MIT Technology Review

When Will Gene Therapy Come to the U.S.?

Several gene therapies are or will soon be in late-stage human trials. One of them could be the first to get FDA approval for sale in the U.S.

By Susan Young on September 30, 2013

Though many gene therapies have been tested in patients around the world in hopes of curing hereditary diseases, few governments have approved their sale, and none has been approved in the United States. That could change in coming years as several therapies enter advanced trials.

A big step forward already came in November 2012, when the European Medicines Agency gave the Dutch biotech startup UniQure permission to sell its treatment. That approval came as a relief to many in the field, who had been waiting for a break in the clouds hanging over the technology since failed and fatal trials in the 1990s. “You see a resurgence in terms of investors, and in truth, a number of problems have been solved,” says Katherine High, a medical researcher at Children’s Hospital of Philadelphia, who is overseeing a late-stage clinical trial for a different gene therapy.

Still, experts say it is likely to be a few years before a treatment is approved in the U.S. With its European approval in hand, UniQure may have good chance of also getting the first U.S. approval, but the company says it has not yet submitted an application to the FDA.

Like most gene therapies, UniQure’s treatment uses a modified virus to deliver a working copy of a gene to patients who lack a healthy version. In this case, the gene is needed for the body to break down fats; without it, patients can develop painful and even fatal inflammation of the pancreas. UniQure uses a modified version of a virus that most of us already carry. The choice of virus used to deliver a gene therapy depends in part on where the treatment needs to go in the body and whether the viruses are intended to replicate themselves. Some viruses, for instance, are designed to spread throughout the body to kill cancer cells.

There are several groups that could be the first to develop a U.S.-approved gene therapy (see table). High’s team is one; they are enrolling patients in a late-stage trial of a treatment for a disorder that causes blindness at an early age. The patients in this trial have previously been given the gene therapy in one eye, and now the other will be tested.

Gene Therapies Nearing Final-Stage Testing

COMPANY/INSTITUTION	DISEASE TARGET	STATUS
Advantagene	Prostate cancer	Expects to complete late-stage trials in September 2015
Amgen	Metastatic melanoma	Promising late-stage human results
AnGes MG	Artery failure in limbs	Approved by FDA to start global late-stage testing
Bluebird Bio	A hereditary and often fatal form of early neurodegeneration	Mid- and late-stage combination trial to start by end of 2013
Children's Hospital of Philadelphia	A hereditary form of early blindness	Late-stage trial expected to end in April 2015
Cold Genesys	Bladder cancer	Mid- and late-stage combination trial to start by October
Henry Ford Hospital	Prostate cancer	Approved by FDA to start late-stage testing
UniQure	A hereditary and sometimes fatal disorder that prevents the body from breaking down fat	Approved for sale in Europe

MIT Technology Review

In the experimental treatment, doctors inject a virus-borne gene just behind a patient's retina. The treatment improved some patients' vision to the point that they were no longer legally blind. Some patients have been stable for nearly six years. The trial is scheduled to end in April 2015.

Another possibility comes from Massachusetts-based Bluebird Bio, which has published results from patients who have seemingly been cured of a genetic blood disease (see "Gene Therapy Combats Hereditary Blood Disease"). The company is about to start testing its approach in a hereditary neurological disorder that is often fatal in young boys.

In a different form, gene therapy could also become an option for cancer treatment. At a meeting this summer, Amgen announced that it had met its goals for an advanced test of a gene therapy for melanoma that has spread from the skin to other parts of the body. The Amgen treatment, which was engineered from a virus that normally causes cold sores, takes a two-pronged approach to fighting cancer. The virus selectively infects cancer cells, where it replicates until the cell bursts. While growing inside the cell, the virus also produces a protein that rouses the immune system. When the cell explodes, immune cells are attracted to the tumor site to fight the disease.

In a test in patients with late-stage melanoma, 26 percent of patients whose cancer had spread saw a partial or complete tumor response for at least six months. In 11 percent of patients, the cancer completely disappeared, which suggests that the therapy spreads throughout the body, targeting tumors that weren't initially injected. Overall survival rates for cancer patients in the trials are expected to be reported in the first half of 2014.

The completion of these clinical trials is no guarantee that the technology will become widely used. However, companies and hospitals are also starting to build manufacturing plants capable of producing large amounts of virus-based cures. UniQure, for example, announced in July that it is building a 55,000-square-foot plant in Massachusetts to manufacture commercial-grade gene therapy products. It expects the facility to be operational by early 2015.

Credit: Illustration by Adrian Johnson

Tagged: Biomedicine, cancer, blindness, gene therapy, Amgen, UniQure