A Jet Black Hole in a Radio Galaxy

Astronomers generally believe that physical processes involving enormous amounts of energy are going on in the centers of galaxies. Evidence to support such a view is plentiful. The nuclei of galaxies look brighter than the outer regions in all ranges of electromagnetic radiation. Radio observation also reveals that many galaxies are associated with large lobes of radio-emitting matter that go far beyond the confines of the visible galaxy. Simply, the geometry of these lobes lends plausibility to the suggestion that they consist of material pumped out of the nucleus of the galaxy by whatever is going on there.

A number of theorists have suggested that the center of activity in the nucleus of a galaxy is a giant black hole, one so massive that its gravitational field dominates the center of the galaxy, compels stars to orbit around it, tears stars apart and swallows them whole (SN: 2/19/77, p. 121). Now that suggestion is supported by three observers, A.C.S. Redhead, M.H. Cohen and R.D. Blandford of the California Institute of Technology. They conclude, as a result of radio observations of the galaxy NGC6251, that the phenomena found in the nucleus of that galaxy can best be explained by the presence there of a black hole with a mass approximately 100 million times the sun's, or more. Their report is in the March 9 NATURE.

Redhead, Cohen and Blandford used radio telescopes at three observatories, the Haystack Observatory in Westford, Mass., the National Radio Astronomy Observatory in Green Bank, W.Va., and the Owens Valley Radio Observatory in Big Pine, Calif., as a long-baseline interferometer to observe NGC6251 (and several other radio sources) at a wavelength of 2.82 centimeters. Combining the signals received at the three telescopes yields much finer detail than could be obtained through the use of any single one, and such very long baseline interferometry is a standard technique nowadays for examining the fine structure of the radio-emitting parts of galaxies and quasars.

The observations reported in the March 9 paper concern the small-scale structure of the radio-emitting matter in the nucleus of NGC6251. The most striking feature is a jet of matter that seems to be emerging from the nucleus. The axis of this jet lies along the same line as the axis of two large radio-emitting lobes that lie outside the visible part of NGC6251 on either side of the galaxy. It seems likely that this jet in the nucleus and the two large lobes that lie in the same line are produced by one and the same phenomenon, something in the center of the galaxy that pumps out matter along that line.

The character of the radio waves emitted by the jet and its geometry lead the three observers to make some assumptions about the dynamics of the jet, and then to calculate the probable physical conditions in the region where the pumping takes place. They conclude that these are likely to be "conditions that may exist around an accreting black hole of mass [approximately or greater than 10^8 solar masses]." □

Skin test announced for breast cancer

A skin test for breast cancer, similar to the test commonly used to detect tuberculosis, was announced by George F. Springer at last week's American Chemical Society meeting in Anaheim, Calif. The test is highly reliable for detecting all stages of breast cancer, and differentiates benign from malignant growths.

Springer, a physician at Northwestern University's Evanston Hospital, developed the breast cancer skin test during studies of the human blood group NM antigens. These NM antigens are protein markers on the surface of red blood cells. They form a second major system (after the A-B-O-system) of typing blood.

Springer and co-workers P.R. Desai, S. M Murthy and E. F. Scanlon found that the immediate biochemical precursors to the formation of M and N antigens are the so-called Thomsen-Friedenreich or "T" antigens, and further, that these T antigens can be found in a reactive form in malignant breast tumors, but not in benign ones or in healthy human tissues. Apparently, the normal NM formation pathway is incomplete, stopping prematurely at T antigen formation.

Since red cells carry either N or M marking proteins, no anti-M or anti-N antibodies can be found circulating in the blood. Anti-T antibodies, on the other hand, are found in the blood, since the T antigen is merely a precursor in the formation of M and N in the healthy body and is not available to the immunologic marking system. These anti-T antibodies are apparently supplied by intestinal bacteria, such as *Serratia marcesans*, which carry it on their cell surfaces.

Springer's team found that the formation of anti-T antibodies is depressed in patients with malignant breast tumors. After surgical removal of diseased breast tissue, the anti-T antibodies rebound, and can become depressed again after tumor metastasis occurs. This indicates that the tumor tissue itself is involved in the antibody depression, and that T antigen must occur in an uncovered form only in breast carcinoma. There is preliminary indication, however, Springer says, that some T antigen may be shed into the blood.

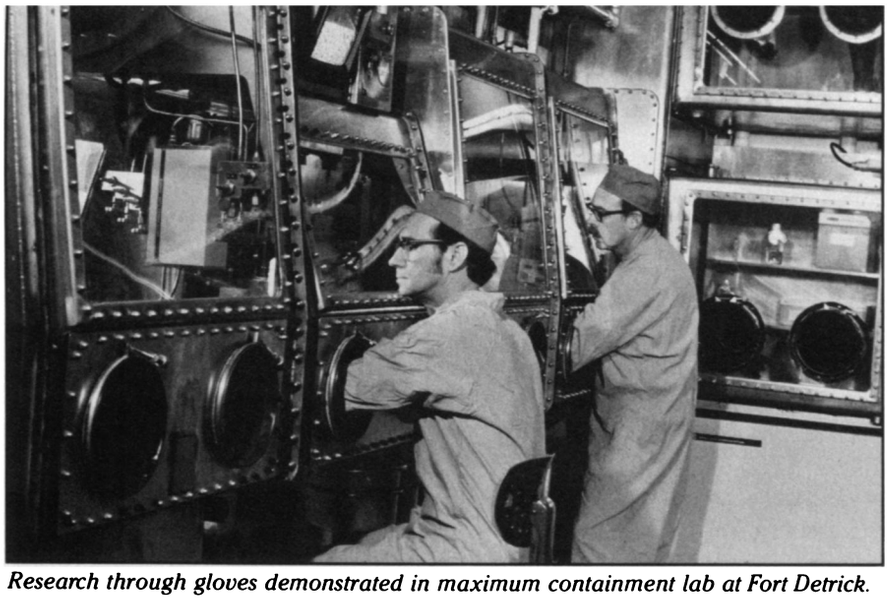
The team found that by injecting additional T antigen into women with breast cancer, the women's white blood cells react and cause the formation of red, hardened skin patches at the site of injection. This cell-mediated immune reaction does not occur in women with normal anti-T antibodies and without reactive T antigen. In tests conducted at Northwestern Hospital in 1974, 248 women suspected of breast cancer were injected with T antigen. Of them, 108 showed positive to the skin test, and malignant tumors were later confirmed by biopsy; 100 of those showing negative reactions were found to have benign tumors, and 40 negatives showed no evidence of tumor formation. In only two of the 248 cases were false positives recorded, that is, women with benign tumors showing positive skin tests. Independent tests were made at Memorial Sloan Kettering Cancer Center in New York, during 1975 and 1976. They confirmed the breast cancer skin tests to be 95 percent reliable.

A major pharmaceutical house, which insists on anonymity, has begun production of a commercial test preparation to be made available to physicians and the public "as soon as possible." In the mean time, Springer and colleagues are exploring further possibilities for treatment and detection, including using radio-labeled anti-T antibodies to attack malignant tumors, and detecting T antigens circulating in the blood. A reliable system for measuring T antigens in the blood could conceivably make the skin test itself obsolete before it has passed the long series of criteria for government approval, that lie ahead. □

U.S. maximum safety DNA lab set to go

Recombinant DNA research succeeds biological warfare experiments in building 550 at Fort Detrick in Frederick, Md. After a $250,000 renovation and equipping, and a legal battle (SN: 3/4/78, p. 133), the glove boxes are ready for action. "I am looking forward with great eagerness to getting this underway," says Malcolm Martin, one of the two scientists scheduled to do the first experiments in the facility.

While a group of protesters from the Peoples Business Commission staged a silent vigil, reporters last week toured the



NIH

Research through gloves demonstrated in maximum containment lab at Fort Detrick.

laboratory in its barracks-like building. It is the first U.S. facility certified for maximum safety requirements (P4) described by the National Institutes of Health guidelines. The National Institute of Allergy and Infectious Diseases, which operates the facility, expects recombinant DNA experiments to begin there by April 1, after a week of "dummy" experiments.

The facility is "essentially a box within a box," John Nutter, NIAID chief of specialized research and facilities, told reporters. Scientists manipulate materials in gastight cabinets by reaching into attached heavy rubber gloves. Within the cabinets are a microscope attached to a TV screen, a refrigerator, animal cages and access to an ultracentrifuge. All material leaving the interconnected cabinets is either steam sterilized or chemically disinfected.

The one-room laboratory containing the cabinets, as well as nearby rooms, a hallway and a staircase, is also sealed. The area will be under negative air pressure, so air would leak in through any break, not out. All people entering the area change into uniforms resembling surgical suits, and they shower as they leave. Materials leaving the area will be sterilized or disinfected. Nutter says the set-up provides "redundancy in safety."

In the first months, Martin and Wallace Rowe of NIAID, will do an experiment intended to help evaluate bases of concern over recombinant DNA research. They plan to insert DNA from polyoma virus (a mouse virus that can cause tumors in newborn rodents, but does not infect human cells) into bacteria and then feed or inject the bacteria into mice. Martin and Rowe will examine whether that viral DNA is transferred from bacteria to mammals, providing an indication of whether various types of recombinant DNA might spread throughout a population. A similar experiment is already in progress at Porton Downs, England.

After completion of that risk-assessment experiment, the P4 facility will be available to visiting scientists. NIH will soon make an announcement inviting applications. Another maximum containment facility for recombinant DNA research is also being readied in a mobile unit at NIH in Bethesda, Md. Finally, plans are underway for a more extensive national biological containment facility of P3 and P4 laboratories at Frederick to be operational in about two years. □

East coast booms: Pick a theory

Nobody just accepts the government's word anymore. In January, the Department of Defense bestowed the Naval Research Laboratory with the task of finding a cause for the mysterious East Coast rumblings heard from early December to mid-February. Dutifully, the NRL checked out all the possibilities: nuclear explosions, meteorites, winter lightning, methane bubbles, Russian laser attacks. On March 3, they released a summary of their 151-page report. Based on a theory by Harvey H. Hubbard and Domenic J. Maglieri of the National Aeronautics and Space Administration, the NRL blamed a combination of unusual weather and supersonic military aircraft that caused sonic booms to travel 50 to 200 miles. Past experience, notably similar events in Florida several years ago, and good correlation between flights, temperature inversions and strong winds satisfied the NRL that they had found the cause. They issued the summary, dusted their hands, sat back and that was that.

That wasn't that. On March 8, the Federation of American Scientists issued a press release saying, "The [FAS] charged today that the Naval Research Laboratory had erred in ascribing the cause of the booms...." The Concorde is the culprit, FAS says. In a press conference March 15, FAS director Jeremy J. Stone elaborated. The JFK-bound Concorde makes a turn near Cape Sable, just south of Halifax, Nova Scotia. The turn causes a "superboom" — shock waves from both sides of the turn focused at the same spot. Stone correlated most of the East Coast booms with French and British Concorde arrivals and departures. And, with some elaborate mathematics and help from IBM physicist Richard Garwin, he accounted for a few more by hypothesizing "hyperbooms." Hyperbooms, he says, are shock waves that travel faster than the Concorde and reach the coast as much as an hour and fifteen minutes before the plane. The hypothesis is based on the fact that sound waves travel faster in warm air. Garwin said the shock wave from acceleration will travel into the very thin and much warmer thermosphere, speed up and be reflected back to earth. By bouncing and gaining speed, it arrives before the plane. Not only that, but all these postulated bouncing booms could be "doing something to the thermosphere." Though NRL did attribute similar events in Nova Scotia to the Concorde, Stone says they didn't look far enough for an East Coast-SST link.

Meanwhile, the man with the measurements, William Donn of Lamont-Doherty Observatory, says the booms are "unequivocally, not the Concorde." Neither are they weather-enhanced military booms, he says. They are either "direct booms from close-in planes in a series of exercises" or "something entirely different." Donn has several reasons for his strong statements. Foremost, he says, is that the sounds detected by the Lamont, Charleston and Wilmington stations all originate in the south. And they are different from SST signals the station has picked up since the start of the flights, he says. Second, the bouncing hyperbooms would dissipate in the thin thermosphere. "[Stone] just made his hypothesis without listening to the physics of it." As for NRL's theory, Donn says there was no unusual weather, particularly in December, to support it.

The NRL plans to look at Stone's theory, and Presidential Science Adviser Frank Press will recommend an independent review. In the meantime, theories are booming. □

Smoking and memory

"Caution: Smoking may be hazardous to your... memory." No one is about to stick that warning on cigarette packs as yet, but there is reported evidence that nicotine can impair both short-term and delayed memory. The results come from a UCLA study reported in the February AMERICAN JOURNAL OF PSYCHIATRY.

UCLA researchers divided 23 "habitual smokers" into two groups and tested each on a series of 75-item, free recall lists containing professions, names, animals, vegetables and minerals. The subjects were first tested before smoking anything and found to be roughly equivalent in free-recall learning ability. (Tests consisted of an experimenter reading the list at a rate of one word every one to two seconds, then giving the volunteers three minutes to recall as many words as they could.)