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A MAGNETIC APPROACH TO CANCER

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Abstract

Cancer has, for long, been the bane of humanity, claiming the lives of those who would have been a lovely contribution to the society, if given the chance. It's cure, however, has been no boon either. Many a cure for cancer such as chemotherapy, radiotherapy, surgery, etc. have been found. Chemotherapy, has however been the limelight of cancer treatment till date. This is because many prefer chemotherapy treatment — a method that deteriorates the general health of the individual, by causing several side effects. Now, a new treatment has come up — one that may save many lives.

A solution that will be explained using a beginner's physics law — magnetism, with the extensive usage of biology. In magnetism, we all know like poles repel and unlike poles attract. The following treatment will work similarly. In this method, a non-toxic (mainly non-carcinogenic) and edible polymer, made using the hydrophilic cyclodextrin and wrapped up using hydrophobic polyurethane, to a biological nanoparticle such as those nanoparticles produced by bacterial magnetosomes, synthesized by magnetotactic bacteria, which would target only cancerous cells, without harming the healthy cells — just like a north pole getting attracted to a south pole.

1 Main text

Taking pancreatic cancer, for example, following will be the procedure for carrying out the treatment:

Pancreatic cancer is one of the most lethal types of malignant solid tumor and is typically associated with a poor prognosis. The FDA approved erlotinib in combination with gemcitabine is used for the first — line treatment of advanced pancreatic cancer. Due to poor chemotherapy outcomes, surgical resection remains the primary treatment strategy for pancreatic cancer. An improved understanding of pancreatic tumor biology allowed the development of the novel chemotherapeutic agent, erlotinib. Erlotinib, an inhibitor of epidermal growth factor receptor, passed clinical trials and with gemcitabine, is now approved

for the first — line treatment of advanced pancreatic cancer.

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Diagram 1

Mixing this erlotinib, with gemcitabine, in a polymer that is non-toxic (mainly non — carcinogenic) and edible made using the hydrophilic cyclodextrin and wrapped up using hydrophobic polyurethane, and attaching it to a biological nanoparticle such as those nanoparticles produced by bacterial magnetosomes, synthesized by magnetotactic bacteria. Examples of such polymers that can be used are poly(lactic-co-glycolic acid)(PLGA) and polyethylene glycol (PEG).

Aptamers can be designed as targeting ligands, and can differentiate between diseased cells and healthy cells, thus enabling the selective delivery of therapeutic compounds to target cells. Aptamers are chemically synthesized, and they possess additional advantages over natural antibodies — anti A, anti B, etc — including a smaller size, and an efficient penetration into biological compartments and due to which they accumulate quickly within the tumor tissue. It is possible to chemically modify aptamers to facilitate covalent conjugation to nanomaterials, for example, with 30 or 50 amino groups. Due to their small size, these aptamers can be easily cleared by the kidneys. To delay their clearance, these aptamer nanoparticles can be added to PEG.

Through an MRI, the tumor site can be found. After finding the tumor site, a beam of infrared light to the polymer, that will melt PEG and release erlotinib with gemcitobine only in the cancerous cells. This will not harm the healthy cells in any manner.

This method can be used for treating other types of cancer, like skin cancer, using the FDA approved Encorafenib (Braftovi) + Binimetinib (Mektovi) drugs and similar polymers such as PEG and PLGA. This method can also be used to treat ovarian cancer, colon cancer, lung cancer, breast cancer, leukaemia and all other types of cancer if used effectively with the appropriate drugs.

Following are the FDA approved drugs that can be used for targeted delivery for some type of cancers -

1. Ovarian cancer - Olaparib (Lynparza)
2. Colon cancer - Avastin (Bevacizumab)
3. Lung cancer - Erlotinib
4. Breast cancer - Trastuzumab (Herceptin)
5. Leukaemia - Gilteritinib (Xospata)

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Figure 1

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