

storm's overall existence and behavior.

A second new experiment will be the seeding of lines of cumulus clouds themselves. Simple cloud lines also have the advantage of being present much more often than hurricanes.

A substantial fleet of aircraft are involved in Stormfury, and as many as a dozen may become involved simultaneously with a single hurricane. In the past, project planes have ranged from DC-4s to Super Constellations, from B-57 bombers to U-2 reconnaissance craft. All are on constant 48-hour alert during August and September, the peak

months of the hurricane season, and on through October 15.

The actual seeding will be done by Navy A-6 Intruder jets, which will begin their runs from an altitude of about 35,000 feet, 50 miles from the storm center, then ram through the eye.

Coordination of all the aircraft involved is so complicated that last week, the first order of business was a dry-run rehearsal, using one circling plane to represent a hurricane's eye. Late in the week, if available, a line of cumulus clouds was to be used to simulate a rain-band in a seeding test. ◇

## BREAST CANCER

### Virus in malignancies



Dr. W. F. Feller

*Cluster (arrow and inset) of particles in breast cancer tissue may be virus.*

Something that looks like a virus has been found in the milk and breast tissue of a suspiciously high proportion of women with breast cancer or a history of the disease.

Cancers caused by viruses have been found in animals—none has yet been proved in humans.

Like other investigators, Dr. William F. Feller of Georgetown University School of Medicine, and his collaborator, Dr. Harish C. Chopra of the Pfizer Co., are cautious in their claims. Writing in the June issue of the *JOURNAL OF THE NATIONAL CANCER INSTITUTE*, just published, they say the small particle they discovered shows more resemblance to a virus than to any other known structure.

Including some cases discovered after

the report was written, they identify the particle in 12 of 28 biopsies and in the milk of six of nine lactating women either with active disease or a history of breast cancer. Identical particles appeared in the milk of normal women, but the incidence of their appearance has been much higher in the milk of breast cancer patients.

"Although the virus-like entity . . . cannot be said definitely to represent a virus," they concede, it looks like one, and "its occurrence in clusters or aggregates ranging up to several hundred particles strongly suggest it is a virus."

Milk and tissue were studied under the electron microscope. Milk collections were made by an electric breast pump on the remaining breast after surgery. Biopsy specimens were ob-

tained from four District of Columbia hospitals.

The researchers emphasize that the presence of a virus in a human cancer does not in itself mean that it was the cause of the malignancy; the virus could be merely a passenger agent.

Assuming that the discovered particle is a passenger virus, however, it could be one that has some predilection for, or is more readily propagated within, malignant mammary cells, or those producing milk. In this case it might, as a secondary invader, have some influence on the course of breast cancer.

It would be important, therefore, the investigators reason, to continue attempts to further characterize it and determine its frequency of association with different biological types of breast cancer.

If the particle is a virus, it could be related to the cause of human cancer and thus make possible a potent weapon against the disease. Although no cancer-causing virus is now known to be as small, some of them are only slightly larger, and one, the polyoma virus, causes mammary gland cancer in mice.

## PULSARS

### Gravity wave search

Since pulsars were discovered last spring, theorists have regarded them as possible strong sources of gravitational radiation.

Such radiation (SN: 4/27, p. 408) would be an energy-carrying wave analogous to an electromagnetic wave. Gravity waves should be produced by massive bodies under acceleration just as electromagnetic waves are produced by charged bodies under acceleration. They should be detectable by the stresses and strains they set up in bodies they encounter.

Gravity waves strong enough to be detectable would require dense, massive bodies that produce strong gravitational fields. Most hypothetical pulsar models fit this prescription—dense stars undergoing physical pulsations, or revolving around each other, have been among the most popular suggestions.

There has been much talk about looking for gravity waves from pulsars; now the one man who may have seen gravity waves, Prof. Joseph Weber of the University of Maryland, proposes to try it.

Prof. Weber has been looking for gravity waves for a long time. He uses aluminum cylinders weighing about a ton and a half to look for radiation at a frequency of about 1,660 cycles, and a pair of these have been responding, he says, "to a common external excitation which may be gravitational radiation." Noted among his colleagues for

his caution, Prof. Weber refuses to make a more definite statement pending further tests.

**Up to now** the search for gravity waves has been more or less at random. Although a number of astronomical systems have been suggested as possible sources, the search has been for any radiation the detector could find. The frequency searched for was chosen because it could be detected by equipment of a convenient size.

Now, in the pulsars, Prof. Weber calculates—in the Aug. 5 *PHYSICAL REVIEW LETTERS*—that he has a definite source of observable and identifiable radiation. Finding it would not only go to confirm the existence of the radiation but might also help decide among pulsar theories.

Gravitational radiation from a pulsar should have the same frequency as the radio pulsations—about 1 cycle per second. A detector for waves at this low frequency would have to be much larger than the ones Prof. Weber has been using. He calculates that a metal beam 50 meters long with a load of 100 tons on one end would be needed.

**Such an object** would not be easy to build. There would be problems with large scale refrigeration—such detectors are kept at cryogenic temperatures to minimize thermal disturbances. But Prof. Weber feels that the work that has been done on a superconducting linear accelerator at Stanford University (SN: 6/22, p. 599) shows the way to a solution to this problem.

There is also a money problem. A cost estimate awaits detailed plans, but Prof. Weber feels that it will be more than is customary for university grants, and the agency he applies to—probably the National Science Foundation—will have to go to Congress for a special appropriation.

“This is a time of austerity,” he admits, “and one wants to do all possible spadework before going to Congress.”

If Prof. Weber succeeds in observing gravity waves from a pulsar, he will throw on the scales of current astrophysical arguments some rather heavy evidence in favor of the view that pulsars are single, small, dense stars engaged in some kind of alternate expansion and contraction. “A pulsar model of a rotating double star doesn’t fit,” he says.

**The reason** is that radiation would damp the motion of the double star. As the system gave up energy to the radiation, the rotation would slow down. This should be observed as a change in the frequency of the pulsar’s pulsations.

Such changes are not observed. Therefore the people who believe that only a rotational motion is precise enough to control the observed pulsar

pulses have to arrange their models so that they do not radiate gravitationally.

Both objects could be about the same size, so that one could block or focus the radiation from the other when it passes in front. But this would require gravitationally stable orbits in which these systems do not radiate even though theory says they should. Although a Cambridge University group postulated this (SN: 4/20, p. 374), the idea was characterized by one theoretical physicist as the “wildest I ever heard,” because of the violence it would do to present gravitational theory.

**More conventionally**, the second body could be very small, in which case there would be no radiation and no damping. But in that model, the small body must produce the pulses. One such theory, published by Dr. F. T. Aldridge of the University of California at Los Angeles in the July *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES*, has a small body orbiting so close to a large body that it causes plasma shock waves in the large body’s outer atmosphere. These shock waves then produce the radio bursts.

## REDESIGNING SCHOOLS

### New form for early grades

Changes in elementary education, now envisioned by Federal innovators, could eventually separate the first three years of schooling from traditional education, and combine them with new preschool systems.

The idea is based on the theory that a child’s first eight or nine years of life constitute a single unit and should be treated together in mental, social and physical development.

About the age of eight, the child changes. His mental equipment and personality become fairly well established. He has the basic tools for self-learning or for working in large groups, such as classes.

Jules Sugerman, former director of Head Start, is one of those looking toward radical changes in early education. He is joined by members of the President’s Panel on Early Education, composed of representatives from the Labor Department, the Children’s Bureau and the poverty war office.

Their plan for a new design in early education is still in the formative stage, but they have been trying out the idea on fellow professionals. The panel recently met with state welfare and poverty officials and some educators, who were receptive.

Sugerman himself tossed out the idea in a series of predictions to the World Organization on Preschool Education meeting in Washington. He predicted future pressure for preschool education

for all children, whether or not they are disadvantaged. “We will come to believe,” he said, “that we need radical changes in early education.”

The question of comprehensive treatment is no longer in doubt, according to Sugerman. “You simply cannot work with a child from the simple educational point of view.”

The President’s panel, headed by Sugerman, has worked up the outlines of a system called the 4-C program—Community Coordinated Child Care. It would not necessarily be run by the educational establishment, which many child development people consider too single-minded to adapt to a program encompassing medical, emotional and educational treatment and including both parents and children.

**Ideally**, says Sugerman, there should be an assessment of each child periodically, starting very early. As the child demonstrates his readiness to read, for example, he would be taught to read. For some this readiness comes at age two, for others at age four. Some children would be put in a class where they learn through hearing, others where they learn from movies, television or other electronic aids.

There are a number of obstacles in the way of radical change—the educational establishment for one. Another problem is the public’s lack of familiarity with concepts of child development.

In its favor, however, is the fact that the 4-C system would benefit middle class as well as disadvantaged children.

Poor children need help just to function in life, Sugerman declares. They have medical needs and problems with motivation that the middle-class child does not face. But the middle-class child can use a more flexible educational system.

Parents put their children in nursery school for a head start on education, only to find them bored when they reach elementary school. Many college students no longer need the freshman year nor medical students the first year of medical school, says Sugerman. “Why are we sitting around and wasting two years of life?”

**Another force** pushing for change is technological. A range of new devices from computers to videotapes and educational TV offer individualized education that was not possible five years ago.

Still another is the fact that Federal programs are moving in the direction of comprehensive preschool education. Head Start began the movement; then came Follow Through in the elementary schools. Next fall parent-child centers for children under three will begin operation in 30 communities.

For the time being, the 4-C program is only a plan to unite these Federal preschool programs.