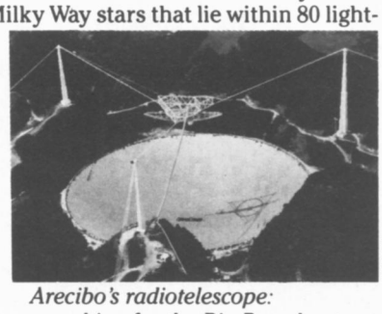
Astronomy

Is there anybody out there?

On Oct. 12, 500 years after Columbus landed on the shores of the New World, astronomers embarked on a new era of discovery: the most extensive search ever attempted for intelligent life beyond the solar system. Using existing radio receivers coupled to state-of-the-art pattern-recognition systems and signal-processing equipment, scientists hope to tune in to the Big Broadcast – messages from whatever life forms may reside near any of about 1,000 Milky Way stars that lie within 80 light-years of Earth.



NASA

Arecibo's radiotelescope: searching for the Big Broadcast.

Off and on during more than three decades, scientists have analyzed radio signals from space in the hope of uncovering evidence of extraterrestrial life. But the new radio survey, though it can only detect signals from nearby stars, has a million times the sensitivity of previous studies, says David Brocker, project manager for SETI (Search for Extraterrestrial Intelligence) at NASA's Ames Research Center in Mountain View, Calif. Brocker says that the new search gathered as much data in the first five minutes of operation as previous searches had in the past 32 years. Thanks to high-speed supercomputers, he adds, the data are analyzed in "real time" – while they're being collected. This allows researchers to immediately identify and conduct follow-up observations of intriguing radio signals.

The 10-year international survey features two key studies.

At the Arecibo Observatory in Puerto Rico, scientists have begun using a 1,000-foot-wide, dish-shaped antenna – the world's largest radiotelescope – to record microwave signals from individual stars. The signals bounce off the antenna to a system of amplifiers and frequency converters suspended above it. From there, they travel down to a huge trailer that houses processing equipment, including a spectrometer that can analyze the polarization, intensity, and duration of radio waves in the frequency range of 1 to 3 gigahertz.

This configuration of amplifiers and analyzers, which will initially search for telltale radio signals from 40 stars within 80 light-years of Earth, will remain at Arecibo only until Nov. 20, when it will have to make way for a planned upgrading of the radiotelescope. Moving to the Parkes Radio Observatory in Australia, the system will study radio emissions from stars that can only be detected from the southern hemisphere. Researchers expect that mobile signal-analyzing systems will eventually be coupled with four observatories, including a return visit to Arecibo in 1995.

Simultaneously with this "targeted" search of individual stars, Brocker and his colleagues have begun using NASA's 112-foot Goldstone radio antenna in the Mojave Desert to scan, at lower sensitivity, small patches of sky. The scanning survey can detect only continuous beams of radio waves, in contrast to the targeted searches, which can also detect radio pulses. However, scanning does offer the advantage of receiving emissions from many stars at once and, over time, surveying the entire sky.

Researchers looking for extraterrestrial activity focus on microwaves, notes Brocker, because stars usually emit little radiation at these wavelengths. With less of our galaxy's background noise to contend with in this "quiet zone" of the electromagnetic spectrum, scientists can more easily pick out alien messages. Such signals may include extremely narrow frequency bands of radiation that atoms don't emit naturally, as well as high-intensity pulses.

Biomedicine

Carol Ezzell reports from Anaheim, Calif., at the annual meeting of the Society for Neuroscience

Skin cells bridge injured spinal cords

Skin cells genetically engineered to produce a protein called nerve growth factor (NGF) can spur the regrowth of nerves within a partially severed spinal cord, according to a new study involving rats. The technique offers hope as a means of treating spinal cord injuries in humans.

A group led by Mark H. Tuszynski of the University of California, San Diego, inserted the gene for either NGF or a control, marker enzyme into fibroblasts isolated from the skin of adult rats. The researchers then injected slurries of cells containing either the NGF gene or the marker gene into the partially severed spinal cords of two groups of rats.

Because fibroblasts normally secrete collagen and fibronectin – two major constituents of connective tissue – Tuszynski and his colleagues predicted the cells would generate connective-tissue bridges to heal the rats' spinal cords. In addition, they hoped that the NGF-containing cells would stimulate severed nerves within the rats' spinal cords to grow across the injured gap and rejoin.

When Tuszynski's group examined the rats two weeks after implanting the cell grafts, they found that both types of cell implant had survived and grown. Moreover, Tuszynski reported at the conference, the rats that had received cells containing the NGF gene showed signs of nerve-cell regeneration.

Tuszynski says the new technique may obviate the need for nervous tissue from aborted human fetuses, which has shown promise in repairing patients' damaged spinal cords. A U.S. government ban now bars federally funded researchers from performing transplants using such tissue (SN: 10/17/92, p.271).

Tuszynski also notes that the procedure would avoid tissue rejection problems because physicians could treat spinal cord injuries using genetically engineered fibroblasts taken from a patient's own skin.

This is your baby's brain on alcohol

A dose of alcohol equivalent to two or three cocktails turns on a stress-related gene in the brains of newborn rats, according to a new study. The finding may pave the way for a biochemical explanation of fetal alcohol syndrome, the mental and physical damage suffered by some babies exposed to alcohol in the womb.

Tara Fletcher and her colleagues at the State University of New York at Albany fed newborn rat pups – whose stage of brain development equals that of third-trimester human fetuses – an alcohol-spiked milk formula for two days. The researchers found that the gene encoding glial fibrillary acidic protein (GFAP) was twice as active in the brain cortexes of these alcohol-fed pups as in the cortexes of control pups that were either nursed by their dams or fed a sugar-milk solution.

GFAP forms the springy inner filaments that give shape to glia, the support cells that enfold and nourish nerve cells in the brain and spinal cord. Glia often overproduce GFAP when subjected to chemical or mechanical injury, perhaps as a means of shoring themselves up following such an insult. One type of glia, known as astrocytes, helps organize brain development.

The cortex – the brain region responsible for cognition in humans – is particularly vulnerable to stress during mammalian development. Fletcher says the enhanced production of GFAP in the presence of alcohol serves as a marker that potentially damaging biochemical changes are taking place within the brains of alcohol-exposed fetuses.

The New York team has also found a particular DNA sequence within the GFAP gene that alcohol may use as an "on" switch to activate the gene. Fletcher says she and her colleagues are now looking for other genes that have this DNA sequence, in order to identify those that might play a more direct role in the brain damage associated with fetal alcohol syndrome.