

Fight the Cancer, Not the Treatment

Heal the World, Great Problems Seminar, Worcester Polytechnic Institute By: Allie Hardy, Mary Hesler, Rachel O'Hara & Juliana Wakeman

Need

The need is to decrease or eliminate some of the physical, mental, and emotional traumas that accompany the treatment of cancer; these are symptoms that decrease the body's ability to respond effectively and fight the cancer or to even survive the treatment.

Side Effects of Chemotherapy

While chemotherapy has been proven to be sufficiently effective in the treatment of cancer, many scientist believe that it can be improved on. Chemotherapy is the only way to reach and destroy the cancer cells that doctors can not even find with current surgical procedures. However, in order to do this the doctors saturate the body with these lethal drugs, this practice leads to a profusion of symptoms which are arguably worse than the cancer itself.

- Thrombocytopenia (extremely low platelet count) - Nose bleeds - Frequent Bleeding and Bruising - Neutropenia (low white blood cell - Immune Deficiency - Leads to Opportunistic Infections - General Infections

-Cardiotoxicity (weakening of heart,

through damage to the muscle)

- Hepatotoxicity (Liver Damage)

- Fever

- Nausea

- Emesis

- Diarrhea

- Palamar-Plantar syndrome: sores on the hands and feet - Secondary Neoplasms - Gastrointestinal Tract Problems - Constipation -Esophageal Inflammation - Nephrotoxicity, Kidney Damage

- Infertility - Depression, Anxiety, Paranoia - Nerve Damage - Hair Loss - Memory Loss - Fatique - Decreased Endurance - Dark Patches on the Skin - Body Aches, Chronic Bone Pain - Anemia - Sensitivity to Sunlight - Decreased Libido - Inability to Concentrate - Foot Pain, Difficulty Walking - Dizziness -Weight Loss - Swelling - Mouth Sores - Dry and Cracked Skin - Hives - Loss of Appetite



Action Plan

• With the information we obtain, we plan to develop an informational pamphlet about this new drug delivery system, since the general public is largely unaware of its potential.

• It is our intention to distribute this information at various audiences. • We also plan on attending as many Relay for Life events as possible to connect with people and share the this information with interested parties.

How Nano Particles Work...

1. The nano particles are introduced into the body in a benign form. 2. Particles travel through the body. 3. The nano particles attach to Epidermal Growth Factor Receptors (EGFR) found on most cancer cells 4. Only once the the particles have attached to the cancer cells will the drug be released.



Fig. 1. This image depicts the nano particles attacking a cancer cell.

Polymer Nanoparticles

Made out of various types of polymers. Easily produced.

One method of production called PRINT (Particle Replication in Non-wetting Templates) technology involves molds made from silicon templates. The ability to create these molds in any shape allows the polymer nanoparticles to be produced in any shape. This easy and flexible production is a huge benefit to using polymer nanoparticles. The chemical composition of the particle does not affect its shape

The shape of the particles makes them "smart" because their shapes are designed such that they will only match up to the shape of proteins on the surface of target particles.





Goal

Our goal is to present the most promising nanoparticle research, as it pertains to the delivery of cytotoxic and antineoplastic drugs. In doing this we hope to raise the public awareness needed for companies to promote this treatment because anything that can be done to expedite the clinical trials is worth doing.

Current Obstacles

Time

- Must wait years to see what long-term effects of introducing nanoparticles into the body may be.
- It will still be a while until a completely successful process is developed.
- With recent statistics from the World Health Organization predicting that cancer will surpass heart disease as the most common killer in the world by 2010, time is of the essence in bringing successful treatment to the predicted 75 million people who will be living with cancer by 2030.

Money

• Research, testing, creation, and FDA approval process costs about \$1 Billion. Constant funding from multiple outside sources is necessary.

Success

- Trials showing both great success and great failure.
- · Some results indicate that diseases caused by introducing some nanomaterials into the body are actually more harmful than cancer itself.
- · We will not be completely sure of the success of any drug until ample time and money allow the drug to be used by a large amount of cancer patients, and years pass during which potential side effects can be evaluated first hand.

Future

In a world where "40.35% of men and women born today will be diagnosed with cancer... at some time during their life" the existence of a drug with the ability to target and kill cancer cells while ignoring healthy cells would be a valuable asset. If this technology could be perfected its applications would be limited only by the creativity of the medical community. Only time will determine whether this revolutionary new technique is as promising as current studies would indicate.

b. Three logenet of Seart' Many action for Channel Through and Manging' 10 Dec. 2008 chttp://water.and.usc.edu/searcy. b. Daug delivery by a stanguation 'MT News 13 Peb. 2008. MT: 11 Dec. 2008 chttp://water.and.usc.edu/searcy. n, S., M.B. Lai, V.V. Dukhande, A. Bhushan, G.K. Daniels, S.W. Leung and J.C.K. Lai, "Billion Divide/Nanopures/DWEAD-Active-Details for adde-Nanopures/DWEAD-Active-Details for adde-Nanopures/D











Gold Nanoparticles

"Nano-gold"

Clusters of gold atoms that are usually less than one-hundred

The company, CytImmune Sciences Inc, is working with nano-

gold, and has shown that it can safely attach anti-cancer drugs to

Been used in medical procedures for over fifty years including the

nanometers in diameter.

the body

treatment of rheumatoid arthritis.

Relatively easy to stretch and shape.

FDA approved for other uses in the body. Biocompatible - not toxic to human tissues or cells. Can move safely through the bloodstream, and is not rejected by

More expensive than the other materials.

its surface and travel through the blood stream. Went through Phase 1 of clinical trials and had some success.







