Hubble telescope reveals a patchy Pluto

Viewed through any telescope on Earth, Pluto looks like an undistinguished fuzzball. But images taken with the keen eye of the Hubble Space Telescope, which were unveiled a year ago but now have been enhanced, directly reveal the first details of the remote planet.

Released last week at a press briefing in Washington, D.C., the pictures show that Pluto has a mottled appearance, with nearly a dozen large bright and dark patches on its icy surface. These include a bright northern polar ice cap bisected by a dark strip, a group of bright spots rotating with the planet, a cluster of dark spots, and a bright linear marking. Pluto's patchiness, probably due to deposits of frost, endow the planet with higher contrast than any other denizen of the outer solar system.

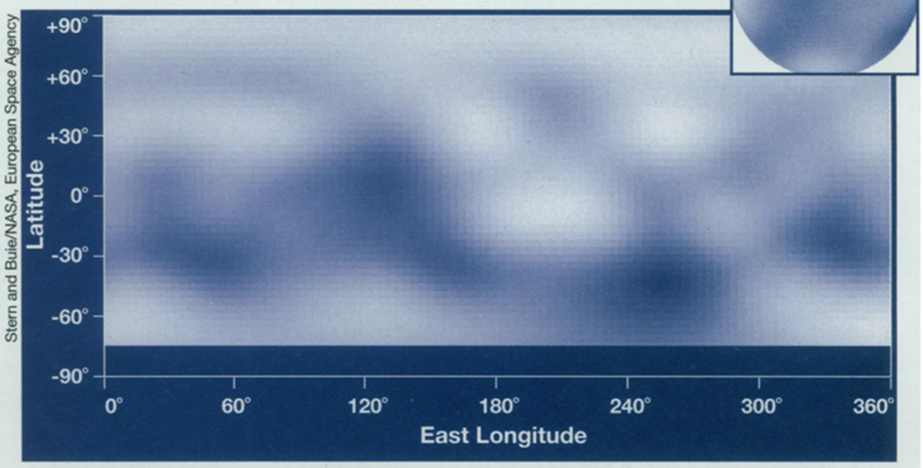
"The things we couldn't see before . . . are turning out to be at least as interesting as we thought they would be," says S. Alan Stern of the Southwest Research Institute, in Boulder, Colo.

Last year, Stern and his collaborators, including Marc W. Buie of Lowell Observatory in Flagstaff, Ariz., and Laurence M. Trafton of the University of Texas at Austin, presented "raw" ultraviolet and visible-light images taken by Hubble's Faint Object Camera (SN: 4/1/95, p. 204). Because even Hubble can barely discern detail on tiny Pluto, the astronomers used computer techniques to enhance the visible-light images.

The darker regions in the enhancement may consist of old methane frost, broken down by the sun's ultraviolet light into dark hydrocarbons. The brighter regions may be fresh nitrogen ice, Stern says.

Scientists say that the distribution of frosts on Pluto may change dramatically as the planet's elliptical, 248-year orbit takes it further into the chillier reaches of the outer solar system. As Pluto, now just past its closest approach to the sun, continues to recede, more of the planet's atmosphere is expected to condense as snow. Fresh, bright frost covering old, dark layers may give Pluto a considerably more uniform appearance in just 20 years.

Five years ago, researchers including Buie and Richard P. Binzel of the Massachusetts Institute of Technology modeled Pluto's surface brightness after viewing partial eclipses of the planet by its moon, Charon (SN: 6/6/92, p. 379). The Hubble images match that model well, notes Binzel, and "set the stage for the next step—exploration of Pluto by spacecraft." NASA is now considering launching a spacecraft, Pluto Express, in the next decade, that would take 12 years to reach the planet. —*R. Cowen*



Map of Pluto, based on enhanced Hubble images, confirms that the planet has a dark equator (shown as blue) and bright polar caps. Inset: Pluto as seen by Hubble.

Regrowing livers with gene therapy

A few years ago, researchers in Norway made an unexpected observation while studying a few patients who had received liver transplants because of a rare, inherited enzyme deficiency. Within the ravaged livers that had been removed were small nodules of healthy tissue containing cells free of the inherited genetic defect. A single cell had apparently reverted to producing the missing enzyme, fumarylacetoacetate hydrolase (FAH), and then vigorously proliferated to generate each nodule.

That surprising claim has now led to a provocative new strategy for gene therapy. Investigators led by Markus Grompe of the Oregon Health Sciences University in Portland report that, under the proper conditions, they can exploit the liver's unique regenerative ability—transplanting fewer than 1,000 healthy liver cells completely regenerates the livers of mice suffering from a disease similar to the Norwegian patients' deficiency. The investigators also found that they can cure such mice by adding functioning FAH genes to just a small percentage of their livers' defective cells.

In a commentary accompanying the report of Grompe and his colleagues in the March NATURE GENETICS, James M. Wilson of the Institute for Human Gene Therapy at the University of Pennsylvania in Philadelphia writes that their work "breathes new life into the prospects of liver-directed gene therapy."

"It's a very impressive demonstration that combines basic science and therapy-oriented research," adds gene therapy investigator Gary J. Nabel of the University of Michigan in Ann Arbor.

Gene therapy targeted to the liver has been hampered by delivery problems. Investigators generally use viruses to carry therapeutic genes into cells. Though certain viruses can infect the whole liver, the extra genes they bring in work only for a short time. Other viruses allow long-term operation of therapeutic genes but infect less than 5 percent of a liver—not enough to cure most diseases.

In transplants of liver cells from healthy mice into FAH-deficient rodents, Grompe's group showed that FAH-making liver cells have a natural growth advantage over the defective cells. And since the frequent cell death produced by enzyme deficiency sends the liver into a vigorous regeneration phase, a thousand or so healthy cells can quickly regrow a normal liver.

The investigators also injected viruses carrying the FAH gene into diseased livers. Multiple injections, which investigators estimate corrected less than 1 percent of the organ's FAH-defective cells, restored liver function in almost all the mice. "The biology favors the survival of the corrected cells. It's amazing how few cells you have to hit," says Grompe.

Before trying this strategy in humans with FAH-deficiency, Grompe plans to determine if the treated mice develop liver cancer—an eventual result of FAH-deficiency if the enzyme's absence has not already destroyed the liver.

This novel gene therapy approach may also be useful for more common genetic diseases of the liver, even ones in which corrected cells do not normally have a growth advantage. Investigators might add to the liver cells a mix of therapeutic genes and genes that confer resistance to a toxic drug. The researchers would then use that drug to damage the liver and let the protected, corrected cells repopulate the organ. "There are all sorts of ways we can envision giving cells a selective advantage," says Grompe. —*J. Travis*