Cannibalizing pulsar lures astronomers

Like a revved-up giant lighthouse, a rapidly rotating neutron star near the Milky Way's center beams radio waves toward Earth at a dizzying rate of 86 times a second. That phenomenon alone would capture the interest of astronomers. But the haphazard variation in the intensity of this newly discovered star's radio signals—which can disappear several times a week for more than six hours—further intrigues scientists. Discovery of the pulsar's intermittent signal, researchers say, strongly suggests the neutron star is eating away at an unseen orbiting companion, tearing off surface matter that erratically eclipses the neutron star's radio beam.

Located in the Terzan 5 globular cluster, PSR1744-24A is only the second eclipsing double-star pulsar ever discovered. The find may add new details to the evolution and history of these radio-emitting cannibals, says Andrew G. Lyne of the University of Manchester in England. In comparison with the "black widow" – a 1.6-millisecond pulsar spotted two years ago some 3,000 light years from Earth (SN: 7/30/88, p.72) – the newly discovered pulsar spins about 10 times more slowly and appears to have a larger, more massive companion on which to feast.

Each of these pulsars radiates enough energy to heat material on its companion's surface. This creates a "wind" of particles that can eclipse radio emissions from the rapidly spinning pulsar, notes Jacob Shaham of Columbia University in New York City.

But several features of the newly discovered radio-emitter, including its fluctuating eclipse period, indicate this pulsar may be undergoing a different, possibly earlier, stage of evolution than the "black widow" – one in which gravitational capture of matter from the companion also contributes to the eclipsing phenomenon, he and Lyne say.

Shaham speculates that the companion's radius is just large enough for the pulsar to occasionally steal a large blob of gas, which then separately orbits the pulsar and temporarily blocks its radio emissions. He adds that any gas that comes closer to the pulsar must penetrate that star's magnetic field, creating X-ray bursts in the process. Such bursts could account for the pulsed X-ray emissions in Terzan 5 detected by a Japanese satellite in 1980, Shaham, Lyne and others speculate. Lyne and an international team of co-workers describe their stellar discovery in the Oct. 18 NATURE.

– R. Cowen

Allergies and shyness: Nothing to sneeze at

Many extremely shy adults apparently have a heightened vulnerability both to allergies—particularly hay fever—and to mood disturbances such as severe depression or anxiety, asserts a team of psychiatrists in the September/October PSYCHOSOMATIC MEDICINE.

The investigators, led by Iris R. Bell of the University of Arizona in Tucson, divided 375 college undergraduates into four groups based on the degree of shyness each student had reported on a questionnaire that focused on shyness with strangers, fondness for large parties, and recollections of childhood shyness and fear of going to school. The researchers also administered questionnaires assessing mood disturbances and allergies, including hay fever, asthma, eczema, hives and drug allergies leading to anaphylactic shock.

Significantly more reports of depression, fearfulness, fatigue and hay fever emerged from the 72 students in the most-shy group than from the other participants. One-third of the students in the two groups ranking highest for shyness suffered from hay fever, compared with about one-fifth of the remaining students. Moreover, hay fever afflicted six of the 18 students reporting the most shyness, but struck none of the 19 students ranked as the most outgoing in the 375-person sample. The four groups shared other allergies evenly.

Other evidence supports the link between hay fever and shyness, the researchers contend. A 1988 study directed by Jerome Kagan of Harvard University indicated that extreme shyness represents a stable temperamental trait among children. Unpublished data show a greater frequency of hay fever among close relatives of extremely shy children than among relatives of outgoing children, Kagan says. Scientists have also linked extreme inhibition among children and adults with greater degrees of depression and anxiety.

Bell and her co-workers speculate that the hay fever-shyness connection may stem from alterations of neurochemical receptors in inner brain structures that regulate mood, smell and immunity. Other investigators have shown that nasal secretions of allergy sufferers contain elevated levels of some neurotransmitters, such as serotonin, they add.

Further studies of shy people with allergies may reveal chemical markers of a vulnerability to anxiety disorders and depression, they suggest. *– B. Bower*

Nobel Prize goes to molecule maker

Elias J. Corey of Harvard University once described synthetic chemists as people who can get "something valuable from almost nothing" by transforming cheap materials "into new materials or substances of relatively great, or even lifesaving, value."

Last week, Corey was honored for just that accomplishment. In awarding him the 1990 Nobel Prize in Chemistry, the Royal Swedish Academy of Sciences also cited his pivotal role in developing "the theory and methodology of organic synthesis."

Like many other organic chemists, Corey has focused on inventing ways of making laboratory duplicates and relatives of naturally occurring chemicals with useful properties. Rather than taking a trial-and-error approach based largely on intuition, he and his coworkers developed a system of logical principles – called retrosynthetic analysis – to help in the rational planning of chemical syntheses. Working backwards from a blueprint of the entire target compound, the researchers determine a sequence of fragmentations, which leads them to known ingredients that they then can assemble into the target structure.

Today, says Corey, "no modern syntheses are designed in any other way."

One of his lab's early successes was the synthesis of eicosanoids—a family of cell-made fatty acids, including prostaglandins, that have diverse effects on mammalian tissues and organs.

"We carried out the first synthesis of prostaglandins in the mid-1960s," Corey says. At the time, only milligram quantities were available, extracted from the prostate glands of sheep and humans. "Our synthesis was scaled up to make kilogram quantities, enough to supply the world's research and clinical people," he told SCIENCE NEWS. Heart disease and rheumatoid arthritis are among the various ailments now treated with lab-made eicosanoids.

Since 1959, Corey and his many graduate students have synthesized about 100 natural chemicals. One current project, he says, focuses on synthesizing glycinoeclepin, a bioregulator made by some bean plants after about 40 chemical steps. Among other effects, the compound triggers nearby eggs of bean-eating worms to hatch.

Corey's lab also designs small, reusable, enzyme-like chemicals known as chemzymes (SN: 6/24/89, p.388), which can accelerate some of industry's most-used chemical reactions while producing only minimal amounts of the isomeric by-products that usually decrease the efficiency and raise the cost of making synthetic chemicals. *– I. Amato*