must be met if polio is not going to start claiming the lives of many Americans once again. James F. Dickson III, deputy assistant secretary for health, HEW, testified that the drug company making the polio vaccine, Lederle Laboratories, is about ready to sign a new contract. "The contract," he explains, "requires us to take appropriate steps to see to it that each person vaccinated or the parent or guardian receives adequate notice concerning risks and benefits." Thus, the temporary shortage of vaccine, he predicts, will soon be over.

But even when it is, some broader questions will not be answered. Who is going to pay for legal damages that polio vaccine victims incur? Who should be in charge of making sure that there is enough polio vaccine available at all times—HEW's Center for Disease Control in Atlanta? If so, it is certainly not doing its job. The same can also be said about recent shortages in measles and rubella vaccines and the difficulties of getting swine flu vaccine produced because of inherent risks. There is a need for a national vaccine policy, Kennedy insists, and he recommends that HEW, in collaboration with the National Academy of Sciences, set up a commission to establish such a vaccine policy.

He also recommends that parents be given a choice between the live and killed polio vaccine. Aldrich agrees, pointing out that the killed vaccine is now being made in Canada and could be made readily available in the United States. □

Gamma-ray bursts: From neutron stars?

It is now more than three years since R. W. Klebesadel and collaborators announced that satellites and spaceprobes equipped with gamma-ray detectors had been observing sharp bursts of gamma rays from somewhere in the cosmos. A number of suggestions about the astrophysics of the origins of these gamma-ray pulses have been made, but none is so far generally accepted. In the Sept. 9 NATURE, two astrophysicists at the Lick Observatory, S. E. Woosley and Ronald E. Tamm, elaborate a theory that attributes these bursts to explosions on neutron stars. They also suggest that the giant X-ray pulses that were recently discovered may come from the same or a similar mechanism.

The basic observed facts about the gamma-ray bursts are: They last between 1 and 10 seconds. At the earth, they deposit between a hundred-thousandth and a ten-thousandth of an erg of energy per square centimeter of detector. They have a spectrum that seems to be typical of a cooling black body with a temperature of 2 billion degrees K. Finally, they are distributed more or less randomly through the sky, and show no correlation with the locations of strong continuous X-ray sources.

Woosley and Tamm's theoretical picture begins with a neutron star that is a member of a close binary system or located in a dense cloud or nebula. The neutron star's gravity draws matter from its companion or its cloud, and if the neutron star is strongly magnetic this matter will not accrete all over the sphere but preferentially in polar caps covering about 10 billion square centimeters each or about a tenth of a percent of the neutron star's surface area.

The accreting matter is mostly hydrogen and helium, but as it is compressed, nuclear fusions begin, and the fusion process burns its way up the scale to carbon. A lot of carbon is made, and the peculiar conditions of the surface of the neutron star keeps the carbon hot and unstable. When a certain critical mass has accumulated in these hypothetical polar caps, the carbon is susceptible to a thermonuclear runaway, the polite term for an explosion.

This explanation of how the explosion happens parallels the theory of how a supernova explosion gets started in a white dwarf star that has made a lot of carbon. But there is one very important difference. The supernova explosion blows the white dwarf apart. But because of the neutron star's extremely strong gravity, the similar explosion on it is more like a pimple than a disintegration. Very little matter gets away, and most of what does is quickly pulled back. The major effect of the explosion is to heat a large amount of matter in a small volume. Cooling of this matter yields the gamma rays. Small blobs of it can break through the surface of the neutron star, and this action contributes the extremely short-timed variations that occur within the bursts.

Considering how well this picture accords with observations, Woosley and Tamm find that the explosions fit the duration of the bursts, the energy and the observed spectrum. Whether they fit the observed frequency and distribution of the bursts leads to a consideration of the statistics of neutron stars and how many may exist in the sort of binary system or dense cloud necessary. It appears that neutron stars made by supernovas of Type II will not do, but those resulting from Type I supernovas may.

This leads to another problem: distribution. The gamma-ray bursts tend to come from all over, but the progenitors of Type I supernovas are believed to be old stars found mainly in the flat disk of the galaxy. However, the day is saved by a reminder that supernova explosions can impart large velocites to the neutron stars they make, and so it is not unthinkable that in the time since Type I supernovas began to happen some of their neutron-star progeny might have gotten to distances of a kiloparsec or more from the plane of the galactic disk.

Of course there are many uncertainties, especially in the statistical arguments, and Woosley and Tamm conclude by remarking: "This subject is ripe for continuing experimental investigations and serious theoretical examination, and hopefully this somewhat speculative paper will encourage both." □

National Institute of Aging: A beginning

Two years ago Congress established the 11th unit of the National Institutes of Health—the National Institute of Aging—and since then the new institute has been getting underway. Last year it received the Gerontology Research Center in Baltimore as its intramural program and aging grants previously administered by the National Institute of Child Health and Human Development as its extramural program. In May it acquired its first director—Robert N. Butler, a psychiatrist and author of the Pulitzer Prize-winning book *Why Survive? Being Old in America* and a person with exceptional compassion for the elderly, since he was raised by his grandparents.

This month, at the 6th annual meeting of the American Aging Association in Washington, Butler spoke on the new institute and the directions it will be taking. He noted that "aging is the one biological condition common to all," yet it has been largely shoved under the rug in America. "A normal lustiness in a young man is considered lechery in an old one." Widows and widowers "live in sin" because the government will take away their pensions if they remarry. Only 15 out of 25,000 physicians on the faculties of medical schools have expertise in the progress of aging and how to care for the aged.

Yet the need for helping older people cope with aging is enormous. The Congress recognized the need by setting up the new institute. Other advanced countries are also recognizing the need and setting up comparable institutes. "We have reached a point," he says, "where there are 300 million retired people in the advanced nations."

In spite of the fears of sociologists and psychologists that the lion's share of institute money will go for research into the biology of aging, and the biologists' fear that most will go for research into the sociology and psychology of aging, Butler is reassuring both parties that he will devote ample research funds to both areas. In the biology arena, for example, the institute will undertake a research program next spring on senility, with the help of the National Institute of Neurological and

Communicative Disorders and Stroke. Senility is a problem for half a million Americans. With the help of the National Institute of General Medical Sciences, the institute will try to reduce the great number of untoward drug interactions and drug effects that occur among the elderly. The institute will study osteoporosis, a problem for 14 million older American women, and will develop new prostheses for the elderly, such as remote control preparation of foods and sensors on canes. It will study exercise for the aged.

One of the greatest differences between the Institute of Aging and the other NIH institutes, Butler stresses, is that the new institute will study the process of aging, not diseases, an altogether different thing. "It is important," Butler says, "that the public realizes that there is a process of aging."

Even with the new institute established, though, Americans have a long way to go before they become deeply committed to better understanding the process of aging and how to cope with it. Although federal funds for the new institute are expected to go up from under $20 million for fiscal 1976 to $26 to $30 million for fiscal 1977, such funds are but a drop in the bucket compared to those allotted to the more popular disease research areas. (The National Cancer Institute was authorized $685 million for fiscal 1977.) □

Nuclear retrenchment around the world

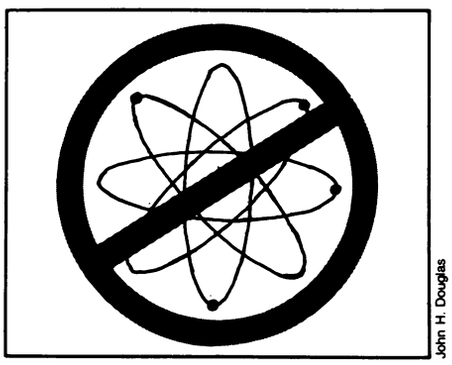
News Analysis

The week of Sept. 19 may someday be remembered as a key watershed in the history of atomic energy. It began with the nuclear power question playing a decisive role in the ousting of Sweden's Socialist government. Next came a British Royal Commission report urging that further nuclear expansion be postponed "as long as possible." And the week ended with a pledge by Jimmy Carter, the first major presidential candidate to have a nuclear engineering background, to curb nuclear exports. More important than the individual events, however, were indications that they reflect a growing international receptiveness to the arguments of antinuclear environmentalists (SN: 1/17/76, p. 44 and 1/24/76, p. 59).

The Swedish election represents the most clear-cut case. Olaf Palme's Social Democratic government was pledged to building 13 new nuclear reactors by 1985, which would have given Swedes the world's highest per capita consumption of nuclear energy. His opponent, Thorbjorn Falldin, has built his career on an antinuclear stance. He promised not only to scrap plans for future nuclear plants, but also to phase out the five now in operation. After the election, Palme said of his defeat: "If the nuclear issue had not existed, we would have won."

Two circumstances of this upset are particularly noteworthy. First, though Falldin has few scientific credentials himself—he is a farmer and shepherd by trade—he apparently came by his nuclear opposition through contacts with Swedish scientists. In particular, he has been influenced by Swedish Nobel laureate Hannes Alfvén, one of the leading antinuclear members of the physics community. Second, his campaign appealed especially to the nearly half-million newly enfranchised voters under 20. Raised with a heightened sensitivity to environmental dangers, these young people bitterly opposed Palme's ambitious nuclear plans.

In the end, Falldin will probably have



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to compromise on the nuclear issue—he heads a coalition government in which his partners are likely to push for some sort of continued nuclear development. The question is whether opposition parties in other European countries will see in the Swedish experience a way to gain voters by campaigning against nuclear power.

In Britain, opposition to expansion of nuclear power came from within the government itself. After a two-and-one-half-year study, the government-appointed Royal Commission on Nuclear Energy concluded that the breeder reactor and the "plutonium economy" should not be developed until after full public debate. The report called for a "special procedure" to set forth and judge the issues of nuclear power. The first step would be to draft a "comprehensive document," similar to American environmental impact statements, to take the place of "bland, unsubstantiated official assurance."

Such blunt talk is rare for Royal commissions, and a protracted debate in Parliament is likely to result. The commission's report is even more significant because of the man who chaired it, Sir Brian Flowers, sometimes called the "father of Britain's reactor program." He told a press conference that he does not wish to see a nuclear moratorium, but that his message is, "For Heaven's sake, stop to think."

Again, the specific issues were those that troubled voters in Sweden and played a role in the California referendum (SN: 5/22/76, p. 324 and 6/12/76, p. 357). The commission cited the dangers of nuclear terrorism, weapons proliferation and the possibility of decreased civil liberties at home, due to security measures. The report's conclusions are particularly significant since nuclear energy is one of the few technological areas in which Britain is still a world leader.

Jimmy Carter's latest remarks on the nuclear question came in a speech to the San Diego City Club on Sept. 25. He promised to halt further sales of nuclear technology or fuels to nations that developed nuclear weapons, built their own fuel reprocessing plants or failed to open their nuclear facilities to international supervision. He called for a five-year ban on all Soviet and U.S. nuclear explosions (including "peaceful" ones) and a ban on the sale of nuclear reprocessing plants, including those already negotiated by France and West Germany.

In remarks submitted to the American Physical Society and published in its October PHYSICS TODAY, Carter expanded on this theme, saying bluntly: "I believe we must make every effort to minimize our dependence on nuclear energy." The "excessive emphasis" on developing a breeder reactor should be reduced, conventional reactors should be located underground, and plants should be located "in sparsely populated areas and only after consultation with local officials."

In the same issue of PHYSICS TODAY, President Ford defended the present government policy: "The use of nuclear energy will increase around the world as the supplies of oil and natural gas diminish. Recognizing this, I believe that we must maintain our role as a major supplier of nuclear fuel and equipment for peaceful purposes—so that we can influence others to accept controls to minimize the threat of proliferation."

Ford said, however, that a review of nuclear policy is continuing, particularly with respect to proliferation, exports and fuel reprocessing. If changes of policy are needed, he promised, "I will act promptly." To underscore this concern over proliferation, the administration has just forced Taiwan into halting its nuclear fuel reprocessing. Though the Taiwanese have never officially admitted carrying on such activity—which is the first step toward weapons production—intelligence reports indicated they had nearly completed construction of a reprocessing facility.

During this fall's election, several states will have nuclear moratorium initiatives on their ballots. Atomic energy advocates once felt confident that the resounding defeat of the California initiative would undermine further opposition. It has also been the conventional wisdom that the rest of the world would follow the American lead in developing nuclear power. This week's events cast doubt on both these assumptions.

—John H. Douglas