A Shot to the Heart Shows Promise

Scientists have demonstrated for the first time that a drug can induce the human heart to create new blood vessels, a process called angiogenesis. The achievement raises the possibility of a treatment that would marshal an assembly line of vessel-producing cells where the heart needs them most—in regions where blood flow has been shut off or curtailed by arterial clogs.

In adults, angiogenesis occurs naturally, but with limitations. Heart tissue damaged by lack of blood and oxygen recovers very gradually; some of it dies, becoming scar tissue. Over the past decade, researchers seeking to prevent such damage have tested in animals the value of angiogenesis-inducing proteins and the genes that encode them.

Among the compounds that induce angiogenesis are the human proteins known as fibroblast growth factors (FGF). Researchers at Fulda Medical Center in Germany have used a genetically engineered version of one such protein, FGF-1, to foster new vessel growth in damaged areas of animals' hearts.

The team began testing FGF-1 on humans 3 years ago. They recruited 40 people over the age of 50 who had at least two blockages in a key artery supplying the heart muscle and who were scheduled for heart surgery. Doctors rerouted an artery from the breast to this cardiac artery, downstream of one obstruction. During the surgery, the doctors injected FGF-1 into the heart of 20 of the patients at a site near a second blockage, located farther downstream; the other 20 received an injection of an inert form of FGF-1.

Angiography revealed that every patient who got active FGF-1 showed signs of blood vessel regeneration near the injection, allowing blood to bypass the second blockage, the researchers report in the Feb. 24 CIRCULATION. The effects of the single injection persisted for as many as 12 weeks. FGF-1 probably works in concert with another protein in the body, vascular endothelial growth factor, to form a web of new blood vessels, says study coauthor Thomas-Joseph Stegmann.

The patients who received an inert protein showed no improvement attributable to the injection.

To date, the patients who got injections of active FGF-1 have shown no side effects. The treatment may offer hope for people who have several blocked arteries and cannot have bypass surgery on all of them and for others who can't undergo surgery because tissue damage from heart disease is widely dispersed, Stegmann says.

"At the moment, we think it is too early to say this is a turning point" in treating heart disease, he says. "The application of an angiogenic growth factor like FGF-1 is not able to replace bypass surgery. On the other hand, we think that FGF-1 is a new attempt of a basically alternative method for treatment of cardiovascular disease."

The work "is a landmark study," says Judah Folkman, a surgeon and cell biologist at Children's Hospital and Harvard Medical School in Boston. In the future, Folkman says, FGF-1 may also be shown to work with angioplasty, a procedure in which a balloon is inserted into an artery to break up blockage.

The study has limitations, however, says Stephen E. Epstein, a research cardiologist at Washington (D.C.) Hospital Center. Angiography, in which researchers track dye injected into the blood to discern where new flows occur, "is not the gold standard" for determining new vessel growth, he says. Only heart function can accurately demonstrate whether the blood is reaching the capillaries, where it benefits muscle, and not simply being shunted through from an artery to a vein, Epstein says.

Also, having surgery simultaneously with the drug treatment confounds the effects of FGF-1, making it difficult to discern how much of any subsequent improvement is attributable to one or the other, he says. Several studies now under way or due to begin soon will also assess the effects in humans of FGF proteins and the genes that encode them, he says, perhaps shedding light on these questions. —*N. Seppa*

Hipparcos finds hint of star streams

Observations over the past few decades have revealed that two key components of the Milky Way galaxy appear to have assembled separately. Stars within the galaxy's disk are, on average, considerably younger than those in its halo, the vast, tenuous sphere of material that envelops the disk.

Recent studies suggest that the halo may have acquired its population of stars by snaring material from tiny neighboring galaxies several billion years ago. Streams of stars stolen from these galaxies merged into the halo, while gas clouds ripped from these neighbors crashed together, settling into a flattened pinwheel that became the Milky Way's disk.

If this model is correct, then instead of possessing an evenly distributed hodgepodge of stars, the halo should contain huge streams. The tug of gravity would stretch these stellar streams around the galaxy like strands of spaghetti.

Evidence that the halo contains such streams has been tenuous. In a new study analyzing highly accurate measurements of the position and velocity of 41 halo stars near the sun, B. Chen of the University of Barcelona finds additional hints of these structures. Chen describes the results in the March 1 ASTROPHYSICAL JOURNAL LETTERS.

The study relies on data gathered by the Hipparcos satellite. From 1989 to 1993, the spacecraft measured the distances to stars by recording tiny shifts in their positions caused by Earth's motion around the sun (SN: 2/15/97, p. 101). Blurring caused by Earth's atmosphere makes such measurements difficult to take with ground-based telescopes.

In examining the Hipparcos measurements, Chen finds three large-scale clumps that could represent distinct streams of halo stars. "The results . . . further suggest that accretion of stellar [material] plays an important part in the formation of the galaxy," says Chen.

Scott D. Tremaine of Princeton University agrees that the Hipparcos data provide a powerful new tool for astronomers seeking streams. He notes, however, that "the disappointing aspect of this paper is the sample size. Chen's 'halo' sample contains only 41 stars, which is much too small to make strong statements about the number of distinct streams in the sample."

Rosemary F.G. Wyse of Johns Hopkins University in Baltimore generally agrees with Tremaine's assessment. She and her colleagues recently examined individual stars in a nearby dwarf galaxy captured by the Milky Way (SN: 4/9/94, p. 228). They find that the tiny galaxy makes a complete orbit around the Milky Way in a little less than 1 billion years and that it has managed to evade the larger galaxy's gravitational appetite for at least 10 orbits.

Unseen material, known as dark matter, may help the dwarf galaxy hang onto its stars, Wyse says. She reviewed the findings early this month in Philadelphia at the annual meeting of the American Association for the Advancement of Science. —*R. Cowen*