POLYWATER CONTROVERSY

Doubters and Deryagin

Anomalous water, polywater and now water II are the names given to a strange substance that appears when water vapor condenses in minute capillary tubes (SN: 3/21, p. 287). The substance has a viscosity between that of molasses and that of heavy motor oil. It is denser than ordinary water, and it does not freeze.

Water II was first reported in 1962 by a Russian chemist, Dr. N. N. Fedyakin. It has been a bone of controversy ever since. Some of the chemists who have worked with it say it is an unusual molecular form of water, a polymer made of water molecules; some say it is a mixture or compound of impurities leached from the capillary surface by the condensing water vapor; many will not commit themselves.

The arguments got an airing last week at Lehigh University in Bethlehem, Pa., at a symposium during the meeting of the American Chemical Society's Division of Colloid and Surface Chemistry.

Very much a proponent of an unusual form of water is Dr. Boris V. Deryagin of the Institute of Surface Chemistry of the Soviet Academy of Sciences. He reported at Bethlehem that he had distilled a column of water II, heated the vapor to 800 degrees C. and recondensed it. The recondensed water II showed the same characteristics as before evaporation, and he takes this as evidence for an unusual molecular form of water that is highly stable.

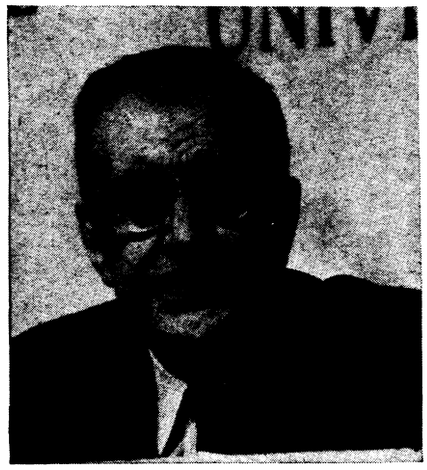
Dr. Deryagin contends that experiments with highly pure equipment show that the properties exhibited by anomalous water cannot be attributed to impurities. When questioners point out that others get the opposite result, he replies, "I can't be responsible for results that are bad and not by us." He insists that if other experiments were as clean as his, they would get the same result. If impurities are present in the equipment, he says, they will turn up in the anomalous water. American experimenters concede that their experiments are not as clean as Dr. Deryagin's.

On the negative side is Dr. Dennis L. Rousseau of Bell Telephone Laboratories at Murray Hill, N.J., who concludes, "I do not believe there is sufficient evidence to justify a polymer of water."

As a test for the existence of the polymer he made anomalous water with heavy water or deuterium oxide. A polymer of deuterium oxide should have a different structure from the polymer of hydrogen oxide, he says. And because of the structural difference, a polymer of deuterium oxide should absorb infrared frequencies other than those absorbed by a polymer of hydrogen oxide. But the infrared absorption by samples of anomalous water and anomalous heavy water turn out the same, he says. This would indicate that whatever is there is not a water polymer.

Further support for the impurity argument is provided by Dr. Robert Davis of Purdue University. Dr. Davis, who worked with Dr. Rousseau and Dr. Robert Board of Hewlett Packard, used an analytical technique called electron spectroscopic chemical analysis to determine that 15 samples of anomalous water were composed mainly of sodium, potassium, sulfate, nitrate, chloride, carbonate, borates and silicates. The impurities came out to be more than 95 percent of the samples.

Another negative judgment is entered by a group from the University of Bristol in England, Drs. D. H. Everett, J. M. Haynes and P. J. McElroy. They conclude that the thermal properties of anomalous water are all consistent with those of a solution of ordinary water and silica gels that could have been formed by water reacting with the tube surface. After this, says Dr. McElroy, "we wonder about some of the other unusual properties of anomalous water that are used to define it."



Lehigh Univ.

Deryagin: Clean experiments needed.

A major problem in determining the properties unequivocally is that samples of anomalous water are small, a few micrograms or milligrams. Experimenters tend to make their own, and sometimes disagree on whether a colleague has been using genuine material.

Says one of the men who introduced the word polywater, Dr. Ellis Lippincott of the University of Maryland, "If credibility is to be maintained, we must come up with a sample that you can show people and that will have definite properties." And Dr. Robert R. Stromberg of the National Bureau of Standards sums up: "With the evidence we had, we started out believing that water forms a polymer. New evidence casts serious doubt." □

BIOSPACE STUDIES

Man the experimenter

Among the unknowns associated with space travel, the most crucial have to do with man himself and the space environment's biological effects on him. Many physical responses to this weightless state can and have been measured, such as blood-cell anomalies and bodily weight and bone-density losses.

Whereas space scientists do not claim to understand completely all of the causes of these phenomena, the fact that astronauts recover with no apparent long-term effects has led the space agency to proceed confidently with longer space flights.

One phenomenon about which they are less confident, however, is the penetration of human cells by high-energy particles of high atomic number (SN: 5/30, p. 523).

It is generally accepted that when these HZE particles penetrate human tissue they damage the cells; nonregenerative cells, such as those of the central nervous system, are destroyed. The major handicap in getting factual data concerning the phenomenon is that these particles are unique to the space environment and can be produced on earth only by a special type of accelerator, which at best would not be available for human tissue studies for five years.

In lieu of experiments with this kind of machine, or actual space research, scientists have flown animals in balloon flights to the top of the earth's atmosphere, where HZE particles are present; but the incident rate at those altitudes is only one-sixth of that of free space outside of the earth's magnetic field.

Several such experiments were flown in the early 1960's. One carried black mice to the top of the atmosphere. As a result of the flight the mice produced gray hairs, consistent with one theory that galactic-ray particles inactivate melanin-producing cells in hair follicles.

In 1962 monkeys were flown in a similar experiment, although the purpose of the flight was not at that time

aimed at research on possible brain damage caused by radiation.

Nevertheless, the brains were preserved and kept, and during the past year they have undergone analysis by a team of neurologists at NASA's Ames Research Center, Moffett Field, Calif. Thousands of sections of these monkey brains have been examined by Dr. Webb Haymaker, chief scientist of the life science department at Ames, along with Drs. Orville T. Bailey of the University of Illinois, Steve Vogel of Duke University, Wolfgang Zeman of the University of Indiana and Eugene Benton of the University of San Francisco.

The neurologists proposed to determine how many of the HZE particles stopped in the brain, and if any of these could be found. Photographic emulsions over the heads of the primates had recorded all cosmic rays hitting the head, but the trajectory of these particles was not followed into the cell. This complicated the determination as to what effects had been actually caused by these particles.

The results, according to Dr. Haymaker, showed that a large number of these particles did terminate in the brain. The four scientists found pathological changes in the primate brain cells as well as evidences of change to nerve tissue and blood tissue.

Charles A. Wilson, project manager of the Biosatellite Program at Ames, described the situation as a statistical problem. Of the 1,400 or so cubic millimeters in the brain only a small portion are actually control center areas. Sooner or later, however, Wilson says, one of these particles could hit a critical place that could cause functional damage.

The data collected were presented in early June to a radio biological panel that met at Ames. The problem facing the group of scientists now, says Dr. Haymaker, is how to interpret the changes that were found. The panel is now evaluating the findings and examining the variables to determine whether the data justify further investigation or more monkey balloon flights.

At present, however, there are no plans at NASA for experiments involving primates. Dr. Ross Adey, the UCLA researcher whose Biosat monkey Bonnie died last July after a few days in space (SN: 7/19/69, p. 46), is presently doing a post-mortem on the monkey's brain for evidence of HZE particles. The next project of any kind with bioexperiments aboard will be Skylab in 1972, and those will involve only pocket mice and drosophila flies.

As Maj. Gen. J. W. Humphreys Jr. of the Office of Manned Space Flight summed up the official NASA view during Congressional hearings last year: "I think in the final definition man is the test animal." □

CYCLAMATES

Still on the block

One Saturday last October, former Health, Education and Welfare Secretary Robert H. Finch called a press conference to announce a total ban on cyclamates (SN: 10/25, p. 369). Though a battle over the safety of the artificial sweeteners had been raging for some time, the Secretary's categorical declaration seemed to come without warning. It settled the issue for about a month.

In late November, acting on the advice of an ad hoc committee working under Assistant Secretary for Health and Scientific Affairs Roger O. Egeberg, Finch modified his stand and the Food and Drug Administration, which regulates food additives, rewrote its rules accordingly (SN: 12/6, p. 524): The ban on cyclamates in beverages would stand but manufacturers would have until Sept. 1 to phase the sweeteners out of canned foods. Meanwhile, cyclamates would be reclassified from food additives to drugs and could be sold thereafter as over-the-counter, nonprescription drugs.

That is more or less where the matter stands at the present. But it is not standing still.

On two fronts changes are anticipated. One involves the fate of cyclamates themselves; the other the law that got them into trouble.

When the FDA ruled that cyclamates could be classified as drugs, it did so on the basis of the Egeberg committee's conclusion that they offer some medical benefit to diabetics and obese individuals who must avoid sugar. The presumption was that their benefits to these persons outweigh the risk of developing cancer that was raised last fall when scientists turned up evidence that massive doses of cyclamates produce bladder tumors in rats.

Within the scientific community, and within the FDA itself, there is considerable opposition to this presumption. FDA Commissioner Charles Edwards is convening a scientific review panel to evaluate old and new data on the subject. Its judgment is expected within three or four months and it is not unlikely that cyclamates will lose their over-the-counter drug status and that the total ban will be reinstituted.

Dr. Edwards has the support of Rep. L. H. Fountain (D-N.C.), who for years has been a gadfly to the FDA. Fountain wants to know what suddenly makes cyclamates drugs.

The law does not permit the casual reclassification of food additives as drugs, he told Dr. Edwards in a June 24 letter; neither the safety nor the efficacy of cyclamates as a drug has been established, and Fountain wants the total ban to be reimposed.

On the second front—the law that sustains the ban—action is not anticipated as soon. In banning cyclamates, Finch indicated that he did so reluctantly but that his hand was forced by the Delaney Amendment to the Food and Drug Act, a provision that flatly prohibits use of food additives that in any dosage cause cancer in any animals. Legislative aides at HEW recently drew up a revision to the Delaney Amendment, modifying its categorical nature by replacing a flat prohibition of cancer-causing additives with a provision allowing for maximum allowable tolerance levels. That raised complicated questions about what the safe limit of a carcinogenic agent is. At the same time, HEW and FDA are facing pressure from scientific organizations to expand the prohibition to bar chemicals that cause mutations and deformities in unborn children (SN: 3/28, p. 314).

Dissatisfied with the proposed Administration revisions to the Delaney Amendment, Dr. Edwards and other HEW officials have managed to table the issue for the time being. □

SHIPBUILDING

Return of the destroyer

They were called destroyers, and once they were the pride of the Navy. Fast, mobile warships, they sent enemy submarines scurrying for safety. But in the half-peace that followed World War II, the greyhounds of the ocean—except for piecemeal replacements—largely slept wrapped in memories and mothballs.

But that has suddenly changed. The Navy Department announced last week that it had awarded Litton Industries a $2.5 billion contract for the construction of 30 multipurpose destroyers. Although providing nowhere near the dozen-a-month figure of World War II, this contract marks the first destroyer construction program since the late 1950's. These ships, the first of which will be delivered in 1974, are expected to be the backbone of the Navy's destroyer fleet in the 1970's and beyond.

The ships will belong to a new class of multipurpose destroyer called the Spruance. They will be driven by gas turbine engines, making them the first major warships in the Navy to use this power source, which offers great mobility. In addition, the highly automated operation of the ships enables them to be run by 20 percent fewer personnel than present destroyers.

The main role for the ships will be antisubmarine warfare, but they will also be equipped to bombard shore installations and launch missiles.

All 30 ships will be built in one spot, Litton's Ingalls West facility at Pasca-