Record: 1

Title: One Heart To Go!

Authors: Piddock, Charles

Source: Current Science; 11/9/2001, Vol. 87 Issue 6, p7, 1/3p, 2 diagrams, 1 color

Document Type: Article

Subject Terms: ORGANS, Culture of
MEDICINE -- Research

Geographic Terms: UNITED States Report Available

Abstract: Focuses on field tissue engineering and culturing of human organs in the United States. Developments in medical research on the growing of human organs; Success of researchers in growing human skin, bones and cartilages; Difficulties in growing organs with multiple cell types.

Lexile: 1060

Full Text Word Count: 918

ISSN: 00113905

Accession Number: 5537766

Database: Middle Search Plus

Section: Health/Life

ONE HEART TO GO!

In the future, you may be able to replace your body's organs almost as easily as you replace the batteries in your CD player.

The time is 30, maybe 40 years from now. You get up one morning and feel a sharp pain in your chest that just won't go away. "Darn!" you say. "My heart's gone bad."

You cancel all your morning commitments and head on down to the neighborhood heart store, put down some cash, and--after a short operation performed by a smart-mouthed robot--walk out with a brand-new heart. "Don't forget your receipt!" mumbles the bored clerk as you make your way to the door.

Silly? Far-fetched? Maybe not.

Researchers around the world are making progress on growing new organs to replace those that are diseased or damaged. A world where you can go into a doctor's office and get a new heart, kidney, or bladder might actually happen in your lifetime. (Sorry, but no one has yet suggested that it would ever be possible to grow a new brain--in case you want to replace the one you have.)

Some doctors predict that 20 years from now, possibly sooner, patients will be able to receive replacement bladders and heart ventricles. In 50 years, more complex organs, such as lungs or kidneys, could be available.

TISSUE ENGINEERS

How do researchers grow tissues and organs? Tissue engineers begin by plucking cells from healthy organ tissue. They then put the cells in a special incubator with liquid nutrients, including carbohydrates and amino acids (the basic building blocks of proteins). The cells then multiply and, in a few days, produce enough interconnected cells to be considered tissue.

So far, researchers have successfully used that method to grow human skin, bone, and cartilage. But growing an entire organ is another matter entirely. Most organs, such as kidneys and hearts, are made up of several different types of cells--ten different types in a heart, for example, and 20 different types in a kidney.

VESSEL NETWORK

An even more serious hurdle in building an organ from cells is that most organs need their own vasculatures, or networks of blood vessels. Such networks supply the blood that carries the organ the nutrients it needs to survive and to perform its intended functions. So before researchers can grow a full-sized organ, such as a heart or a liver, they must learn to manufacture blood vessels.

In 1999, Robert Langer and Laura Niklason, biomedical engineers at the Massachusetts Institute of Technology, grew blood vessels from a few cells collected from pigs. The team "seeded" the outer surface of a tube made of a type of biodegradable plastic that is found in threads used to stitch wounds. The plastic dissolves after a wound heals. A biodegradable substance is one that breaks down into harmless elements over time.

Langer and Niklason cultured the cells in a cell incubator. The cells grew and actually formed vessels.

The researchers then surgically attached the artificial vessels to large arteries in the legs of healthy pigs. After that, the team carefully monitored blood flow to see how the artificial vessels held up under normal blood pressure. According to Langer, the newly made blood vessels worked perfectly, staying open and functioning like natural vessels.

TISSUE ENGINEERING IN MICRONS

Such large blood vessels would be a great help in many kinds of surgeries, but growing complex organs will also require developing the smallest blood vessels, capillaries. And that means doing what Langer and Niklason did on an almost microscopic scale--engineering tissue in microns, or millionths of a meter.

Can that be done? Tissue engineer Joseph Vacanti of Massachusetts General Hospital is convinced that it can--by using methods developed by makers of computer chips.

The smallest human capillary is 10 microns in diameter. Computer chip features, however, are ten times smaller. A team led by physicist Jeff Borenstein of Draper Laboratory in Cambridge, Mass., etched networks of capillary-like grooves into silicon wafers.

They then seeded the wafers with cells from a rat. The cells grew to line the etched grooves. Then the team sandwiched two cell layers grown in this way together to form new vessels that could carry blood.

ARTIFICIAL BLADDERS

Even without the technology to build extensive vascular systems, one tissue-engineered organ has made it almost all the way to human trials. In the late 1990s, a team of tissue engineers at Children's Hospital, in Boston, grew new bladders for six dogs. A bladder is a membranous sac that holds urine in humans and other animals.

The team combined tissue parts and implanted each new bladder into a dog after removing the dog's own bladder. Blood vessels from surrounding tissue grew into the tissue-engineered bladders and kept them healthy. With their replacement organs, the dogs had almost as much bladder capacity as dogs with original bladders. The team hopes to begin the first tests of engineered bladders in people sometime this year.

Tissue-engineered organs could be lifesavers. In 1999 (the most recent year for which statistics are available), more than 72,000 people in the United States were waiting for organ transplants, according to the United Network for Organ Sharing.

By year's end, more than 6,100 people had died waiting.

PHOTO (COLOR): This ear-shaped piece of biodegradable plastic will be seeded with live human ear cells. As the plastic decays, the ear cells will assemble in the shape of an ear that could be used as a replacement for a missing ear.

~~~~~~~~~

By Charles Piddock
~~~~~~~~~