NEWS AND VIEWS

Accelerators for the Seventies?

HIGH-ENERGY physicists are almost as dismayed as the governments which support them by the high costs of making particle accelerators, which is a part of the reason why there is at present great interest in the kinds of accelerators called collective ion accelerators. On the face of things there is at least a possibility that this new technique may eventually lead to the design of simpler and even cheaper particle accelerators. To be sure, there is not the slightest prospect that collective ion accelerators will allow European governments to shelve the awkward question of whether or not to contribute towards the 300 GeV accelerator that Cern is anxious to build. At this stage, indeed, nobody can be sure that schemes like these can ever justify the enthusiasm which they have stimulated in many places. By all accounts, however, the symposium on the subject at Berkeley the week before last showed that these developments are too valuable to be ignored.

The new proposals turn on the way in which, in the presence of a sufficiently strong magnetic field, it is possible to embed large numbers of protons in an organized cloud which consists of a still larger number of electrons. Doing this is simple enough, given the availability of some of the techniques which have come into fashion in plasma physics. A toroidal ring of 10^{13} electrons with linear dimensions of the order of a metre can be loaded with protons simply by the intervention of hydrogen gas. It seems usually to be assumed that there will be one proton for every hundred electrons or so. The large ring can then be contracted into a more manageable one a few centimetres across, and the result is an electrified object, a charge to mass ratio which is for practical purposes the same as that of an electron—with the understanding that the mass is the relativistic mass of the electrons moving within the torus, possibly with an energy of 20 MeV or so. The result is that, when an electron lump like this is stripped of its electrons—which is, by all accounts, all too easy to accomplish—the protons which are left have individual energies which are greater than those which would have been acquired by electrons in the same circumstances in the ratio of the mass of the proton to that of the relativistic electrons within the lump—a factor of forty or thereabouts.

The first practical suggestion for using these electrified objects as fodder for a linear accelerator seems to have been made by the Russian group at Dubna, which described some of its ideas at a conference of techniques for particle accelerators at the Massachusetts Institute of Technology last September. The notion seems to have been taken up with great enthusiasm, particularly at Berkeley, still then mourning the loss of its scheme for a 200 GeV proton synchrotron to Weston in Illinois. The recent symposium there was preceded by a working party which spent two weeks on detailed discussion of possible realizations of the principle, and which seems to have confirmed the mood of watchful optimism which prevailed before. Thus it does appear that it should be possible to accelerate electron lumps along the axis of a linear accelerator in such a way as to give the protons which they contain about 1 MeV of energy for each centimetre length, which is a handsome promise. On the other side of the balance sheet, however, are several snags. The meeting at Berkeley has, for example, drawn attention to the very large amounts of power that would be needed to keep an accelerating machine in operation. There are also potential problems in the maintenance of a magnetic field along the axis of the accelerator. And potential users of machines like this are quick to point out that pulses of fast particles which last for a nanosecond or thereabouts would not bring much joy to those among the conventional machine builders who spend much of their time seeking ways of flattening the much longer pulses of particles which are now available from accelerating machines so as to make more efficient use of them. Clearly there is a great deal to be done before anybody will be able to face any government with a request for money.

How Immortal are Amoebae?

from our Microbiology Correspondent

ONE of the most intriguing questions posed to biologists concerns the life span of cells and how this defined period of viability is controlled. Data are accumulating on the differential life spans of cells in animal bodies and, in a few instances, this conclusion is being corroborated by studies of animal cell cultures. Hayflick (*Exp. Cell Res.*, **37**, 614; 1965), for example, showed that human foetal lung cells had a life span equivalent to a doubling potential of 50 ± 10, whereas cell lines derived from adult lung had a significantly lower doubling potential. The presence of a latent virus, mycoplasma or the nature of the growth medium did not account for this finite life-time.

For a number of years, Danielli has been investigating the life span phenomenon in *Amoeba*. Clones of *A. proteus* and *A. discoides* were reported to have apparent immortality when cultured with an unlimited supply of *Tetrahymena* as food organism, but after a period of culture on maintenance diet a defined life span was induced. Further analysis of the "immortal" and "spanned" states in *A. proteus* has been directed towards elucidating the control of this switch phenomenon (Muggleton and Danielli, *Exp. Cell Res.*, **49**, 116; 1968) and transplantation experiments have allowed some assessment of the roles of the nucleus and cytoplasm. Muggleton and Danielli found earlier that spanned amoebae exhibited two behavioural patterns following division. In the first, type A, stemline growth occurred in which one product of binary fission showed early mortality while the second daughter cell underwent disparate division again. This sequence continued for a finite period and was followed by death of