

Union are energetically pursuing laser fusion, and at the same time both have taken up electron-beam work. Now, workers at the Kurchatov Institute in Moscow, where Soviet fusion work of all kinds seems to be concentrated, have claimed an important advance in electron-beam fusion experiments.

The report came not in a scientific journal, but in an article in the March 10 *Pravda* written in connection with the 25th Communist Party Congress. The article dealt mostly with other thermonuclear fusion experiments underway at the Kurchatov Institute (notably tokamaks) but devoted one paragraph to the electron-beam work.

The paragraph claimed the achievement of some fusions. It said electron beams had compressed fuel pellets containing deuterium to 100 times their original density. The crushing raised the temperature of the fuel to nearly 11 million degrees K. The reaction gave off more than a million neutrons, which the Russian physicists claim as evidence that fusions actually took place in the fuel.

The number of neutrons, if in fact they do come from fusions, is still a long way from what is necessary for a practical device producing useful energy, but the achievement is a significant step, in the opinion of Gerold Yonas of Sandia Laboratories in Albuquerque, who heads the American program in electron-beam work. On receiving the *Pravda* report, Yonas telephoned the leader of the Soviet group, Leonid I. Rudakov, to determine whether the report was accurate, to offer his congratulations if so, and to seek further information. He was assured that the report was correct, offered his congratulations and got no further information.

What Yonas was especially interested in was the diagnostic methods used at the Kurchatov Institute to determine what happened in the imploded fuel pellets. There are a number of possible sources of neutrons in such events, and it takes delicate methods to be sure that the neutrons seen are really those thrown off as excess when two nuclei fuse, and not the result of some other process. Rudakov would not describe the diagnostic methods, but referred Yonas to a forthcoming scientific publication in an unspecified journal at an unspecified date.

The American program has so far succeeded in crushing dummy pellets but has yet to experiment with targets filled with fuel, which in this case will be a mixture of deuterium and tritium. The American effort, as described by Yonas's colleague M. J. Clauser at a meeting last fall, uses electrons of 100 million electron-volt energy and protons of 10 million electron-volts to irradiate the targets. What the energy of the Soviet electron beams may be is not known, nor have they said whether they are also trying protons or any of the other ions that have been suggested. □

Miniaturizing flies with membrane leaks

Three California biologists have discovered an enzyme from bee venom that can cause fruit fly larvae to grow up tiny. The miniaturizing effect is due to the enzyme's action on cell membranes; it causes them to leak. Although this fly "shrinking" phenomenon can carry the imagination off to science fiction scenarios, the enzyme will be mainly a tool for basic membrane research. Sadly, for those inclined to wonder about such applications, it won't be at all useful for shrinking overweight humans.

Cell biologists Peter H. Lowy, Herschel K. Mitchell and Ursula W. Tracy of California Institute of Technology report the leak phenomenon in the April issue of *Toxicon*. Lowy and Mitchell discovered the miniaturizing enzyme purely by accident five years ago. They were studying a bee venom enzyme that causes biological molecules to break down. They injected a control group of fruit fly larvae with a different venom enzyme. To their amazement, they found that the injected larvae hatched into perfect, miniature adults that produce a second generation of normal-sized flies. The team has since studied the action of this enzyme, which is called phospholipase A-2, and can now state that it causes permeability changes—leaking.

In order to determine the mode of action, the team immersed human cancer cells (HeLa cells), red blood cells and mitochondria (metabolic organelles) into weak solutions of phospholipase A-2. The enzyme has no apparent effect on the red blood cells, but it attaches to HeLa and mitochondrial membranes and causes them both to leak. Mitochondria have a double membrane, and the inner layer allows larger than normal molecules to pass through in the presence of phospholipase A-2. The HeLa cells accumulate lipid droplets. This is due either to a change in membrane permeability or to a release of lipids within the cell, the team suggests.

The miniaturizing effects on fruit fly larvae are probably a result of membrane permeability changes, too, Mitchell says. Insect larvae are essentially eating machines, but fruit fly larvae injected with phospholipase A-2 don't eat at all. When they metamorphize, there is just too little larval tissue to create full-sized adults. The insects' lethargy is probably due to muscle and nerve dysfunction resulting from leaky membranes.

Phospholipase A-2 in bee venom and its counterpart in cobra and rattlesnake venom seems structurally similar to the phospholipase present in normal cell membranes. This similarity suggests, Mitchell says, that normal cell phospholipase may have a permeability regulating function. The bee venom enzyme should be a useful tool for studying that

normal membrane regulation.

As for miniaturizing overweight humans, Mitchell replies to the somewhat facetious question, "the enzymes would be useless—in fact, worse than useless." The enzymes will arrest the growth of insects at a certain stage of development, but "if an organism is already big, there is no reason to believe it will get smaller." Besides, "you just wouldn't want to do this to a person. The change in his membranes might cause him to stop eating, but he also might stop breathing. Breathing is a membrane function, too." □

The hidden energy of silent quakes

It's almost as though violent earthquakes, with their rumblings and sudden upheavals, are just diversionary tactics. According to geophysicist Hiroo Kanamori of the California Institute of Technology, much of the real, large-scale earth-moving along the faults and trenches surrounding the Pacific basin seems to reveal itself only in slow, ponderous "silent earthquakes," whose seismic waves don't even show up in the measurements used to rate quakes on the Richter scale.

Kanamori's research was reported this week at an international symposium conducted by Columbia University at Arden House in New York, in honor of the late Maurice Ewing, whose name is associated with many of the great discoveries in marine geophysics in the last 30 years.

His findings are based on a study of the "repeat time"—the time between periods of heavy quakes—for the various earthquake zones around the basin. His findings, coupled with plate-tectonic theory, suggest that the major recorded quakes have not been sufficient to account for all or even most of the earth movement that plate-motion studies indicate has been taking place.

Off the coast of Japan, for example, where the Pacific crustal plate is said to be thrusting under the Asiatic plate, the repeat time, by Kanamori's calculations, is about 100 years. (The entire subduction zone broke within the last 25 years, while the previous sequence of breaks was between 1850 and 1900.) Each major quake sequence, he says, involved a relative slip between the plates of 6 to 9 feet, yet the Pacific plate advances beneath the Asiatic plate about 30 feet every 100 years. The difference, Kanamori concludes, must be due to slippage without the accompanying ground-shaking. In other words, the silent quakes.

The seismic waves of the silent quakes as Kanamori defines them are those with periods of 300 seconds or more—frequencies, that is, of 12 cycles per hour

and lower. The commonly monitored waves of higher frequencies are usually produced, according to plate tectonics theorists, when the relative plate movements somehow stick, releasing the tension in jerky spasms. The smoother movements produce the low-frequency waves.

Further evidence in Japan shows up in measurements by Caltech geophysicist Kunihiko Shimazaki, who has found that crustal tilting and lifting in northern Japan can account for only 20 percent of the known plate slip. Somehow, he believes, the Pacific plate is creeping under the Asiatic one without deforming.

Off the Alaskan coast, the repeat time is not definitely known, although 1,000 years has been suggested, during which time plate subduction amounts to about 120 feet. The Alaskan quake of 1964 involved 30 to 60 feet of displacement, only a fourth to a half of the total if the

1,000-year repeat time is correct. The San Andreas fault in California also shows gradual, non-quake-related creep, but the repeat time for quakes along the fault is not known, says Kanamori, so the "silent quake" theory cannot yet be evaluated.

One of the major implications of Kanamori's work is for predictions of tsunami, or tidal waves. Sometimes, he says, a quake can appear small on the Richter scale, which incorporates only higher-frequency measurements, yet have a total energy that is very large. An 1896 quake at Sanriku, Japan, for example, produced only minor shaking, but it was accompanied by one of the most devastating tsunamis ever to strike the country. Realization of the danger of low-frequency, "silent" quakes, Kanamori says, should be incorporated into tsunami warning systems, which at present are based largely on Richter-type measurements of earthquake magnitude. □

Washington's era of Metro begins



Spacious stations, comfortable rides greeted Washington Metro's first passengers.

When ground was broken in 1969 for beginning construction on Washington, D.C.'s, metropolitan rapid transit system, Metro, then-President Nixon expressed a common hope of planners trying to stem decay of the nation's capital: "More than a subway will begin . . . a city will begin to renew itself, a metropolitan area to pull itself together." Thus, with the opening this week of the first 4.6-mile segment of Metro, one of the boldest urban renewal experiments ever attempted got underway.

The urgent need for something to halt the spread of squalor has long been apparent. A study of the Metro idea, conducted by Development Research Associates, concluded that Washington might benefit more from such a project than any other metropolitan area in the United States. The report showed the city to be "ideally suited for rapid rail transit," with a strong downtown, relatively compact

suburbs and high transit ridership.

The initial line—less than five percent of the projected system—will hardly make a dent in the life of the capital, but Metro officials hope that its very attractiveness and success will spur local governments to raise the money needed to complete the rest. Estimated costs have soared from \$2.5 billion at the start to \$4.67 billion currently. Some suburban governments are considering pulling out of the cooperative effort, construction is limping along on federal funds left over from highway projects, and overall progress has been held up by strikes, storms, management problems and lawsuits.

Despite inevitable start-up problems, opening day was generally a success, with more than 50,000 people showing up for free rides. They were treated to the fastest, most comfortable journey in town—once technicians could get all the train doors

closed, a task that once took up to 40 minutes. (Heavy loads apparently buckle the cars just enough to jam the doors.) The cars have carpeting, plush, two-inch-thick padded seats (though some will have to be replaced because of potential fire hazard), year-round air conditioning (which also needs to be tinkered with) and steel wheels well suspended for a smooth, silent ride (though the brakes must be adjusted so they don't jam under heavy loads). Most problems had been worked out by the time the first paying passengers rode on Monday, in numbers twice as high as expected.

Underground stations are built inside long, continuous arches, indented like wrap-around waffles for noise suppression. Platforms are set away from walls to prevent vandalism and have been cleared of pillars and hiding places that could invite muggers. The whole effect, in the words of one architecture critic, is "a serene kind of beauty."

To cut down noise to surrounding areas, tracks along some segments are supported on pads that absorb the vibration of passing trains. Tracks are also welded, so there is no "clickity-clack." In particularly sensitive areas, the whole concrete track platform is suspended to keep noise from disturbing people in buildings above. Inside the subway cars, sound levels are about the same as in a good automobile, except for moaning brakes.

Already one can begin to see improvement in neighborhoods bordering on prospective Metro lines, and the system is eventually expected to return \$3 for every \$1 invested, including increased property taxes. (In Toronto, a 4.5-mile system costing only \$67 million sparked a \$10 billion building program.) But the overall impact of Metro on the life of the community will depend on how much of the proposed system is eventually finished. At present, about half the planned 99.8-mile system is under construction or completed, including 42 of 87 proposed stations.

Commuters can begin to take advantage of the new rapid transit—supposedly about four times faster than a taxi—by driving to the only above-ground station along the new line. There a parking lot and "kiss and ride" area (drop-off point for commuters) have been provided; later a complete rerouting of bus lines will provide an integrated system of area-wide transportation. The next section of line is scheduled to open next year, which will include service to National Airport.

Meanwhile, this summer's expected flood of tourists may not find Metro too helpful: As they board at the Union Station Bicentennial Center, the new line can only take them into a nondescript Northeast neighborhood or across to the bustling commercial district—bypassing the Mall and popular monuments. Still, come July, Metro may be one of the safest, most comfortable places in town. □