LIGHT POLLUTION

Development Blocked Near Tucson Telescopes

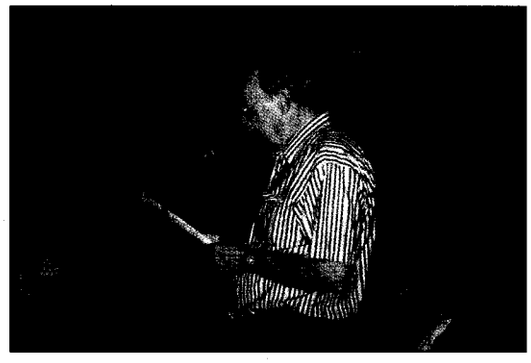
TUCSON, ARIZONA—Astronomers are applauding a decision last week by county officials to reject a $900 million development that could have brightened skies and degraded viewing conditions at three major observatories nearby. By a 4-to-1 vote, the Pima County Board of Supervisors turned down a plan to build 6000 homes and a large commercial district on a former ranch at the foot of the telescope-studded Mount Hopkins, 60 kilometers south of Tucson. Instead of savoring their victory, however, scientists have pledged to work harder to preserve dark skies on the outskirts of this rapidly growing southwestern metropolis.

"We won this time," says Craig Foltz, director of the soon-to-be-reopened 6.5-meter Multiple Mirror Observatory (MMT), the world's fifth-largest telescope, on Mount Hopkins. "But we need to get out there and fight to protect the really good sites in the world." Pima County Supervisor Sharon Bronson agrees. "The astronomers made the difference this time," she says, "and I hope they will provide the impetus to amend our light ordinances to make them even more progressive and protective of the industry."

For 35 years, astronomy and the rapid urbanization of southern Arizona have coexisted peacefully. In 1972 the community created the first outdoor lighting code in a major city to reduce streetlight glare and restrict business and home lighting without damaging residents' standard of living. More recently, the International Dark-Sky Association (IDA), the world's first advocacy group of its kind, has worked to preserve good seeing conditions for Kitt Peak National Observatory, Whipple Observatory, and the University of Arizona binocular telescope being erected atop Mount Graham to the east. "Tucson is the pioneer; it practically invented light sensitivity," observes Frederic Chaffee, director of the W. M. Keck Observatory in Kamuela, Hawaii, and a former director of the Mount Hopkins Observatory. "That's what's so distressing about this blowup."

The dispute burst into flames in December after smoldering for 3 years. Fairfield Homes of Green Valley, Arizona, had asked county officials to rezone 5700 acres of the undeveloped Canoa Ranch near the mountain's base for a residential and commercial development, including four times the number of homes permitted under current zoning plus offices, stores, and an airstrip. In October, a company-backed study requested by the county's Outdoor Lighting Code Committee said the development would produce less light pollution than would haphazard growth and a negligible increase in sky brightness.

That estimate, however, was quickly challenged by astronomers. A study by Foltz and Chris Luginbuhl of the U.S. Naval Observatory in Flagstaff, Arizona, showed a potential 8% to 14% increase in sky brightness. Robert Kirshner, associate director of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, which runs the Whipple Observatory, said such levels would "significantly compromise the usefulness of $220 million of taxpayers' investment" on Mount Hopkins. The developers' attorney, Frank Cassidy, dismissed the scientists' calculations and late last month talked about suing the Smithsonian for $900 million for "improperly" interceding in the zoning process.



Heat over light. Astronomer Dave Crawford addresses an overflow crowd before a vote on the controversial development plan.

CREDIT: MARY CHIND/*TUCSON CITIZEN*

What followed were 2 weeks of heated public debate over how to reconcile rapid development in the Sun Belt with world-class astronomy. As astronomers circulated electronic petitions and faxed letters to county officials, Cassidy complained that the observatory's staff had avoided discussions of how to minimize the amount of light pollution and overstated the bright commercial development. Whipple's spokesperson, Dan Brocious, told a local newspaper that astronomers "have a duty to speak out" about potential actions that jeopardize telescopes like the MMT, now completing a $20 million expansion.

Now that the Canoa fight has died down, both sides seem to be taking the long view. "Nobody wants to hurt the observatory," says David Williamson, president and chief executive officer of Fairfield Homes, who does not rule out resubmitting a scaled-down development plan. And astronomers vow to push for tougher light-emission standards later this year when public officials begin revising the area's pioneering lighting ordinance. "What this controversy revealed was that we need tighter controls in closer to the observatories," says Dave Crawford, a founder of IDA and member of the lighting code committee. But some scientists suspect it's a losing battle. "With all this growth, you realize you can only stay so long in a place," says Foltz. "And that's too bad." **–MARK MURO**

Mark Muro writes from Tucson, Arizona.

CREUTZFELDT-JAKOB DISEASE

Diagnostic Test Scores High Marks in Study

Since 1996, when a new human brain disorder linked to eating beef from cattle infected with "mad cow disease," or BSE, was first identified in the United Kingdom, health officials have been waiting for the other shoe to drop. Although only 34 cases of the disease—called variant Creutzfeldt-Jakob disease (vCJD)—have been confirmed so far in Britain, no one knows if these are isolated occurrences or the first signs of a major epidemic. Getting a handle on this crucial question has been made more difficult by the lack of a diagnostic test for vCJD. Now, help may be at hand: In the 16 January issue of *The Lancet*, a team of U.K. researchers reports that sensitive immunological and molecular tests can detect in tonsil biopsies an abnormal protein linked to vCJD.

Previously, the primary way physicians and researchers have diagnosed cases of vCJD has been through examination of brain biopsies taken from patients in advanced stages of the disease or, more commonly, after they had died. But a team led by neurologist John Collinge of St. Mary's Hospital in London has recently developed a different approach. Their tests seek to identify an abnormal form of a biomolecule called the prion protein (PrP) that is a signature of vCJD. The study shows that the tests can distinguish vCJD not only from normal controls but from other forms of CJD caused by different prion "strains" not linked with BSE, as well as from other prion-caused diseases.

With some reservations, the study is being welcomed by researchers as a first step toward a diagnostic test that could detect vCJD at earlier stages, as well as a tool for epidemiological studies. Britain's Medical Research Council and Department of Health are currently hatching plans to use the new test as part of a mass screening program of previously stored tonsils and appendixes, which might provide better estimates of how big an epidemic the country might be facing (*Science*, 4 September 1998, p. 1422).

The study was inspired by an earlier finding, reported by Collinge's group in 1997, of abnormal PrP in the tonsils of a

patient who had died from vCJD. For the recent study, the team collected a large number of samples of lymphoid tissues—including tonsils, spleens, and lymph nodes—from a variety of sources. These included tonsil biopsies from 20 patients suspected of having some sort of prion disease—nine of whom were later shown to be suffering from vCJD. The rest were from tonsillectomies or stored autopsy materials taken from vCJD victims, normal controls, and sufferers of other neurological diseases, including "classic" forms of CJD not linked to BSE.

In search of PrP, Collinge's team then subjected samples to two types of laboratory test. The first, immunohistochemistry—in which a target protein is "stained" with antibodies that specifically recognize it—can tell if PrP is present but not whether it is abnormal. The team found that PrP was detectable in lymphoid tissue only among vCJD sufferers; they found no PrP in any of the other samples. The second test, known as Western blotting, detects proteins both by their molecular weight and their reactions with antibodies. Collinge has claimed that this test can distinguish different prion strains because they have different patterns of sugar residues on their surface and hence different molecular weights. The new results may support that claim: They confirmed that only vCJD sufferers had PrP in their lymphoid tissue and found that all the vCJD patients shared the same prion strain.

The study "looks very convincing," says Oxford University epidemiologist Roy Anderson. And molecular biologist Chris Bostock, director of Britain's Institute for Animal Health, says that the new test "looks like a promising tool, along with others, to confirm diagnosis of vCJD." But researchers caution that use of the test for wide-scale screening raises serious ethical questions. For example, with no cure for vCJD in sight, should people be told they are harboring the disease? "The situation is analogous to the early stages of the AIDS epidemic," says Anderson. Health officials are therefore considering an anonymous screening program, for research purposes only.

Yet some researchers say that screening tonsil tissues could give rise to misleading data on the extent of the epidemic. Moira Bruce of the Institute for Animal Health's Neuropathogenesis Unit in Edinburgh points out that tonsils and appendixes are normally removed because they are inflamed and flooded with immune cells such as lymphocytes. "We know that expression of PrP on lymphocytes is elevated as part of the immune response," Bruce says, so such a screening program could lead to "false positives" and overestimate the infected population.

On the other hand, some researchers believe abnormal PrP may be undetectable in the disease's early stages, and because nobody knows at what stage the protein moves from infected beef in the gut to lymphoid tissues, screening might underestimate the epidemic. Nevertheless, screening will be required if health officials are to know what they are up against. Says Collinge: "It would be irresponsible not to make use of this test. We might find evidence of a major problem, and we need to know sooner or later."

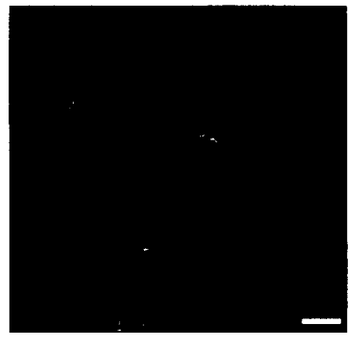
–MICHAEL BALTER

DEVELOPMENT

Brain Stem Cells Show Their Potential

Brains memorize organic chemistry equations, control typing fingers, and integrate the sensory input needed to navigate snarled traffic—all feats of profound sophistication and versatility. Now the brain is proving itself even more of a renaissance organ, for some of its cells can perform the tasks of a completely different tissue.

On page 534, Angelo Vescovi, a neurobiologist at the National Neurological Institute Carlo Besta in Milan, Italy, and his colleagues report that neural stem cells, which give rise to the three main types of brain cells, can also become blood cells when transplanted into mice whose own blood-forming tissue, the bone marrow, has been mostly destroyed. It wasn't until the early 1990s that scientists found ways to isolate neural stem cells and grow them in the lab. "Now the brain's making blood," Vescovi says.



Double duty. Yellow color identifies white blood cells produced by neural stem cells. (Bar equals 10 micrometers.)

CREDIT: R. RIETZE AND C. BJORNSON

"What's interesting is the idea that cells can shake their fates," says Ron McKay, a neurobiologist at the National Institute of Neurological Disorders and Stroke in Bethesda, Maryland. The result provides a strong push to find other stem cell types with similar capabilities. And it opens the possibility of using neural stem cell transplants to treat human blood cell disorders such as aplastic anemia and severe combined immunodeficiency—an appealing idea, as bone marrow stem cells don't replenish themselves well in lab cultures.

Several observations had hinted at brain cells' versatility. During development, muscle cell types—which arise from a layer of embryonic cells distinct from that which generates the brain—appear in the central nervous system, says Vescovi. Furthermore, scientists sometimes see muscle tissue in a particular type of brain tumor. Because no one knows where the muscle cells come from, "we theorized that maybe there's a brain cell that possesses a much wider potential for differentiation than previously thought," says Christopher Bjornson, a developmental biologist currently at the University of Washington, Seattle, and a co-author of the *Science* paper.

To find out, the team isolated neural stem cells from adult and embryonic mice and grew them singly in lab cultures. After irradiating mice to kill most of their bone marrow cells and create a vacancy that new cells might occupy, the researchers injected the neural stem cells into the animals. Because the donor mouse cells carried distinctive genetic markers, the researchers could trace their fate in the injected animals.

Five months later, the investigators found that the blood of the recipients contained cells that not only displayed the donor cell marker protein but also produced proteins that only mature blood cells make. They also showed that the animals' bone marrow carried immature blood precursor cells that were descended from the neural cells.

No one knows exactly what caused the neural cells to turn into blood cells. But Vescovi and his colleagues suspect that the neural cells might be responding to the same signals that normally stimulate the few remaining blood stem cells to reproduce and mature after irradiation wipes out most of the bone marrow. "The result suggests that there's something quite powerful in the mature adult blood system that can instruct cells from a different origin what to do," says Arturo Alvarez-Buylla, a neurobiologist at The Rockefeller University in Manhattan.

Whatever that is, its effects appear to be long-lasting. The Vescovi team could detect the neural-derived blood cells a year after the injection. That means that the transplants may persist long enough to be clinically useful, the researchers say. If the Vescovi team's work can be replicated in humans, agrees Irving Weissman, a stem cell biologist at Stanford University School of Medicine, the neural cells "could become a source for blood stem cells."

–EVELYN STRAUSS