be invoked to explain channeling radiation.

For the immediate future Berman and Bloom stress that they would like to learn more about aspects of the physics that they do not understand well. They want to see how many bound states there are in the spectrum. They want to know how the effect changes with the energy of the incident particle. They have so far done electrons at two energies and positrons at two energies. They have worked at generally high energies, and they would like to see what happens at very low energies. The electron accelerators in hospitals, where channeling radiation might find important applications, work mostly at very low energies.

They want to know the angular distribution of the photons — that is, how far away from the direction of the incident particle beam they appear. They want to know what happens if they use a thinner crystal. They want to know the number of photons produced per incident particle, an important consideration for designing practical devices.

They want to see what happens with a different kind of crystal. So far they have used only silicon. "We have a South African-English-Dutch connection," says Berman, and through it they expect to get a diamond cut just the right way. Diamond has the same crystal structure as silicon, but a slightly different atomic number and so different lattice spacing. This means being able to study the effect of a small known change.

Eventually there may be practical devices. Bloom and Berman think more must be learned about the physics, but in not too long the Standford members of the group intend to begin work on one. If successful it could have uses in many lines of scientific research and in medical diagnostics and therapeutics. □

Do cool incubators make male sea turtles?

Scattered programs throughout the world have attempted to restock declining wild sea turtle populations with animals raised from eggs incubated in captivity. But good intentions aside, scientists may be doing about as much harm as good by inadvertently skewing the sex ratios of the animals they raise, according to research reported last week at the World Conference on Sea Turtle Conservation (SN: 12/1/79, p. 372).

The reasoning behind captive incubation is simple: It increases the chance that a turtle will survive its weeks of unprotected incubation on what are often public beaches, such as those in Ft. Lauderdale, Fla. Predation by hungry animals or by humans harvesting eggs for sale in local markets has been known to wipe out 100 percent of the eggs within only a day or two of when they were laid.

But a previously unknown problem facing eggs incubated in captivity was outlined by University of Toronto zoologist Nicholas Mrosovsky. Research he is conducting with C.L. Yntema of the Upstate Medical Center in Syracuse, N.Y., shows that the sex of sea turtles is — like that of some of their landed cousins — determined by the temperature at which they incubate. The pivotal temperature is 30°C. Eggs incubated at that temperature produce roughly equal numbers of male and female hatchlings. But raise the temperature just 2° and the hatchlings are all female, lower it 2° and male turtles are hatched.

This finding was made possible by the development of a technique that permits simple identification of the sex of hatchlings via microscopic examination of the tissue structure of an animal's gonads. Until now, scientists had not been able to identify the sex of a sea turtle until just before it reached sexual maturity — something long assumed to take seven years. As a result of a number of reinforcing studies and observations reported last week, however, it now appears sea turtles in the wild probably take somewhere between 12 and 60 years — perhaps even longer — to reach sexual maturity.

Since harvesting of adult turtles primarily involves nesting — therefore reproductive — females, it would be of questionable benefit to restock overharvested populations with only male animals.

Mrosovsky worries that without auxiliary heating, styrofoam hatching boxes, which most hatcheries use, may cool and thereby masculinize eggs. He cautions against ignoring another variable, however. His work has so far only involved eggs incubated at constant temperatures, but the temperature of beach sand can fluctuate widely every day. □

Smithsonian Tropical Research Inst., Panama

Hanging pot (right) contains eggs — often eaten raw — from oviducts of butchered turtles. In Panama, turtle meat sells for $.40 a pound while the cheapest beef is $1.25 per pound.

The genetic price of heroin abuse

The ability of radiation and certain toxic chemicals to wreak genetic havoc and in some cases contribute to cancer is well documented. But in other cases, such as drug abuse, genetic damage has been inferred but not observed. "Not all chemically induced mutations result in observable changes," says Arthur Falek, director of the Human and Behavioral Genetics Research Laboratory of the Georgia Mental Health Center in Atlanta. "Mutations can hide in the genetic pool for generations without producing any apparent disorder."

However, Falek and his colleagues report perhaps the first direct observation of genetic damage caused by heroin abuse. Moreover, they have found that straight withdrawal from heroin, or the substitution of methadone, appears to at least partially reverse such drug-induced changes in chromosomes. And as part of the same study, the researchers report that cigarette smoking may hamper a person's ability to self-repair genetic damage.

The investigators studied the chromosomes in white blood cells of heroin addicts and controls as the cells underwent the normal process of division. The ability of the chromosomes to self-repair — after damage induced by heroin or experimentally by ultraviolet radiation — was examined in 38 street heroin addicts, 18 methadone maintenance patients and 90 non drug users.

"We have found that opiate addicts have more DNA damage than controls based on our findings of significantly increased chromosome damage in their white blood cells and of their much lower ability to repair DNA damage," Falek said last week at an informal news conference sponsored by the Alcohol, Drug Abuse and Mental Health Administration. The study appears in the November PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

The researchers found a "significant increase" among heroin addicts in the number of "poor" repairers of genetic material; the poor repairers displayed only one-fourth the capacity of control group members to repair damaged DNA. "After long-term methadone treatment, however, there was no significant difference between the DRS [DNA Repair Synthesis] mean ... for these patients and those for controls," they report. "Finally, withdrawal from street heroin without any methadone treatment also results in a decrease in chromosome aberration."

The only factor among sex, age, alcohol, tobacco and coffee use that seems to affect repair capacity is tobacco use. Among the non-addicts who smoked, none were classified as "high repairers," although smoking did not produce repair scores as low as those for addicts.

While heroin itself does not appear to be a direct mutagen, "it seems to act by preventing the cell from repairing DNA damage done by mutagens," Falek says. Such a mechanism could render a person more susceptible to the development of cancer, he suggests. "It is likely there is an increased rate of mutation among heroin addicts leading to genetic defects which are manifest in an increased rate of carcinogenesis," he says. However, no increased rate of birth defects has been reported among the offspring of opiate addicts, according to Falek, "so it remains to be determined whether these mutations have been passed on through the chromosomes in the germ cells to the next generation." Also participating in the study were John J. Madden, David A. Shafer and Jean H. Glick. □

Artificial blood succeeds in humans

Artificial blood made from fluorochemicals has been used to replace up to 80 percent of blood in mice, rats and dogs and has kept many of them alive for years with no signs of ill effects (SN: 9/28/74, p. 203). Now, artificial blood made from such compounds is being injected into humans. The first use was last April, in a Japanese man bleeding severely, following prostate surgery. The artificial blood was used until blood of the patient's type could be obtained. Six more cases have followed throughout the world, the most recent being in the United States.

In September a patient at the University of Minnesota Hospital in Minneapolis refused a blood transfusion following surgery because his religion (Jehovah's Witnesses) forbids blood transfusions on the basis that the Bible prohibits eating blood. When the patient became severely anemic, Robert Anderson, professor of surgery at the University of Minnesota Medical School and a researcher with an interest in artificial blood made from fluorochemicals, sought permission from the Food and Drug Administration to give an injection of perfluorocarbons developed by a Japanese drug company for artificial blood use. FDA permission was granted, and on Nov. 14 the patient received two liters of the chemicals, constituting about 25 percent of his total blood volume. After that, his condition improved, the artificial blood was slowly excreted from his body (its life in the body is about a week), and his bone marrow produced enough natural blood to correct the anemia.

What is the future of the use of artificial blood in humans? Anderson foresees that it will probably be limited to emergency room or accident situations in which not enough of a patient's normal blood type can be obtained immediately or in rare situations, such as blood transfusions for Jehovah's Witnesses. □

Testing the short-term chemical tests

As demands increase for chemical safety, a wide variety of rapid techniques to identify cancer-causing agents have arisen in laboratories around the world. The International Program for the Evaluation of Short-term Tests for Carcinogenicity has just tallied results from 66 investigators who tested a set of 42 pure chemicals in a total of 29 short-term assays. According to preliminary results presented to a public meeting at the National Institutes of Health, no single assay or set of assays stands out as obviously best suited for carcinogen screening. Most of the assay systems gave both false positives and false negatives. "It is probably necessary to use more than one test for a wide range of chemicals," says Iain Purchase of Imperial Chemical Industries, Ltd., in England.

The tests that look at single point mutations in bacteria (including the Ames test) are useful in screening, the program concludes, but because they often label innocent chemicals as carcinogens, they must be followed with other tests, says Frederick J. de Serres of the National Institute of Environmental Health Sciences. In contrast, the program does not recommend for initial carcinogen screening tests that measure DNA repair in bacteria. John Ashby of ICI says such tests are not better than the mutation assays and there is uncertainty as to whether the changes observed are relevant to cancer.

Two advantages were listed for the group of tests that examine genetic changes in yeast, instead of in bacteria. Although the yeast tests are on the whole less sensitive than those using bacteria, growing yeast metabolize chemicals as animals do. Also, yeast tests identified two carcinogens that bacterial tests missed.

A group of tests that uses mammalian cells grown in laboratory culture also picked up carcinogens that bacterial tests miss. "The pattern of performance in these tests tends to fill in gaps in the prokaryotic [bacterial] tests," Purchase says.

Intact animals, such as fruitflies and mice, are used in the final group of short-term tests. Although these tests missed more than half the carcinogens tested, they seldom identified a non-carcinogen incorrectly. While such tests are not suitable for primary screening of chemicals, they could be useful for verifying positive results as a second tier of tests.

Patterns are beginning to emerge among the test results. Some chemicals seem to be potential carcinogens in bacterial and yeast tests, but not in tests with intact animals. Another chemical appears negative in bacterial tests, but according to Ashby is an "absolute knockout" in short-term animal tests.

The number of short-term tests is extensive, but still not sufficient to flag all chemicals that cause cancer. For example, the program found no group of short-term tests that clearly identifies chloroform as a carcinogen. "The mechanism by which chloroform causes cancer is not represented in any of these tests," Ashby says.

The program is making no recommendations on which assays could be best grouped into a test battery. Purchase says the profile of such testing depends on the use intended for test results. A regulatory decision, for instance, would have different requirements than a chemical company's decision early in product development. However, the large set of data collected by the program should identify tests suitable for various uses and for further development. □

Psychoses: A 40-year follow up

Behavioral scientists are learning considerably more about the causes and treatment of serious emotional disturbances than they knew even a few years ago. Still, most agree that it is still far too early to talk of "curing" the majority of psychoses; in the meantime, thousands of persons diagnosed with schizophrenia and serious, psychotic depression continue to struggle—with varying degrees of success — to overcome their chronic problems.

Just how such persons cope over a lifetime has been difficult to determine, primarily because of the problems in tracking down former patients. Now, however, psychiatrists at the University of Iowa College of Medicine report they have followed the progress of 557 patients over 30 to 40 years and compared them with a control group of 144 nonpsychiatric surgical patients. The subjects were tested on a variety of psychiatric, occupational, marital and residential tests.

The results, reported in the November ARCHIVES OF GENERAL PSYCHIATRY, indicate that diagnosed schizophrenics have considerably more difficulty adjusting over the years than do persons with "affective" disorders such as depression and manic depression. (The controls had the most favorable outcomes.) Faring better than schizophrenics but worse than affective cases are persons with schizoaffective disorders—a condition with symptoms of each of the other two categories. Psychiatrists have appeared undecided as to how to classify schizoaffective disorder; researchers Ming T. Tsuang and G. Michael Dempsey say their results indicate the problem frequently does include elements of both schizophrenia and depression and mania but that in some cases it may be a distinct affliction. □