Planet X: Going, Going... But Not Quite Gone

The case for a tenth planet comes under fire at an astronomical conclave, but a handful of observers aren't giving up just yet

London—IS THERE A NEW PLANET LURKING in the icy depths of the solar system, waiting to be discovered? A few astronomers think it a distinct possibility. They argue that the gravitational pull of the planet, dubbed Planet X, has left its signature in quirks in the orbits of Neptune and Uranus. But judging by the presentations at an international conference on Planet X, held here on 8 November by the Royal Astronomical Society (RAS), anyone searching for Planet X may be on a wild goose chase.

At the RAS meeting, the idea of Planet X came under three different lines of attack. More than a decade of observations, including an infrared sky survey by IRAS, the infrared astronomy satellite launched in 1983, have turned up nothing, participants reported. Meanwhile, theorists argued that the orbital anomalies of Uranus and Neptune might reflect nothing more than observational error. And one researcher asserted that another major planet simply couldn't have formed in those remote reaches of the solar system.

Planet X proponents aren't giving up just yet, though they agree that hopes of finding their quarry are fading. "I wouldn't give you better than 50-50 odds on Planet X," says astronomer Robert Harrington of the U.S. Naval Observatory (USNO) in Washington, D.C., a leader of the search. "But the evidence is sufficiently strong—and the potential gain sufficiently great—for me to [go on] looking for it."

What spurs Harrington and his colleagues is evidence that something is missing from the current dynamical models of the solar system. Even the best of these models, incorporating decades of observations, can't predict the positions of the outer planets more than 10 years into the future. For Pluto, the discrepancies are embarrassingly large. "If you sent a probe to Pluto at the moment, you'd miss it," joked Leslie Morrison of the Royal Greenwich Observatory, one of the meeting's organizers. In Pluto's case, the prediction failures are almost certainly the result of having too few observations to feed into the theory. But some astronomers have been less willing to blame observational error for the discrepancies in Uranus's and Neptune's orbits.

Solar system specialists thought they had the culprit as long ago as 1930, when Clyde Tombaugh of the Lowell Observatory in Flagstaff, Arizona, discovered Pluto. But even at the time, Pluto looked smaller than had been predicted, and Tombaugh himself went on vainly searching for another 13 years for a bigger planet at the edge of the solar system. In 1978 suspicions that Pluto was not the answer were confirmed when the discovery of Pluto's moon, Charon, opened the way to determining the combined mass of the planet and its satellite. The result: Pluto's mass was 50 times too small to account for the curious behavior of its giant neighbors. If Pluto couldn't do the trick, Harrington and his colleagues reasoned, they would have to think about a tenth planet.

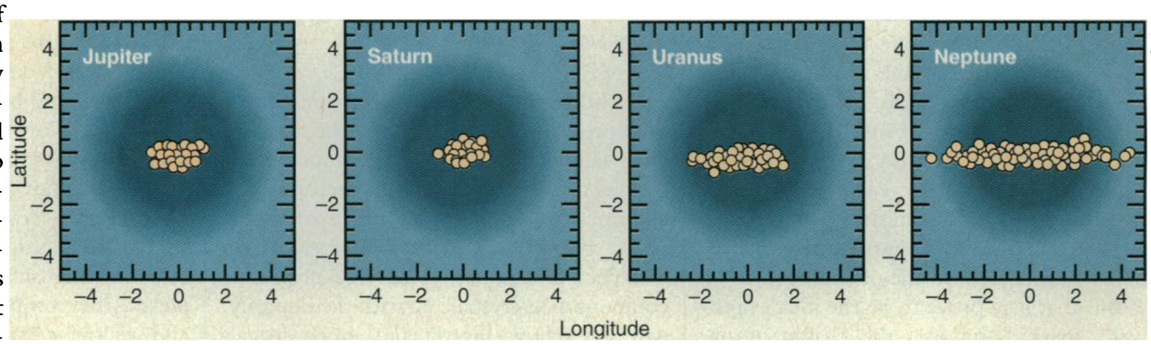
Harrington renewed the search for Planet X by first trying to compute its likely characteristics. He put hundreds of thousands of guesses about Planet X's size and position into a computer and calculated the effects of each one on the orbits of Uranus and Neptune. The best candidate to explain the discrepancies: a body with a mass about 3.5 times Earth's, following an oval orbit tilted at about 30 degrees to the plane of the solar system and lying about three times as far from the sun as Neptune. Just now, says Harrington, this putative planet probably lies in the constellation Centaurus, deep in the southern sky—which would explain why Tombaugh, observing from the Northern Hemisphere, never found it.

Harrington feels sure enough of his calculations to have actually searched for Planet X from a USNO outpost in New Zealand. He has checked about a third of the likely area, with no luck so far. But just in case Harrington is right about the existence of Planet X but wrong about its exact position, Michael Rowan-Robinson of Queen Mary and Westfield College, London, turned to the IRAS database, which covers most of the sky. He focused his search on objects that moved between one pass of the satellite's cameras and a later pass, but saw nothing resembling another planet. Rowan-Robinson told the RAS meeting that he is now "70% certain" that Planet X doesn't exist.

Rowan-Robinson is quick to admit that Planet X has plausible alibis. For one, it may not be warm enough to have revealed itself to the satellite's infrared cameras. For another, a quarter of the sky escaped IRAS's search for slow-moving objects. And if Planet X lies along the line of sight to the Milky Way—which is just where Harrington's prediction and several others place it—the infrared glow from the galaxy's gas clouds might well have swamped the planet's feeble signal.

But to several theorists who spoke at the RAS meeting, there's a simpler explanation for the failure to find Planet X: It may not be there. As Gerald Quinlan of the Canadian Institute for Theoretical Astrophysics at the University of Toronto told the meeting, there's a good chance that the supposed "perturbations" in the orbits of Uranus and Neptune have been leading astronomers astray.

Quinlan and his colleagues David Hogg and Scott Tremaine developed a computer "orrery"—a model of solar system motions—for the four giant planets, from Jupiter through Neptune. They fed 80 years of observations into the orrery and ran it to predict the positions of the planets for 20



No need for Planet X? *Random observational errors are enough to smear out 20-year forecasts of the positions of Uranus and Neptune, mimicking the signature of a tenth planet.*

years into the future. Then they modified the data by adding or subtracting random errors of just the kind thought to plague real observations and ran the orrery again. The random errors had little effect on the predicted positions for Jupiter and Saturn, but they left the positions of Uranus and—even more so—Neptune distinctly smeared out. Indeed, the smearing looked remarkably like that expected from the gravitational pull of an unseen planet.

"This suggests to us that the discrepancies do not require a tenth planet," says Quinlan. That's not to say it can't exist, he quickly adds. But tracking it down wouldn't be easy. The finding that random errors can account for the apparent orbital anomalies of Uranus and Neptune means that the signature of a Planet X would be lost in the noise unless it were much more massive than Harrington predicts.

Theorist David Hughes of the University of Sheffield goes further, arguing that even if observational error weren't blurring the picture, there would be nothing to see. There hasn't been enough time yet in the history of the solar system for a planet to form at the distances proposed for Planet X, he argued at the RAS meeting. His calculations show that, given the scarcity of primordial material at those distances, it would take 10 billion years—twice the solar system's age—for anything substantial to condense. "If you believe this theory, then the solar system probably ends at Neptune [currently the farthest planet from the sun]," he says.

But even if Hughes is right, Harrington maintains, Planet X could slip through a loophole. Perhaps it formed closer to the sun, then was flung out toward the edge of the solar system by the chaotic dynamics that may have dominated the planetary motions. Indeed, Harrington and his USNO colleague Thomas van Flandern think that scenario could simultaneously explain the existence of Planet X, Pluto's small size, and some peculiarities of Neptune's satellite system. They propose that on its way out to the edge of the solar system, Planet X veered close to Neptune and stripped away one of its moons, which became the planet we now know as Pluto.

Harrington calculates that the mass Planet X would need to succeed in that celestial abduction is close to that needed to cure the orbital discrepancies of Uranus and Neptune. Far from pronouncing Planet X dead, Harrington says, he is light-heartedly rechristening it. The new name he has chosen: Panacea. ■ ROBERT MATTHEWS

Robert Matthews in an Oxford-based journalist who covers science for the Sunday Telegraph *in London.*

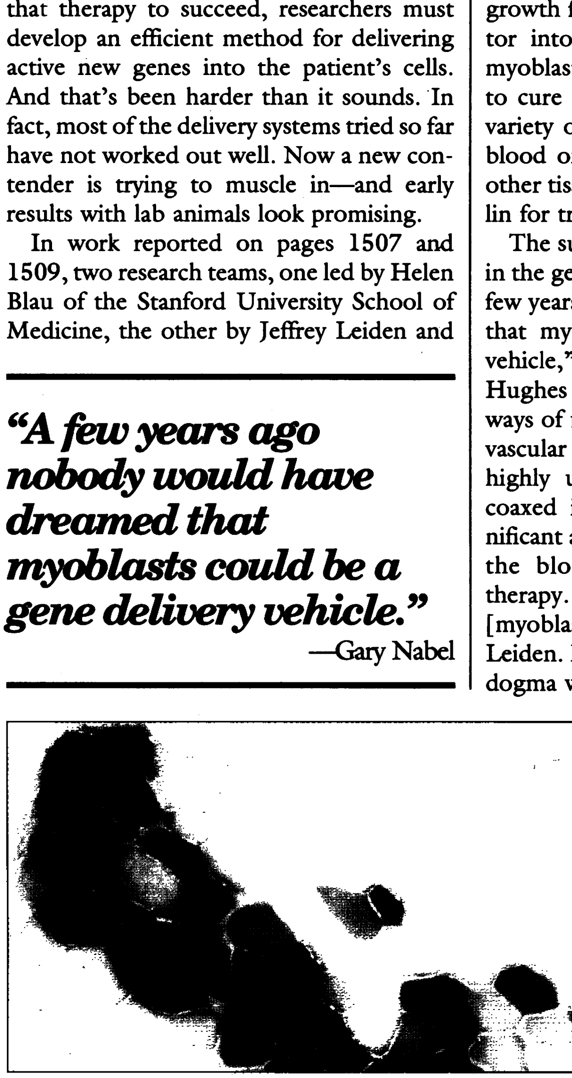
Putting New Muscle Into Gene Therapy

Immature muscle cells may provide an efficient system for delivering therapeutic new genes into the body

GENE THERAPY, THE INSERTION OF THERAPEUTIC genes into a recipient's cells, holds enormous promise for curing many diseases, both inherited and noninherited. But for that therapy to succeed, researchers must develop an efficient method for delivering active new genes into the patient's cells. And that's been harder than it sounds. In fact, most of the delivery systems tried so far have not worked out well. Now a new contender is trying to muscle in—and early results with lab animals look promising.

In work reported on pages 1507 and 1509, two research teams, one led by Helen Blau of the Stanford University School of Medicine, the other by Jeffrey Leiden and Eliav Barr of the Howard Hughes Medical Institute at the University of Michigan Medical Center in Ann Arbor, have demonstrated the feasibility of using immature muscle cells called myoblasts to carry genes into the muscle fibers of mice.

"A few years ago nobody would have dreamed that myoblasts could be a gene delivery vehicle."
—Gary Nabel


HELEN BLAU

Right at home. *Myoblasts, carrying a gene that makes them blue, become part of the recipient animal's muscle.*

One obvious potential application of the technique is to treat the genetic defects that cause muscular dystrophy. But the new method could have a much wider application as well, because the researchers have shown that the myoblasts, which were genetically engineered to contain the human growth factor gene, secrete the growth factor into the animal's blood. Engineered myoblasts might therefore be used not only to cure muscle cells but to deliver a wide variety of substances that either act in the blood or are transported by the blood to other tissues. A prominent possibility: insulin for treating diabetes.

The success with myoblasts caught many in the gene therapy business by surprise. "A few years ago nobody would have dreamed that myoblasts could be a gene delivery vehicle," says Gary Nabel of the Howard Hughes Medical Institute, who is exploring ways of using gene therapy to treat cardiovascular disease. For one thing, it seemed highly unlikely that myoblasts could be coaxed into secreting physiologically significant amounts of the desired protein into the bloodstream—a key need in gene therapy. "It had always been the dogma that [myoblasts] weren't secretory cells," says Leiden. But, as the current work shows, the dogma was wrong.

In showing the fallacy of that dogma the two groups used different "vectors," or vehicles, for carrying the human growth factor gene into mouse myoblasts in culture. Blau and her colleagues made use of a modified retrovirus; Leiden and Barr used a plasmid. That difference aside, the procedures and results were similar. Both groups injected the engineered myoblasts into mouse muscles and subsequently found physiologically significant levels of human growth hormone circulating in the serum of the mice, a finding that indicates that the implanted cells were manufacturing and secreting the protein. Best of all, both teams have seen hormone secretion sustained over a fairly long period—up to 3 months in the Blau lab.

That's a marked improvement over the results with previous gene delivery systems, which have used several cell types including