Artificial Blood

Artificial blood made of perfluorocarbons has already helped save the lives of 95 patients and holds even more promise for the future

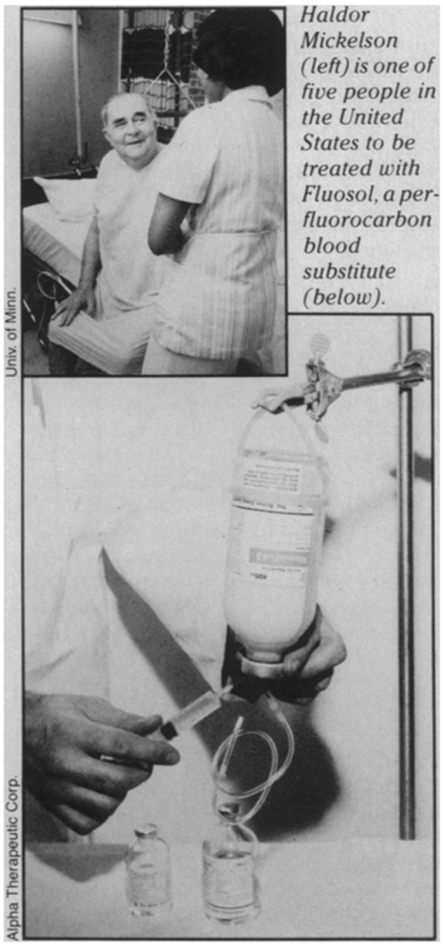
BY JOAN AREHART-TREICHEL

Life is full of ironies, and science is no exception. During World War II, for example, scientists working on the Manhattan Project explored many chemicals for separating uranium isotopes in order to make an atomic bomb. Finally they came across a class of compounds that worked: perfluorocarbons. Now, 40 years after the bomb was dropped, Japanese scientists have taken perfluorocarbons and turned them into something that is saving lives in the United States. The substance is artificial blood.

Artificial blood, researched and developed by Ryoidi Naito and his colleagues at the Green Cross Co. in Osaka, Japan, has already saved the lives of four patients in the United States and 91 in Japan, and it promises to save thousands more throughout the world in situations where natural blood is not readily available for transfusions. It will have uses during medical emergencies, natural disasters and wars as well as in rural areas and developing countries.

Although the story of artificial blood started with the atomic bomb, its next chapter actually did not occur until the mid 1960s when three U.S. scientists suggested that "perfluorocarbons might make a good artificial blood since they, like red blood cells, carry oxygen." The scientists who explored the idea were Leland Clark of Children's Hospital Research Foundation in Cincinnati, Robert Geyer of Harvard University Medical School and Henry Sloviter of the University of Pennsylvania Medical School (SN: 9/28/74, p. 202).

While traveling in Europe, Naito happened to read about some of these research efforts in a newspaper, and they greatly excited him. After visiting the United States to talk with Clark, Geyer and Sloviter about their research, he returned to Japan, where he and colleagues at Green Cross decided to undertake their own research on artificial blood. During the next 15 years they spent millions of dollars to test hundreds of perfluorocarbons on animals in order to find one that was both nontoxic and effective as an artificial blood. Finally they found one that looked good and named it Fluosol. In February 1979 Naito injected Fluosol into his own body and those of 10 associates to see what it would do. And as he hoped, it had no ill effects.



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Alpha Therapeutic Corp.

Haldor Mickelson (left) is one of five people in the United States to be treated with Fluosol, a perfluorocarbon blood substitute (below).

In April 1979 Fluosol received its first clinical use — in a Japanese man bleeding severely following prostate surgery. The artificial blood was used until blood of his particular type could be obtained for transfusions. Six similar clinical uses then followed in Japan, and last September Fluosol was used clinically for the first time in the United States — in a man bleeding severely following surgery, but whose religion (Jehovah's Witness) forbids blood transfusion on the basis that the Bible prohibits eating blood (SN: 12/8/79, p. 391). So far, artificial blood has helped save the lives of all but one of 96 patients, and autopsy attributed death not to the administration of artificial blood, but to a heart attack.

In this country, Fluosol was used under a U.S. Food and Drug Administration proviso called a "humanitarian investigational new drug," a clause that even many drug company officials are not aware of. In each instance, a physician had a patient who needed blood immediately, but who, for one reason or another, couldn't get a normal blood transfusion. So the physician contacted the hospital review board to see whether Fluosol might be used on the patient. If the review board gave approval, the physician contacted Alpha Therapeutic Corp. in South Pasadena, Calif., Green Cross's subsidiary in the United States. And if Alpha's medical directors felt that use of Fluosol was indicated, they contacted the FDA. If the FDA also agreed, an Alpha physician, physiologist or biologist would fly to the scene of the emergency and help administer Fluosol and maintain the patient on it. In most cases, the red tape surrounding the emergency treatment took no more than a few hours — contrary to the usual decade required to get a drug officially approved by the FDA for clinical use. "The FDA has been wonderfully cooperative in these situations," says Thomas C. Drees, Alpha's president.

The ultimate hope of Green Cross and the Alpha Therapeutic Corp., however, *is* to get Fluosol officially approved by the FDA for clinical use. But before this can happen, they have to have sound scientific data demonstrating that the drug is both effective and safe in special clinical situations. And to obtain such data, a formal clinical trial of Fluosol must be conducted at various U.S. medical centers. Drees and his colleagues at Alpha are now working on getting such a trial set up.

Provided Fluosol is found safe and effective in specific clinical situations, it would probably be approved by the FDA for blood transfusions when a patient needs oxygen-carrying red blood cells but cannot receive a transfusion of natural, packed red blood cells for one reason or another. Military surgeons, for instance, already have expressed great interest. Fluosol, however, would not be helpful to patients who need transfusions of white blood cells, albumin, hepatitis antibodies, hemophiliac factor or other blood components besides red blood cells.

Even assuming Fluosol is approved by the FDA, it probably will never constitute more than 20 to 30 percent of blood transfused in the United States, Drees estimates. The donations of natural blood to the Red Cross will continue to be very much needed. In fact, Drees says, Fluosol's greatest use will probably turn out to be not in the United States or in Japan, but in developing countries. □