during bypass surgery, the work presented at the meeting concerned laser energy delivered via fiber optics threaded through the patient's leg and up to the narrowed heart vessel.

The treatments began just a few months ago at Boston University and Northern Hospital in Sheffield, England, following use on clogged leg arteries in people. Timothy Sanborn, who heads the Boston project, says surgeons there have used a 1.7-millimeter-diameter metal tip heated to 400°C by laser light to treat seven people with coronary arteries that were 90 to 95 percent narrowed.

The device decreased the narrowing in four of the seven — from 95 percent blocked to 20 to 30 percent. A balloon inflated in the artery pushed back the arterial walls a little more. Perforations and blood clots, which have occurred in animal trials and with human leg arteries, were not a problem, says Sanborn. "Laser thermal angioplasty in the coronary system is in its early stages," he says. "The initial results are very encouraging."

The laser, he says, may someday be used to clear out the blockage completely without the balloon follow-up; the process could prove more resistant to the reblocking that often occurs after balloon use. The advantage of lasers over balloons, says Sanborn, "is that you leave behind a very smooth arterial surface. [Plaque] is removed rather than stressed or fractured."

"The preliminary experience has indicated [lasers] can be used successfully in the human [heart]," says laser researcher Jeffrey M. Isner of Tufts University-New England Medical Center in Boston. "As recently as a year and a half ago, some people believed it couldn't be done."

When will lasers move from an experimental process to conventional therapy? "For the past six years we've been saying in two years," says George S. Abela of the University of Florida in Gainesville, who is credited with much of the research that laid the groundwork for human trials. "So I'll say in two years." — *J. Silberner*

Voyager: Setting safe sights for Neptune

Late in August of 1989, the Voyager 2 spacecraft will hurtle past the planet Neptune, the probe's last scheduled encounter in what by then will have been a 12-year, four-planet grand tour of the solar system. Last week, members of the project's Science Steering Group met at Jet Propulsion Laboratory (JPL) in Pasadena, Calif., to discuss the specific route through the Neptunian system. The crux of the matter is a firing of Voyager 2's rocket engine, at present planned for next March 13, to fine-tune the encounter trajectory and determine how close the craft will pass to its never-before-visited objectives.

But how close is too close? The spacecraft is due to go nearer to Neptune than it did to any of its past goals of Jupiter, Saturn or Uranus. The general plan calls for Voyager to approach from the south, pass up through the planet's equatorial plane and swoop close over the north pole before angling back down toward Neptune's big moon Triton, believed from earth-based observations to have a significant atmosphere as well as possible "lakes" of liquid nitrogen. To many of the Voyager scientists, says Charles Kohlhase of JPL, the "polar crown" part of the flight is the mission's "holy grail." But in getting safely through it all, he says, there are three principal concerns:

• *The atmosphere:* The warmer its outermost reaches, or thermosphere, the farther it will extend from the planet's surface. Though extremely thin in its distant fringes, it could conceivably affect the fast-moving probe's orientation or radio transmissions. Fortunately, measurements from the earth-orbiting International Ultraviolet Explorer satellite suggest a relatively low temperature (about 227°C, compared with 477°C actually measured at Uranus). The Voyager team anticipates no difficulty.

• *The rings:* Detected only by their brief blockages, or occultations, of starlight seen from earth, the rings seem to be not continuous bands but only a few segments, possibly because the ring particles in many places are not closely packed enough to block the starlight. The concern, however, is not the "ring arcs" themselves, which are only about 8 to 20 kilometers wide and easy to miss. The issue, says Kohlhase, is the possibility of much finer material, virtually undetectable from earth but perhaps diffusing inward from the visible arcs in concentrations sufficient to damage Voyager 2.

The task of avoiding such material is presumably linked to the distance from Neptune at which the craft penetrates the equatorial plane, in which the rings are thought to lie. This distance also determines the closest approaches to Neptune and Triton, which in turn are linked to other factors. A likely version of the encounter would pierce the plane about 45,800 kilometers from Neptune's surface (just outside the outermost ring arc and allowing 4,000 km for the uncertainty of the arc's position), carrying Voyager about 4,300 km from the north pole and about 38,000 km from Triton. It also positions the craft to study Triton's atmosphere by looking at sunlight through it, and by sending radio signals through it to earth. There has been one report, disputed by some, that the ring arcs may lie in the plane of Neptune's rotation axis. If so, says Kohlhase, missing the arcs would be easy, though there might then be a choice between flying through the diffuse material or displacing the polar crossing and flying much farther from Triton.

• *Trapped radiation:* This is "our major concern," says Kohlhase, in part because it is the least-known item on the list. No signs have been detected yet of auroras or other clues to a magnetic field that could help scientists estimate the possible radiation hazard facing the spacecraft (signs of the Uranian field were not detected until the craft was five days out), which could cause false instrument readings or even damage some parts. Theoretical predictions range from benign to a peak radiation level higher than that at Jupiter, where a few components did fail. Specialists in the field will gather for a one-day meeting in January in hopes of narrowing the uncertainty. — *J. Eberhart*

Leech swimming: The neural story

Contrary to modern popular understanding, leeches give as well as take. They can suck up a blood meal nine times their weight, but they offer a variety of research services as well. Using leeches in the lab, scientists at the University of Virginia in Charlottesville have discovered a cellular link in a neural chain that enables them to explain the animal's rhythmic swimming movements in terms of neural mechanisms. Because such movements have features that are common to all rhythmic motor behaviors, including chewing, walking and breathing, the scientists say their findings extend far beyond the leech.

Whereas the human nervous system is woven from billions of cells, the nervous system of the leech species *Hirudo medicinalis* has about 13,000 cells, all of which scientists suspect are hard-wired to the point where any neuron can be labeled and identified from leech to leech. The leech has two ganglia, or discrete collections of nerve cells, in the head region and one in the tail region. In addition, there are 21 nearly identical segmental ganglia along the animal's axis. It is the exceptional regularity in its neural architecture that makes the leech especially suitable for detailed neuroethological studies, says W. Otto Friesen, who reports on the work in the Nov. 21 SCIENCE with Peter D. Brodfuehrer, now at Cornell University. Neuroethology is the study of animal behavior in terms of the underlying neural mechanisms.

By removing nearly the entire nervous system of the leech, the scientists were able to eavesdrop on individual neurons in different parts of the nervous system. Using two microelectrodes, they stimulated either of two brain neurons called Tr1 cells and observed electrical activity downstream in the segmental ganglia, in neurons already known to be involved in swimming. To determine that Tr1 cells