1969) have prepared from the multienzyme complex, fatty acid synthetase. This aggregate contains no fewer than seven different recognizable enzymes, and has a molecular weight of some 2.3 million. After fifteen months at 4°, a preparation threw down small crystals, and these were then used to seed fresh samples, which they did in two days. It is interesting that the activity, especially of one of the components, decreases with time, unaccompanied by any deterioration in the crystals. The organization of the molecules in these crystals stimulates the greatest curiosity.

VIROLOGY

Viruses and Cancer

from our Cell Biology Correspondent

TUMOUR virology is the great growth sector of cancer research; in the United States, for example, the National Cancer Institute spends 62 per cent of its allocation for cancer aetiology on tumour virology. And, in spite of the misgivings of the old guard in the ranks of cancer research, the wholesale importation of the technology and, above all, the ideas of molecular biology is bound to increase. The parallels between the lysogenization of bacteria by bacteriophage and the transformation of cells in tissue culture by DNA tumour viruses are too compelling to ignore. Lysogeny for certain, and transformation most probably, depends on the integration of the virus or phage genome into the chromosome or chromosomes of the host cell.

The parallels between lysogeny and cell transformation by RNA rather than DNA viruses are, however, less obvious—whether and how an RNA viral genome becomes stably integrated into the genome of a transformed cell is a vexed question—but superficially at least they exist. Aaronson, Hartley and Tadaro (*Proc. US Nat. Acad. Sci.*, **64**, 87; 1969), for example, reported recently an experiment with mouse cells and mouse leukaemia virus, which seems to resemble the induction of prophage from lysogenic bacteria. They have isolated stable cell lines from embryos of inbred BALB/c mice which became tumorigenic when maintained in tissue culture on a schedule of rapid sub-culturing at high cell densities. Several of these independently maintained BALB/3T12 cell lines, as they are called, also began to produce murine leukaemia virus after many passages in culture, even though there was no evidence of the virus in the original embryo culture from which the cell lines were selected, or in the cell lines themselves at the early stages of the experiment.

The trivial explanation that the virus appeared as a result of accidental infection of the cultures can apparently be ruled out. Two other explanations remain. Either the cells were all the time infected with virus but with amounts below the limit of the detection assays used or, more interesting, the mouse cells may have in a repressed form the information needed to make murine leukaemia virus. Aaronson *et al.* favour the latter explanation because, when they infected the original embryo cells with the virus from the BALB/3T12 lines at a multiplicity of infection of 10–50, high titres of virus appeared within twelve culture transfers after infection. On the other hand, the virus did not appear “spontaneously” until after at least thirty

passages. They argue, therefore, that if the embryo cells had all the time been infected with a very small amount of virus, the presence of virus should have become apparent in the cell lines much sooner than observed.

The idea that the mouse cells contain the information for leukaemia virus in a completely repressed form is of course what Tadaro's group would like to prove unambiguously. Such a proof would go a long way towards substantiating Huebner and Tadaro's hypothesis that cells contain latent RNA viruses, or at least the information to specify an RNA virus, which can be transmitted vertically from cell to cell, animal to animal without being expressed as infectious virus. Expression of such a latent virus would presumably be controlled by a combination of genetic and environmental factors and, of course, if the virus once produced was oncogenic the occurrence of cancer could be explained in terms of its induction. The trouble with this suggestion is that it is almost as difficult to prove as it is to disprove. Experiments such as those of Aaronson *et al.* are undeniably consistent with the hypothesis that cancer results from the induction of latent RNA viruses, but it is debatable whether or not they test it.

ELECTRON MICROSCOPY

Aids to Biology

from a Correspondent

THE advantages of holding an international gathering in a rapidly developing country were revealed from December 1 to 3, when a symposium on electron microscopy in the life sciences was held at the Sasa Institute in Calcutta. As well as the interchange of ideas between established scientists, young research workers and students, not usually able to attend such meetings, were given the opportunity of learning about the methods and standards of work followed in the United States and Europe.

Contributions covered both pure and applied research. Dr S. Höglund (Uppsala, Sweden) reported that tobacco necrosis virus satellite (TNVS) has a particle 175 Å in diameter with morphological subunits of 40–50 Å, and he suggested a model comprising twelve capsomeres. Adenovirus has a more complex capsid containing 240 hexons and twelve pentons each with a molecular weight of about 400,000. The nucleoprotein of influenza A2 virus, Höglund said, appears as flexible threads with helically arranged 35 Å × 45 Å tubular or U-shaped capsomeres.

Dr W. Bernhard (Paris, France) reviewed the role of the nucleolus in biogenesis and showed how electron microscopy can be used with other biophysical techniques to elucidate the fates of nucleic acids in cells. He described how DNA transcription gives rise to a 45S RNA which breaks down, either through several stages to give 28S ribosomal RNA or directly to give 18S ribosomal RNA. The 28S RNA complexes with about thirty-five proteins, and the 18S RNA complexes with about twenty proteins to give preribosomal ribonucleoprotein granules (granular nucleoli). The granules migrate to the cytoplasm and, after complexing with a 5S RNA, two molecules of tRNA and one of mRNA produced active ribosomes.