Science & Society

Two faces of gene therapy

The prospect of using genetic engineering to cure inherited diseases has been considered both exciting and forbidding. Two recent reports on the state of the field divide gene therapy into two categories, concluding that one is imminent and acceptable while the other is more distant and raises ethical questions.

Gene therapy that would affect only individual patients, but not their offspring, is so similar to other medical treatments that it does not raise fundamentally new ethical issues, says the Congressional Office of Technology Assessment (OTA). Some such noninheritable gene therapy is likely to be attempted this year for several rare, devastating diseases for which no adequate treatment is available. In these early attempts, researchers are likely to take bone marrow cells from a patient, provide the cells with a new gene and return them to the patient. For such procedures, an analytical and regulatory framework, coordinated by the National Institutes of Health (NIH) and the Food and Drug Administration, is already in place to prevent premature applications, OTA reports. The NIH Recombinant DNA Advisory Committee (RAC) last year set up a working group to consider human gene therapy. The group reported to the last RAC meeting (SN: 11/3/84, p. 278) that it had decided to limit its immediate considerations to noninheritable gene therapy, which would be the first to be attempted, and to leave "the more difficult question" to a later date.

The other category of gene therapy, making changes that would be passed on to subsequent generations, may raise ethical questions, OTA says. But this type of germline therapy is not practical at present, according to the report. "Heritable gene therapy is not being seriously considered in humans because of both technical barriers and unanswered ethical questions," says Senator-elect Albert Gore Jr. (D-Tenn.), who requested the OTA report. "If heritable gene therapy is ever contemplated, it must be widely discussed before experiments are started." Ethical questions aside, OTA argues that heritable gene therapy may never be widely practiced because as currently conceived it would offer little advantage over available procedures.

According to the OTA report, human gene therapy is expected to be considered in the next several years for five diseases, the most common of which is Lesch-Nyhan syndrome, which has 200 new cases reported in the United States each year. The other diseases under consideration are rare deficiencies of specific enzymes: adenosine deaminase, 40 to 50 reported cases worldwide; purine nucleoside phosphorylase, 9 cases; arginosuccinate synthetase, 53 cases; and ornithine carbamoyl transferase, 110 cases. Gene therapy is currently thought not to be applicable to chromosome disorders such as Down's syndrome, environmental and multigene disorders and such complex traits as physical strength or intelligence.

Moratorium on sending USSR bacteria?

In protest of Soviet refusal last spring to allow the emigration of molecular geneticist David Goldfarb, two U.S. microbiologists have joined European colleagues in calling for scientists to refuse to send bacterial strains to laboratories in the Soviet Union. According to the microbiologists, Max Gottesman of the National Institutes of Health in Bethesda, Md., and Charles Yanofsky of Stanford University, Goldfarb's visa was suspended in part because he allegedly was planning to take with him a collection of bacterial strains, some of which had been derived from U.S. strains. According to the Committee of Concerned Scientists, a New York organization, Goldfarb was told he was under investigation for an attempt to take "material of importance to Soviet nation security" out of the country. "But if these strains are vital to the security of the Soviet Union . . .," Gottesman and Yanofsky say, "why should we American scientists continue to supply the Soviets with such strains?"

Physical Sciences

World's shortest light pulse

Extremely short pulses of light can illuminate many chemical and biological processes. With them investigators can follow step by step reactions for which they previously knew only the beginning and the end.

The shortest pulses so far — 12 femtoseconds, or 12×10^{-15} seconds — are now claimed by Jean-Marc Halbout and Daniel Grischkowsky of the IBM Research Division in Yorktown Heights, N.Y. The apparatus, which was designed by Grischkowsky along with Anne C. Balant and Hiroki Nakatsuka of IBM, produces 800 12-femtosecond pulses every second.

It starts with 100-femtosecond pulses from a dye laser, which it puts through the core of an optical transmitting fiber. The optical transmitting fiber tends to spread out the wavelengths in the pulse so that the longer, redder wavelengths are ahead of the bluer, shorter wavelengths, a process called "chirping."

After chirping, the optical pulse goes through multiple reflections between a pair of diffraction gratings. The gratings tend to scatter different wavelengths in different directions, with the result that the front and rear ends of the chirped pulse are pushed together.

Nearest gravitational lens

A gravitational lens is a heavy object, a galaxy or cluster of galaxies, that lies on the line of sight between earth and some distant object (in all known instances a quasar) so that its gravitational field bends the light rays from the distant quasar to produce multiple images of that object. Until recently, five gravitational lenses were known. Now a group of astronomers with the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., reports the sixth, which is also the nearest one so far to earth.

The lens is a 15th-magnitude spiral galaxy, 120 megaparsecs (400 million light-years) from us, which acts on the light from a previously unidentified quasar, apparently 2,300 megaparsecs (7 billion light-years) away. It is cataloged as 2237+0305. Astronomer Edward Horine found it while observing with the 60-inch telescope of the Whipple Observatory on Mt. Hopkins in southern Arizona. Further observations were done by John Huchra and Graeme Smith with the Multiple Mirror Telescope, also on Mt. Hopkins, and by Stephen Kent with a 24-inch telescope.

This lens is only a tenth as far away as any of the other known examples, so studies of the details of its structure and lensing properties should be easier.

Antiprotons' anti-strong interaction

The "strong interaction" is the name physicists give the force that holds atomic nuclei together. Through it protons and neutrons attract each other. In stable nuclei the effect of the strong interaction completely overwhelms the repulsion among protons due to electrical forces.

Recently physicists at the CERN laboratory in Geneva have been replacing electrons in hydrogen atoms with antiprotons. The experiment is called ASTERIX (Antiproton STop Experiment with tRigger on Initial X-rays), which is also the name of a popular French comic strip. ASTERIX is connected to LEAR (Low Energy Antiproton Ring).

The investigation compares the X-rays emitted as such an "antiprotonic" hydrogen atom moves from one energy level to another with those emitted by ordinary hydrogen. Although proton and proton attract each other by the strong interaction and repel each other electrically, the reverse is true for proton and antiproton. Having opposite electric charges, they attract each other electrically, but the strong interaction between them is repulsive.