Rockefeller Institute's Peyton Rous isolated the first animal retrovirus in 1910. But it was not until 1978 that Gallo and colleagues found the first *human* retrovirus: Human T-cell Lymphotropic Virus, or HTLV-I, which sets off leukemia. In 1982, another carcinogenic retrovirus, HTLV-II, was identified. Then, in May 1983, Luc Montagnier and his associates at France's Pasteur Institute published details of a third human retrovirus, HTLV-III, now known to cause a then obscure illness: AIDS.

The link between retroviruses, cancer, and AIDS is only now being clarified, says Gallo. This much is known: HTLV-III attacks the immune system and the nervous system. Killing brain and spinal cells, it prompts symptoms akin to dementia and multiple sclerosis, plus a skin cancer, Kaposi's sarcoma. Neither AIDS nor cancer is a disease of any one group, says Gallo. Retroviruses are spread by "intimate contact," but "the form of contact seems to be less important than the contact itself."

How did retroviruses get going? No one knows. They seem to have emerged from Africa. HTLV-I has been spotted in the Caribbean, the Americas, and Japan. (Gallo speculates that Portuguese slave traders may have transported HTLV-I there during the 16th century.) HTLV-III, though, is a recent variant. Blood samples taken around the world as early as the 1950s show no sign of it—except in Africa. Somehow, during the 1970s, Gallo believes, HTLV-III spread to Haiti, Europe, and America.

Researchers are trying to develop retrovirus-fighters. One promising drug: Azidothymidine (AZT), an anticancer potion that blocks the action of HTLV-III on host cells.

RESOURCES & ENVIRONMENT

Why $1 Water?

"Water: Not as Cheap as You Think" by Peter Rogers, in *Technology Review* (Nov.-Dec. 1986), Massachusetts Institute of Technology, Room 10–140, Cambridge, Mass. 02139.

Samuel Taylor Coleridge's line about water everywhere without "any drop to drink" has meaning for landlubbers too. Worldwide, the yearly volume of rain, the source of "new" fresh water, is 126,000 cubic *miles*. But 78 percent of that falls at sea. Most of the rest is lost to evaporation or floods. Only 3,000 cubic miles winds up in rivers and reservoirs.

But demand for water is expanding, observes Rogers, professor of environmental engineering at Harvard. Some 86 percent of the world's rural population lacks adequate supplies. Saudi Arabia has built costly plants to desalinate seawater. China is considering a $20 billion dam to shunt irrigation water from the Yangtse to the Yellow River basin. The Soviet Union, though it has more rain than any country but Brazil, began an effort—since halted, mostly for cost reasons—to reverse the flow of three Siberian rivers to aid grain-growing in central Asia. All nations, Rogers argues, must move beyond "the common perception of water as a free and unlimited resource."

Agriculture is the top consumer; in the United States, farming absorbs

83 percent of the water supply. But irrigation is often wasteful. The flooding of fields common in many countries is reckless. Plants absorb only 30 percent of the water, while drip- and spray irrigation are 90 percent efficient. Rogers thinks that some arid nations should import food and focus on cash crops; cotton and tobacco can be produced with far less water than grain, which requires 2,000 to 3,000 tons of water per ton harvested.

Industry uses relatively little water, but it pollutes much more. Of the money that the United States spends on tending its water supplies, nearly 60 percent—$185 per person in 1979—goes to cleaning up waste water.

Rogers argues that waste would decline if fees were charged on water use, rather than just the cost of supply, as is common now. Most power plants pipe in and pump out huge amounts of river or lake water; a fee of, say, five cents per 1,000 gallons would encourage the use of recycling systems that reduce usage drastically. And studies show that people use less water as its cost rises. The typical U.S. water rate of $1 for 1,000 gallons is low; in 1983, residents of Frankfurt, West Germany, paid $2.82.

DDT Redux?

"TBT: An Environmental Dilemma" by Edward D. Goldberg, in *Environment* (Oct. 1986), 4000 Albemarle St. N.W., Washington, D.C. 20016.

TBT, which stands for tributyl tin, is one of the most effective pesticides ever devised for preventing algae, barnacles, and other organisms from clinging to the hulls of ships and slowing them down.

Derived from organotin, a family of compounds used in making bottles, film, and fungicides, TBT is mixed with the paint that coats ship bottoms. It remains effective for seven years, more than three times as long as less toxic copper-based protective paints. The result: lower fuel and upkeep costs. The U.S. Navy reckons that TBT could save it $150 million a year.

Yet TBT, warns Goldberg, an oceanographer with the Scripps Institution in La Jolla, Calif., includes "probably the most toxic compounds ever *deliberately* introduced by societies into natural waters." Britain and France restricted TBT use after discovering that the malformed shells and high mortality rates of several oyster populations were caused by high TBT levels in seawater. British scientists have proposed 20 ppt (parts per trillion) as an acceptable level. But researchers in North America have found TBT in much higher concentrations—such as 150 ppt in the Detroit and St. Clair rivers and 500 ppt at San Francisco's Antioch Marina.

The author finds parallels between TBT and the "miracle" insecticide of the 1930s, DDT. As with DDT, TBT often kills "nontargeted" organisms—e.g., shrimp and mollusks—while targeted ones build up resistance to it. True, TBT is quicker to "biodegrade" than DDT, and has not yet been found to be harmful to humans, who may touch TBT-treated hulls or swim nearby. For this reason, the Environmental Protection Agency is expected to recommend reducing, rather than eliminating, TBT's presence in U.S. waters. But such a step, argues Goldberg, won't suffice. DDT, he warns, was only banned *after* the full extent of its perils became "too evident" to ignore.