Astronomy

Watching a young star eat

Like proud parents showing off their baby, astronomers last month published the first pictures of a newborn star eating. Still swaddled inside a gas cloud, the fledgling star grows more massive by using gravity to draw in cold gas and dust from the envelope of material surrounding it.

The images provide compelling evidence for the classical model of how newborn stars accrete matter, the same process our own sun underwent soon after its birth.

Residing in the gas cloud known as Bok Globule B335, the infant star lies behind a veil of dust and can't be seen in visible light. Instead, astronomers used radio telescopes to measure the velocity of matter raining down on the star.

"It's a beautiful confirmation of [a key step in] star formation," says coinvestigator William D. Langer of NASA's Jet Propulsion Laboratory in Pasadena, Calif. He notes that star formation has four stages. First, gravity pulls together a cloud of gas, creating a compact ball—a protostar—surrounded by a gaseous envelope. Then a disk of material forms around the protostar. As it snares matter falling onto the disk, the protostar grows bigger. Finally, it may develop a jet of gas or wind that eventually stops mass from accumulating.

Langer and his colleagues tracked the infalling gas by measuring the velocity of a trace component, dicarbon monosulfide, which emits radio waves. Combining data from the Very Large Array radio telescope near Socorro, N.M., and NASA's 70-meter single-dish antenna in Goldstone, Calif., the astronomers found that at some spots, the infalling gas moves toward Earth, while at others it recedes at the same speed. Gas raining down on a central star from all sides of a spherical envelope would create such a velocity pattern.

Langer and JPL colleagues Thangasamy Velusamy and Thomas B.H. Kuiper report their study in the Oct. 1 Astrophysical Journal Letters.

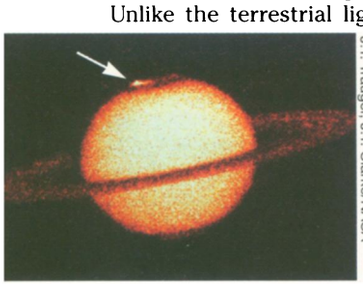
Langer notes that the protostar is already about 150,000 years old and will probably double its age before it reaches maturity and takes off the feedbag. Intriguingly, the astronomers detected the dicarbon monosulfide gas only in the outer, coldest part of the envelope. Either the gas condenses on dust grains in the inner, denser part of the envelope or some chemical process transforms the molecule, Langer notes. Similar activity may have taken place in the outer region of the envelope around the infant sun. Icy material from this area coalesced onto a disk to form Pluto and the other outer planets.

Langer told Science News that in the last few weeks, his team has observed activity in the inner part of the star's envelope by monitoring another trace compound, carbon monosulfide, at the Owens Valley Radio Observatory near Big Pine, Calif.

Hubble views aurora on ringed planet

Corralled by Earth's magnetic field, the sun's wind of charged particles crashes into atmospheric molecules at the poles, creating the dazzling display of colors known as an aurora. Now, the Hubble Space Telescope has taken the first image of Saturn's aurora, some 2,000 kilometers above the cloud tops near the north and south poles of the ringed planet.

Unlike the terrestrial light show, Saturn's lies in the far-ultraviolet, a set of wavelengths absorbed by Earth's atmosphere. Because Saturn's magnetic pole aligns nearly perfectly with the planet's axis of rotation, the auroral "ring" is centered directly on the pole.



J.T. Trauger, J.T. Clarke/NASA

Hubble's view of aurora above Saturn's north pole (arrow).

Biology

Breast cancer protein gets lost

Location, location, location. That's the mantra chanted by owners of shops and restaurants, who understand that where they situate a business is vital to success.

The same rule holds for most cellular proteins. To function properly, some proteins must reside in the cell's membrane, some in the nucleus, and others in the watery fluid in between, the cytoplasm. In the wrong location, a protein can place the cell at risk.

A new study now suggests that one tragic outcome of a misplaced protein is breast or ovarian cancer. Last year, researchers finally tracked down a gene called *BRCA1* that had been implicated in breast and ovarian cancers (SN: 11/5/94, p.298). But while mutations in this gene account for large percentages of hereditary breast and ovarian cancers, *BRCA1* is almost always normal in nonfamilial incidences of these cancers, which form the large majority of cases.

In these cases, the gene may be fine, but the protein it encodes has gone astray, a team of researchers led by Wen-Hwa Lee of the University of Texas Health Science Center at San Antonio asserts in the Nov. 3 Science. Using antibodies that bind to *BRCA1*'s protein, Lee and his coworkers discovered that it normally resides in the nucleus.

Yet when they examined 20 populations of cells derived originally from breast or ovarian cancers, the researchers noted that the protein appeared either in the cytoplasm or in both the nucleus and cytoplasm. Similar results came from a study of cells obtained directly from breast and ovarian tumors.

These data suggest that most nonfamilial cases of breast and ovarian cancer result from problems with *BRCA1*'s protein, Lee's group says. Mutations that cause these sporadic cases may actually occur in genes necessary for the proper localization of the protein, not in *BRCA1* itself, they explain.

If these findings are confirmed, they could provide a new way of determining who is at risk of breast and ovarian cancers. Instead of looking for genetic mutations, physicians might examine where in cells *BRCA1*'s protein resides.

Paired proteins tell time

Since 1971, investigators have explored how a gene called *period* and its protein, per, help determine the day-long cycle of the fruit fly's innate biological clock. Researchers led by Michael W. Young of the Howard Hughes Medical Institute at Rockefeller University in New York City discovered recently that a second gene was also vital to this internal pacemaker.

Young's group has now collaborated with researchers from Harvard Medical School in Boston and the University of Pennsylvania in Philadelphia to clone the second gene, which they call *timeless*, and to describe how its protein, tim, interacts with per. Their results appear in the Nov. 3 Science.

Timeless has day-long cycles of activity almost identical to those of *period*. Both genes become active around midday, generating messenger RNA (mRNA) molecules that cells use to construct each gene's protein. Researchers had observed a daily accumulation of *period*'s mRNA in cells' cytoplasm, but the only time they saw large quantities of the per protein was late in the evening, inside the nucleus.

The new studies show that tim can attach itself to per, suggesting that the second protein may be necessary to stabilize newly produced per. If so, then the buildup of tim probably regulates the timing of per's activity. "We think tim allows per to both survive and travel into the nucleus," says Young.

Once in the nucleus, he explains, per-tim complexes directly or indirectly affect the action of many genes, including shutting down *period* and *timeless*. Then, after the nucleus somehow breaks down the protein complexes, the two genes would reactivate and start the daily cycle over again.