Further transcription, however, of progeny plus strands from the replicative form would be blocked because translation of the nascent plus strands would be terminated by the polar mutation. This less likely model requires that the infecting plus strand can be translated whereas nascent progeny plus strands cannot.

Recent work by Roberts and Gussin (*J. Mol. Biol.*, **30**, 565; 1967) and latterly Lodish (*J. Mol. Biol.*, **32**, 47; 1968) indicates that the first, purely translational model is correct. Roberts and Gussin using the polar coat mutant of R17 showed conclusively that, as predicted by the translational model, infecting RNA molecules are only poorly incorporated into a double stranded replicative form during infection of a host that lacks amber suppressor genes. Lodish has shown the same for the polar coat mutant of f2. The level of incorporation of parental RNA molecules into a double stranded molecule is only 15–25 per cent of the wild type levels.

Furthermore, Lodish has shown that the few double stranded replicative form molecules that are formed with the polar coat mutant RNA function normally as templates for synthesis of progeny plus strand RNA molecules. The amber mutation does not therefore block the transcription of progeny RNA molecules from a replicative form (Gussin's 1966 delayed complementation experiments also indicate this).

To prove this, Lodish used a double mutant which has the polar coat mutation and in addition a temperature-sensitive mutation in the RNA synthetase cistron. This temperature-sensitive mutation affects the RNA synthetase enzyme so that at 43° C it can synthesize plus strands but not minus strands. Thus at 43° C a parental plus strand displaced from the double stranded template by the synthesis of a progeny plus strand does not serve as template for the synthesis of another minus strand. At 43° C, therefore, displacement of parental plus strands which are not reincorporated into double stranded molecules becomes a sensitive measure of plus strand synthesis. What Lodish found is that both wild type and double mutant RNA molecules are displaced from a double stranded template at the same rate at 43° C. The polar mutation therefore has no effect on transcription of double stranded RNA. The only effect of the polar mutation on RNA replication is that it depresses the incorporation of parental plus strands into a replicative form.

These results, together with the demonstration of polarity in *in vitro* protein synthesizing systems programmed with polar coat mutant RNA (see *Nature*, **216**, 1070; 1967), conclusively show that at least with RNA phages polarity is a translational phenomenon.

The Centriole and the Spindle

from our Cytogenetics Correspondent

TECHNIQUES for synchronizing the phases of the cell division cycle have allowed the timing of events in the cycle to be analysed in some detail. Most work with synchronized cells has been concerned with events in the nucleus, but now Robbins, Jentzsch and Micali (*J. Cell Biol.*, **36**, 329; 1968) have studied the timing of centriole replication in a synchronized population of HeLa cells. Electron microscope observations of the centriole complex at telophase and early G_1 interphase show that it consists of two orthogonally paired bodies. Later in G_1 the members of the pair move apart, and as the cell enters S , each centriolar body appears to

bud a replica. By the end of S there are two complete centriolar complexes. This coincidence of centriole replication and nuclear DNA replication suggests there may be a common control of replication because centrioles may contain DNA.

A different view of centriole replication is held by Batisse (*C. R. Acad. Sci.*, **266**, 130; 1968). Strictly speaking, he observed kinetosomes (in the Suctorian *Discophrya*), but these structures are probably homologous with centrioles. Batisse believes the parental kinetosome does not divide but is able to cause the condensation of precursors for a new kinetosome.

In the HeLa cells, signs of centriole activity are first seen in G_2 and as the cell enters prophase. In these phases the centrioles are the focus for the aggregation of electron-opaque bodies and less opaque vesicles. Moreover, the cytoplasm around just one of the centrioles becomes electron-dense. These changes probably represent early stages in the assembly of the mitotic spindle. Later in prophase the centriolar complexes migrate to opposite ends of the cell where, at metaphase, they define the apices of the spindle.

Hoskins (*Nature*, **217**, 748; 1968) recently suggested that chromosomal DNA at the kinetochore may play a part in ordering the structure of the spindle; it may be equally plausible that the DNA contained by the centriole may play a similar part in spindle organization. Hoskins's diagram of kinetochore structure is very similar to electron micrographs of the kinetochore at meiotic metaphase in *Tradescantia* and *Lilium* pollen mother cells, published respectively by Wilson (*Planta*, **78**, 379; 1968) and Dietrich (*C. R. Acad. Sci.*, **266**, 579; 1968). In both cases the kinetochore is large, less electron-opaque than the rest of the chromosome and serves as an attachment point for spindle fibres. These observations may imply that DNA has another function besides genetic coding, namely, serving as a site for the assembly of protein sub-units for the spindle.

Improving Crops

AGRICULTURE is going to have to play an even more important part in the economy of most countries, and plant breeding has a great deal to offer, as it has done in the past twenty years. This was the starting point taken by Dr G. D. H. Bell, director of the Plant Breeding Institute in Cambridge, when he gave a review lecture at the Royal Society on March 7. His topic was "Plant Breeding for Crop Improvement in Britain: Methods, Achievements, and Objectives".

Among the cereals, since 1946–47 the yield of wheat has increased from 19 to 31.2 cwt/acre, that of barley has increased from 17.8 to 28.7 cwt/acre and that of oats has increased from 16.3 to 24.4 cwt/acre. During this time, many new varieties have been developed for commercial use, incorporating higher yields, better straw, and earlier ripening. Improvements in barley were made possible by hybridization of British varieties with Scandinavian varieties. A spring barley that proved particularly successful was Proctor, which shows a good yield, field resistance to some diseases, and high malting quality. Winter malting barleys such as Pioneer and more recently Maris Otter have been developed by hybridization. Higher yielding varieties than Proctor are now available, but the chief problem is combating leaf disease, particularly mildew. Some