In blood taken straight from the refrigerator and transfused within, say, three hours, bact ria will not have time to multiply to a serious degree but blood which is allowed to stand at room temperature or which is w rmed or is given as a long slow transfusion is potentially dangerous. Bottles should be removed from the blood bank singly and just before they are to be used.

The patient who has received infected blood becomes very ill very quickly, with intense flushing of the face, severe headache, vomiting, diarrhœa, pain in the chest and profound hypotension. A few patients have recovered but the majority succumb within twelve to forty-eight hours in spite of prompt treatment by vasopressor drugs and antibiotics. In many cases death is probably due to toxæmia rather than to bacteriæmia. The residual donor blood and the patient's blood should be cultured. If no bacteria grow the accident was not due to infected blood; if some organisms are found they may have been present in the transfusion bottle or might have been introduced later; if gross cont mination is found and the patient's condition ran a classical course it is probable that the blood transfused was infected.

TRANSMISSION OF DISEASE

Homologous serum hepatitis.—The development of homologous serum hepatitis is a hazard which besets rather less than one per cent. of recipients of whole blood or small-pool plasma (Medical Research Council, 1954). It is caused by the transmission of a virus from a carrier donor to a susceptible patient. The donor is probably not aware that he is a carrier, he gives no history of ever having had infective hepatitis himself (otherwise he would have been excluded from the donor panel) and no single test or battery of liver function tests has yet been devised which will reliably distinguish carriers of the virus from normal subjects.

Recipients vary in their susceptibility. It has been found that a minute fraction of a millilitre of virus-laden blood was enough to cause hepatitis (Murray, 1955) and it was for this reason that the production of large-pool plasma, made from the contributions of more than 300 donors, was abandoned in favour of limited pools derived from not more than ten donors.

Some patients suffer no upset from the transmitted virus, some may have only a transient liver dysfunction with or without jaundice and yet others may develop a rapidly fatal hepatic necrosis. The incubation period of infective hepatitis is about 20 to 40 days whereas that of homologous serum hepatitis is 40 to 160 days. Attempts have been made to find a means of killing the virus in the blood without damaging the plasma proteins, such as exposure to ultra-violet light, addition of chemicals or the storage of liquid plasma at room temperature for six months before use, but none of these methods has proved wholly satisfactory.

Malaria.—People who have had malaria, particularly of the malignant tertian variety due to *P. falciparum*, or who have lived in a country where malaria is endemic, may harbour the parasites in their blood for many years.

The parasites are carried in the red cells and they can survive blood-bank temperatures for at least two weeks (Grant *et al.*, 1960). When such people offer their services as blood donors in countries where malarial infection is not endemic the red cells of the donation are discarded and only the plasma is used. In spite of these precautions malaria has occasionally been accidentally transmitted by transfusion even when the parasites were so few in number that only after a prolonged search of the donor's blood film was one found. If the clinician is alive to the possibility that a spiky pyrexia following transfusion may be due to malaria he can curtail the development of the infection by prompt treatment with antimalarial drugs.

Syphilis.—In order to prevent the spread of syphilis by transfusion it is standard practice to test blood from every donation by one or other of the serological techniques generally acknowledged to be reliable, such as the Kahn, Wassermann or Meinicke tests. Although serological tests will pick up the one true positive in, say, 20,000 donations they are not a complete safeguard against infection by blood from a donor in the early stages of primary syphilis before the serological reactions become positive. Spirochætes, however, cannot survive at the blood-bank temperatures of 2° to 6°C. for more than three or four days (Kolmer and Rule, 1942) and since most of the blood used in hospitals has been stored for longer than this before use the risk is negligible. When ordering fresh blood for transfusion the clinician should bear in mind that one of his shields which prevents the transmission of infection is absent. In the rare event that blood containing spirochætes has been given, the first sign in the recipient is likely to be a typical secondary stage rash developing about ten weeks after the transfusion.

CITRATE AND POTASSIUM POISONING

When large amounts of stored blood are given rapidly to a patient with poor liver function, changes in blood chemistry occur which affect the heart muscle and may cause death by cardiac arrest. The toxicity may in some instances be attributable mainly to an excess of citrate and in other cases to a high plasma potassium concentration but, as shown by Taylor and his colleagues (1961), when a combination of both high levels exists the effects can be extremely serious.

Toxic effects leading to skeletal muscle tremors and lengthening of ST or QT segments in the electrocardiogram may arise when the plasma citrate level reaches 100 mg./100 ml., as can happen during exchange transfusions to the newborn or when, say, 10 pints (5.5 litres) of blood are administered at a rapid rate (a bottle in two minutes) to an adult. The giving by injection into a site other than that used for transfusion of 10 ml. of 10 per cent. calcium gluconate to the adult patient (or a proportionally smaller amount to an infant) will abolish the changes due to the citrate. The dose may have to be repeated after every second bottle if the transfusion is prolonged.

In freshly shed blood the red cells contain about 100 mEq. of potassium per litre of packed cells but the level in the plasma is only about 5 mEq. per