Casting Shadows on Spiral Galaxies

Dust spoils the view no matter which way astronomers look. This pervasive cosmic smoke blocks light emanating from stars at the Milky Way's core, dims nearby galaxies and distant quasars alike, and cuts off much of the universe from direct view. To make matters worse, a new analysis reveals that spiral galaxies — long thought to contain only a modest amount of light-absorbing dust — may themselves be much cloudier than astronomers had assumed.

Reporting in the July 12 NATURE, Edwin A. Valentijn of the Kapteyn Astronomical Institute in Groningen, the Netherlands, suggests that major parts of most spiral galaxies are heavily clogged with light-absorbing dust. In many cases, the dust enshrouding the inner parts of a galaxy appears so thick that astronomers actually see only the outer crust of stars.

The new findings may force astronomers to rethink their explanations for a number of important astronomical effects, including their reasons for invoking exotic forms of "dark matter" to explain why spiral galaxies seem to emit less light than their apparent masses would suggest. "If spiral galaxies are opaque, astronomers — and cosmologists in particular — will need to revise some of their ideas," says Michael Disney of University College in Cardiff, Wales.

The old view that spiral galaxies are largely transparent arose from studies of how the average surface brightness of galaxies differs depending on whether an observer sees a galaxy face-on or tipped at an angle. Dust-free, transparent galaxies would have comparable luminosities when viewed from any direction, whereas dust-clogged galaxies would look brightest observed face-on.

Valentijn originally set out to determine what factors may have biased the original studies of spiral-galaxy transparency. His precise measurements of the brightness of more than 12,000 carefully selected spiral galaxies revealed that these galaxies appear much more opaque than earlier studies had indicated. "I was very surprised because the results contradicted many famous papers in this area," Valentijn says.

The brightness data also point to large collections of cool, compact molecular clouds as the prime candidates for the main light-absorbing components in typical spiral galaxies. To confirm this prediction, astronomers now face the difficult task of mapping infrared and submillimeter-wavelength emissions from spiral galaxies in sufficient detail to pick out the obscuring molecular clouds.

Moreover, Valentijn's analysis suggests that either the Milky Way is unusually transparent compared with other spiral galaxies, or its molecular clouds cast deeper shadows than most astronomers assume. Our own galaxy may be more opaque than we think, he says. "That is a possibility that at least does not contradict any present observations."

Because spiral galaxies make up a significant proportion of all galaxies, Valentijn's discovery that they are remarkably opaque could have considerable impact on astronomy. "If it's true, there are all kinds of implications," says Jeremiah P. Ostriker of Princeton (N.J.) University. "It makes obscuration of distant objects more likely. It lessens the amount of ultraviolet light that gets out of galaxies, and that's important in the intergalactic medium."

The results also call into question the need to assume the presence of extra, nonluminous mass in the form of halos of exotic dark matter around the disks of spiral galaxies to account for the way these galaxies rotate. Indeed, the hidden matter, at least in part, may be nothing more than stars buried in dust.

— I. Peterson

Growth-gene mickey makes mice mini

Gene-splicing scientists trying to make supermice even larger got minimice instead — only half the size of normal and one-fourth as big as the "giants" raised in earlier experiments.

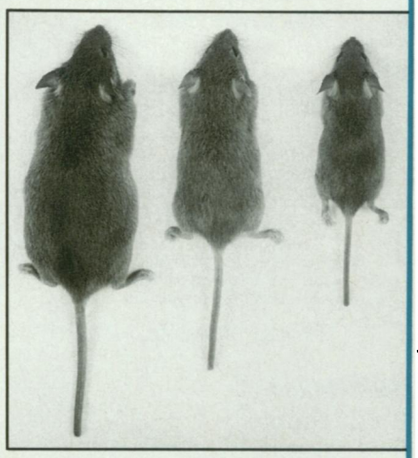
"We're ecstatic," says molecular biologist John J. Kopchick of Ohio University in Athens. His delight stems from the surprise discovery of a growth hormone look-alike that instead suppresses growth. By modifying a growth hormone gene and slipping it into mouse DNA, he and colleague Wen Y. Chen may have chanced upon a powerful tool for probing the hormone's function.

Eventually, Kopchick says, their finding might also lead to drug treatments for rare diseases of unchecked growth such as "giantism," which results when a pituitary tumor releases excess growth hormone.

Growth hormone does more than promote growth. Other functions include assisting in metabolism and stimulating the production of red blood cells and milk. The means by which the hormone carries out all of these tasks remain largely unknown.

Kopchick and Chen started with the gene that codes for bovine growth hormone and altered a sequence of its DNA that they hoped would affect growth regulation. Then they spliced this gene into the DNA of fertilized mouse eggs and observed three generations of offspring. The mutant bovine hormone apparently binds to cell receptors favored by the normal mouse hormone, but unlike the normal hormone, it doesn't turn on growth, they report in the July PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol.87, No.13).

Their discovery opens the door for further attempts to manipulate specific parts of the hormone while leaving the binding sites intact. Indeed, the Ohio scientists have already begun changing every amino acid in the molecule's apparently active region to explore the effects on its biological function, Kopchick told SCIENCE NEWS.



Ohio University News Service

See how they . . . shrink? The smallest of these 9-week-old mice carries a modified version of the bovine growth hormone gene that created the "giant" at far left. Middle mouse is normal.

A growth-hormone-like substance that binds without stimulating growth "would be very useful," says molecular endocrinologist Pierre De Meyts of the City of Hope National Medical Center in Duarte, Calif. Such a tool might help researchers determine which cell receptors respond to the hormone. It might also enable them to resolve a controversy about whether growth hormone, which stimulates cells to release growth-causing agents, also acts directly to spur growth, De Meyts says.

Although the new findings "need more work" to confirm that the altered hormone blocks the normal hormone from receptors, Kopchick and Chen have made "a very important first step," De Meyts says.

— P.L. Weiss