continued. If the angular velocity of the container is further increased, however, then it may become energetically favourable for one or more vortex lines to appear in the liquid. Each of these consists of a narrow core, oriented parallel to the container's axis of rotation, and around which the helium flows with a tangential velocity which is inversely proportional to the distance *r* from the core. The strength, known as the circulation, of each vortex is quantised in units of h/m where h is Planck's constant and m the mass of a helium atom but, so far, only singly quantised vortices have ever been detected.

Arguments based on minimising the total energy suggest that a single vortex line in a smooth container will lie along the axis of rotation, that two vortices will circle around each other under influence of their mutual flow fields, and that larger numbers of vortices will form a hexagonal lattice rotating with the container. But the recent elegant photographic experiments of Packard and Sanders (*Phys. Rev. Lett.*, **33**, 280; 1974) have shown that this does not seem to be the case in practice: the vortex cores seemed to be arranged in no definite pattern and indeed to wander aimlessly relative to the container while still presumably remaining parallel to its rotational axis.

The MIT group employed a container with a pair of definite pinning centres, designed to detect the appearance of a single vortex. The helium was contained in a 2.5 mm diameter cylinder at each end of which, positioned on the axis, was a needle, the two points being separated by about 5 mm. There were two reasons why it was expected that the first vortex would form between the needle points: first, even in a flat-ended container, a single vortex minimises its energy by being on the axis of rotation; and, second, by spanning the space between the needles, the vortex could be shorter, and thus of lower energy, than in any other feasible position. To detect the formation of a vortex line, one of the needles was used as a field emitter, injecting electrons into the liquid, while the other acted as a collecting electrode. Because vortex lines are able to trap and hold electrons, it was hoped that there would be a sudden change in the collector current when the vortex appeared.

As the rotational speed of the chamber was gradually increased from zero, a discontinuous decrease in the collector current was indeed observed, and it occurred at approximately the expected angular velocity. Although the mechanism responsible for the fall in collector current is still not understood in detail, the authors ascribe the phenomenon to the formation of a singly quantised vortex line strung between the two needles. If they are right, then it will be the first time that a pinned vortex, long a familiar concept in connection with superconductors, has been observed in superfluid helium.

A particularly interesting suggestion by the MIT group is the possibility of using the same apparatus to search for a vortex line having two or more quanta of circulation. They argue that, if the separation of the needles is considerably less than the length of the chamber then, as the rotational speed is increased, it must be energetically preferable to add more quanta of circulation to the existing pinned vortex rather than creating further singly quantised lines which would have to span the whole length of the cylinder. Their preliminary attempts to detect such a double-strength vortex have been unsuccessful. This is perhaps because of the randomly orientated tangles of vortex lines which are believed to be generated by electrons in the large electric field close to a field emitter and which would be likely to interfere with the stability of the main, rotationally created, vortex. If this effect can be suppressed, however, perhaps by conducting the experiment under pressure when it is known that electrons have much less tendency to create vortex lines, some interesting new phenomena may be anticipated.

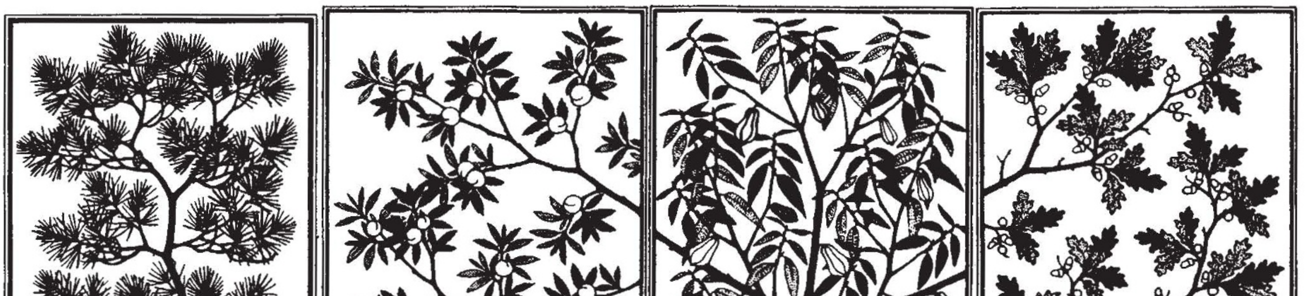
On the trail of epidemic hepatitis

from Arie J. Zuckerman

INFECTIOUS or epidemic hepatitis, now referred to as hepatitis type A, remains a major public health problem, occurring endemically in all parts of the world with frequent reports of small and large epidemics. Spread is usually by person to person contact and major outbreaks result most frequently from the faecal contamination of water and food. Subclinical cases are common; the disease has in general a low mortality but patients may at times be incapacitated for many weeks or months. Further general information on transmission experiments to human volunteers and studies in non-human primates may be found in a recent WHO report (*Viral Hepatitis: Report of a WHO Scientific Group; Techn. Rep. Ser.*, **512;** 1973).

The discovery of the association between an antigen found in blood and hepatitis type B (serum hepatitis) has prompted efforts to find a similar antigenic marker in patients with hepatitis type A. To date, a specific serum antigen has not been found but examination by immune electron microscopy of faecal extracts prepared from patients with acute hepatitis A yielded interesting results. An antigen was detected by immunodiffusion in faecal extracts from about 50% of patients admitted to hospital in Australia with hepatitis A and in only 2% of control patients (Ferris *et al., Lancet*, **ii**, 243; 1970). Antigenic activity was associated with two types of particles measuring 15–25 nm and 40–45 nm in diameter. Animal antisera to this faecal antigen yielded encouraging results but also a number of non-specific reactions, and studies are currently in progress with antisera with improved specificity.

In December 1973, virus-like particles measuring 27 nm in diameter were demonstrated by immune electron microscopy in faecal extracts obtained from 2 out of 4 adult volunteers who were infected by injection or by



Painted panels from the ceiling of the Natural History Museum, London. According to *The British Architect and Northern Engineer* of June 1878 "the chief idea . . . is that of growth". Left to right: Scots pine *Pinus sylvestris*; peach *Amygdalus persica*; cacao *Theobroma cacao;* English oak *Quercus robur.*