NEWS AND VIEWS

New Baskets for Old

UNICELLULAR organisms reflect the extremes to which cellular morphogenesis can be stretched, as any protozoologist will testify. However esoteric their appearance they also retain the ability for clonal growth—to generate repeatedly two "finished" cells from one. They, and indeed most cells, contain organelles made up of microtubules—arrays of globular protein subunits which form hollow tubes of diameters around 250 Å. Protozoa should therefore spell out the range of possible structures which can be formed from microtubules and yet be reduplicated in a spatially precise manner at each cell division. The control of such a system presents intriguing problems. On page 387 of this issue of *Nature* J. B. Tucker of the University of St Andrews, Scotland, raises questions about the spatial discrimination that must underlie the formation of microtubular components in the ciliated protozoan *Nassula*.

The largest organelle in *Nassula* is the feeding apparatus the pharyngeal basket), a palisade of rods made up from longitudinal microtubules and attached to the cell surface. At division the old basket detaches from the surface and two new ones appear. Each new rod begins its assembly close to a basal body, another and more ubiquitous microtubular structure. The rods first appear in short rows; they align and detach from the basal bodies and then roll up to constitute the circular palisade. The completed baskets make microtubular connexions to other surface basal bodies. The two new baskets do not always include all the new rods, and these "errant" rods, after moving away, break down as do the old rods, while the integrated new rods elongate by addition of microtubular protein to their tips. How can rods in one area of the cell add subunits while apparently identical rods elsewhere in the same cytoplasm are being dismantled?

Like flagella elongation in *Chlamydomonas* the synthesis and assembly of rod microtubules are separable events. Cycloheximide inhibits synthesis and colchicine blocks assembly. Errant rods do not move away from the new baskets in the presence of vinblastine, nor are they resorbed, although the old rods continue to break down. Tucker erects two alternative hypotheses to explain this effect. Further research relevant to this study will be the resolution of the number of different types of microtubule subunit involved, and whether the microtubular assemblies appearing at different times and in different places are composed of identical subunits, and if so whether these share a common subunit pool, and are recycled when the structures are broken down.

The questions that Tucker raises—how the subunits are localized at the points of assembly and whether random diffusion of subunits synthesized throughout the cell accounts sufficiently for the observations—are two among several problems. They include the nature of the information system specifying the location of "nucleation" centres for organelles, the number of such centres and the regulation of the dimensions of the realized structures, and the self-assembly properties of the subunits. Tucker has previously observed in living cells that rod length fluctuates with feeding and starvation and that when the number of developing tubules is reduced they reach greater than normal length; both these facts are consistent with the available subunits determining the length. Dingle can upset the control of flagella number in *Naegleria* by heat shock at the moment of amoeboid-flagellate transformation (*J. Cell Sci.*, **7**, 463; 1970). The attraction of this system is that high developmental synchrony can be obtained in populations of these amoebae. Tilney (*Devel. Biol.*, **2** (Suppl.), 63; 1968) and Roth (*J. Ultrastr. Res.*, **30**, 7; 1970) have suggested that the pattern of microtubules in the axopod of the heliozoan *Echinosphaerium* is a function of cross-linkages of fixed length and orientation between tubules rather than of an "orientation centre". Heat-shock disruption of rod tubules in *Nassula* and the subsequent abnormal arrangements of tubules argue in favour of the initiating sites as the determinants of the final pattern.

The solution of these problems promises to be of interest to all cell biologists and it may in addition shed light on the phenomenon of "cortical inheritance" in ciliates—alternative patterns of the same microtubular structures existing stably over hundreds of cell divisions in the absence of gene differences. Finally, it would be a glaring omission not to point out the close affinity in interest and attack between this field and that of phage morphogenesis (Levine, *Ann. Rev. Gen.*, **3**, 323; 1969).

Filling the Dating Gap

THE dating of the earlier part of the Pleistocene period still presents considerable problems but further exploitation of the various "radioactive clocks" should eventually overcome these difficulties. It is particularly encouraging that thermoluminescence dating may soon be extended to date bones and teeth from archaelogical deposits (Christodoulides and Fremlin, *Nature*, **232**, 257; 1971). The use of this method is well established for the dating of baked clay obects, and its potential for solving questions of authenticity has been illustrated in the past week by Martin Aitken and his colleagues at the University of Oxford who have demonstrated clearly that some "Etruscan" wall paintings on terracotta in European and American museums are at the most 12 years old (Aitken *et al.*, *Archaeometry*, **13**, 89; 971; Fleming *et al.*, *ibid.*, 143).

The promise of the thermoluminescence dating method of Christodoulides and Fremlin is that it will span the gap which still separates the time range of radiocarbon dating and the clocks of longer half-life. At the early end of the human time scale, potassium-argon dating has been useful in establishing a chronology for artefacts or hominid remains. The youngest dates obtainable from the uranium-lead and rubidium-strontium methods are about 10 million years, so that these isotopes, which are useful for longer geological time spans are not helpful here. The half-life of ^{40}K is 1.03×10^9 yr, however and mass spectrometry allows the determination of one of its decay