news and views

Recurrent Mach

A STUDENT of the science of science might find it entertaining to try to discover what it is that reawakens interest in Mach's principle every three or four years, why each ingenious suggestion on the subject has almost no effect upon any subsequent ingenious suggestion—except possibly to stimulate the attempt to be more ingenious—and above all why nobody ever actually states Mach's principle. All of which points seem to be instructively illustrated by the article "Relative-distance Machian Theories" by Barbour in this issue of *Nature*. It does seem to be a few years since at any rate *Nature* carried a contribution on the subject: Barbour's suggestion is ingenious and it does not make use of any previous work; he starts from an assertion of something that "Mach's principle, in essence, requires", and he proceeds to treat this requirement itself as a "postulate". But, once again, no statement of Mach's principle! And there never can be a statement of Mach's principle until somebody discloses that Mach actually stated a principle, and in fact nobody has done this. Mach discussed this problem of inertia in a general way, and he seems to have had some idea that inertia depends upon matter in the Universe in the large. But anybody who wants to go further does have to state his own "postulate" because Mach does not help him.

Inertia in the technical sense is a notion of Newtonian physics. Before Newton, the systems of Ptolemy, Copernicus and Kepler each treated a whole Universe—in a very simplified way, of course. Wonderful as they were, they were arid when it came to solving any new problem. Newton came along and said, in effect, that we can break the Universe up—divide and conquer; we may take any small part of the Universe and assert that a frame of reference exists such that the part obeys laws of motion which take certain forms (Newton's laws as usually stated) when this frame is used. The frame of reference—any inertial frame will serve— is the rest of the Universe in the model. Incidentally, it can be seen at once why the Newtonian treatment cannot apply strictly to the whole Universe, because the treatment depends upon this partition of the Universe, Then Mach came along and, so to say working from the opposite end, redetected what Newton had done. From one point of view, it was no great achievement to suggest that an inertial frame might have something to do with the Universe in the large, when all the time the inertial frame is the Universe in the large. From another point of view, Mach did something great in making people wonder why the Newtonian treatment is so successful. People are still wondering about this, and Barbour's paper is an obviously interesting endeavour to push it back to more rudimentary postulates. It might be inappropriate here to discuss details, since he remarks that he is preparing a paper on a different model with more interesting properties.

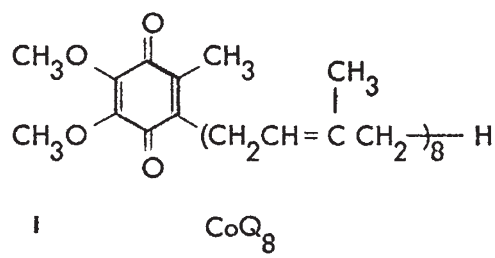
There is still the general question as to whether such ideas carry over into relativistic models. Barbour evidently believes that his treatment will extend to special relativity; this would be natural, for special relativity also is founded upon the use of inertial frames. It is outside his present scope to say much about general relativity. In general relativity, however, every problem produces an entire universe (in general, not an interesting one); so there is no Newtonian partition and therefore Mach's problem does not arise in the same way. Some writers have indeed, produced sophisticated criteria as to whether any particular general relativity model is "Machian" or not, but this seems to be somewhat far from Barbour's interpretation of "Machian".

W. H. McCREA

Possible new antimalarial drugs

ALTHOUGH it is well established that malaria parasites inside host red blood cells utilise glucose, the extent to which this process provides the parasites with energy has been little explored. One of the technical problems hindering such an investigation was the difficulty of distinguishing between the biochemical processes of the intracellular parasite and those of the host cell. Until recently much effort was directed towards separating the parasite from host erythrocytes and from other cellular blood elements, particularly white cells and platelets, the activities of which could invalidate biochemical assays of, for example, oxygen consumption and the action of classical metabolic inhibitors. Homewood and her colleagues (*Proc. helminth. Soc. Wash.*, **39** (special issue), 382; 1972), have utilised a technique based on the observation that the pigment of erythrocytic stages of the rodent malaria parasite *Plasmodium berghei*, clumps when exposed to a low concentration of chloroquine, and that this process is dependent on energy (Warhurst and Robinson, *Trans. R. Soc. trop. Med. Hyg.*, **65**, 11; 1971). From a study of the action of various respiratory inhibitors on pigment clumping induced by chloroquine, Homewood and her colleagues postulated that these parasites possess a very unusual, branched electron transport chain. The major branch, they suggested, terminates in an unidentified acceptor of parasite origin, and they believe that the minor branch passes electrons finally to oxygen by way of a cyanide-sensitive cytochrome oxidase system.

There is now good evidence to show that the erythrocytic stages of a variety of *Plasmodium* species, including *P. berghei*, do indeed contain cytochrome oxidase (mainly in the mitochondria). and that the enzyme occurs also in the mosquito and pre-erythrocytic liver stages (Howells *et al.*, in *Comparative Biochemistry of Parasites*, Academic, London and New York, 1972). The idea that electron transport mechanisms may play a vital part in the malaria parasite has now been exploited by Wan, Porter and Folkers (*Proc. natn. Acad. Sci. U.S.A.*, **71**, 952; 1974) who have synthesised a series of structural analogues of coenzyme Q_8 (I).



I CoQ_8

During the Second World War antimalarial drug screening