Targeting Breast Cancer with Nanoparticle Actein Coated with Herceptin

BACKGROUND

Breast cancer is the second most common type of cancer in the world. Problems with existing treatments for breast cancer therapy are:
- **Toxicity**: Most anti-cancer drugs are often not selective for tumor cells vs. normal cells;
- **Bioavailability**: The efficacy of drugs, as well as herbal extracts/components, is limited by bioavailability.
- **Resistance**: Repeated treatments produce tumors that are resistant.

INVENTION

The invention will develop relatively nontoxic and effective black cohosh derivatives and an immuno-nanocarrier therapy for ER negative breast cancer using nanoparticle actein coated with the cancer-cell targeted antibody Herceptin. Since actein inhibits pathways that are activated in Herceptin-resistant breast cancer, this therapy will also attack tumors in patients who have demonstrated intrinsic or secondary resistance to Herceptin, as well as other therapies.

APPLICATIONS

- The invention can prevent and treat breast cancer;
- The technology can be applied to a variety of cancers beyond breast cancer;
- It may have added health benefits and can be used as an:
  - anti-inflammatory,
  - lipid lowerer,
  - anti-HIV, statin and osteoprotective agent.

ADVANTAGES

The present invention has many advantages over the existing cancer therapies:
- novel, relatively nontoxic, actein derivatives and components that target pathways activated in Herceptin-resistant breast cancer;
- nanoparticle technology;
- techniques for coating the nanoparticles with the cancer-cell targeted antibody Herceptin to enhance their potency;
- a synergy is created among actein, Herceptin, and nanoparticles, with minimal toxicity. This approach can be tested on other herbal agents and combinations with chemotherapy agents.

MARKET

**Initial Market**: Breast cancer is the second most common type of cancer worldwide. In 2012, it was estimated that approximately 290,170 women would be diagnosed with breast cancer and there would be 39,510 breast cancer deaths.

**Rising Revenues**: Pharma companies in 2010 made over $12.7 billion, in U.S., in breast cancer treatments. In addition, some patents for older drugs, including aromatase inhibitors and selective estrogen receptor modulators, will expire soon.

**Secondary Markets**: Add other cancers and other diseases, such as HIV and lipid disorders, and the market probably exceeds $50-100 billion, worldwide

TEAM

**Lehman College**:
- Dr. Linda Einbond, genetic and dietary factors in human cancer causation/chemoprevention

**College of Staten Island**
- Dr. Krishnaswami Raja, organic synthesis, nanopoarticles

**Columbia University Medical Center**:
- Dr. Rong Cheng, statistics and bioinformatics
- Professor Nancy Reame, clinical trials

**European Foundation for Oncology and Environmental Sciences “B. Ramazzini,” Bologna, Italy**
- Dr. Morando Soffritti, M.D., Scientific Director, animal models of cancer

**Advisors**:
- Dr. Keith Bostian, Jon Saxe, Aaron Etra, Stanly Kohlenberg

License Contact
Douglas Adams
TCO
The City University of New York
555 West 57th Street, Suite 1407
New York, NY 10019

T 646-758-7906
F 646.758.7907
douglas.adams@mail.cuny.edu
www.cuny.edu/research/ovcr/tco.html

Ref #: 13A0009
Lead Inventor: Linda Einbond

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