case history of a well documented former blood donor who has been a healthy carrier for more than 20 years.

In high prevalence areas, for example in tropical countries, the antigen is detected in individuals of all ages, most frequently in children. The prevalence of antigen in Caucasians living in some tropical areas is higher than those in temperate zones yet it is considerably lower than in the indigenous population. In all regions the antigen is reported to be more frequent in males than in females and in urban than in rural communities. The universal problem which the carrier state poses to blood transfusion and other medical services, to morbidity from liver disease and to health in general, requires no elaboration. Yet the mechanisms leading to the formation of the carrier state are little known.

In a recent study by Gerety and his colleagues (*J. Pediat.*, **84,** 661; 1974), paired samples of serum from 200 children in the United States and 1,165 children from Upper Volta in West Africa and from two Pacific islands (Guam and Tol, Truk Islands) were tested for hepatitis B antigen by radioimmunoassay and for the homologous antibody by passive haemagglutination. The antigen was not detected in any of 100 normal children in the United States but it was found in 5% of 100 children resident in institutions in that country. The antigen was found in 2–10.9% of sera from normal children from overseas. Hepatitis B antibody was not detected in normal American children, but it was present in 9% of American children in institutions, 3% in Guam, 20.3% in Tol and 7% in Upper Volta.

Gerety *et al.* calculated the 'per cent. carriers' according to the formula: antigen carriers/infected group × 100, where the infected group is defined as children with hepatitis B antigen or antibody, or both. The figures obtained were nil for normal American children, 35.7% for children in institutions, 40% for children in Guam, 35.2% for children in Tol and 28.6% in Upper Volta. The respective figure for American adults, calculated from published reports, is 1.8–3.5%.

Several different mechanisms may predispose to persistent carriage of hepatitis B antigen. It has been suggested that the establishment of a complete or at least a partial immunological tolerance to this antigen is the most likely explanation. A relative immune deficiency, associated with slow maturation of cellular immunity in newborn infants, is one possibility. This mechanism may play an important part in carriers resulting from vertical transmission of hepatitis B virus (*Nature*, **249,** 105; 1974). Gerety and associates (*loc. cit.*) found, however, that the risk of becoming an antigen carrier seemed to be uniform among children ranging in age from 1 month to 15 years. They considered that factors of exposure such as the route and amount of virus may contribute to the disparate chronic infection rates between children and adults. For example, means of transmission of low dose of virus in children, other than by direct skin penetration, might influence the severity of the infection and the immune response, favouring the development of the carrier state, but the available information is incomplete. An intensive immune response may be essential for the elimination of the virus and the prevention of the establishment of an equilibrium between the host and the infecting agent. There are reports in the literature which suggest that adults seem to become carriers more frequently after a mild attack of hepatitis (Barker and Murrey, *J. Am. med. Ass.*, **216,** 1970; 1971; Aach *et al.*, *Proc. natn. Acad. Sci. U.S.A.*, **68,** 1656; 1971; Gocke, *J. Am. med. Ass.*, **219,** 1165; 1972). And, in general, children experience a milder disease with many subclinical infections.

Carriage of hepatitis B antigen has been consistently reported to be more frequent in males than in females and evidence has been obtained which indicated sex as an independent primary variable factor responsible for a higher prevalence of the antigen in males than in females. Washburn and colleagues (*Pediatrics*, **35,** 57; 1965) studied the sex difference in susceptibility to a number of infections. A significant preponderance of males was found and this was most marked in infancy. The sex difference in susceptibility was postulated to be consistent with a gene locus on the X chromosome which is involved in the synthesis of immunoglobulins. Small differences in the amounts or rates of synthesis of antibody might be responsible for a slightly greater susceptibility to infection among members of one sex. Gerety and his colleagues found that the likelihood of the development of the carrier state in the groups of children they studied did not seem to correlate with the sex or with the geographical origin of the children or with the subtype of hepatitis B virus. What the results did show clearly was that children became presistent carriers more frequently after infection with hepatitis B virus than adults in the United States.

Channelled scablands of Washington

THIS picture shows part of the 40,000 km² 'channelled scablands' of eastern Washington, and is from a new booklet produced by the US Geological Survey (*The Channeled Scablands of Eastern Washington*, US Government Printing Office, Washington DC, 1974, 65c). The geological events leading to the formation of this unique landscape began during the Miocene with the extrusion of up to 3,000 m of basalt lava flows which later tilted and warped and acquired a 30–60 m cover of loess. Then beginning about 100,000 years ago ice lobes from the northern hemisphere glaciation encroached on the lava field, damming rivers with glacial ice and debris and forming large lakes. Finally, 10,000–20,000 years ago the dam containing the largest lake broke and more than 2,000 km³ of water and debris were released within a day or two, carving the surface as observed today.

P.J.S.