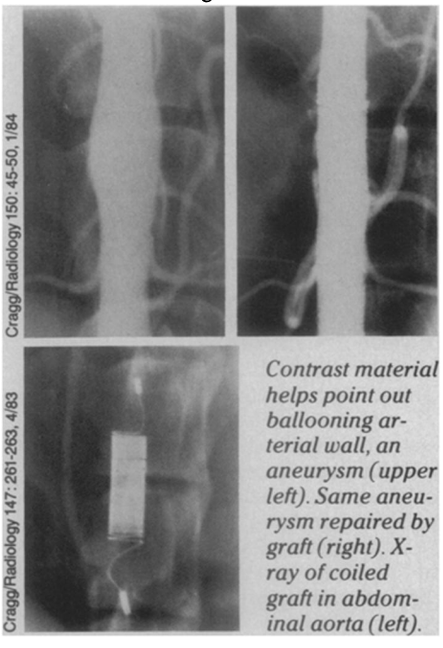
Body heat reshapes wired arteries

Imagine performing major repairs on the body's vascular network—such as implanting metal grafts to permanently reline weak-walled arteries—all without use of a scalpel or general anesthetic. Researchers at the University of Minnesota Hospitals in Minneapolis are now experimenting with techniques to do this. What makes it possible, explains radiologist Andrew Cragg, is nitinol — one of the new metals with a memory.

This nickel-titanium alloy can be engineered to return to a pre-set shape after deformation. Threaded through the skin and into arteries as straight wires — via thin tubes called catheters — the wire, triggered by the body's heat, will coil itself into a tight spring. Though implanting coiled-metal arterial grafts via catheters was proposed in 1969, "it really wasn't until we came upon nitinol wire that the technique became feasible," Cragg says.

To construct grafts, nitinol wire is wound around stainless-steel pipes to form a coil whose outside diameter matches the inside diameter of the artery above and below the damaged segment needing repair. Then the wire is heated in the flame of a Bunsen burner until the wire changes from its initial straw color to a deep blue. This "teaches" the wire its preferred shape. Subsequent cooling in ice water allows the wire to be straightened again without forgetting the coil.

The challenge, Cragg says, has been to develop a means for extruding the wire into the arteries; the wire invariably begins to warm—and tries to snap itself into a tight fat coil as it is being threaded up the tiny catheter. Cragg now uses a saline-cooled catheter-within-a-catheter to insert the wire for a graft.



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Contrast material helps point out ballooning arterial wall, an aneurysm (upper left). Same aneurysm repaired by graft (right). X-ray of coiled graft in abdominal aorta (left).

At the annual meeting in Chicago recently of the Radiological Society of North America, Cragg and colleagues reported on their success using nitinol grafts to treat nine dogs with obstructive vascular lesions (narrowed arteries) and aneurysms (weak, ballooned-out arterial walls threatening to rupture). Within only a half hour of insertion, the graft repaired aneurysms: Blood clots filled ballooned-out segments between the coils and the arterial walls so that blood now flowed exclusively through the coil's internal passages. After four hours a uniform 0.5 millimeter layer of fibrin covered grafts. Within eight weeks, the coils had been completely incorporated into arterial walls. The grafts worked equally well in propping open narrowed arteries.

Cragg hopes to begin human trials within a year. But his eventual goal is not to use nitinol exclusively, but instead as the supporting coiled brace for a fabric graft. "I'm working with some people to develop a very thin fabric that could be twisted down on the outside of a catheter," he told SCIENCE NEWS. "Once transformed by the body's heat, it would pop out and open like a wind sock. If we got the technical problems worked out, it's something we could introduce almost immediately," he said. *—J. Raloff*

A problem with some ultrasound devices

One of the primary reasons for using fetal altrasound is to determine fetal age. Physicians use these data to help them determine when a baby is overdue, how best to manage problem pregnancies, even when to cut off the period for conducting therapeutic abortions. But researchers at the Johns Hopkins School of Medicine in Baltimore now report that one of the more widely used types of ultrasound imaging systems does not give reliable readings.

The device in question is known generically as a mechanical sector scanner. Measuring errors inherent in these devices could be large enough to throw off estimates of fetal age by as much as four weeks, according to Frank Leo, the electrical engineer who headed the study.

Experiments were conducted using several brands of the most commonly used types of real-time (immediate imaging) ultrasound scanners — including linear arrays and electronic sector scanners — to view femurs (thighbones) in a tank of water. In a paper presented last month at the Radiological Society of North America meeting in Chicago, the Hopkins team reported that their data showed the mechanical sector scanners not only gave poorer size information than any other type of system, but also that errors "are not consistent from one system to the next." Moreover, they found "effects that produce these discrepancies are not limited to one individual type of system or transducer [the ultrasound emitter/receiver]."

In these scanners, the transducer moves back and forth from one end of the viewing field to the other (either directly or via a mirror). As it moves, it emits pulses and listens for the return echo. One source of error, Leo says, is that "between the time the transducer sends out a signal and then collects its echo, the transducer has moved." But the system doesn't account for that movement when calculating the distance the returning echo has come. Then there is hysteresis, he says, "a type of resistance that is inherent in moving electro-mechanical devices." As the transducer gets to the end of a field of view it must stop and reverse. That takes time. But the signals it emits are given at a constant rate. Thus, more of the data are collected from the ends of the scanning field. In all, the Hopkins team identified five sources of system errors.

Leo told SCIENCE NEWS that the first source of error could account for errors of 5 percent — or up to 2.5 millimeters — in femur length. That alone, Leo says, could affect age estimates by more than two weeks. *—J. Raloff*

Weather satellites won't be sold

Early last week, President Reagan signed legislation that included an amendment halting the commercialization of U.S. weather satellites. Congress instigated the president's action when it got wind in October that the Commerce Department was asking for proposals from private industry on the operation of land (Landsat) and meterological (Metsat) satellites.

The Reagan administration has been trying to transfer as many of the Commerce Department's operational systems — including the satellites — to the private sector for more efficient operation. Leery of the prospect that the government would have to buy back all of the weather data from industry (the federal government accounts for 95 percent of the weather data market), legislators were icy over the satellite transfer because no guidelines were set for future operation by the private sector. Sen. William Cohen (R-Maine), co-author of the amendment, was unsure how the commercial sector might change weather reporting practices. "Mainers are very dependent on weather reports for fishing, forestry and other industries," said a representative for Cohen. "He [Cohen] is not unhappy with the status quo ... this thing seemed to come out of nowhere."

Unaffected by the amendment is the possible transfer of Landsat systems.
—M. Wolfe

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