physical sciences

Radio waves from a galaxy-cluster X-ray source

The X-ray satellite Uhuru has discovered a number of diffuse X-ray sources that appear to be related to clusters of galaxies, and the Uhuru investigators have suggested that all rich clusters of galaxies probably have such X-ray sources associated with them (SN: 6/10/72, p. 382). Of the possible theoretical explanations, the one that many theoreticians more and more lean to is inverse Compton scattering: Photons of the universal microwave background collide with electrons moving at relativistic speeds. The collisions transfer enough energy to the photons to turn them into X-ray photons. The electrons would be ejected by radio galaxies within the clusters.

The idea is an attractive one because some of the clusters involved are known to have radio sources. If it is the universal mechanism, however, they all must have radio sources. C. H. Costain of the Dominion Astrophysical Observatory in Penticton, B. C., and A. H. Bridle and P. A. Feldman of Queen's University at Kingston, Ont., report in the July 1 ASTROPHYSICAL JOURNAL LETTERS, they have found at least one such source. They identify it with the X-ray source 2U 1706+78 and say it is probably associated with the galactic cluster Abell 2256.

Beaming of Jovian radio waves

One of the standing mysteries of the solar system is Jupiter's decametric radiation, the radio waves in the wavelength range between 10 and 100 meters. Part of this radiation is known to be produced by a source affected by the passage of Jupiter's innermost satellite, Io; other components are not. It now appears that the part not related to Io is beamed.

The rate at which the decametric radiation is received on earth tends to drop off after opposition, the moment when the sun, the earth and Jupiter are all in line. Georg M. Gruber and Clive Way-Jones of Rhodes University in Grahamstown, South Africa, did an analysis of the records in which they separated the Io-related portion from the rest. They came up with a non-Io-related portion the apparent strength of which depends on Jupiter's position relative to the sun. In the June 26 NATURE PHYSICAL SCIENCE Gruber and Way-Jones suggest that this non-Io-related radiation is beamed in a cone and that the earth passes out of this cone at about the time of opposition. They speculate that the source may be due to interactions between the solar and the Jovian magnetic fields on the evening side of Jupiter.

Intergalactic helium

An important question to cosmologists is whether there is enough unseen matter in intergalactic space to close the universe and prevent endless expansion. Bruce Margon, Stuart Bowyer and Michael Lampton of the University of California at Berkeley have used the X-ray spectrum of the quasar 3C 273 to obtain an upper limit on the possible density of intergalactic helium. The limit varies according to the value chosen for the Hubble constant but is around 10^{-28} grams per cubic centimeter. This is more than necessary to close the universe, but they point out in the ASTROPHYSICAL JOURNAL for June 15 that the limit is crude. Setting a limit does not prove the existence of intergalactic helium; it merely says there can be no more than this amount. There may not be any at all.

medical sciences

Why some tissues age faster than others

There are various molecular explanations for aging: The more deleterious mutations that occur in a cell's genes, the more a cell ages; changes in the expression of certain genes lead to aging; a breakdown in gene repair causes aging. In the June 23 NATURE NEW BIOLOGY a Soviet scientist proposes another explanation for why identical, nonregenerating tissues from different species age at different rates.

Genetic material of higher organisms includes nucleotide sequences that transcribe their information only once as well as sequences that may transcribe their information several to a million times throughout an organism's lifetime. Thus Zh. A. Medvedev of the Research Institute of Physiology and Biochemistry of Farm Animals proposes that if mutation rates, replication errors and other molecular mishaps are equal in identical tissues from different species, tissues with a larger number of repetitious genes will live longer than tissues that have more genes that express themselves less often. The reason, he says, is that highly expressive sequences have more occasions to correct molecular accidents.

The biochemistry of depression

When the chemical 6-hydroxydopamine (6-OHDA) is injected into the brains of experimental animals, it permanently and selectively destroys neurotransmitters—chemicals made by brain cells—while allowing the animals to regain activity. Using this technique, physiological psychologists C. A. Sorenson of Amherst College and Gaylord D. Ellison of the University of California at Los Angeles and pharmacologist David Masuoka of the Veterans Administration Hospital in Sepulveda, Calif., significantly destroyed noradrenaline, somewhat decreased dopamine and did not decrease seratonin in rats. Three weeks after the animals received the injections they were tested for food and water intake. Their thirst had not changed but their appetites were considerably depressed.

Because depressed people often lose their appetites and there is evidence that depression may be a dysfunction of noradrenaline, dopamine and seratonin, the authors suggest in the June 28 NATURE NEW BIOLOGY that 6-OHDA lesion studies in animals might clarify the roles of these chemicals in depression.

Trypanosome action at membrane level

The one-celled organism *Trypanosoma lewisi* causes sleeping sickness and a number of other diseases in man and animals. There are drug treatments for trypanosome infections, but the parasites tend to build resistance to them. Thus, understanding how drugs act on trypanosomes at the cellular levels should give researchers better leverage for coping with trypanosomes pharmacologically.

Yale University microbiologist Curtis L. Patton reports in the June 21 NATURE NEW BIOLOGY that ouabain, a drug normally not used against trypanosomes, can keep trypanosomes from reproducing. The drug does so by inhibiting the enzyme ATPase, which lets sodium and potassium pass through the parasite's membrane.

Ouabain inhibits the sodium-potassium pump in many kinds of animal cells, but such action has not been shown to exist in trypanosomes before.