The Industrial Perspective of Somatic Gene Therapy

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Somatic gene therapy is a new form of medical treatment where defined genetic material is transferred to specific target cells of a patient with the ultimate purpose of preventing or treating diseases.

The driving force behind this effort is, that despite the enormous number of available pharmaceutical drugs we are still confronted with many disorders without any or with limited treatment possibilities.

Gene therapy has the potential to revolutionize modern medicine since it could be one possible way to provide a rational treatment approach for genetic disorders instead of a symptomatic management of manifestations.

The obvious candidates for gene therapy are single gene defects that are clearly inherited. Examples are haemophilia, cystic fibrosis, phenylketonuria and familial hypercholesterolaemia. However, their common factor is that their incidence rate is relatively low and if the development of gene therapies would be limited to these relatively rare diseases this technology would have a limited commercial and medical perspective.

There are also obvious examples of acquired chronic diseases in which there is a genetic predisposition that can be triggered by environmental or endogeneous factors. Among those are common and life-threatening diseases like cancer and AIDS, but also disorders such as diabetes and neurodegenerative conditions. In all cases, it seems possible to develop a treatment with a specific manipulation of the genetic repertoire of the somatic cells carrying the defect or to transfer additional genetic information to body cells in order to obtain a therapeutic benefit.

The most important prerequisite for in vivo or ex vivo somatic gene therapy is the availability of safe and specific transfer methods for the genetic material. It is a great challenge for researchers in that area to find suitable vector systems with a high degree of specificity and efficiency and minimal side effects.
Somatic gene therapy is performed with the goal to cure patients or to increase their quality of life. This is covered by the basic principles of medical ethics as well as the basic requirements of conventional medical drugs. The main criteria for gene therapeutics are therefore the same as for any other medication: safety, efficacy and quality.

The introduction of an intact gene into the cells in a human body is under the above mentioned prerequisites comparable to an organ transplantation and does not raise new ethical questions.

Gene therapeutic manipulations with objectives other than to prevent, cure or treat diseases are not acceptable. This is also the case for manipulation of the human germ line which would lead to the permanent inheritance of the new genetic characteristic. Germ line gene therapy is prohibited by law in Germany and Austria.

Bayer is dealing with the possibilities of somatic gene therapy as one of the important fields of innovation. We believe that it may become a new key technology with a high medical and economical importance. Our interests are especially focused on medical targets and indication areas where Bayer is traditionally represented and has it’s research strength.

One example is the somatic gene therapy of Hemophilia A, a single-gene hereditary disease where the present medical treatment standard is a substitution therapy with coagulation factor VIII. The objective of this project is a permanent expression of factor VIII in the liver cells of the patients. Somatic gene therapy may become the next generation of Hemophilia treatment where Bayer is present with Kogenate® a recombinant form of factor VIII.

Other pharmaceutical companies have also started cooperations and strategic alliances. Favorite target firms are small american companies working on various therapeutic approaches.

For the next phase of development in Europe, it is of key importance that we have scientific and technical innovation structures which include small, specialized companies. They must be flexible enough to serve as a link between excellent research departments from the many universities and the traditional pharmaceutical companies.

Over 85 % of the clinical protocols with ex vivo and in vivo studies have relied on viral vectors such as retroviral vectors, adenovirus and adeno-associated virus. Non viral systems consist of cationic lipid complexes, plasmid DNA and receptor mediated delivery systems.

So far none of these gene delivery systems is able to deliver the therapeutic genes specifically and in sufficient quantity to the target tissue and to sustain the