would otherwise die, or it could encourage new connections between neurons. But in either case, rats that endured traumatic early days are somewhat more sensitive to pain as adults. Some animals that had experienced the painful injection as pups were injected again as adults. Compared to rats that were injected for the first time as adults, the previously treated ones pulled their paw away from a hot floor faster. Their spinal cord neurons also fired more rapidly in response to a tail pinch in the treated adult rats.

As for how this study relates to human newborns, Charles Berde, a professor of pediatrics and anesthesiology at Harvard Medical School, says the rat pup is a "useful model," even though a few days in a rat's life correspond to months of development in a newborn human. Animal research that shows early pain causes hardwired changes might help convince skeptics of the importance of managing pain in newborns, says Berde.

Kanwaljeet Anand of the Arkansas Children's Hospital in Little Rock, a pediatrician and neuroscientist whose surveys show that babies in intensive care aren't always getting the analgesics they need, agrees. "What we need now," says Anand, "is an NIH[-sponsored] consensus panel to provide evidence-based guidelines and help standardize the way premature and full-term babies receive analgesic management." This sort of research, he says, should help dictate those standards.

–LAURA HELMUTH

OCEAN SCIENCE

Academy Panel Backs Sea-Floor Observatories

The National Academy of Sciences wants marine scientists to go deep. An expert panel last week strongly endorsed a network of remotely operated sea-floor observatories to monitor everything from water chemistry to bacteria. The backing may help ocean researchers win a boost in next year's budget proposal now being crafted by the outgoing Clinton Administration.

The new report* is in response to a request last year by the National Science Foundation (NSF), which asked whether submerged stations packed with sensors—an approach promoted by some marine scientists—are technically feasible and scientifically desirable. The eight-member panel, led by seabed mapper William Ryan of Columbia University's Lamont-Doherty Earth Observatory in Palisades, New York, answered "yes" on both counts. "Sea-floor observatories present a promising, and in some cases essential, new approach for advancing basic research in the oceans," it concluded.

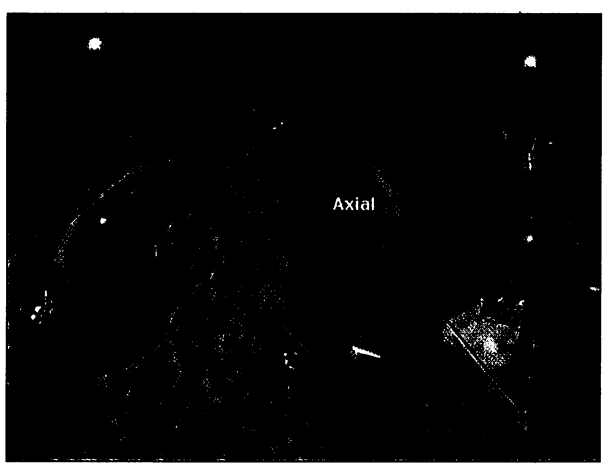
The panel urged NSF to get on with plans for long-term monitoring stations hung beneath a buoy or hitched to abandoned sea-floor cables that can provide power and communications. Such stations, which might be assisted by automated submarines that scan surrounding seas, would augment traditional short-duration, ship-based expeditions and help researchers get a clearer picture of long-term changes in marine environments, says panel vice chair Robert Detrick, a geophysicist at the Woods Hole Oceanographic Institution in Massachusetts. He suggests that NSF could phase in the new program by field testing new sensors and power supplies at a few sites, such as the University of Washington's planned NEPTUNE system that would wire sensors to 3000 kilometers of fiber-optic cable in the northeastern Pacific (see below).

Expanding such test-beds into a "comprehensive" network of deep and shallow water bases would be expensive, however. The panel estimated that it would cost several hundred million dollars to build and tens of millions a year to operate. NSF's budget couldn't accommodate that "extremely ambitious vision" immediately, says NSF's Mike Purdy, head of ocean sciences. But advocates are hoping that NSF will propose spending up to $30 million in start-up funds as part of its 2002 budget request, to be submitted this fall.

Some recent high-profile interest in marine research may help their cause. On 28 June President Bill Clinton suggested that Congress consider "shifting another few hundred million dollars to explore the deepest depths." The speech came a few weeks after Marcia McNutt of the Monterey Bay Aquarium Research Institute in Moss Landing, California, bent his ear on the topic during a White House "millennium" event. And last week, the leaders of a new Congressional Oceans Caucus, including Representatives Tom Allen (D–ME) and James Greenwood (R–PA), told a sea science conference that they will work to strengthen the field next year.

Another endorsement could come this fall, when the Commerce Department's National Oceans Service is due to deliver a White House–ordered wish list for federal oceans research. Some scientists are pulling for sea-floor research to float to the top of the list.

–DAVID MALAKOFF



CREDIT: NEPTUNE/UNIVERSITY OF WASHINGTON

NEPTUNE's realm. Ocean studies would benefit from automated sea-floor observatories like this proposed Pacific Ocean system.

* *Illuminating the Hidden Planet*: The Future of Seafloor Observatory Science, National Research Council.

DEVELOPMENTAL BIOLOGY

Embryonic Lens Prompts Eye Development

A blind cave fish is providing new insight into how eyes come to be. In work reported on page 631, developmental biologists Yoshiyuki Yamamoto and William Jeffery of the University of Maryland, College Park, show that the lens plays a leading role in eye development in this fish. If it doesn't form properly, the researchers found, the embryo will not go on to make the cornea and other eye structures.

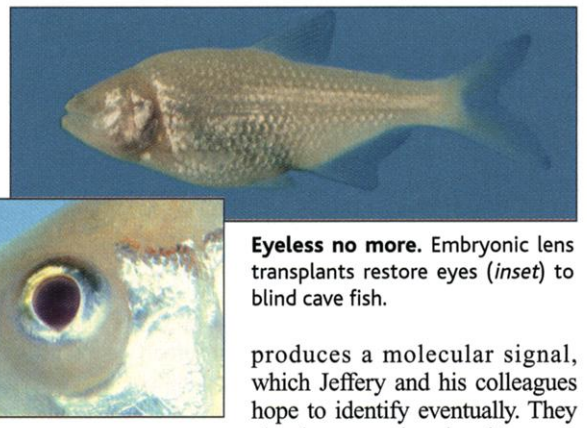
During the 1960s, work in Russia and Spain had suggested such a role for the lens, but this new study "nails it," says Peter Mathers, a developmental biologist at West Virginia University School of Medicine in Morgantown. What's more, he adds, because the eye develops similarly in all vertebrates, including humans, "the implications are much broader than [for] just the cave fish."

The Maryland team has been studying the fish, which is called *Astyanax mexicanus*, for the past 6 years. Several dozen isolated populations of the species exist in northeastern Mexico, with some living in surface ponds and streams and others in caves and underground waterways. Over the past million years or so, the eyes of the underground fish have degenerated to varying degrees, while the surface fish have retained their large eyes.

To begin to understand this difference, Jeffery and Yamamoto first monitored eye development in the blind fish. They observed a precursor lens and the rudiments of the optic cup forming during the embryo's first 24 hours. But soon afterward, they found, the cells in the embryonic lens underwent programmed cell death. Other eye structures, such as the cornea and the iris, never appeared, and the retina never developed distinct, organized layers, as it does

in normal eyes. The eyeball gradually sank back into the socket and was covered by a flap of skin.

Because eye development seemed to progress normally until the lens degenerated, Jeffery and Yamamoto wondered whether this disintegration was triggered by a signal from the embryo or from the lens itself. To find out, Yamamoto removed the embryonic lens from one eye of a blind cave fish embryo and replaced it with a lens from a surface fish embryo. He also did the opposite experiment, replacing the lens of an embryonic surface fish with one from a cave fish embryo. In all cases, he labeled the transplanted tissue with dye so he could track what happened to it. "It's not a complicated experiment, but it really [was] very elucidative," says Mathers.



Eyeless no more. Embryonic lens transplants restore eyes (*inset*) to blind cave fish.

In both types of transplants, the lens behaved as if it were still in its original embryo. The one from the cave fish degenerated, even though it was in an environment conducive to further development, whereas the lens from the surface fish thrived in the cave fish embryo and the eye differentiated, forming a cornea, anterior chamber, and iris. These results show that "the lens plays a central role" in determining whether the eye develops, comments David Beebe, a developmental biologist at Washington University School of Medicine in St. Louis. Jeffery doesn't know, however, whether the fish can actually see, as a vision test is quite difficult to devise.

Other recent work by Jeffery and his colleagues may explain why the lens undergoes programmed cell death in the cave fish. The researchers looked at early embryos for changes in the expression of a variety of proteins that help specify how cells differentiate into specific organs and tissues. As they reported last month in Boulder, Colorado, at the annual meeting of the Society for Developmental Biology, cave fish embryos seem to make more of a protein called Sonic hedgehog in the area destined to be the head. As a result, fewer cells are set aside to form the eyes (*Science*, 23 June, p. 2119). Jeffery suspects that with fewer cells to start with, the precursor lens may wind up smaller than usual, perhaps too small to survive, and therefore decays. "It's possible you are looking at a single gene defect that has caused a drastic developmental change," Mathers notes.

Still unclear, however, is how the embryonic lens of the sighted surface fish triggers further eye development. Presumably the lens produces a molecular signal, which Jeffery and his colleagues hope to identify eventually. They also hope to pinpoint the genes involved in eye development in *A. mexicanus*. Studying different populations of the fish may provide clues to these genes, notes Beebe: Because populations became isolated when the fish could see and became blind independently, different mutations may be involved in each population.

–ELIZABETH PENNISI

CREDITS: YAMAMOTO *ET AL.*

EUROPEAN SCIENCE

Urgent Call for Research Overhaul

BERN—The European Union is in danger of losing ground in the global research competition unless its member nations devote more resources to science, restructure the E.U.'s flagship research program, and develop a Europe-wide science strategy, an expert panel says. The recommendations are music to the ears of E.U. Research Commissioner Philippe Busquin, who has been arguing for major changes along those lines.

In a report issued on 20 July, the 11-member panel calls for "an urgent reengineering of the overall management and administration" of the E.U.'s Framework Program. Framework 5—which provides $17 billion over 5 years for multinational research efforts and scientific networking—should be made more flexible to respond to hot new research fields, the report suggests, and its complex grant-application procedures should be made "much simpler and easier to understand."

Taking a broader perspective, the panel—scientists, academics, and business leaders from 11 E.U. states—contends that the Framework Program (which accounts for only 5% of Europe's total spending on research) by itself cannot chart a course for European research. They recommend that member nations find better ways to coordinate national research efforts. The panel, appointed by the European Commission, also calls on E.U. member nations, which now spend an average of about 2% of their gross domestic product on R&D, to step up public

ScienceScope

Rephrase the Question The overhead that the federal government pays for universities to subsidize research done on campus is an incendiary topic, capable of infuriating Congress and deposing college presidents. So perhaps it's not surprising that two reports issued this week generate more heat than light.

The first, by RAND's Science and Technology Policy Institute (www.rand.org), estimates that universities are shortchanged from $700 million to $1.5 billion a year in a $15 billion portfolio of federally funded academic research. It also argues that any government attempt to force universities to pick up even more of their so-called indirect costs could shrink research efforts.

Unfortunately for presidential science adviser Neal Lane, who assigned RAND the study, Congress in 1998 had asked the White House for a report on ways to *reduce* indirect costs, including a comparison of university rates with those charged by industrial labs. So after Lane saw a draft version this winter of the RAND report, he quickly ordered up a study by his own Office of Science and Technology Policy. That brief report takes a more neutral tone by, for example, laying out the pros and cons of four options to further cut overhead costs.

Legislators are especially interested in whether the system favors wealthier universities, says a Senate aide. "But we need to read the reports before we decide whether to propose any changes," he says. Both reports, however, complain that there are insufficient data for a meaningful analysis and urge the government to make more information available.

Staying or Going? France's giant basic research agency, the CNRS, may soon have a new leader. The 3-year term of its current director-general, physicist Catherine Bréchignac, expired 18 July. But as *Science* went to press, the government had yet to decide whether to renew her mandate. The holdup is due to a disagreement between French President Jacques Chirac, who wants to keep Bréchignac, and Prime Minister Lionel Jospin, who wants to dump her, according to the daily *Le Figaro*. If Bréchignac goes, potential replacements include the directors of two research centers in the Paris suburbs: biologist Pierre Tambourin, head of the GENOPOLE research complex in Evry, and mathematician Jean-Pierre Bourguignon, chief of the Institute of Advanced Scientific Studies in Bures-sur-Yvette. A decision is expected by early August.

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