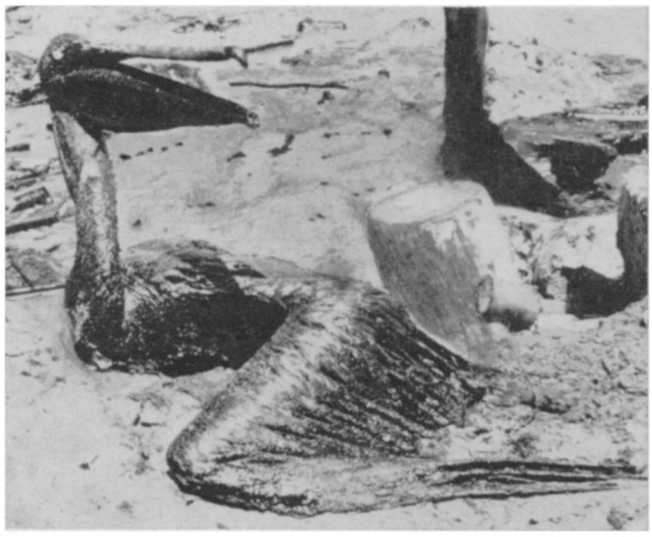
Protecting Man from Man

Symposia at the meeting of the American Association for the Advancement of Science in Dallas last week warned of:

Technological intrusions, from oil spills to disposal wells, that limit man's ability to live with his own depradations.

Genetic engineering, now technologically feasible, that may grow out of bounds unless some reasonable limits are set.



World Wide

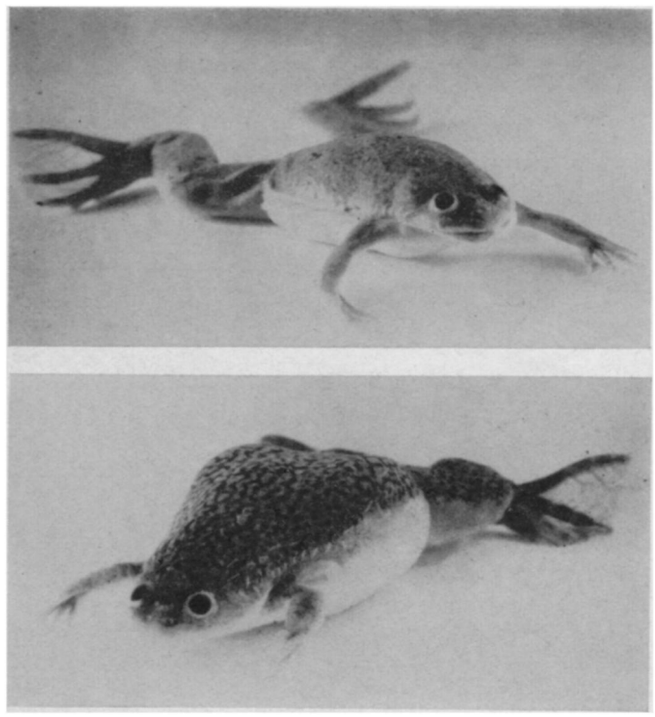
A dirty bird: Pelican after Puerto Rican oil spill

Judging from the hazards that technology has visited on the world, it almost seems that the only reasonable response is despair.

In three days of meetings, a dozen scientists at the annual meeting last week of the American Association for the Advancement of Science ran through the list of hazards caused by insults to the environment. They include DDT contamination of land and sea, a widening ring of asbestos disease, nitrogen poisoning from modern fertilizers, the little-understood spread of oil spills, ecological damage to Vietnam from defoliation of the forests and ground contamination caused by pumping poisonous waste products into deep wells.

The scientists titled their symposium "Unanticipated Environmental Hazards from Technological Intrusions." But it was clear that few of these hazards should be called intruders. As one participant pointed out, most of them are invited guests of society; they have not been so much unanticipated as unattended. That situation is changing rather quickly in the scientific world. But the mood, as exemplified at the AAAS symposium, is not one of despair; a few scientists were angry, all were highly concerned, and some have begun taking action to stem sources of contamination or give warning beforehand.

(See Intrusions, p. 32)



J. B. Gurdon

Frog from normal egg (top) and intestine cell nucleus

In 1932, Aldous Huxley's "Brave New World" was a literary nightmare of assembly-line humans. And in 1968, frogs, salamanders and the geneticist's perennial favorite, fruit flies, are acting it out. Even the most conservative of scientists declare that man's ability to control his evolution is at hand.

Nobel Laureate Marshall W. Nirenberg predicts that in 25 years it will be possible to manipulate heredity, to add or subtract information from genes.

"In truth," Dr. Robert Sinsheimer told the meeting of the American Association for the Advancement of Science in Dallas, where 6,000 scientists gathered at year's-end, "all that seems needed is the technology to transfer what we already know to be feasible in bacteria, carrot cells or frogs, to man. I feel strangely akin," says the biophysicist from the California Institute of Technology, "to the physicists who pointed out in the 1930's

(See Genetic, p. 32)

. . . Intrusions

USDA

A cost of industrial pollution.

One such move is being taken to control asbestos fibers loose in the environment. The fibers cause a high risk of lung cancer and scarred tissue in asbestos workers. Recent information collected by Dr. I. J. Selikoff of the Mount Sinai School of Medicine suggests that even a low level of these fibers increases disease risk among the family members and neighbors of asbestos workers. Workers on construction sites run a similar risk from breathing the fibers. The asbestos worker knows this material is dangerous, says Dr. Selikoff, and on a construction job he will position himself upwind so that asbestos dust carries away from him blowing toward other workers.

Dr. Selikoff points out an even more dangerous possible source of lung damage, fibrous glass, often used in ventilator ducts. Although the material has not been around long enough to show a link with lung disease, Dr. Selikoff says its effects on animal lungs resemble those of asbestos damage. If they are the same, fibrous glass, because of its prevalence, could be a public health danger.

While the asbestos problem may be controlled with industrial safeguards, DDT contamination, it seems, may already be past solution.

Dr. Lawrence R. Cory, a biologist at California's St. Mary's College, estimates that there is enough DDT in the environment to contaminate land and sea. "We know there is widespread contamination of the ocean," notes Dr. Cory, and his group has now determined that frogs high in California's Sierra Nevadas, carry marked amounts of DDT in their body fat. The mountain survey was done principally to see how far DDT could be carried by the wind.

From this information Dr. Cory concludes that a long-puzzling chromosomal change in fruit flies of the West is caused by persistent DDT.

This chromosomal change has the effect of interfering with the insect's ability to adapt to such environmental conditions as weather and temperature, and presumably could have the same effect on other animals.

Perhaps even more ominous is a recent laboratory study indicating that DDT interferes with the capacity of phytoplankton to absorb carbon dioxide and produce oxygen. Ocean plankton supply a good part of the world's oxygen. In the single study, so far unconfirmed, very small amounts of DDT depressed the CO_2 uptake 50 percent and more in several species.

Only a few parts per billion of DDT caused this effect and, according to Dr. Cory, oceans already contain the chemical in this concentration. Should the plankton work be confirmed, it suggests a serious threat to the world's oxygen supply.

A newer technological intrusion shows promise of becoming a rich source of future contamination. Pressured to stop polluting rivers and lakes, industry is beginning to pump dangerous waste products into the ground. There are at the moment 110 such deep wells into which are being pumped sulfuric acid from steel mills, paper-mill waste and pharmaceutical and chemical wastes which are mostly poisonous chemicals. The deep wells are also considered a good place for disposing of nuclear wastes; a uranium installation in New Mexico is pumping in what it calls small quantities of radium 226.

David Evans of the Colorado School of Mines, points out that only one three-trillionth of a curie of radium 226 added to a liter of water causes bone damage. The substance is dangerous for thousands of years.

A major threat from disposal wells is that the material will break out. No one can know where waste products will go in the geological system.

Evans estimates that in two years the country will have three times as many disposal wells as there are now, sweeping pollution under one more rug.

In one recent incident, a well on the shores of Lake Erie, used for the disposal of paper mill wastes, blew its steel casing and for three weeks it spewed 150,000 gallons of waste a day into the lake.

Waste pumped into the ground, explains Evans, is not replacing other liquids, but is adding to them, changing fluid pressure under the earth's surface. Thus pressure will equalize itself into surrounding areas by earthquakes or by breaking out of prescribed zones, he believes.

The hazards described by the AAAS scientists are created and extended by the twins, ignorance and complexity. No one understands, for instance, enough about geological systems to judge with certainty what will happen when tons of liquid waste are pumped into underground wells.

But these problems are exaggerated by what Dr. Barry Commoner, of Washington University, calls the "near fatal illusion" that humans can barge into the environment with technological intrusion without biological harm.

. . . Genetic

that the principles required for the release of the energy locked in the atomic nucleus were understood. Here too the principles seem in hand."

What is not in hand, the geneticists and political scientists who gathered in Dallas concur, are the means of dealing with the social implications of this dramatic science. "Man's value system will be drastically affected by the coming revolution in biology," warns Dr. Eugene B. Skolnikoff, professor of political science at MIT.

"An Einstein could literally be made immortal," says Dr. Anthony Blackler of Cornell University in Ithaca, N.Y., a transplant scientist. "One may envision a transplant generation," he predicts, referring not to a generation of individuals surviving with borrowed hearts but to individuals born from eggs fertilized by nuclei transplanted from body cells rather than by sperm.

Man will be able to manipulate genes to cure inherited diseases or predetermine the sex and intelligence of his children. He will also, Stanford University's Dr. Joshua Lederberg declares, be able to turn such skills into belligerent weaponry.

The techniques of nuclear transplantation are not yet perfected but, Dr. Blackler points out, in amphibians about 30 percent of transplanted nuclei maintain their ability to produce a new organism. With frogs, for example, it is possible to extract the nucleus of a skin cell and transplant that naked nucleus into a denucleated frog egg. The result is a new frog—an exact duplicate of

the one whose cell nucleus was transplanted.

"When a nucleus is transplanted, the egg behaves as if it has been fertilized," he explains. This phenomenon, too, is being studied by researchers interested in cell differentiation because it supports the view that cell cytoplasm plays an important role in the expression of genes or genetic material.

The nuclear genes contain all the information for the creation of a new frog, but when in a skin cell, they produce only more skin cells. When transplanted to an egg cell, they express themselves differently.

Although experiments with amphibian nuclear transplants often result either in abnormal development or no development at all, the reason, Dr. Blackler suggests, is because the host egg is faulty, perhaps immature or too aged, and not because the nucleus is defective.

Nuclear transplantation has not yet been applied to mammalian cells; they are smaller and more difficult to work with. But there appears to be no insurmountable technical barrier to such transplants. Dr. Blackler anticipates that when they come the incidence of failure and abnormality will be even lower than it is in amphibians. First applications, once the technique is perfected, are likely to be put to breeding identical prize cattle, hens that lay many eggs and the like.

The social issues raised by the prospect of genetic engineering were the prime concern of the AAAS participants in the genetics symposia. Their only firm conclusion was that these problems must be faced before genetic surgery becomes as common as a tonsillectomy. According to Dr. Skolnikoff, the public must talk about it, Congress should debate it and more committees, such as the one headed by Representative Emilio Daddario (D-Conn.) on science, research and development, should try to anticipate the effects of scientific advances.

Looking back, Harold P. Green, professor of law at George Washington University in Washington, D.C., suggests that there would be some value in slowing the pace of such revolutionary research by deliberately limiting funding for work in sensitive areas. If history repeats itself, Green and others agree, genetic technology will evolve on a laissez-faire basis; legal rules for social control of the technology will not be formulated until the social problems actually emerge.

The alternative, the imposition of legal restrictions in advance, could dull or kill a field of research that has as much potential for good as for misuse.

Dr. Sinsheimer sees in genetic technology the potential realization of man's ancient dream of self-perfection. "The new eugenics would permit in principle the conversion of all of the unfit to the highest genetic level. I know there are those who find this concept repugnant, but they do not see our present situation whole. They are not among the losers in the chromosomal lottery that so firmly channels our human destinies. Repugnance isn't the response of the four million Americans with diabetes or the 250,000 children born in the United States every year with genetic diseases or the 50 million healthy Americans whose IQ is below 90."

When genetic surgery comes, viruses are likely to be the surgeons' tools.

When a virus infects a cell it substitutes its own genetic material for the cell's, directing the manufacture of new viruses instead of new, healthy cells. It is possible, in bacteria, to attach non-viral DNA (deoxyribonucleic acid) to non-infectious or safe viruses; those viruses will carry the DNA into the cell, and new genetic instructions with it.

Conceivably, then, if a person has a genetic defect because he lacks the gene that codes for production of an essential protein or hormone, one could attach a suitable synthetic gene to a virus which would carry it into his cells. This would supply him with additional, corrective genetic information.

Already Dr. Arthur Kornberg of Stanford has created the synthetic core of a virus (SN: 12/30/67, p. 629). Shortly, scientists expect, Nobel Laureate Gobind Khorana of the University of Wisconsin in Madison (SN: 10/26/68, p. 411) will complete the first synthesis of a gene. And only last month, researchers succeeded in crystallizing transfer-RNA, ribonucleic acid—another essential carrier of genetic information, (SN: 1/4, p. 9). Crystallization will lead to determination of its structure, which will lead to synthesis.

COMBINATION ANTIBIOTICS

FDA moves against nine

Antibiotics suffer from the appellation of wonder drug. Patients have asked for, and doctors often have prescribed, antibiotics in almost every conceivable type of illness.

Recently this often indiscriminate use has come under serious questioning by some parts of the medical community, most noticeably those near the government. The first major action against antibiotics was taken earlier this year by the Food and Drug Administration against chloramphenicol (SN: 2/24/68, p. 184).

The FDA, saying the broad-spectrum antibiotic is both dangerous and far too freely prescribed, imposed label warnings on the drug and sent a "Dear Doctor" letter out to the nation's physicians warning of the danger of overuse.

The agency now plans action against nine other antibiotic-containing products, as a result of a review of the efficacy of some 3,000 drugs being carried out for the FDA by the National Academy of Sciences (SN: 2/17/68, p. 160). The review is the result of the Kefauver-Harris Drug Amendments of 1962.

These require that a drug placed on the market shall not only be safe (as previous law required) but also effective for the purposes advertised. The 3,000 drugs being checked by the NAS are those marketed since 1938 but before the amendments became effective.

Periodically throughout 1968 the FDA has announced plans to withdraw approval of drugs found ineffective by the review. With the exception of bioflavonoids, which caused a flurry in January, most of the drugs named are little used or obsolete. In fact, a spokesman for the drug industry said early in the proceedings, "When all is said and done, there are going to be some dogs taken off the market."

The spokesman may not have been thinking of the list of nine antibiotic combinations, however. These have been widely prescribed in the past decade and their makers have pushed them hard. Panalba, for instance, made by the Upjohn Co., has been the star of several full-page advertisements in recent issues of the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION.

The efficacy review panel has labeled as ineffective for their recommended purpose the following combination products:

- Achromycin Nasal Suspension, made by Lederle Laboratories. This product contains the antibiotic tetracycline, hydrocortisone and phenylephrine and is touted for nasal decongestion and the reduction of inflammation of the nasopharynx. Presumably the antibiotic is supposed to fight secondary bacterial infections which often accompany primary viral infections of the tract.
- Mysteclin-F, made by E. R. Squibb and Sons. This contains tetracycline and amphotericin B, the latter an antibiotic effective against some fungal infections. It is promoted for simultaneous control of a broad range of bacterial and fungal infections.
- Albamycin G.U. tablets by Upjohn, containing calcium novobiocin and the sulfa drug sulfamethizole, promoted for the treatment of urinary tract infection.
- Panalba capsules, Panalba half-