apparent that the cells [of the nucleus basalis] don't suddenly die. They survive for long periods—months or years. And there is increasing evidence that plaques evolve."

One possible scenario is that the nucleus basalis cells begin to function abnormally and no longer make enough acetylcholine to allow the nerve terminals in the cortex to function properly. The axons start to turn into plaques as nerve transmission in the cortex falters.

Price believes there is a long period of time between when a nerve cell in the nucleus basalis is first affected by Alzheimer's disease and when it dies. "That's an important time to learn about," he says, "If we knew what is happening to the cells, the disease might be stopped or at least slowed."

But what causes the cells to die? A number of neurologists speculate that in diseases like Alzheimer's or Parkinson's or Huntington's, in which a specific population of nerve cells dies, the nerve deaths might be due to a loss of "trophic factors." The idea is that the target sites at the ends of the axons release some undefined factor that keep the cell bodies alive. If they stop making the factor for some reason, the cell bodies die.

This trophic factor theory, however, does not seem to hold in Alzheimer's disease. Price and his associates think it less likely now that they have examined the brain of a young woman who was admitted to Johns Hopkins hospital after trying to commit suicide by carbon monoxide poisoning. She failed to kill herself but she did destroy her cortex. After 10 months she died and, when the Hopkins neurologists looked at her brain, they saw that her nucleus basalis cells were relatively intact—despite the lack of any sort of trophic factors after her cortex was destroyed.

Price says that he and his colleagues are now looking more closely at the neuroanatomy and physiology of the nucleus basalis. "We still don't know what the basal forebrain does to the cortex, but we think it's an activator," Price says. "It might activate that part of the cortex that lets you attend to a person's face or attempt a complex action. It might also keep up the general tone of the cortex so you don't go to sleep."

In his clinical studies of Alzheimer's disease, Price wants to experiment with monkeys first, perhaps by selectively destroying nucleus basalis cells. Then he wants to go on to look at people with familial Alzheimer's disease—those in which Alzheimer's disease is inherited as an autosomal dominant trait—and persons with Down's syndrome.

Price warns, however, that the nucleus basalis is likely not to be the whole story in Alzheimer's disease. "There is increasing evidence that other transmitter systems are involved, although not so severely or so consistently as the cholinergic system. The cholinergic system may be the tip of an iceberg."

But whether or not it is the tip of an iceberg, the discovery of a specific group of cells that dies is an important beginning. "For perhaps the first time we can focus on a cell population that we know is affected in Alzheimer's disease," Price says.—**Gina Kolata**

Deep-Sea Drilling Rescued by a New Option

Blocked in its drive to convert the Glomar Explorer, *the National Science Foundation has found a practical substitute*

The world oil glut has pulled the National Science Foundation (NSF) out of the tight corner that it found itself in when budgetary reality finally collided with NSF's ambitious plans for scientific deep-sea drilling. In the wake of glut-induced price cutting in the offshore drilling market, NSF finds that it can convert and lease a modern drill ship that is more capable than the planned stripped-down version of *Glomar Explorer*, yet no more expensive than an upgraded but less powerful *Glomar Challenger*. The ad hoc committee summoned to weigh this new prospect against other needs in crustal studies has given the new option its approval, even as it deep-sixed the *Explorer*. Next, NSF must convince Congress.

For 5 years, NSF has been pushing the *Explorer* as the only logical alternative to the aging and antiquated *Challenger*. Conversion of the one-time CIA retriever of submarines to scientific drilling would have made *Explorer* the most powerful, deepest-drilling vessel in the world. A long line of blue-ribbon committees and scientific study groups certified that the scientific return from *Explorer* would be well worth the added costs when compared to the limited capabilities of *Challenger*. *Explorer* maintained that approval even after budgetary constraints had indefinitely postponed development of one of its most attractive attributes, the ability to perform riser drilling on the continental margins (*Science*, 21 August 1981, p. 851). A riser and its blowout preventer are necessary to drill wherever oil or gas might be encountered.

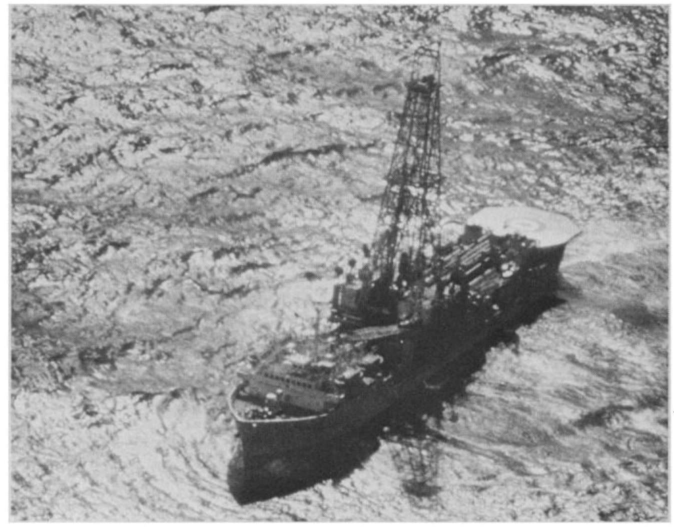
Then, somewhere in the budget process for fiscal year 1984, the *Explorer* dream finally died. NSF did not ask for the $36 million for *Explorer* in the final budget request; the Administration would not have given NSF the money if it had asked. That left NSF with nothing but a *Challenger* drilling program, whose numerous deficiencies had been emphasized for years. Reluctantly, NSF asked for $26.3 million to continue *Challenger* drilling, something that it had told Congress in its fiscal year 1983 request it would not do. In the meantime, the new director of NSF, Edward Knapp, requested that some fiscally realistic priorities be assigned to ocean drilling and competing programs.

In the nick of time, industry offered NSF a third option—leasing a modern oil exploration drill ship. In early January, Sedco, Inc., the firm that would have operated the *Explorer*, approached NSF with the suggestion that one of its idled ships, such as the *Sedco 472*, might be leased at half the cost being paid for its services by industry only a few months earlier. That would be close to the $33,000-per-day rate now being paid for *Challenger*. The generous offer was spurred by the prospect of declining oil prices, the slackening pace of oil exploration, and rampant overconstruction of drilling platforms. The resulting glut of drilling vessels has severely depressed drill ship demand, especially for the half dozen ships that have been able to drill with a riser in more than 600 meters (2000 feet) of water while staying over the drill hole solely with the aid of positioning engines. *Challenger* pioneered such dynamic positioning, but she has been surpassed by newer ships.

NSF thus had a viable option again, but no scientists had ever been asked if that kind of option should be pursued. So NSF asked the recently created Ad Hoc Advisory Group on Crustal Studies* to review and rank long-range plans for crustal studies, placing particular emphasis on ocean drilling. As Frank Johnson of NSF pointed out to the group on 3 February at the beginning of its 2-day meeting, all earlier recommendations had been made in "budget isolation," under the assumption that increased funding for drilling would not mean less funding for related studies. "The myth of budget isolation has been dispelled," Johnson noted. The advisory group in the 2 days given it was not able to rank all crustal studies. Nonetheless, they did conclude that, compared with other opportunities, deep-sea drilling with a ship like the *Sedco 472* is well worthwhile, as long as costs do not greatly exceed those projected by NSF.

Sedco 472

Idled by the downturn in the oil industry, and with specifications somewhat midway between those of the outdated Glomar Challenger *and the too expensive* Glomar Explorer, Sedco 472 *sails to the rescue of the NSF's financially strapped deep-sea drilling project.*



American Petroleum Institute

As the table illustrates, the *Sedco 472*, which NSF is viewing as only a typical example of the ships available, is smaller and less powerful than *Explorer* but its performance equals that of *Explorer* in the aspects crucial to the drilling program envisioned by most scientists. The *Sedco 472* and *Explorer* would accommodate an equal number of scientists, which would help attract foreign participation and funding. *Sedco 472* could handle almost as much drill string, the drill pipe that must extend from the ship to the bottom of the hole. It carries plenty of mud to clear and lubricate the drill bit as needed. Both the *Sedco 472* and *Explorer* could drill in the same difficult sea conditions. And both might be more likely to operate in stormy high-latitude waters; however, no ship could actually drill in icy waters without an accompanying icebreaker. The *Sedco 472* would provide only half the laboratory space of *Explorer*, but then *Explorer*'s planned scanning electron microscope, microprobe, and expanded libraries and conference rooms had not been considered essential.

Most attractive of all, *Sedco 472* and similar ships offer riser drilling. *Explorer* could have handled enough riser to drill in up to 4000 meters (13,000 feet) of water. The cost of such a riser, however, proved too high when added to the required $90 million conversion of the oversize *Explorer*. The *Sedco 472* can handle 1800 meters (6000 feet) of riser, and with minor modification the riser could be lengthened to 10,000 feet, according to the ship's owner. That would be sufficient for all but the deepest drilling targets within the ocean crust and near the edges of ocean margins. After conversion from exploration to scientific drilling, the *Sedco 472* would require an escort vessel to carry the riser, but the 50 percent higher costs need be borne only during riser drilling.

The cost of the commercial leasing option is as attractive as the technical capabilities. The $10-million cost of conversion would be about that for the required upgrading of *Challenger* and far below the now unacceptable costs of converting *Explorer*. The daily operating expenses of all three ships are comparable, although *Challenger*'s would inevitably drop if renegotiated in today's depressed market. Conveniently enough, NSF considers the $26.3 million of ocean drilling in the fiscal year 1984 budget sufficient to convert a modern exploration vessel and resume drilling with it in the following budget year.

The new option has been an instant favorite among scientists. The ad hoc advisory group unanimously rejected the *Explorer* option and designated the *Challenger* upgrading as the option of last resort. The group concluded that the most desirable choice, assuming that NSF's budget projections are reasonably accurate, is the leasing of a modern drill ship. It also emphasized that the still considerable costs would unduly affect other research in the rest of the earth sciences and especially the ocean sciences. Thus, they recommended that a goal of 50 percent foreign funding be achieved within a few years.

Roger Larson of the University of Rhode Island, who helped organize last year's Conference on Scientific Ocean Drilling, shares the advisory group's enthusiasm. "I think the third option is great," he says. "It's going to do everything or almost everything we would want it to do. It's just the kind of compromise we needed."—**RICHARD A. KERR**

Relative capabilities of the three ships. [Source: National Science Foundation]

	Challenger	*Sedco 472*	*Explorer*
Length	400 feet	470 feet	617 feet
Operating displacement	10,600 tons	16,700 tons	44,400 tons
Installed power	7,700 kilowatts	14,700 kilowatts	27,500 kilowatts
Scientific party	29	50	50
Drill string	23,000 feet	30,000 feet	33,000 feet
Mud-cement systems	Limited	Good	Good
Casing storage	Limited	Good	Unlimited
Riser and blowout preventer	No	6,000 feet+	Maybe someday
Weather limits for drilling	Less than other ships but not precisely known	45-knot wind, 15-foot seas, 2.5-knot current	45-knot wind, 15-foot seas, 2.5-knot current
Sea keeping	Good	Good+	Excellent
High-latitude capability	Fair	Fair to good	Good
Laboratory space	4,500 square feet	9,000 square feet	19,000 square feet
Operating budget estimate	$53,000 per day	$53,000 per day	$57,000 per day
Capital investment	$11 million	$10 million	$90 million

*Charles Drake, chairman; Donald Anderson, Edward Bingman, Kevin Burke, William Dickinson, Myron Horn, John Hower, John Imbrie, John Knauss, Jack Oliver, Barry Raleigh, Robert Rutford, Eugene Seibold, Derek Spencer, and Francis Stehli.