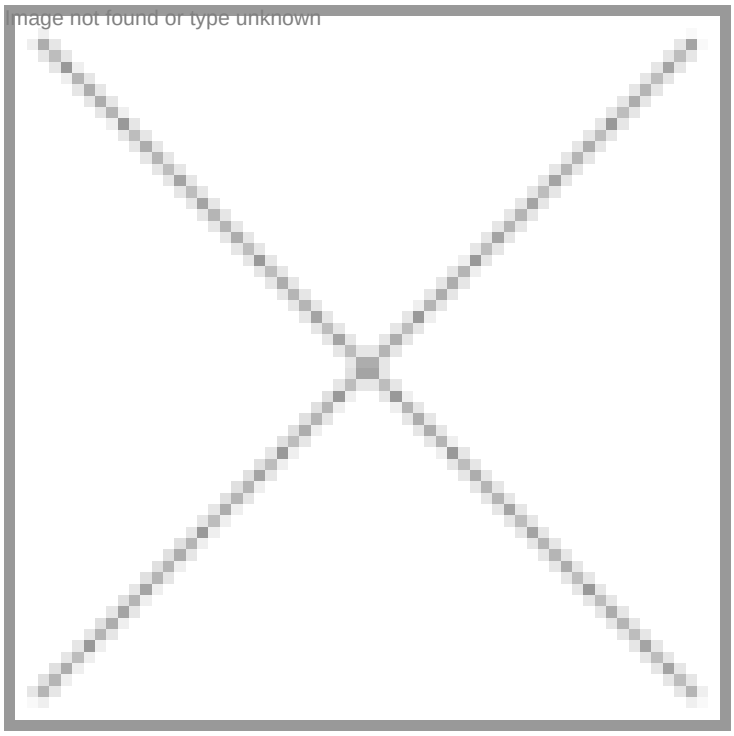
BioSpectrum the business of Bio & Health Sciences

# Gene Therapy, Enabling Patient-specific Treatment

10 March 2009 | News

Image not found or type unknown



## Gene Therapy, Enabling Patient-specific Treatment

*If you thought only clothes could be tailor made? Think again. Medicine and even medical treatment can be tailored to suit your genes.*

It was on September 14, 1990 at the U.S. National Institutes of Health, W. French Anderson M D and his colleagues performed the first approved gene therapy procedure on four-year old Ashanthi DeSilva. Born with a rare genetic disease called severe combined immunodeficiency (SCID), she lacked a healthy immune system. White blood cells were removed from her body, grown in the lab, missing genes were inserted into the white blood cells and the genetically modified blood cells were infused back into the patient's bloodstream. Laboratory tests have shown that the therapy strengthened Ashanthi's immune system by 40 percent; she got relief from recurrent colds, she has been allowed to attend school, and she was immunized against whooping cough. This procedure was not a cure; the white blood cells treated genetically only work for a few months, after which the process must be repeated.

**Development over the years**

Gene therapy uses purified preparations of a gene or a fraction of a gene, to treat diseases. A common approach in gene therapy is to identify a malfunctioning gene and supply the patient with functioning copies of that gene. Other approaches include switching specific genes on or off or introducing genes to kill cancer cells, to suppress tumors by inhibiting the blood supply or to stimulate the immune system to attack certain types of cells. Whichever approach is used, the aim of gene therapy is to introduce therapeutic material into the target cells, where it becomes active and exerts the intended therapeutic effect.

In the mid 1980s, the focus of gene therapy was entirely on treating diseases caused by single-gene defects such as cystic fibrosis, hemophilia, muscular dystrophy and sickle cell anemia. In the late1980s and early 1990s, the focus of gene therapy

shifted towards the treatment of a number of acquired diseases. There are a number of ongoing trials conducted on patients with advanced solid tumors or non-Hodgkin's lymphoma and the stem cell gene therapy is used to treat X-SCID (X-linked severe combined immunodeficiency).

There is very little gene therapy work being done in India. The exceptions are Actis Biologics Pvt Ltd (ABPL) and Advanced Center for Treatment Research and Education in Cancer (ACTREC). ABPL is currently working on the introduction of Gene MSP36 into cancer cells to make them die by producing a protein, which will inhibit the rapid multiplication of the cells and their metastasis. Gene MSP36 also inhibits the further production of blood vessels, which are critical for the delivery of nutrition to these cancer cells.

In 2007 Mumbai-based ONCO Life Sciences got the regulatory nod to market its the unique cell-based gene treatment for breast cancer, lung cancer, renal cell carcinoma and colorectal cancer. The therapy was developed by Berlin-based biotechnology company Mologen AG which has given exclusive marketing rights to ONCO Life Sciences. It promised to prolong the lifetime of a cancer patient by 2-5 years.

However it was only recently that doctors have treated a cancer patient by injecting him with billions of his own immune cells, a development that projects the huge power of gene therapy for the killer disease. According to a report in the New England Journal of Medicine, US researchers at the Fred Hutchinson Cancer Research Center in Seattle treated a 52-year-old man afflicted with melanoma by cloning cells from his own defense system and injected them back into his body, in a process known as 'immunotherapy'. Within eight weeks of immunotherapy treatment the patient recovered from tumors. Even after two years of treatment he is still free from the disease, which had spread to his lymph nodes and one of his lungs. It raises hopes that this approach could not only offer a more effective treatment for skin cancer or melanoma, but can be applied to other cancers too.

A new study reported in the journal Nature Medicine outlines the success of gene therapy to treat HIV and has produced promising results in clinical trials. Researchers at the University of California, Los Angeles gave patients modified blood stem cells to carry a molecule called OZ1, which is designed to stop HIV reproducing itself by targeting two key proteins. After 100 weeks, the patients who received the gene therapy had higher levels of CD4+ cells, the key cells of the immune system which are specifically destroyed by HIV. In theory, one treatment should be enough to replace the need for a prolonged anti-retroviral therapy.

**Future**

The combination of gene therapy and other approaches such as stem cell therapy are expected to have a huge impact in the treatment of critical illnesses. Gene therapy has the potential to cure diseases such as cystic fibrosis, cancers, heart diseases and human immunodeficiency virus infection. However, to date, no clinical trial of gene therapy has resulted in the development of a commercially available treatment.

Unsettled issues in gene therapy like effectiveness of delivery, longevity of the therapy and safety procedures have to be sorted out. While patients are largely satisfied with the current disease-led approach than the gene therapy approach. Scientists are stressing the need for more studies on vector safety, delivery techniques, molecular causes of diseases and the uncertainty of outcomes. Formation of bypasses around a clot, by the body, to replace bypass surgery, could be made possible with the help of gene therapy. Gene therapy has the potential to rejuvenate dead neurons in the brain and hence, can be used for the benefit of Alzheimer's or diabetes patients. The possibilities are enormous.

Shalini Gupta