
RELIGION & PHILOSOPHY

Surgeons in at least six U.S. hospitals can now perform nine different operations on fetuses, from repairing lesions to correcting nutritional problems. In one case, a fetus was removed from the uterus, treated for a urinary tract obstruction, and returned to its mother's womb.

"The fetus now begins to make serious claims for a right to nutrition, to protection, to therapy," Catholic theologian Richard McCormick argued in 1982. "How can tolerance of abortion be morally reconciled with those claims?" But according to Ruddick and Wilcox, both New York University philosophers, the new procedures will make little difference in the debate over abortion. "Liberals" are unlikely to change their views, since they already favor permitting abortions of healthy fetuses; "conservatives" have always believed that fetuses have a right to life regardless of their condition.

But for "moderates" and physicians, who seek a balance between the rights of the mother and of the fetus, the moral questions do become stickier. To a "moderate," the authors say, "abortion is justifiable to prevent the birth of a severely defective child." But should a mother be required to submit to surgery if her fetus has a treatable ailment? Is abortion justified if she refuses? For their part, the authors dismiss such worries, arguing that since fathers are not required to donate blood, bone marrow, or kidneys to spare their children suffering, women should not be required to undergo surgery.

The dilemma for doctors is similar: Who is the patient, the mother or the fetus? To avoid this conflict, the authors propose using "therapeutic contracts." A "gynecological" contract would leave all decisions to the woman; the "pediatric" would make the interests of the fetus paramount; the "obstetrical" would seek a balance between the two. Allowing "pediatric" contracts suggests that the fetus is a patient, and thus a person. But citing patients in extremis who are "brain dead," Ruddick and Wilcox argue that *all* patients are not necessarily persons.

They conclude that the possibility of fetal therapy will not create a moral bind for physicians. Such procedures are essentially gynecological, they argue, and the mother remains the principal decision-maker.

SCIENCE & TECHNOLOGY

Discovering Pluto

"The Ice Planet" by Derral Mulholland, in *Science* 82 (Dec. 1982), P.O. Box 10790, Des Moines, Iowa 50340.

After Pluto, the sun's ninth planet, was discovered only 53 years ago, scientists set to work estimating its size, mass, and composition. Yet all of their best guesses about the planet have been disproved by recent research, writes Mulholland, a University of Texas astronomer.

Four billion miles from the sun, Pluto is barely visible even with powerful telescopes. It was discovered in 1930 by a 22-year-old amateur

SCIENCE & TECHNOLOGY

astronomer named Clyde Tombaugh, who was hired by Percival Lowell, a wealthy Bostonian, to carry out the search.

A 1950 estimate by the Palomar Observatory's Gerard Kuiper put Pluto's diameter at 3,800 miles, about half that of the Earth. A 1965 experiment that measured the time Pluto took to cross a star of known size narrowed the estimate to a maximum of 3,600 miles. When another "occultation" took place on Easter Sunday 1980, a new measurement technique allowed astronomers to fix the diameter at 2,500 miles—barely larger than Earth's moon.

It took nearly as long to discover Pluto's mass. Early estimates had put its weight at 6.6 times that of Earth; by 1955, Pluto had shrunk to roughly Earth's size. Astronomers believed that it was composed mostly of rock and iron, like Earth. Finally, in June 1978, James Christy of Washington's U.S. Naval Observatory discovered that Pluto had a moon, which he named Charon. Since the period of a moon is governed by its "parent" planet's mass, it was possible to calculate Pluto's weight—.0024 that of Earth.

Putting information about the planet's diameter and mass together, astronomers determined that Pluto's density is only 35 pounds per cubic foot, making it the lightest planet in the solar system. A 1978 spectroscopy experiment revealed that Pluto is composed partly of frozen methane, possibly mixed with some rock and ice. Its dark side probably has no atmosphere; the sunny side's atmosphere contains methane gas and, probably, argon, oxygen, carbon dioxide, or nitrogen. When Charon crosses between Pluto and the sun two years from now, it will cause parts of the planet's atmosphere to freeze. By observing how quickly its gases turn to frost, astronomers will be able to pinpoint their identities.

Paring Pluto down to size has raised an intriguing question. Back at the turn of the century, scientists first hypothesized the planet's existence when they noticed that some unknown celestial body caused nearby Uranus and Neptune to wobble slightly. But Pluto is too small to produce such effects. That means there is probably a 10th planet yet to be found on the fringes of the solar system.

*Man's Delicate
Body Clocks*

"What Hath Night to Do With Sleep?" and "Sleeping as the World Turns" by Martin C. Moore-Ede, in *Natural History* (Sept. and Oct. 1982), P.O. Box 4300, Bergenfield, N.J. 07621.

Sleeping by night and working by day are not merely habits, but rhythms dictated by internal human "clocks." According to Moore-Ede, a Harvard physiologist, understanding these regulators is particularly important now that one-fifth of the U.S. labor force works on night shifts.

Two "pacemakers" located within the brain appear to govern human sleep and wakefulness. Each functions on about a 25-hour cycle,