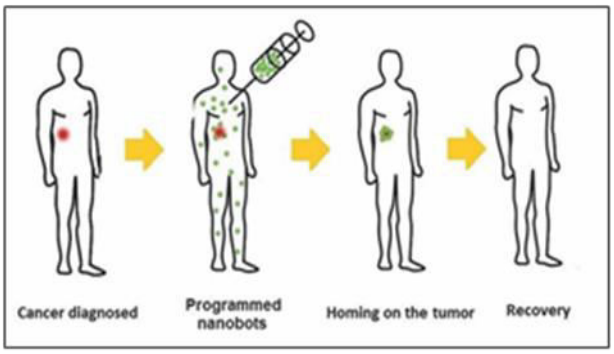

Fig. 2. Cancer treatment with nanobots

III. PROPOSED METHODOLOGY

Bacheletetal.,[2]developed DNA basednanobots that deliver cancer therapeutic drugs also as carrier. The DNA based nanobots injected into the human body in which it is accumulates to destroy the cancer cell in and around the tissue. The size of DNA based nanobots is 35nm in diameter smaller than 200 times of RBC (Red Blood cell). Cadano is the open-source software to design the structure of the DNA based nanobots.

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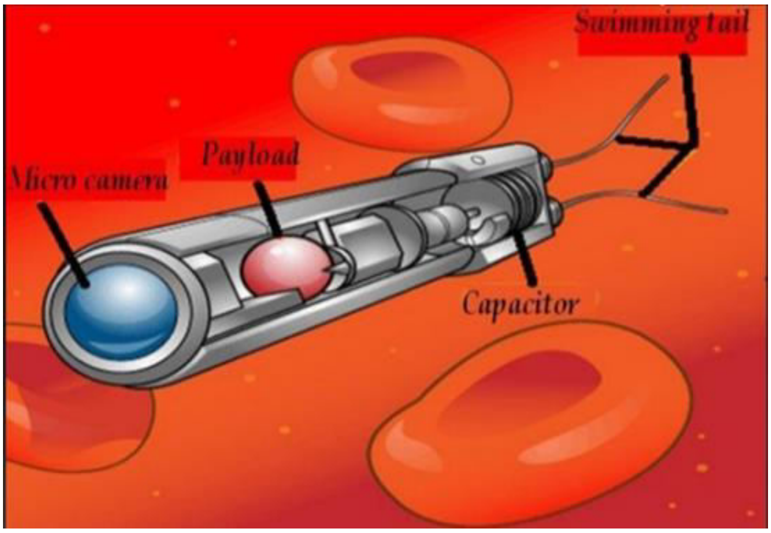

Fig. 3. Construction of Nanobots

Researchers have constructed the nanobots using DNA origami. DNA can have design into user defined shape by segmenting a small portion from staple strand into long strand. To form the desire shape is integrating the complementary two base pairs can be built into a desired shape by cutting a small portion of it (staple strand) and attaching it to alongstrand shown in figure 3. The nanobots consist two halves as opened and closed in the form of grapple. The molecular centers are used to make connection together as molecular latch for DNA double helixes.

The payload molecules are attaching 12 sites available already inside the nanobots also used to inject the drug, the aptamers are attaching two positions available outside of the nanobots also identify the target.DNA aptamer is single stranded DNA or RNA that can selectively bind to a specific target, proteins, toxins and even a living cell. They have the tendency to form helices and single stranded loop.

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The nanobots have been isolated to be in two states

- ON : Nanobot is delivered the drug into particular cell (Open)
- OFF : Nanobot is bypass the drug into the healthy cells (Close)

The gold nanoshell particles are effectively used as a drug to treat the cancer. The reason behind the usage of gold nanoparticles, they are designed in the way that they can convert the near infrared into heat and effectively ablate low to intermediate tumors.

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Nanobots are injected in the human body through IV injection to flow through the bloodstream. The Nanobots flows along with blood and detects the cancer cells and tumors by the sensors fitted in it. The key to programming a nanobot that only attacks the cancer cells are often achieved by include a special payload on the surface called DNA aptamer. The nanobots introduce the anticancerous nanoparticles in the site of data about the action on cancer cells can be recorded and send the monitoring system via wireless communication.so the doctors can get precise report of their patients in the treatment of cancer shown in Figure 4.

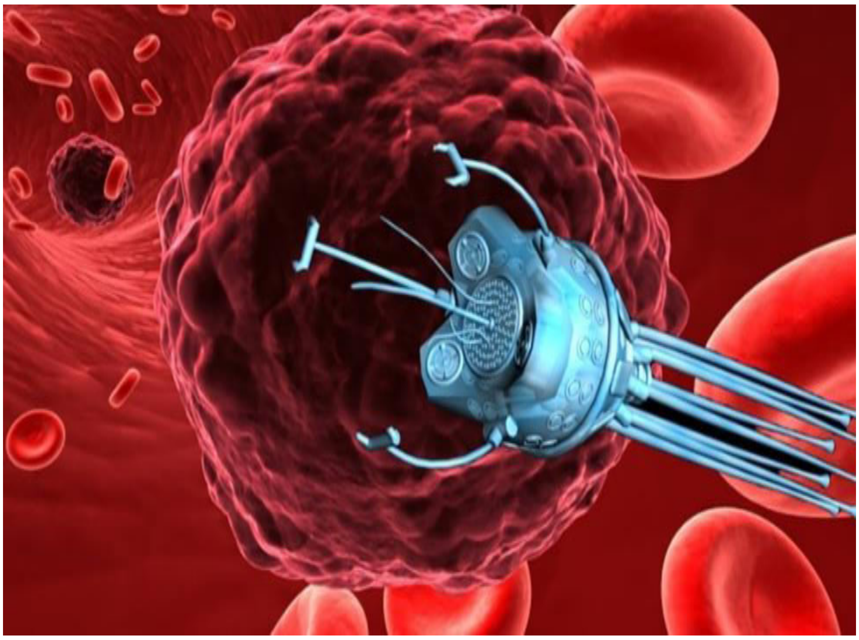

Fig. 4. Drug transfer of nanorobot to cancer cell

IV. ADVANTAGES

- Cost of surgery is low
- Rapid elimination of disease.
- No operative failures and safe
- Faster and precise results
- Capacity to produce copies of themselves by self -replication.
- Does not affect other healthy cell
- Reduce the adverse side-effects of chemotherapy.
- Speedup the medical treatment.
- Reduce the death rate due to cancer.

V. RESULTS AND DISCUSSION

As a consequence of death of a cancer cell, the remaining drugs from the payload reaches the dentritic cells and antigen presenting cells. This cells takes up the drugs and priming taken place at lymph nodes. This leads to activation of t cells (especially killer T cells) and APCs by the drugs to kill the cancer cells. These cells trafficking and recognizing the tumor cells by infiltration through the epithelial cells of blood vessels. Finally the T cells also kills the cancer cell. By this way the treatment through the nanobots induce the T cells, which also now able to memorize and kill the cancer cells curing the cancer in an effective manner in a short period shown in Figure 5.

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The nanoparticles have been extensively developed for precise cancer imaging and targeted cancer therapy, as evidenced by a few breakthroughs have been made in the explorations of preclinical and clinical nanomedicine. This review summarizes the explorations and recent trends of the nanoparticles in cancer nanomedicine.

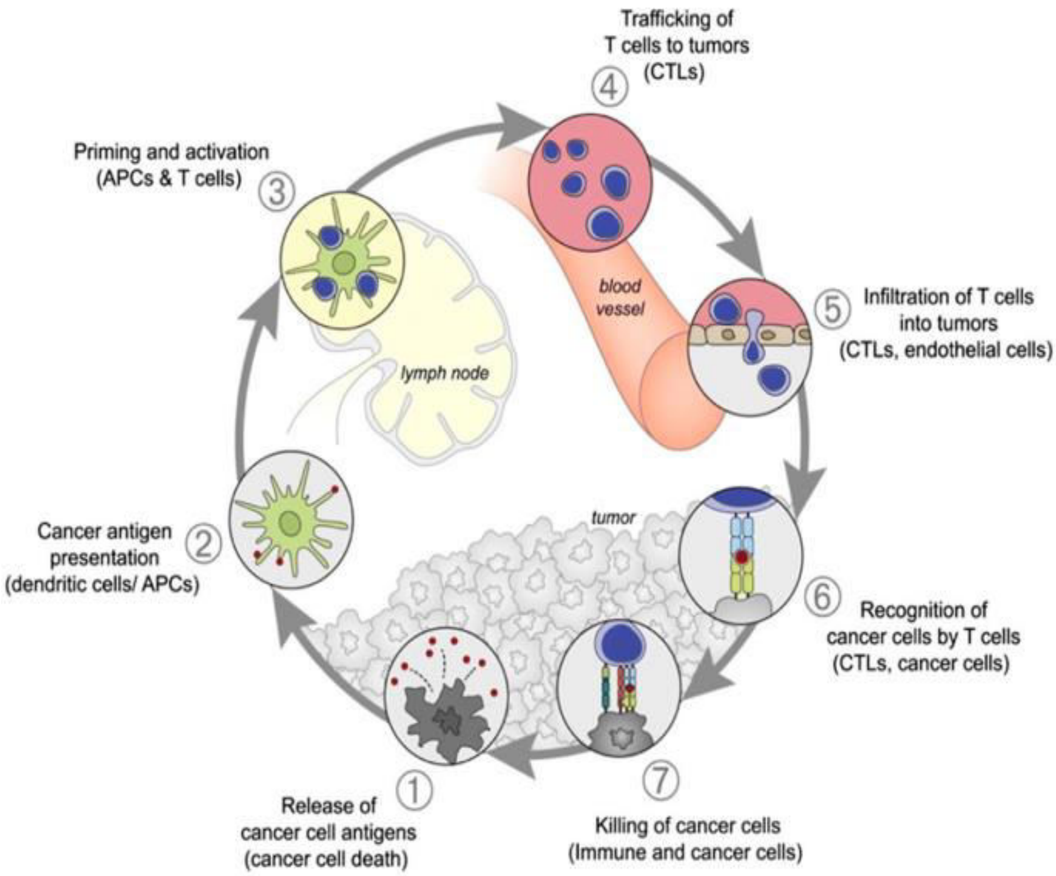

Fig. 5. Results for the proposed methodology

In any case, simplified and powerful designs of smart nanoparticles are highly desired for clinically potential cancer nanomedicine, as indicated by the emerging frontiers in this review that might bring new and promising concepts for cancer nanomedicine. The developments presented in this review are expected to inspire more successful explorations and clinical translations of intelligent nanoparticles for the revolution of precise nanomedicine.

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