

ASTRONOMY

Infrared galaxies and continuous creation

Present data on bright infrared emissions from certain distant galaxies suggest that the continuous creation of matter is being witnessed, says Dr. Frank J. Low of Rice University and the University of Arizona.

His group has now detected nine galaxies, including the Milky Way, that are bright infrared emitters. Several of them emit almost exclusively in the far-infrared. It is possible, he says, that the large amount of energy required is the result of continuous creation of matter in the nuclei of galaxies.

He suggests the existence of individual cells in which matter and antimatter are continuously formed and annihilated. Cosmologists proposing a so-called steady-state universe have made similar suggestions (SN: 12/13, p. 562). The resulting high-energy particles would produce the observed infrared. Since these cells, termed irtrons, always possess the same magnetic field and emit infrared radiation in the same way, he considers them to be large, fundamental bodies packed closely together in the galactic nuclei. If this general picture is correct, he says, galaxies are growing out of their nuclei, and the rate of infrared emission is directly related to the rate at which new matter is being formed. This hypothesis of a fundamental connection between the power emitted in the far-infrared and the growth rate of galaxies is being tested by further ground-based and airborne observations.

PHYSIOLOGY

Spare parts from animal protein

Collagen, a ubiquitous animal protein constituting 20 to 30 percent of the total protein in vertebrates, has great potential as a biomaterial for human use.

Drs. Albert Rubin and Kurt Stenzel of Cornell University Medical College in New York City predict that collagen will be made into spare parts for man, replacing or reinforcing heart valves, arteries, bile ducts, corneal surfaces and a host of other materials.

Because it is a natural substance, they point out, collagen is nontoxic, compatible with blood, does not lead to clotting and is relatively stable within the body. Its natural function is largely structural and the protein is found primarily in skin, tendon and bone.

Its only drawbacks as a human biomaterial, the researchers say, is that it is difficult to purify and is mildly antigenic. Both problems are giving way to research, however. For example, collagen's molecular structure is understood sufficiently to permit scientists to modify it, reducing its capacity to stimulate the immune system. Dr. Rubin explains that by subjecting collagen to a variety of proteolytic enzymes, certain peptides or small appendages on the molecule can be removed, leading to a "significant alteration in antigenicity."

As a biomaterial, collagen also is used experimentally as a membrane in artificial kidney machines and as a gel that appears to be useful in replacing vitreous humor in the eye.

DENTISTRY

Tooth transplant survival improved

Transplanted teeth from donors rarely survive more than four years. At that point, the immune system rejects them. Says Dr. Leonard B. Shulman of the Harvard School of Dental Medicine, "Tooth transplants would be practical if they could be made to last for an average of eight years."

New methods of preparing for the transplant may make this possible. Dr. Shulman is altering the donor tooth to enable the recipient to accept it for longer periods. But immunosuppressive therapy that is used to prevent rejection in organ transplants is not even under consideration for tooth-transplant patients because the serious side effects of the drugs are not justified for the procedure.

To ready the donor tooth, the Harvard researcher soaks it in two enzymes successively (hyaluronidase, then collagenase) to removal all the soft tissues of its surface. These tissues are considerably more antigenic than the tooth's hard, calcified tissues. Pulp is also removed, and the donor tooth is soaked in strong fluoride to increase its resistance to dissolution by the rejection process.

METEOROLOGY

Climatic effects of urbanization

The creation of the new town of Columbia, Md., northeast of Washington, D.C., is more than an experiment in urban living. It is also providing new information on man as an agent of meteorological change.

There is nothing new about the idea that cities change the climate in their local area. But there are many problems in getting good scientific data.

To measure the effect precisely, a group led by Dr. Helmut E. Landsberg of the University of Maryland, has been making detailed meteorological observations at Columbia for the past two years as the site has changed from rural to urban.

Although the population so far is only about 7,000 the urbanization is already producing marked climatic effects, he reports. Air temperatures have risen 1 to 2 degrees F. Pollutants have risen 10 percent over the former level. The concentration of sulfur dioxide has measurably increased. Winds have decreased due to the new man-made surface obstacles.

All these are consistent with theory. The effects are local. But, says Dr. Landsberg, "with accelerating urbanization one can predict that local climatic changes will increase from a local to a regional scale and will appreciably affect the ecological balance."

TRANSPLANTS

An artificial tooth

Avoiding the threat of rejection in human tooth transplants, Dr. Milton Hodosh of Brown University reports progress in the development of artificial teeth

made of bone and plastic that can be imbedded into an empty socket. He has molded teeth of an inert plastic (polymethylmethacrylate) mixed with 20 percent of treated bone. In experiments with animals, including rats and baboons, he finds that the plastic-bone teeth last as long as ten years without causing abscesses, inflammation or toxicity. The 20-percent bone content, he says, is the optimum amount. If there is more than that, the recipient's body eventually recognizes it as foreign tissue and rejects it.

The artificial teeth are inserted into empty sockets and temporarily attached to adjacent natural teeth. Within a few weeks, gums heal normally and within a few months connective tissue fibers in the jaw replace the bone material in the new teeth so that they become attached almost as firmly as natural teeth. Wires holding the new teeth in place are then removed. "It is possible," Dr. Hodosh speculates, "that the plastic-bone material will find other uses, including skull repair."

GEOLOGY

Erratic pace of change

Most of the geological changes in the Green and Colorado Rivers in the Southwestern United States occur not by the gradual wearing away or deposition of material but by a series of small and large catastrophes. These are events, such as landslides, that take place in a matter of minutes, and are preceded and followed by decades of little change.

This is the main preliminary result of a comparative study of photographs taken in 1968 by a United States geological survey expedition with those taken in 1871 by two photographers on the second expedition down the Colorado by the noted geological pioneer, John Wesley Powell. In the new project, photographs were taken from 150 points used as camera stations during the Powell expedition.

There were very few easily detected changes in the bedrock or the surface deposits, reports Dr. Eugene M. Shoemaker of the California Institute of Technology, who took part in the 1968 project. In most places small and large boulders in and around the rivers were in the same position they had been 97 years earlier. Changes that were observed included rock slides and other large local movements. In general, the scene was changed either entirely or not at all.

ECOLOGY

Water and the landscape

Man's increasing control of water runoff has caused major changes of river channels that duplicate to a large extent the natural changes of the geologic past, reports Dr. Stanley A. Schumm of Colorado State University.

Some of the most spectacular changes in river dimensions have occurred on the great plains as a result of the construction of dams and diversion of river water upstream for irrigation. Both the North and South

Platte Rivers in Nebraska, for instance, once were between one-half and three-quarters of a mile wide. Now they are both about 200 feet wide.

The Arkansas, Red and Republican Rivers also show a major reduction in channel size as a result of reduced annual discharge and flood discharge.

A different effect on land forms would be caused by the eventual use of weather modification to increase rainfall greatly, filling reservoirs, clogging irrigation canals and changing drainage patterns that would affect bridge and highway stability. "In fact," says Dr. Schumm, "the economic benefit of increased precipitation in arid regions might be far outweighed by damages caused by the greatly increased movement of sediment."

THERAPY

Metal-binding drug for gangrene

The bacterium that causes gas gangrene, *Clostridium perfringens*, thrives in oxygen-free wounds such as those caused by deep penetrating shrapnel, bullets, abdominal surgery or abortion. If antibiotics are administered almost as soon as the organisms infect muscle tissue, the bacteria can be destroyed. But once the infection has really taken hold, surgical removal of the muscle is the most effective way of preventing death.

While the disease is rare, it continues to be a problem among soldiers, and has killed an average of 45 civilians in the United States every year between 1962 and 1966, the last years for which figures are available.

Now, Dr. Marwin Moskowitz, professor of biology at Purdue University, reports that a metal-binding compound called DTPA halts the lethal infection even when administered well along in the course of the disease. Metal ions in the body, he explains, are the agents that activate the gas gangrene toxin. DTPA binds to these metals, blocking their ability to activate the poison. A metabolically inert substance, DTPA is not broken down in the body, but is excreted unchanged and appears to have had no deleterious side effects in animal experiments.

AIR POLLUTION

Cutting sulfur dioxide

A method developed in France for burning fossil fuels known as fluidized bed combustion could cut down sulfur dioxide pollution, reports Dr. Arthur M. Squires, a chemical engineer at the City University of New York.

In the fluidized bed method, the coal to be burned is in the form of finely divided solids in turbulent random motion like a boiling liquid. The principal products are not carbon dioxide and sulfur dioxide but carbon monoxide and hydrogen sulfide. The latter sulfur product can be much more easily broken down than sulfur dioxide.

The technique should also result in a lower cost of power than the traditional pulverized fuel combustion technique, says Dr. Squires.