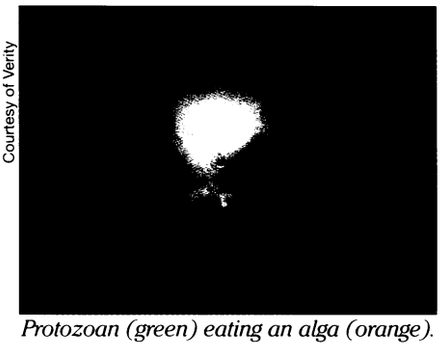
"*Oxyrrhis* is the *Tyrannosaurus rex* of marine protozoa," says Wolfe. "It's voracious. It'll eat almost anything. But even this nonfussy eater prefers food A over food B."

Wolfe cautions that he has not proved that the DMSP lyase reaction underlies the protozoan's food choice. The different algae strains are members of the same species, but they could differ in other ways besides lyase activity. The results do provide a solution to a previously troubling problem: Acrylate is toxic only at extremely high concentrations. Such concentrations, however, could be reached if algae were confined to the small digestive compartments within protozoa.

There are still "major gaps in our understanding," Wolfe said. He wonders how predators know in advance which strains of algae to avoid. The correct choice benefits the high-enzyme-producing algae because, unlike multicellular plants, which can sacrifice small amounts of tissue for the sake of the whole organism, single-celled creatures do not have any cells to spare.

The recent work also contributes to a growing appreciation that protozoa are more sophisticated than previously realized. "Unicellular organisms [like protozoa] are usually thought of as being simple, especially in terms of their behavior," says Peter G. Verity, an ecologist at the Skidaway Institute of Oceanography in Savannah, Ga. "But unicellular does not necessarily equate with simplicity in terms of form or function."



Courtesy of Verity

*Protozoan (green) eating an alga (orange).*

"A lot of people are building computer models of marine microbial food webs," says Wolfe. "They assume that if a prey is present, a predator will eat it. The models need to be made more sophisticated." —*E. Strauss*

# Astronomers get new spin on black holes

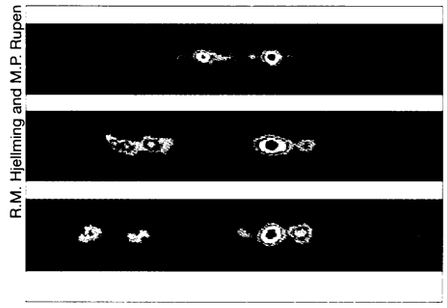
They swallow everything in sight, warp space and time into an unfamiliar tangle, and trap even light in their clutches. Yet for something so complex, black holes are defined by just three properties: mass, charge, and spin.

By studying how ordinary stars are whipped around by their black hole companions, astronomers have measured the mass of many of these dense, invisible objects. Although they have not yet figured out a way to detect charge, scientists now report that they have indirectly determined the spin of several small black holes—those comparable in mass to stars—in the Milky Way.

"Now that we've learned how to measure a second property, spin rate, one might say that we are two-thirds of the way to understanding black holes," says study coauthor Shuang N. Zhang of the Universities Space Research Association at NASA's Marshall Space Flight Center in Huntsville, Ala.

The measurements reveal a specific relationship between the spin of a black hole and the energy it emits as gas is pulled from an orbiting companion onto a disk of material that surrounds and feeds the hole. Some black holes expel jets of material. Black holes with highly energetic jets—those that travel at nearly the speed of light—spin the fastest and in the same direction as the disk, Zhang and his collaborators report in the June 20 ASTROPHYSICAL JOURNAL LETTERS.

The team, which includes Wei Cui of the Massachusetts Institute of Technology and Wan Chen of NASA's Goddard Space Flight Center in Greenbelt, Md., and the University of Maryland at College Park, identified two other indicators of spin. Black holes that emit their highest-intensity radiation at an X-ray energy of 1,000 electronvolts were found to spin rapidly but in a direction opposite to the disk. Holes with X-ray energies that peak at one-fifth to one-tenth that amount spin slowly or not at all. This pattern fits all the stellar-mass black holes they've looked at, says Zhang, and may offer new clues about how these exotic beasts form and behave.



R.M. Hjellming and M.P. Rupen

*Radio images taken over a week in 1994 show blobs of material ejected at high speed in opposite directions by the black hole GRO J1655-40 (central red spot).*

To deduce the spin, the astronomers took note of several related properties. A black hole consumes any material that gets closer than a certain distance. This distance, and the spectrum of radiation emitted by infalling material, depends on the black hole's spin.

Using data from four Earth-orbiting spacecraft, the team found the link between spin and X-ray emission. Two of the black holes they examined emit high-speed jets. Both rotate rapidly, and one of them, called GRO J1655-40, spins about 100,000 times per second.

When he heard Zhang present his results at a recent workshop, Mario Livio of the Space Telescope Science Institute in Baltimore got a jolt. In puzzling over the origin of a wide variety of jets in astronomy, Livio had predicted a year ago that black holes that spew such streams must spin rapidly. Unaware of that prediction, Zhang's team validated it. Calling the findings "intriguing but by no means certain," Livio says they provide a new step in deciphering the physics of black holes and jet production. —*R. Cowen*

## Genes induce human obesity

In recent years, studies of abnormally hefty rodents have revealed several genetic mutations that induce obesity. Scientists have now found similar mutations in people, although they stress that such genetic flaws are rare.

In the June 26 NATURE, Stephen O'Rahilly of the University of Cambridge in England and his colleagues describe an 8-year-old girl and a 2-year-old boy, cousins and both dangerously obese, who have mutations in the gene for the hormone leptin. Leptin, secreted by fat cells, is thought to govern body weight by sending signals to the brain (SN: 7/29/95, p. 68).

Since finding that mice with mutations in their leptin gene become obese, scientists had unsuccessfully searched thousands of people for similar mutations.

In the July NATURE GENETICS, O'Rahilly's group describes a second obesity-inducing human mutation. They analyzed a woman who had been dangerously obese during her childhood but who has since controlled her weight through dieting. She has a mutant gene for prohormone convertase 1, an enzyme that activates certain proteins, including insulin, as the final step in their production. A similar enzyme is mutated in some obese mice, though how such enzymes influence body weight remains unclear (SN: 6/3/95, p. 341).

"These observations are important not because the etiology of most human obesity has been elucidated—it has not—but because they vindicate an approach to this complex phenotype that emphasizes biology over 'will power' and regards body weight as the result of complex interactions between genes and environment rather than a psychological aberration of free will," comments Rudolph L. Leibel of Rockefeller University in New York in the same issue of NATURE GENETICS. —*J.T.*