

## Radio galaxies: Supernova to synchrotron

Cerro Tololo Inter-American Observatory



Visible part of the galaxy Centaurus A.

One of the earliest surprises yielded by the science of radio astronomy was that galaxies emit radio waves. The processes that produce visible light — the nuclear burning in stars — were self-evident in galaxies. Radio waves hadn't been expected there. Yet some galaxies emit as much energy in radio as they do in light. Furthermore, the radio-emitting matter of galaxies generally extends a long distance beyond the visible portion of the galaxy. This extension raises rather serious problems of organization and dynamics.

Centaurus A was the first radio galaxy discovered and remains the nearest known radio galaxy, about 10 million light-years away. Its shape is typical of the breed. Visibly, Centaurus A is a bright, compact ellipse with a dark lane or band of dust across its middle. In radio Cen A has two teardrop-shaped lobes extending at right angles to the dust band and reaching far beyond the bright disk to a distance of 50 or 60 kiloparsecs (160,000 to 200,000 light-years). The question is what makes these lobes and what maintains them? David De Young of Kitt Peak National Observatory now presents a theory that answers those questions at least in part.

Since the beginning of radio astronomy it has been known that the radio emissions of Cen A and other radio galaxies are synchrotron emission, the radiation of energetic electrons spiraling around in a magnetic field. So the question becomes how to ensure a continuous supply of energetic electrons.

De Young begins with recent observations made at Cerro Tololo Inter-American Observatory in Chile that all is not dark in the radio lobes. Sensitive observation can see groups of massive young stars there. De Young postulates that in the core of Cen A is a large rotating mass of gas. Some of this gas continually spews out along the poles of rotation. As it moves through the inner part of the galaxy, it picks up "processed" material, debris ejected from stars, and drags it out into the lobes. In the lobes stars like the ones observed can be formed

from this mixture of primordial and processed matter. Some of these stars will be so massive that they last only a short time, say 10 million years, before they explode as supernovas. Supernovas yield lots of energetic electrons. The sequence continues for eons: gas from the core, new stars, supernovas, energetic electrons. What remains to be explained is why the gas is ejected from the core in the first place.

—D. E. Thomsen

### A drug to prevent migraines

Medications to prevent migraine headaches appear to have come of age. A first such drug was approved by the U.S. Food and Drug Administration in 1979. It was the beta-blocker propranolol (Inderal). And now another drug, called flunarizine, may eventually join its ranks, a study reported in the November HEADACHE suggests.

Flunarizine has been known for some time to keep blood vessels from constricting by inhibiting the influx of calcium into the smooth muscle cells that line blood vessels. Last year, the drug was also found to be highly effective in preventing decreased blood flow to the brain — one of the major physiological events that trigger a migraine (SN: 10/11/80, p. 237). Paul Louis, a neurologist with the Eeuwfeestklinik in Antwerp, Belgium, and colleagues then conducted a clinical trial to see whether flunarizine could prevent migraines in migraine sufferers.

Louis and his colleagues gave a 10 mg. daily dose of flunarizine, or a placebo, for a three-month period to 58 patients who had had at least six migraines during the preceding six months. Throughout the study the patients reported any migraines or drug side effects they experienced, and at the end of the study rated the treatments they had received as to their level of effectiveness.

As Louis and his co-workers report in HEADACHE, flunarizine turned out to be highly effective, compared to a placebo, in

preventing migraines. During the treatment period, more than 80 percent of the 29 patients getting flunarizine had a reduction in headaches, with five remaining headache-free altogether, and only one of the 29 getting more than three headaches. In contrast, all 29 control patients experienced at least two migraines during the treatment period.

Clinical trials exploring flunarizine's value as a migraine preventive are also underway in the United States.

—J. A. Treichel

### Modest cut urged for meat nitrites

A 600-page report released last week by a National Academy of Sciences committee emphasizes the uncertainties of a food safety question. Although nitrites protect cured meat from the organisms causing botulism and spoilage, there is no agreement on how nitrites work, their minimum effective level or how much illness they prevent. On the other hand, nitrites and nitrates may be involved in human cancer and they are converted in the body to nitrosamines, many of which have been demonstrated to cause cancer in laboratory animals. But reliable calculations of risk cannot be made because of lack of definitive information, the committee reports.

Faced with such uncertainties, the committee addressed the relative role of processed meats in total exposure to nitrosamines, whatever their risk may be. When only dietary sources are considered, a substantial proportion (39 percent) of nitrite comes from bacon, ham, frankfurters, sausage and other processed meats. Vegetables are a larger source of nitrate, which can be converted to nitrites but vitamins present seem to inhibit nitrosamine formation.

The dietary sources are swamped in many cases by other exposures, the committee reports. Cigarettes or occupational exposure in the rubber, leather tanning and rocket fuel industries can produce nitrosamine levels more than 100 times higher than does the average consumption of processed meats. Where there is agricultural runoff, people receive high doses of nitrate in their drinking water. Thus, in terms of lifetime cancer risk, eliminating nitrite from cured meat will not make a major impact, Maclyn McCarty, the bacteriologist who chaired the committee, told reporters.

The committee recommended, nonetheless, that nitrite be reduced in cured meats "to the extent that protection against botulism is not compromised." It also recommended eliminating nitrate added to poultry and many meat products, where it has no direct preservative effects. The committee is now evaluating alternative curing agents for meats. —J. A. Miller