

Down the tubes

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Need a new artery? Grow your own

ANY structure, however well built, suffers wear and tear over the years. In the human body, it is not merely some of the main organs that can go kaput, but also the plumbing system: arteries and veins. Finding replacement plumbing is not yet as simple as buying a length of copper tube, however. But two new techniques for growing replacement arteries may make life easier for surgeons.

At the Georgia Institute of Technology, Raymond Vito and his team have been experimenting with "distraction angiogenesis". This involves implanting a mechanical device that stretches an existing section of an artery, known as the gastroepiploic artery, which is located below the stomach. The device uses hydraulically driven rollers to lengthen the artery. Pressure is released by withdrawing fluid via a subcutaneous port with a syringe.

According to Dr Vito, the artery responds with remarkable alacrity. In only a month, it can create a surplus section up to 30cm long that can be removed and implanted wherever it is needed. Indeed, the gastroepiploic artery seems almost to have been designed with just such a procedure in mind. The artery varies in diameter, so surgeons can stretch different sections—depending on the diameter they are looking for. Better still, it is usually disease free, even in patients who have vascular disease elsewhere in their bodies.

Dr Vito believes that this artery would happily yield to being stretched, snipped and rejoined several times over. Another possibility would be to have the artery stretched in advance, and frozen, in expectation of future procedures. Dr Vito is, in short, providing living proof that the way to a man's heart is through his stomach.

In California, meanwhile, **Cytograft Tissue Engineering**, a research company in Novato, is developing more elaborate techniques for growing new blood vessels. The company uses the novel approach of sheet-based tissue engineering. At present, most tissue constructions rely on encouraging cells to divide and grow on a scaffold—to give the tissue shape.

Instead, the company grows flat sheets of fibroblast cells (the basic building-blocks of most connective tissues), and then simply rolls the sheet into a tube around a steel rod. The key to the technique is a culture medium that stimulates cells to produce their own glue, in the form of collagen and other binding proteins.

After the steel rod is removed, the artery is completed by seeding its inner walls with a layer of cells that form the lining of blood vessels (these are harvested from a patient's own blood or veins). So far, the engineered grafts have been successful in animals for periods of as long as 90 days. Further studies are planned.

According to Todd McAllister, a researcher with Cytograft Tissue Engineering, it may in a few years' time be possible to create arteries which, by incorporating layers of other cell types (including genetically modified cells), are actually stronger than native veins and arteries. Such super-arteries would not be developed simply out of scientific hubris. They

would be invaluable candidates for arterio-venous shunts, ie, connections made between veins and arteries in dialysis patients to increase blood flow. Synthetic vessels are often used for such patients, but they rarely last longer than a few months before being compromised by leaks, clots, infection and clogging.

Human trials of the basic technology may begin in as little as 18 months' time. If they are successful, the procedure might even become commercially available in only three years' time. If Dr Vito and his team manage to commercialise artery stretching, though, approval by America's Food and Drug Administration would only require approval of the stretching device. Home-grown arteries do not, after all, involve the implantation of foreign tissue or substances.

Either way, both technologies hold great promise for the hundreds of thousands of patients who are facing coronary bypasses, or even the loss of a limb due to deteriorating blood flow. In commercial terms, then, such research may certainly have hit a rich vein.