Astronomy

Ron Cowen reports from Atlanta at a meeting of the American Astronomical Society

A shower of gamma-ray findings

Gamma rays pack more energy than any other radiation in the universe. Born during such cataclysms as supernova explosions, galactic collisions, and interactions between charged particles and monster magnetic fields, gamma rays may shed light on violent events throughout the universe. Last week, researchers presented the latest findings on these emissions from space—the only environment in which they are directly detectable — based on data gathered by NASA's Compton Gamma Ray Observatory (GRO).

Detectors aboard the Earth-orbiting observatory, launched last April, have logged a total of 210 gamma-ray bursts so far, nearly double the number reported in September (SN: 9/28/91, p.196). Scattered across the sky, the highly uniform distribution of emissions from these cosmic flashbulbs continues to confound scientists, says Gerald J. Fishman of NASA's Marshall Space Flight Center in Huntsville, Ala.

Prevailing theory held that the bursts emerge from explosive events on or near ultradense, rapidly rotating neutron stars, which cluster along the plane of our galaxy. But the emissions detected by GRO's Burst and Transient Source Experiment (BATSE) show no evidence of such clustering, casting doubt on the theory.

Fishman cites three alternative explanations for the bursts, which typically last only a few seconds before vanishing, apparently forever. Unknown sources along the outskirts of the solar system could produce the uniform distribution, although such nearby bursters seem unlikely, he notes. On the other hand, sources may reside in an as-yet-unseen halo surrounding the Milky Way. The new data indicate that such a halo would have to lie at least 150,000 light-years from the center of our galaxy—about 1.5 times more distant than speculated last fall, Fishman says. Only at that distance could a halo centered on the Milky Way produce an array of bursts that would appear uniform even from Earth's off-center location, about two-thirds of the way out from the galaxy's core. The bursts might also emanate from extragalactic bodies scattered throughout the observable universe, he adds.

BATSE has also detected a gamma-ray pulsar—only the third known example of such an object. Named the Circinus pulsar for the galaxy in which it resides, this rhythmically flashing neutron star rotates 400 times per minute and has a magnetic field trillions of times stronger than Earth's, Fishman says. Like its two siblings, it also radiates radio waves and X-rays, but gammas make up most of its pulsed energy.

The other two gamma-ray pulsars emit their gamma flashes twice during each rotation; scientists have speculated that one flash comes from the north magnetic pole, the other from the south. Circinus, in contrast, seems to flash only once per rotation. However, F. Curtis Michel of Rice University in Houston suggests that it may actually emit two flashes per rotation, with one flash obscured by the pulsar's orientation in relation to Earth.

Michel adds that Circinus' gamma-ray flashes last longer than its radio-wave pulses — an observation that appears to support the theory that gammas originate higher above the pulsar's poles, where the magnetic field is weaker, than do radio waves.

Data gathered by another GRO instrument, the Energetic Gamma-Ray Experiment Telescope, show that three previously discovered quasars are spewing so many gamma rays that each quasar emits about 10 million to 100 million times the total gamma-ray output of the Milky Way, reports Carl E. Fichtel of the Goddard Space Flight Center in Greenbelt, Md. These cosmic powerhouses lie between 10 billion and 20 billion light-years from Earth in the constellations Eridanus and Hercules and in a region near the Crab nebula, Fichtel says.

Biomedicine

Hair-raising adjunct for chemotherapy

Many cancer patients undergoing chemotherapy rank hair loss as the treatment's worst side effect. While they can take medicines to help settle a sick stomach, they have no way to prevent their hair from coming out by the handful.

A naturally occurring protein, recently tested on rats, may one day block this emotionally distressing loss. Two physicians from the University of Miami have found that the protein, called epidermal growth factor (EGF), prevented balding among a group of six rats receiving high doses of cytosine arabinoside, a widely used anticancer drug also known as ARA-C.

Rat at left retains tuft of white hair on EGF-treated skin patch after chemotherapy.

Joaquin J. Jimenez and Adel A. Yunis rubbed EGF on a 1-centimeter patch of skin between the rats' shoulder blades three hours before each chemotherapy treatment. The EGF-treated spots retained hair after a week of daily chemotherapy, while the rest of each rat became denuded, they report in the Jan. 15 CANCER RESEARCH. In contrast, six rats receiving chemotherapy but no EGF lost all of their hair, Jimenez and Yunis found.

They and their colleagues had previously stumbled upon evidence that an immunity-stimulating bacterial compound named ImuVert could prevent hair loss when injected into rats treated with ARA-C or doxorubicin, another anticancer drug (SN: 9/29/90, p.199). But ImuVert's flu-like side effects make it "probably not too practical" for use in cancer patients, Yunis says, so he and Jimenez turned to other substances. In earlier clinical trials conducted by others, topical EGF had shown promise in promoting wound healing, with few side effects.

Although researchers still do not know how it works, EGF "may prove useful" as a topical preventive for hair loss among cancer patients receiving ARA-C, Yunis says. He cautions, however, that EGF does not block hair loss among animals given other anticancer drugs. He also notes that injected (but not topical) EGF is known to promote tumor growth in animals.

One-two punch for AIDS prevention

Attempts to develop an AIDS vaccine have so far run up against a road block: Infected people die even with high blood levels of antibodies against the AIDS virus, because the antibodies don't attack infected cells, which can produce new generations of viruses. For this reason, many researchers are trying to create vaccines that stimulate cytotoxic T-lymphocytes (CTLs), immune-system cells that kill virus-infected cells in the body. But because the AIDS virus continually mutates, such a vaccine would have to spur the body to make CTLs that work against a wide range of different AIDS viruses.

Now, U.S. and Japanese researchers have hit on a double-barreled vaccination strategy that recruits CTLs to fight a variety of AIDS virus strains. In the Jan. 17 SCIENCE, they report that two genetically engineered *Vaccinia* viruses—one bearing pieces of a common AIDS virus, the other containing slightly altered pieces of a less common strain—can prime lab-cultured CTLs to attack a range of AIDS viruses.

The team, led by Hidemi Takahashi of Nippon Medical School in Tokyo and Jay A. Berzofsky of the National Cancer Institute in Bethesda, Md., writes that such cross-reactive CTLs "may suffice to protect [humans] against at least low-level exposure to a variety [of AIDS virus strains]." But they caution that they have not yet tested the strategy outside a test tube.