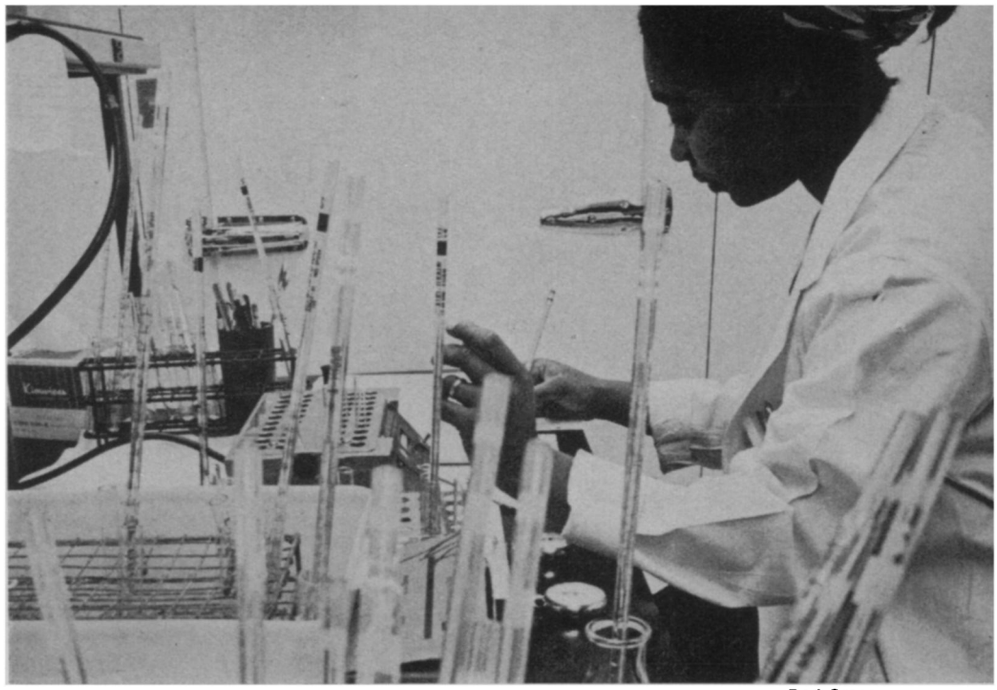
BLOOD

Taking the blood apart

A $1 million effort is underway to find blood components that will provide therapy in disease

by Faye Marley



Red Cross

Effect of blood fractions on clotting time being studied by Jane Hubbard.

In human blood, the parts may be larger than the whole. Already routinely split into some fractions, for a few purposes, blood will soon provide some 100 more, if the million-dollar research program of the Red Cross and the National Heart Institute is successful.

Each of those more-than-100 blood-derived medicines could be specific against a disease or a group of diseases.

While whole-blood therapy continues to be a vital tool in the doctor's bag, the trend now is toward blood components, says Dr. James Stengle, special assistant for the blood resources program of the National Heart Institute.

"One of the interests from the beginning," says Dr. Graham A. Jamieson, the Red Cross' assistant research director, "has been fibrinogen, the clotting factor in whole blood. Now we are turning our attention to research with other blood factors, such as the antihemophilic factor (AHF) VIII, which is in great need for bleeders."

Under present circumstances, it is estimated that adequate treatment of emergency bleeding and protection during surgery for all hemophiliacs would require one-fifth of the blood collections throughout the world. Dr. Alan Johnson, head of the branch laboratory operating at New York University-Bellevue Hospital in New York, is testing Red Cross-purified AHF in humans in the hope that hemophiliacs, like diabetics, may soon be able to carry their own injections with them.

Antihemophilic blood could be carried in a container about the size of a fountain pen. A bleeder then could rapidly convert himself into a nonbleeder, at need, with a simple injection. Recently, such a blood factor was cleared for distribution—but it keeps only a few days without refrigeration.

Many diseases, hopefully, can be helped by this kind of approach. Christmas disease, for example, is hard to distinguish from hemophilia. It is attributable to a deficiency of factor IX (plasma thromboplastin component), and transmitted to males by a sex-linked gene.

Another is Von Willebrandt's disease, a vascular hemophilia. It is characterized by a long bleeding time and deficiency of hemophilic factor VIII. It occurs as frequently in women as in men, with copious bleeding during menstruation and after childbirth.

Parahemophilia, a familial bleeding disorder affecting both sexes, is caused by a deficiency of factor V (proaccelerin). During surgery or when abnormal bleeding is sufficiently severe to justify transfusion, fresh blood or plasma should be given in amounts adequate to maintain the plasma level of factor V at about 25 percent of normal.

Congenital deficiency of factor VII (proconvertin) affects both sexes. Large volumes of plasma are needed for effective treatment because of the rapid disappearance of this factor from the circulation.

Stuart disease, a rare congenital disorder of blood coagulation, is characterized by deficiency of factor X. Bleeding can be controlled by plasma transfusion. Factor II (prothrombin) is being studied because it is the key agent in coagulation and is involved also in cirrhosis of the liver as well as in other disorders.

The National Cancer Institute played a major role in platelet research.

Platelets have, at present, shelf life of only four to six hours, but research looks to improve the quality of platelet concentrates. An acidification process has been developed that provides platelet preparation without injury to the plasma. And clinical testing is now going on in Red Cross laboratories to see if a new method, eliminating the need for acidification, adequately controls the temperature of the concentrate after plasma removal.

Plasma, the fluid portion of blood, transports all the nutrients needed throughout the body. In addition to red cells, white cells and platelets, the plasma carries a number of proteins, each with specific functions. Some general categories of these proteins are enzymes, hormones, immunoglobulins, blood-clotting factors, fibrinolytic factors (which dissolve blood clots) and metalloproteins for transporting essential metals such as iron.

Classic plasma fractionation provides only three proteins for routine treatment of patients: albumin, gamma globulin and fibrinogen. These useful blood products can be fractionated in higher yield and purity by new laboratory methods. New fractionation techniques are being developed for preparing some of the other proteins.

One of the major problems in transfusions has been the transmission of hepatitis by blood and its components. During the past year a transferable substance has been found in the blood and serum of patients with infectious hepatitis that suppresses the common mode of cell reproduction and causes chromosome abnormalities. This phenomenon is being studied to determine what this factor is and to develop a simple technique of determining its presence so it can be used in mass screening for hepatitis in blood banks.