It is obviously hazardous, in our present state of ignorance, to attempt to explain cytological phenomena at a molecular level. The explanation proposed does, however, fit the observation and no alternative explanation springs readily to mind. Whether the particular hypothesis is or is not eventually proven correct, the work of Wolff, Lindsley and Peacock is a fine example of how much of interest can be gleaned from intelligent microscopic observation of chromosome behaviour.

Facts of colonial life

from a Correspondent

A meeting on the Biology and Systematics of Colonial Organisms was held at the University of Durham, on April 7-8, 1976, organised by the Systematics Association.

MANY organisms live in colonies but the varied nature of coloniality suggests that such associations are influenced by an interplay of factors among which cooperation, competition for space and reproductive and feeding requirements are most significant. At the meeting the phenomenon of coloniality was traced from bacteria, through bryozoans and echinoderms, to sea birds in an attempt to discover what common factors link the phenomena of association, gregariousness and coloniality. Groups of animals of the same species may live in close proximity (gregarious colonies) and so form associations which differ from the integrated growing-together of "conventional" colonial organisms (corporate colonies).

The significance of cooperation was illustrated at microbial level (M. J. Carlile, Imperial College, London) for bacterial colonies. These aggregations are more able to withstand desiccation and show enhanced rates of enzyme production, improving substrate attack and serving as a barrier between colonies of different ages and genotypes. Cooperative coloniality occurs also in protozoans where, in more advanced taxa, some parts of colonies are already functionally specialised for gamete and spore production (C. R. Curds, British Museum (Natural History)). Proto-cooperation may be significant in gregarious colonies as in the bizarre and extinct, sedentary, rudist bivalves which maintained growth away from their substratum only with the support of contiguous neighbours (P. W. Skelton, University of Liverpool).

Higher levels of cooperation are

T4 chromosome

from a Correspondent

THE complex chromosomes of higher organisms are tightly organised, their DNA being coiled into standard "beads" which contain 200 base pairs associated with specific histone proteins. Recently the DNA of bacteria has also been shown to have a similar structure, although it is stabilised by a different kind of protein. Do bacteriophages, which are probably the simplest type of living organism, also replicate their DNA in a highly structured manner? In phage T4 it has been known for some time that intracellular phage DNA must be organised in some way, as the rate at which it sediments during centrifugation (about 700S) would reflect DNA concatemers with lengths of nearly 1,000 T4 genomes if attached end-to-end; but in fact the concatemers are at least 10 times smaller than this. The intracellular DNA must therefore be tightly folded and/or attached to some type of non-DNA molecule.

A surprising property of these structured T4 DNA molecules is their stability. Unlike the chromosomes of eukaryotes or bacteria their sedimentation rate is unaffected by treatments with protease, RNase, heat or detergent. One method of affecting this stability has been found however. When bacteria infected with a temperature-sensitive phage mutant in gene 32 (which controls the synthesis of unwinding protein) are grown at low temperature, normal intracellular DNA sedimenting at 700S can be isolated; but within one minute of shifting these infected cells to 42 °C

the phage DNA is found to have an appreciably lower sedimentation rate which is approximately that of T4 DNA which is now only one genome in length.

Curtis and Alberts (*J. molec. Biol.*, **102**, 793; 1976) have studied the reasons for this dramatic change in sedimentation behaviour in detail. They have shown that along the DNA concatemer which is formed during T4 replication there are sizable single-stranded regions spaced at average intervals of approximately one genome. Normally the product of gene 32 binds tightly to these single-stranded regions and protects them from nuclease action. This protection is rapidly lost if the 32 protein is inactivated, leading to strand scissions and the formation of phage DNA of single genome lengths.

On its own this new information concerning the existence and regular spacing of the single-stranded regions does not explain the higher sedimentation rate of normal intracellular T4 DNA. It does however suggest that single-stranded regions play a key role in holding the T4 DNA in a tight configuration, perhaps by attachment to some non-DNA substance in a way not too unlike the situation obtaining with the chromosomes of higher organisms and bacteria. As Curtis and Alberts point out, some high degree of order in the structure of DNA might be required to guide the simultaneous processes of DNA transcription, replication and recombination—and in the case of phage, of maturation as well.

seen in corporate colonies in which specialised polymorphs, or groups of polymorphs (cormidia) function at several hierarchically cooperative levels. This is spectacularly marked in byozoans where an increasing number of colonial structures have been recognised as modified zooidal features common in colonies with very high levels of integration (J. S. Ryland, University College of Swansea). Colony-wide feeding and maintained current systems may be related to these levels of integration (P. L. Cook, British Museum (Natural History)).

By contrast, the level of cooperative coloniality in sponges is uncertain. Grafting experiments (A. S. G. Curtis, University of Glasgow) indicate that clones or clusters of sponges do not exhibit corporate coloniality. Grafts from a single sponge body will be accepted by another only if they are of the same strain. Similar strains will

coalesce if they grow adjacent to one another. Although it was argued (W. G. Fry, Luton College of Technology) that a sponge is a colony in which aquiferous units represent individuals it is evidently difficult to define the individual in sponge morphology and the implication of Curtis's experiments were of wide interest to participants at the meeting.

Reproduction as a factor in coloniality is significant in that most corporate colonies develop by asexual budding. The factors controlling the timing of the appearance of new individuals are not known. Indeed no obvious relationship to age or maturity for asexual budding can be deduced in, for example, rugose corals. Asexual reproduction in corporate coloniality links closely with the cooperative function but sexual reproduction may itself be a cause of aggregation in some organisms. Barnacle aggregations relate to their