

Computational Biology- Nano Programmed Carrier and Computed Aided Surgical for Cancer

Smith S Trivedi

Department of Information Technology, Loyola-ICAM College of Engineering and Technology, Chennai, India

*email: smithstrivedi.21it@licet.ac.in, Tel.: +00-12345-54321

Available online at: www.ijcseonline.org

Abstract— The task of dealing with human body is one of the most complex one especially when it comes to curing someone suffering from heavy torment of malignant tumors. Cancer therapies are currently limited to surgery, radiation, and chemotherapy. All three methods risk damage to normal tissues or incomplete eradication of the cancer. Computational methods involves the development and application of data-analytical and theoretical methods, and computational techniques to the study of biological, and behavioral systems, and with Nanotechnology it offers the means to target chemotherapies directly and selectively to cancerous cells and neoplasms, guide in surgical resection of tumors, and enhance the therapeutic efficacy of radiation-based and other treatment modalities. All of this can add up to a decreased risk to the patient and an increased probability of survival. “Nano programmed carriers” or “NPC” carrying effective drugs are deployed in the blood stream. They are programmed to hit only the right spot through DNA computing which is interface to biochemical processes and are highly directional. On the other hand cancer abrupt can be predicted through Cancer computational biology. It aims to determine the future mutations in cancer through an algorithmic approach .It allows the gathering of data points using nano programmed robots and other sensing devices. This data is collected from DNA, RNA, and other biological structures. Areas of focus include determining the characteristics of tumors, analyzing molecules that are Involved in causing cancer, and understanding how the human genome relates to the causation of cancer

Keywords— nano programmed carriers, nanotechnology, programmed bio sensors, CAS, cancer computational biology

I. INTRODUCTION

The life we live now is very cozy and comfortable, thanks to the new technologies and creative inventions. But still the future is very uncertain especially when it comes to our health. A sudden birth of a cancer cell could fix our appointment with death. It is pretty difficult to diagnose cancer in early stages as it does not reveal its true colors initially and pretends to be some common disorder. And in later stages, when cancer is confirmed it becomes too late to treat. And even if treatment is done through chemotherapy and radiations, it spoils normal functioning of other organs and reduces the quality of health and life. But, what if the drugs meant for cancer cells are only utilized on cancer cells, not affecting any other part of the body? What if this abrupt of tumor cells could be predicted accurately before they are born? This could be possible by introducing a systematic approach and identification of the exact location and component of the tumor and mapping the information provided by Microarrays and through integrating concepts of bio-chemistry, Nano-technology, computational programming, and big data analysis. The traditional use of nanotechnology in cancer therapeutics has been to improve the pharmacokinetics and reduce the systemic toxicities of

chemotherapies through the selective targeting and delivery of these anticancer drugs to tumor tissues.

II. NANO PROGRAMMED CARRIERS

This concept of Nano programmed carriers (NPC) is improvement of theory of application of nanotechnology in treatment of cancer. These NCP are of very small size and the size could be of 10^{-6} to 10^{-9} meter and made up of organic silica compounds that don't dissolve in blood as they are meant to be introduced in blood stream. These NCP'S are made programmable and directional.

A. Micro Array data and analysis-BIG DATA

A DNA micro array (also known as a DNA chip) is collection of DNA sequence that represents the entire set of genes of an organism. They are used to measure the expression level of genes.

These micro arrays the very basic information about how the cells function in an individual. This set of systematic functioning is converted into digital data, and huge amount of data of each genome is created in a computer system. It is impossible for a doctor or scientist to study entire genetic data of an organism but computers can do it quickly.

B. Why microarray analysis?

- Large-scale study of biological processes
- To know what is going on in the cell at a certain point with respect to time.

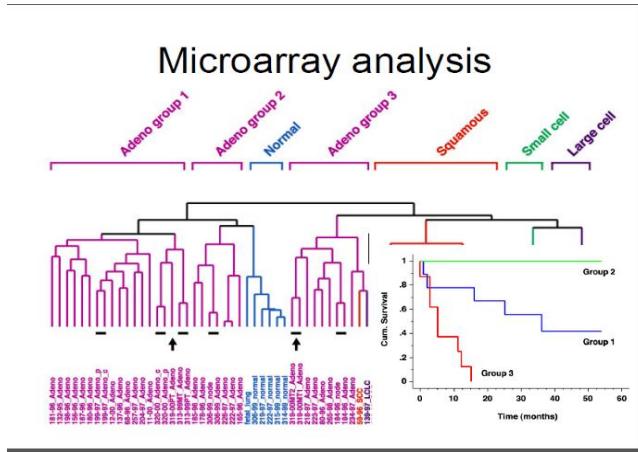


Figure 1. Microarray analysis

C. Summary of NPC process

The NPC are programmed especially to distinguish between normal cells and tumor cells through bio sensors and are enclosed with the data available through microarray analysis to function according to behavior of general body cells. The major part of programming is based upon the difference in chemical properties of normal cells and tumor cells. The bio sensor works on principle of bio-chemical reaction and the entire biological data is analyzed and converted into binary data. The NPC are also programmed to carry locomotion along the blood stream in search for tumor cells. They carry chemotherapeutics in Nano formulations and as soon as they spot the target tumor cells they release the chemotherapeutics at that specific location. Once their job is done they destroy themselves and disintegrate as programmed to or carry on further similar operations depending on the need.

D. Algorithm

1. The NPC are made recognize and differentiate tumor cells from normal cells through bio sensors.
2. They are programmed to act only on tumor cells and all the actions to be performed are given in form of logical instructions.
3. They are encoded with microarray details of the host organism in order to function accordingly to the host environment and behavior.
4. They are loaded with chemotherapeutics and pharmaceutical agents.
5. They are introduced in the blood stream of the host.
6. The NPC wanders and on spot of tumor cells it releases the loaded chemicals.

7. After their job is done the NPC disintegrates and is excreted by the body.

E. But how do NPC get to know that the cells are normal cells or tumour cells?

- Image analysis: Spot recognition of the scanned image
- Data processing: Determination of spot intensity (condition, action and energy)
- Chemical analysis: The chemical properties of the target cells are analyzed.
- Dimensional reduction: it involves linear approach using mathematical principles and concepts such as Eigen and Laplacian concepts.

F. Advantages and significances

The systematic flow of NPC is shown in figure 2.

- It is a powerful tool for combating cancer. There is nothing inherently dangerous about using nano sized devices and it has very minimal level of toxicity.
- It does no or negligible harm to human body during treatment when compared to direct chemotherapy and radiation.
- It could help in predicting of certain things that may not be existing now but might be existing in future
- Can be updated regularly
- It could help in developing realistic models of how cells work and make it understandable to manipulate them.
- It could provide eradication of cancer from an individual's body without much struggle and agony.

III. CURRENT TRENDS

The use of nanotechnology for diagnosis and treatment of cancer is largely still in the development phase. However, there are already several nanocarrier-based drugs on the market and many more nano-based therapeutics in clinical trials. The application of nanotechnology to medicine includes the use of precisely engineered materials to develop novel therapies and devices that may reduce toxicity as well as enhance the efficacy and delivery of treatments. As a result, the application of nanotechnology to cancer can lead to many advances in the prevention, detection, and treatment of cancer.

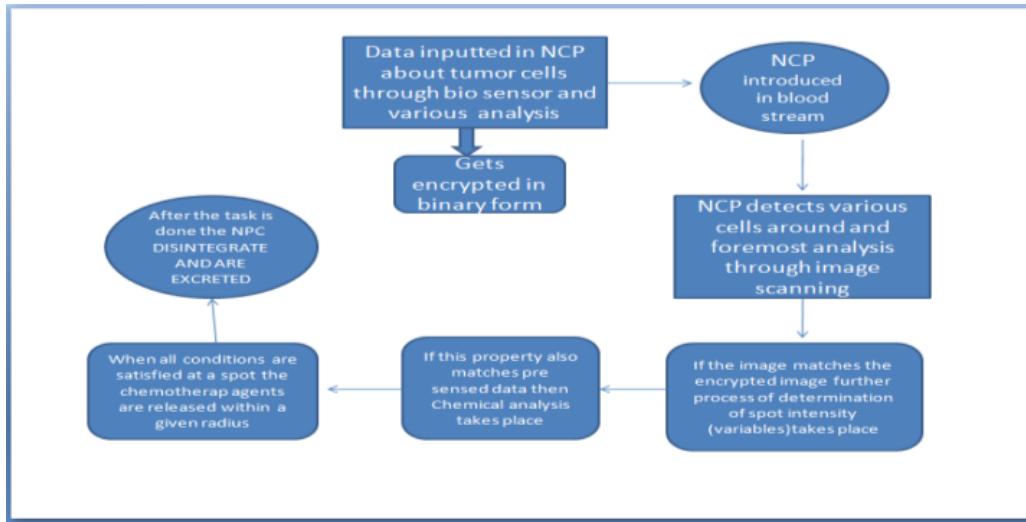


Figure 2: Systematic flow of NPC

IV. CONCLUSION AND FUTURE SCOPE

This can be the best and cheapest possible way to deal with cancer. It can be evergreen by regular updating depending upon the need and computer can never fail on their own, so risk level is very minimum. 1. This is improvised technical version of “carbon Nano tubes and their application in drugs therapy”, which is still under research phase. It could predict abrupt of cancer before the birth of cancer cell by studying the condition of internal body and analyzing it through various methods. It could fix genetic disorder in an individual in near future. It could predict lifespan of an individual by analyzing the functioning and action of various organs, cells, etc. It could replace direct chemotherapy and radiation process in cancer treatment. It could deliver augmented radiotherapy, immunotherapy and gene therapy without undergoing heavy treatments. It can be a basis for “computer aided internal surgery”.

REFERENCES

- [1] R. Weissleder, M.C. Schwaiger, S.S. Gambhir, H. Hricak, “Imaging approaches to optimize molecular therapies”, *Science Translational Medicine*, Vol. 8, Issue. 355, pp. 355-371, 2016.
- [2] Phillips E, Penate-Medina O, Zanzonico PB, Carvajal RD, Mohan P, Ye Y, Humm J, Gönen M, Kalaigian H, Schöder H, Strauss HW, Larson SM, Wiesner U, Bradbury MS, “Clinical translation of an ultrasmall inorganic optical-PET imaging nano particle probe”, *Science Translational Medicine*, Vol. 6, Issue. 260, pp. 260ra149, 2016.
- [3] Haun JB, Castro CM, Wang R, Peterson VM, Marinelli BS, Lee H, Weissleder R, “Micro-NMR for rapid molecular analysis of human tumor samples”, *Science Translational Medicine*, Vol. 3, Issue.71, pp.71ra16, 2011.
- [4] Maeda H1, Nakamura H, Fang J, “The EPR effect for macromolecular drug delivery to solid tumors: Improvement of tumor uptake, lowering of systemic toxicity, and distinct tumor imaging in vivo”, *Advanced Drug Delivery Reviews*, Vol. 65, Issue. 1, pp. 71-79, 2013.
- [5] Bertrand, N., Wu, J., Xu, X., Kamaly, N. & Farokhzad, O. C. “Cancer nanotechnology: the impact of passive and active

targeting in the area of modern cancer biology” *Advanced Drug Delivery Reviews*, Vol.66, pp. 2-25, 2014.

[6] C He, X Duan, N Guo, C Chan, C Poon, RR Weichselbaum, W Lin, “Core-shell nano scale coordination polymers combine chemotherapy and photodynamic therapy to potentiate checkpoint blockade cancer immunotherapy”, *Nature Communications*, Vol. 7:12499, pp. 1-12, 2016.

Authors Profile

Mr Smith S Trivedi is currently pursuing his undergraduate studies in the field of information technology at Loyola-ICAM College of Engineering and Technology, Chennai.

