Karolinska Institute in Stockholm, Barry Hoffer of the University of Colorado and their colleagues, and Franz Hefti and Klaus Beck of Genentech and their co-workers show that direct injections of GDNF into the brains of rats and mice can save dopaminergic neurons that have been damaged by either the neurotoxin MPTP or surgical injury.

In the Genentech group's experiments on surgically injured rats, the control animals lost 50% of their dopaminergic neurons, while animals that were treated with GDNF after the injury retained nearly normal numbers of healthy cells. Hoffer's group had similar results with mice treated with MPTP, and in addition found that the GDNF injections also alleviated the Parkinson's-like symptoms induced by MPTP. (The neuron-severing injury used by Hefti's group doesn't produce symptoms in the rats, so they couldn't test for recovery.)

Although preliminary, these experiments have raised hopes that GDNF will have similar neuron-saving effects in humans. But Freed cautions that it's not yet clear whether the results can be extrapolated to humans, because the existing animal models are only approximations of Parkinson's. "We simply don't know," he says, what effects growth factors such as GDNF might have in human patients.

We might know soon, though. Amgen Pharmaceuticals bought Synergen last month and plans to move toward clinical trials, although Collins, now at Amgen, says there is no schedule yet for the trials. The first trials will probably involve pumping GDNF directly into the patients' brains, because it is a protein that does not cross the blood-brain barrier. If GDNF proves successful, Amgen and other companies will no doubt search for a small molecule that mimics the protein's effects but can cross the blood-brain barrier and therefore can be administered systemically.

Will this therapeutic approach eventually make brain-cell grafts obsolete? "It is too early to call it," says Hefti, because the approaches to both transplantation and rescuing the patients' own neurons are in such early experimental stages. "Both approaches are very valuable at this point," he says, "and they should be pursued." And it's possible that one of them will prove to be a much better substitute for the existing therapies and their merely temporary respite from the devastation of the disease.

–Marcia Barinaga

Additional Reading

L. J. Fisher and F.H. Gage, "Intracerebral transplantation: Basic and clinical applications to the neostriatum," *FASEB Journal* **8**, 489 (1994).

L.-F. H. Lin *et al.*, "GDNF: A glial cell line–derived neurotrophic factor for midbrain dopaminic neurons," *Science* **260**, 1130 (1993).

MEETING BRIEFS

Quasars and a Dwarf Star Break the Rules in Tucson

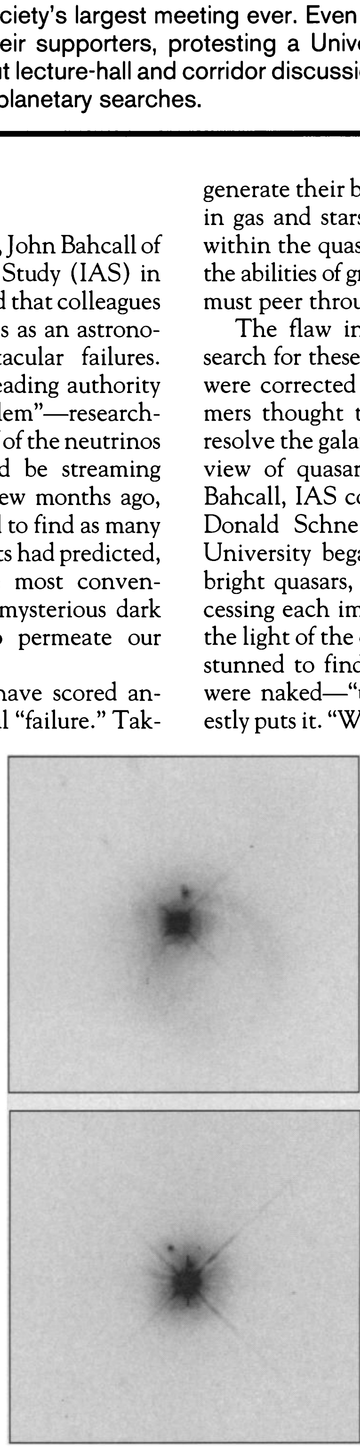
Earlier this month, more than 2000 astronomers convened in Tucson, Arizona, for the American Astronomical Society's largest meeting ever. Even the war drums beaten by a few local Apaches and their supporters, protesting a University of Arizona telescope project, could not drown out lecture-hall and corridor discussions of topics such as naked quasars, flaring stars, and planetary searches.

Quasars Bare All

At a press briefing at Tucson, John Bahcall of the Institute for Advanced Study (IAS) in Princeton, New Jersey, noted that colleagues jokingly attribute his success as an astronomer to a series of spectacular failures. Bahcall, for instance, is a leading authority on the "solar neutrino problem"—researchers' failure to find a good half of the neutrinos that theory predicts should be streaming from the sun. And just a few months ago, Bahcall led a team that failed to find as many dim red stars as some theorists had predicted, apparently eliminating the most conventional explanation for the mysterious dark matter that is thought to permeate our galaxy's outer regions.

Now Bahcall seems to have scored another dramatic observational "failure." Taking the closest look ever at the mysterious, powerful beacons known as quasars with the repaired Hubble Space Telescope (HST), he and his colleagues were largely unable to find the galaxies that are thought to fuel them. "We've taken a giant step backward. We need to rethink how quasars shine," argues Bahcall. Not all astronomers are going that far, but nearly everyone is at a loss to explain Bahcall's "naked" quasars. "This was completely unexpected. It's the most surprising finding to come out of HST," comments Jeremiah Ostriker of Princeton University.

The desire to get a better look at quasars was one of the original motivations for the orbiting telescope. The standard view holds that quasars are supermassive black holes lurking at the centers of well-developed galaxies, where they generate their brilliant radiation by dragging in gas and stars. But spotting host galaxies within the quasars' glare was largely beyond the abilities of ground-based telescopes, which must peer through Earth's atmosphere.



Naked came the quasars. Instead of the expected bright host galaxies, new Hubble images reveal only a hint of a host galaxy around one quasar (*above*) and the wispy remnants of a disrupted galaxy near another (*top*).

JOHN BAHCALL/INSTITUTE FOR ADVANCED STUDY/NASA

The flaw in HST's mirror delayed the search for these galaxies, but after the optics were corrected in late 1993, most astronomers thought the telescope would quickly resolve the galaxies and support the standard view of quasars. But last February, when Bahcall, IAS colleague Sofia Kirhakos, and Donald Schneider of Pennsylvania State University began taking images of nearby, bright quasars, confusion set in. After processing each image by computer to subtract the light of the quasar, the astronomers were stunned to find that the first eight quasars were naked—"unclothed" as Bahcall modestly puts it. "We couldn't figure out what we were doing wrong," says Bahcall. "According to the paradigm, we expected the monster to be feeding on its environment. And we expected that environment to be visible." A measure of relief was finally provided by the ninth HST image, which showed an obvious host galaxy. But of the 15 quasars imaged so far, only four are clearly centered in host galaxies.

Some astronomers believe the standard picture of quasars may weather this latest spectacular Bahcall failure. "It's hard for me to believe that the galaxies are not there at some level," says Robert Williams, a quasar investigator and director of the Space Telescope Science Institute in Baltimore. Williams suggests that longer exposures or more sophisticated subtraction of the quasar light may be needed to see the hosts.

Bahcall acknowledges that the eight completely naked quasars may have faint host galaxies that were beyond the power of these latest observations to resolve. He maintains, however, that current thinking requires bright, nearby quasars (like those his team observed) to have obvious host galaxies feeding them. And in none of the 15 cases, says Bahcall, "did we detect a really bright host galaxy."

To Bahcall, the new HST images suggest that quasars may not need mature galaxies teeming with stars to fuel them. Instead, he thinks the images may support a "quasar first, galaxy second" model in which the brightest quasars shine within galaxies that are just forming. A nascent galaxy's condensing gas, plus a few early stars, would be enough to feed the quasar. As the galaxy matures and more stars form, the quasar might dim, which could explain why so many galaxies have so-called active nuclei—fainter cousins of quasars.

A few astronomers are suggesting that this latest failure has even more radical implications—for example, that quasars may not be huge black holes at all. "I think it casts doubt on the whole paradigm," says Geoffrey Burbidge of the University of California, San Diego. Burbidge is a longtime advocate of the steady-state model of the universe, a minority view holding that matter didn't form all at once in the big bang but is constantly trickling into the universe from sources scattered around it. Quasars, he thinks, are one of these wellsprings of mass, generating light and radiation as byproducts. Although these quasars could get their start at the centers of galaxies, he thinks they are often ejected to shine on their own. The HST images, he says, "bear out what I've been saying all along."

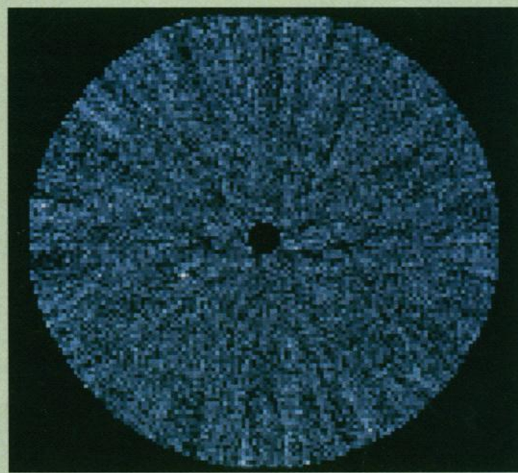
The absent hosts aren't the only startling revelation in the new HST images, however. Even though many of the quasars aren't enveloped in host galaxies, nearly all of them do seem to have small companion galaxies, a curious observation that a few ground-based telescopes had made as well. "Please don't ask me what they're doing there. I don't know," pleads Bahcall. He does note, however, that the quasars and their companions may interact. In one HST image, he points out, the companion's shape appears to be distorted by the gravitational influence of a quasar; apparently, the quasar and the galaxy are merging.

In search of more clues, Bahcall's group plans to image three other nearby quasars over the next 6 months. It's only with more data, they say, that the quasar mystery will be resolved and their bewilderment eased.

Can We See E.T.'s Home?

Imaging a planet around even a nearby star is beyond the best telescopes of today. But the computer simulation below, showing a telescope image of a hypothetical extrasolar planet, suggests that the needed technology is not far off.

Astronomers already have indirect evidence of planetlike masses orbiting a pulsar, a rotating neutron star that is the burnt-out cinder of an exploded star. But imaging a planet around a star like our sun is a bigger challenge because of the difficulty of detecting the faint light reflected from the planet in the glare of the nearby star, which may be a billion times brighter. Last year, however, University of Arizona telescope expert Roger Angel argued in *Nature* that a large ground-based telescope could image a Jupiter-sized planet orbiting a nearby star if it were equipped with adaptive optics, a technology in which a deformable mirror constantly changes its shape to eliminate the blurring of Earth's atmosphere.



To test Angel's argument, David Sandler and Steve Stahl of ThermoTrex Corp. in San Diego used a computer to model how a Jupiter-like planet circling a star 24 light-years away would appear to a 6.5-meter telescope sporting a slightly more advanced adaptive optics system than exists today. Their artificial image, presented in Tucson, suggests that Angel was right. The hypothetical planet is clearly visible as a white dot near the blacked-out central star.

–J.T.

The Dwarf That Flared

Small stars should lead uneventful lives, at least according to astronomical theory. They don't bloat into red giants—as sun-sized stars are wont to do—or explode as supernovae, as still more massive stars can. And in theory they lack the strong magnetic fields that power the sunspots and flares seen on larger stars. But last October, a tiny red dwarf known as Van Biesbroeck 10 (VB10), a star that has a mass less than one-tenth that of the sun, reminded astronomers that even the smallest stars aren't always sedate.

The reminder came when astronomer Jeffrey Linsky and his colleagues saw the star erupt in a powerful flare. "They were unbelievably lucky. They caught VB10 in the act," comments Robert Rosner, a theoretical astrophysicist at the University of Chicago. What they glimpsed was not just a spectacular display, says Linksy, an astronomer at the Joint Institute of Laboratory Astrophysics in Boulder, Colorado; it was also "a clear signature that the star has a strong magnetic field."

Linsky and his colleagues were using the high-resolution spectrograph on the Hubble Space Telescope to study the spectrum of ultraviolet light from the star, which lies 19 light-years from Earth in the constellation Aquila. They expected to see only steady, relatively meager ultraviolet emissions from near the star's surface. But in the last 5 minutes of a planned 1-hour observing run, the detector was showered with ultraviolet light as a flare apparently sent temperatures in the outer atmosphere of VB10 soaring to more than 270,000 degrees Fahrenheit.

Flares are thought to require a magnetic field, because theory holds that they take place when the lines of magnetic force store up energy from the stellar interior and suddenly release it into the star's outer atmosphere. And though VB10 isn't the first low-mass star to show signs of magnetic activity, it's the smallest yet. As a result, says Linsky, it underscores the puzzle of magnetic fields in low-mass stars.

Astronomers believe larger stars such as our sun generate a magnetic field because they have distinct layers. In the so-called radiative core, energy propagates outward without stirring the hot gases, but the outer "convective" layer loses energy by circulating like boiling water. The sun's layers rotate at different speeds, and their interface acts as a dynamo, accelerating electrons to generate a magnetic field.

Stars whose mass is less than 20% of the sun's are thought to be fully convective; they should have no faster moving radiative core to drive a dynamo. For years, theorists have been playing with stellar models in which turbulence in a fully convective star could generate a magnetic field, but there's no clear winner yet. In light of VB10's recent outburst, says Linksy, "the theoreticians need to go back to work."

–John Travis