of cells from patients with xeroderma pigmentosum show they are able to mend other DNA damage, such as a clear-cut break in the strand of chemical bases. Such breaks could be identified without the aid of an endonuclease.

To test the possibility of genetic engineering, Dr. Cleaver now plans to take cells from xeroderma patients, grow them in the laboratory and infect them with the SV-40 virus, an agent known to cause cancer in animals but thought to be harmless in man. In the process of infection, the SV-40 virus will empty its DNA into the nucleus of a xeroderma cell, thereby giving it a transfusion of genes. In this case, the virus is merely the vehicle for transporting the new DNA because it is able to penetrate the nuclear membrane and get into the nucleus of the cell.

Hopefully, the deficient cell will incorporate the viral DNA into its own genetic machinery and use the information it contains to make the endonuclease it cannot produce on its own. Preliminary experiments with hybrid man-mouse cells (SN: 10/11, p. 323) and with viruses show this may be possible, but whether the effect would be long-lasting and whether the deliberate introduction of viruses into a human being is safe are questions that have yet to be answered. □

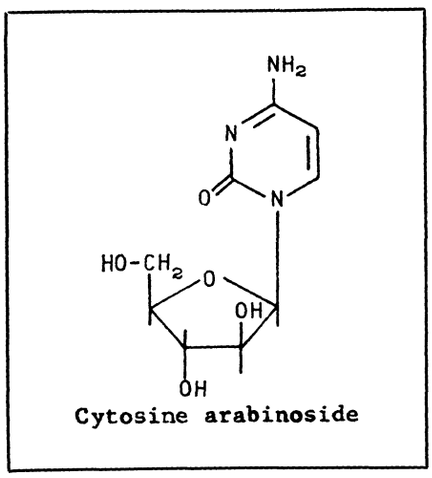
LEUKEMIA

A stronger arm in the arsenal

During the past several years, drug therapy has been the most effective mode of treatment for acute leukemia in both adults and children (SN: 12/21, p. 626). These anticancer drugs act against cells during their reproductive cycles, one cycle of which is DNA synthesis. By inhibiting this synthesis, the production of leukemic white blood cells causing the disease can be halted.

Recent results in humans show that a drug, cytosine arabinoside, that acts during this cycle, but in a different way than previous drugs, may be the most promising in this arsenal to date. Clinical studies show that the drug induces complete remissions of acute granulocytic leukemia in adults and acute lymphocytic leukemia in children in from 40 to 60 percent of patients, for up to periods of 18 months. This remission rate is both higher and of longer duration than any drug used thus far. Although the drug is not a cure, the results of human tests are regarded as more than satisfactory and have elated cancer specialists.

With leukemia, white blood cells proliferate uncontrollably—probably a result of cancerous mutation of the cell. Cytosine arabinoside destroys these cells in their reproductive stage by preventing the conversion of cytidine to deoxycytidine, a chemical component which is necessary for the synthesis of new DNA and therefore new white cells.



Cytosine arabinoside

Formula for a more specific fighter.

Other antileukemia drugs which inhibit DNA synthesis act by a different pathway. They inhibit as well the synthesis of RNA and, in some cases, proteins, which are synthesized prior to DNA. Such inhibitions limit the usefulness of these drugs because both leukemic and normal cells are destroyed by them. A drug that zeros in on the DNA phase is more selective, singling out mainly the weaker leukemic cells for destruction.

The National Cancer Institute, which conducted most of the clinical studies done with cytosine arabinoside, reported that of 184 patients with acute leukemia—both adults and children—the drug induced complete remissions in 69, giving an overall remission rate of 37 percent. And Dr. Emil Freireich, chief of experimental hematology at M. D. Anderson Hospital in Houston, reported complete remissions in up to 56 percent of patients. When the drug was given in combination with other drugs to patients under 30, an overall remission rate of 80 percent was obtained. Dr. Freireich calls cytosine arabinoside a "whole new direction in cancer treatment."

According to Dr. Freireich, the drug has two other advantages: It can be given in large doses because of its relatively low toxicity, and though it does deplete bone marrow, it shows few side effects on other parts of the body.

Information on cytosine arabinoside was presented last week at an all-day conference on the drug called by the National Cancer Institute. Dr. Gordon Zubrod, scientific director for chemotherapy at NCI called the meeting an "experiment in communications." He used the Food and Drug Administration's approval of the Upjohn Company's application on the drug as a way to wave a research success in the face of the budget cutters (SN: 9/20, p. 236).

Development of the drug was the result of cooperation involving Federal Government, industry, universities and independent research institutions. The Chemotherapy Program of the NCI, established by Congress in 1955, allows the Government to help develop new drugs where the profit potential is too small to stimulate the pharmaceutical industry. In the case of cytosine arabinoside the production costs were so high—originally $57 per gram—that more extensive clinical studies were precluded.

Other than NCI and Upjohn, the project included the Sloan-Kettering Institute for Cancer Research, Roswell Park Memorial Institute and the Henry Ford Hospital in Detroit. In addition, grants for research were provided by the American Cancer Institute.

Dr. Saul A. Schepartz, associate scientific director and chief of the Cancer Chemotherapy National Service Center at NCI, said that "perhaps 1,000 patients have been treated with the drug, and the cost for clinical studies has well exceeded $1 million." □

HEAVY-ION ACCELERATORS

The cry from the South

Nuclear physics has always been a major subject of study at Oak Ridge National Laboratory. The laboratory was founded to contribute to the development of the nuclear bomb. Since World War II, it continued to build on the base established in the 1940's, stressing the study of the atomic nucleus in its pure scientific and its practical aspects in nuclear physics, nuclear chemistry and radiation biology.

The laboratory's cooperation with Southern universities has helped to build up a regional constituency in these fields, many of whose members work at universities that were hardly known for scientific research before the war.

But while Oak Ridge was building up its capabilities in nuclear sciences, other national laboratories went after the new field of particle physics, and others—like Brookhaven, Argonne, Lawrence Radiation Laboratory—were the ones that got the big new particle accelerators. "We think the Southern part of the country has been underprivileged in these large accelerators," says Dr. Arthur H. Snell, assistant director of Oak Ridge, and an effort is being made to redress the balance. The vehicle is an accelerator proposal for nuclear, not particle physics.

After existing in something of a

shadow for years, nuclear physics is making a comeback in the wake of newly developing possibilities, including a search for stable elements heavier than uranium and the study of nuclear structure in greater detail than ever before. One of the new types of equipment needed for these new reaches of nuclear physics is a heavy-ion accelerator, a machine that would accelerate nuclei of heavy elements and throw them against targets of other heavy elements. "The situation in science is just crying for it," says Dr. Snell.

The Oak Ridge scientists have proposed to the Atomic Energy Commission that they be authorized to build a machine they would call APACHE (Accelerator for Physics and Chemistry of Heavy Elements). The machine would consist of a tandem Van de Graaff accelerator coupled to a cyclotron and would accelerate nuclei to energies of 7.5 million electron volts per nuclear particle. This means that a uranium nucleus would come out with an energy of about 1,800 MeV, more than enough to overcome the electrical repulsion of another uranium nucleus and bang into it.

Experiments of this sort can help to discover whether there are stable nuclei heavier than uranium. They are also useful in studying how nuclear fission occurs. The details of the fission process are still imperfectly known, and if they can be determined, nuclear physicists see the possibility of such knowledge affecting the practical uses of nuclear fission.

The Oak Ridge experimenters see APACHE as the capstone to the collection of nuclear physics equipment that they now have. They are basing their argument for it on their possession of complementary equipment, their experienced staff and long tradition in the field.

One example that they cite is their High Flux Isotope Reactor, which produces "substantial amounts" of the heaviest elements known, such as californium and einsteinium. Samples of such elements would make interesting targets for a heavy-ion accelerator, but they are radioactive and short-lived, so it would be convenient to put a heavy-ion accelerator nearby.

But the cry that Dr. Snell refers to has been heard in other parts of the country, and competition is intense. The AEC is considering requests for heavy-ion accelerators from Argonne National Laboratory, Los Alamos Scientific Laboratory, the University of Rochester, Michigan State University and the Princeton-Pennsylvania Accelerator Laboratory. The cost of such an item runs around $25 million, and money may prove a worse hang-up than interregional competition.

"There are no funds requested for this in the fiscal 1970 budget," says an AEC spokesman, "and money is so tight that we don't know whether we'll be able to build any of these." □

NEWS BRIEFS

Defections, disarmament, grass

The brain drain from the Apollo Program (see p. 355) continued last week as Dr. Eugene Shoemaker of the California Institute of Technology, chief lunar geologist for the program, announced he will leave his NASA post in March. He calls the Apollo Program a poor scientific prospect, saying that Apollo hardware is designed to transport men to the moon, but is very clumsy for exploration and research once they get there. The National Aeronautics and Space Administration, he says, will not slow up its schedule to Apollo's scientific capabilities.

The United States and the Soviet Union reached agreement last week on a joint draft of a treaty banning the placement of nuclear weapons on the ocean floor. Representatives of the two countries submitted the draft to the disarmament conference in Geneva; they hope to get the conference's endorsement of the proposal this month before submitting it to the United Nations General Assembly. The key provision would forbid the emplacement on or beneath the ocean floor of "any objects with nuclear weapons or any other types of weapons of mass destruction, as well as structures, launching installations or any other facilities specifically designed for storing, testing or using such weapons."

The Nixon Administration has endorsed lesser penalties for persons convicted of offenses involving use or distribution of marijuana and similar hallucinogens than are enforced against persons involved with hard drugs. The treatment of marijuana as if it were a hard narcotic has aroused considerable controversy (SN: 9/27, p. 263).

In testimony presented to the House Select Crime Committee this week Dr. Roger O. Egeberg, assistant secretary of Health, Education and Welfare, expressed the view that it is unjust to penalize users of marijuana with heavy prison terms and make them serious criminals by definition. Dr. Egeberg's deputy, Dr. Jesse Steinfeld, told the committee new Administration proposals would soon be forthcoming. Dr. Steinfeld presented Dr. Egeberg's testimony to the committee. □

WATER POLLUTION

The other ear opens

As of last year 1,550 sewer-equipped communities in the United States had no treatment plants. As a consequence 9.5 million people dumped 260 million gallons of raw sewage a day into U.S. rivers, lakes and bays. And of approximately 12,000 treatment plants in the country, only 7,100 were deemed adequate by the communities they serve.

In the past, except for a few dedicated conservationists, Congress has turned only one ear to the cry for better sewage treatment.

But last week, the other ear opened as the House of Representatives voted to appropriate $600 million for the construction of sewage treatment plants. The total actually comes to $665 million if a carry-over from last year is included.

The basis for the action stems from the 1966 Clean Water Restoration Act. The act authorizes $3.55 billion for sewage treatment plants over a 5-year period. But Congressional appropriations have been substantially below the authorized level over the last three fiscal years.

The situation wasn't helped any by the Johnson Administration's meager $214 million recommendation for fiscal year 1970, when the authorization called for $1 billion. When the Nixon Administration took over, it adopted the $214 million figure.

The House decision to triple that amount, despite the failure of efforts to appropriate the whole $1 billion, was termed "a major victory" by Rep. John Dingell (D-Mich.). "I think it reflects a tremendous concern over the problem of pollution," he says.

Bryan LaPlante, associate commissioner of the Federal Water Pollution Control Administration which administers the funds, says his agency, after years of disappointments, is satisfied. His organization couldn't have spent the $1 billion if it had been appropriated, he says. This is because the money would have been for fiscal year 1970, but municipalities which actually build the treatment plants would not have been able to meet FWPCA requirements to qualify for the funds.

Furthermore, LaPlante cites FWPCA administrative difficulties: "We're not geared to handle more than $600 million. We have a backlog now."

Dingell, who plumped for the $1 billion level, will get his chance again next year when the slated authorization is $1.25 billion. In the meantime, the $600 million amendment passed by the House now goes to the Senate where the indications are that it will be approved, and may even go higher. □