Fight the Cancer, Not the Treatment

Heal the World, Great Problems Seminar, Worcester Polytechnic Institute
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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.

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 2030, there is 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.

Side Effects of Chemotherapy
- Thrombocytopenia (extremely low platelet count)
- Nose bleeds
- Protozoa and Bacterial Infections
- Neutropenia (low white blood cell count)
- Immune Deficiency
- Leads to Opportunistic Infections
- Dental Infections
- Fever
- Pelvic-Fruey-Purcell syndrome: sore on the head and test
- Secondary Neoplasms
- Gastrointestinal Tumor Problems
- Nausea
- Diarrhea
- Constipation
- Gastrointestinal Inflammation
- Nephrotoxicity, Kidney Damage
- Cardiotoxicity (weakening of heart, heart attack, heart failure)
- - Decreased Endurance
- Dark Patches on the Skin
- Body Aches, Chronic Bone Pain
- Anemia
- Sensitivity to Sunlight
- Increased Blood Pressure
- Skin Rash
- Chills
- Weight Loss
- Swelling
- Muscle Soreness
- Dry and Cracked Skin
- Loss of Appetite
- Decreased Leukocyte Activity
- Fatigue
- Body Aches
- Depression, Anxiety, Paranoia
- Nerve Damage
- Hair Loss
- Memory Loss
- Fatigue
- Decreased Endurance
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Polymer Nanoparticles
Made out of various types of polymers. Easily produced. One method of production called PRINT (Particle Replication in Non-wetting Templates). Polymer nanoparticles are used in various medicine applications. Polymer nanoparticles are designed such that they will only match up to the shape of proteins on the surface of target particles.

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

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 proteins on the surface of the cancer cells.
4. Only once the the particles have attached to the cancer cells will the drug be released.

Gold Nanoparticles “Nano-gold”
- Clusters of gold atoms that are usually less than one-hundred nanometers in diameter.
- Been used in medical procedures for over fifty years including the treatment of rheumatoid arthritis.
- 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 the body.
- Relatively easy to stretch and shape.
- More expensive than other materials
- The company, CytImmune Sciences Inc, is working with nano-gold, and has shown that it can safely attach anti-cancer drugs to its surface and travel through the bloodstream.
- Went through Phase 1 of clinical trials and had some success.

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.


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.

Success
- Trials showing both great success and great failure.
- Some results indicate that diseases caused by introducing some nanoparticles 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 resources 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.

Current Solutions
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