Biomedicine

Tina Adler reports from Dallas at the American Heart Association annual scientific meeting

Embracing the heart with muscle

Muscles that help control arm movements may have a new, nonstop job: keeping diseased hearts beating and giving some patients an alternative to heart transplant surgery.

During a surgical procedure called dynamic cardiomyoplasty (CMP), physicians take a large skeletal muscle in the upper back and wrap it around the heart. They then stimulate the muscle electrically to train it to beat in synchrony with the heart (SN: 11/19/88, p.334).

Surgeons used this procedure on people for the first time in 1985 in France and went on to perform the surgery on 420 additional patients, primarily outside the United States. Now, a study of the long-term survival of 68 of those patients suggests that the procedure can help some people live a more active life than they had before their surgery, reports Anthony P. Furnary of St. Vincent Heart Institute in Portland, Ore.

Prior to the surgery, the participants could undertake only limited activities, and medication did not improve their condition. "So it was either this, or transplant, or stay the same," Furnary says. The patients had a mean age of 57, and almost 80 percent of them were men.

After the surgery, patients' heart function improved, but not on all measures. While exercising, for example, the maximum amount of oxygen they could take in did not increase, Furnary says. Moreover, 1 year after the procedure, almost one-third of the participants had died. After 2 years, 46 percent had died.

Furnary hopes in a future study to compare the death rates of equally sick people who undergo or don't undergo CMP, he says. However, he adds, his European collaborators consider it unethical to withhold the surgery from any study participant.

Just over 10 percent of the patients died soon after the procedure, primarily because their hearts were not strong enough to withstand the period of muscle conditioning. After that, people died primarily because their hearts beat irregularly, which CMP can't prevent, he acknowledges.

Losing back muscle made some patients' arms weaker, even though other muscles took over the job of raising and lowering their arms, he adds.

Mutant gene keeps 'good' lipos low

Some people's genes appear to give them carte blanche when it comes to eating high-cholesterol foods (SN: 11/20/93, p.325). Others aren't nearly so lucky.

About 5 percent of Caucasians who suffer from premature atherosclerosis — arteries blocked by fatty deposits, including cholesterol — can put much of the blame for their disease on a mutant gene, says Michael R. Hayden of the University of British Columbia in Vancouver. The team has yet to determine the prevalence of the mutation in non-Caucasians.

The gene handles the activities of lipoprotein lipase (LPL), an enzyme that helps break down fat particles, known as triglycerides, in the blood. The remnants of the triglycerides promote production of high-density lipoprotein (HDL), which helps rid the body of the excess cholesterol that can cause heart disease, Hayden explains.

In people with a particular mutation in the gene, the enzyme becomes sluggish; as a result, these people have smaller supplies of HDL, he suggests. They may have normal concentrations in their blood of low-density lipoprotein (LDL), which deposits cholesterol on artery walls and helps cause heart attacks.

The researchers screened almost 900 Dutchmen with heart disease. Almost 10 percent of the group with inherited lipid disorders had the mutation. The lower a man's HDL, the more apt he was to carry the mutation. Overweight people with the mutation appeared more likely to have low HDL. Other genetic factors underlying coronary disease are generally less common than this mutation, Hayden asserts.

Computers

Ivars Peterson reports from Washington, D.C., at Supercomputing '94

Clusters for a virtual supercomputer

When a computational problem is simply too big for a modest desktop computer to deal with, it makes sense to get help by tapping into other computers. This is the notion behind cluster computing. All the computers in a cluster are linked in such a way that the "overflow" from one can be handled by the rest. Such a group of computers, spread across many different locations within an institution, can sometimes perform as capably as a supercomputer.

Now, research groups at several universities have embarked on an ambitious scheme aimed at connecting computer clusters at different locations into a cluster of clusters. A user at one computer would have access to as many additional computers as necessary to solve a given problem, no matter where the user is or where the computers are.

Physicist Robert J. Hollebeek of the University of Pennsylvania in Philadelphia, computer scientist Robert L. Grossman of the University of Illinois at Chicago, and physicist Andrew Baden of the University of Maryland at College Park head this collaborative effort, known as the National Scalable Cluster Project.

"With emerging technology in telecommunications, we can link dozens of computers in three cities to act like one supercomputer," Grossman says. "It's like putting a virtual supercomputer on everybody's desktop."

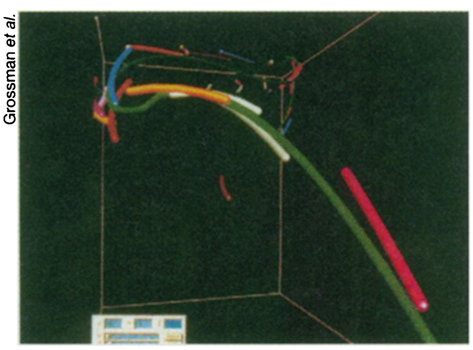
Such a scheme represents a logical step beyond the Internet — the network of computer networks — now widely used by researchers and many others. However, instead of merely exchanging messages and reading files, users end up with access to computational resources far beyond those normally available to their own machines (SN: 5/1/93, p.280).

One crucial element is the use of high-speed, high-capacity telecommunications technology so that geographically distributed clusters can operate as a single computing facility. Another is the development of system software that makes it easy to add new computers to the supergroup to increase its resource pool.

Researchers at each of the three institutions involved in the project already have experience with cluster computing on the local level. For example, Grossman and his collaborators have been developing methods for managing huge quantities of data on such clusters. They recently introduced a technique for approximating the best possible flight path for an airliner traveling from one city to another, taking into account fuel costs, weather conditions, and other factors. Their scheme involves creating a large database made up of short trajectory segments, which can be assembled to match as closely as possible the required conditions for the desired flight path (see illustration). That's typically faster than computing the flight pattern from scratch.

Cluster computing has also aided in the analysis of data from particle physics experiments and on a larger scale may prove useful in medical imaging, robotics, manufacturing, scientific computing, and managing digital libraries. But to get there, the researchers have some sticky issues to resolve, ranging from effective resource sharing to achieving sufficiently high levels of security and reliability.

"Every time you go to a new scale, you discover new problems," Hollebeek says. "It's not a done deal."



Grossman et al.

Selected from millions of possibilities, short trajectory segments can be assembled into a desired flight path.