at 42° C, and therefore has its own genetic machinery for initiating DNA replication, set about isolating mutants of this phage which by lysogenizing CRT46 cells can cause the cells to replicate at 42° C. Exploiting a strain of P2 known as P2*tsD*$_4$*c*$_5$, which specifies a temperature sensitive repressor and cannot complete its replication at 42° C because of a block in the maturation of phage tails, they obtained lysogens of CRT46 and selected for cells which would grow at 42° C. A few of the cells which survived this selection were found to liberate phage particles one strain of which was studied further.

This phage which suppresses the T46 mutation when it lysogenizes carries a third mutation, *sig*$_5$, which by three factor crosses has been mapped on the phage P2 genetic map and has been shown to be an insertion. This phage integrates at several sites in the *E. coli* chromosome and when it is at least one of these sites the T46 mutation is suppressed. Furthermore, in a series of elegant crosses Lindahl *et al.* have established that a protein specified by the gene *A* of P2 is required to suppress the T46 mutation and allow the cells to replicate their DNA at the nonpermissive temperature, 42° C. This A protein is probably essential for the initiation of DNA replication and biochemists eager to come to grips with this process would dearly like to get their hands on it. But it has one tantalizing property; it is a *cis* acting protein and probably cannot be investigated by any sort of complementation analysis because it only acts on the genome which specified it. The biochemistry of DNA replication retains its secrets.

MEMBRANES

CMF Controls Mg Flux

from our Membrane Correspondent

WHEN cytoplasmic macromolecular fraction (CMF) was first described by Loh *et al.* (*Biochemistry*, **7**, 726; 1968), it did not seem to be of more than passing interest, because it was only reported as affecting the oxygen consumption of dinitrophenol (DNP)-inhibited mitochondria. Later it transpired (Kun *et al.*, *ibid.*, **8**, 4443; 1969) that CMF also prevented the loss of magnesium ions from DNP-inhibited mitochondria. Binet, Gros and Volfin (*FEBS Lett.*, **17**, 193; 1971) and Binet and Volfin (*ibid.*, 197) now report significant progress towards the determination of the structure of CMF and ascribe to it a more universal role in membrane function.

CMF (now called cytoplasmic metabolic factor) in common with many substances of profound biological activity is present in tissues at very low concentrations. From 5 kg of porcine liver, Binet *et al.* eventually obtained 1.5 mg of CMF, but it was not possible to assay its purity because they were unable to get it to migrate in the thin-layer chromatography systems used. Their analytical results suggest that CMF is a water soluble, acidic cyclic peptide of twenty amino-acid residues, sixteen of them different. The water solubility and amino-acid composition indicate that there is little similarity between CMF and cyclic peptides such as gramicidin-S or alamethecin which can act as ionophores (that is, promote the transport of ions) in membranes. Indeed, the chief effect of CMF is to inhibit the movement of magnesium ions across membranes. Apart from confirming that CMF prevented the leakage of magnesium ions from mitochondria, Binet and Volfin also found that CMF prevented the light-induced ejection of magnesium ions from chloroplasts and inhibited the lethal ejection of magnesium ions from *Escherichia coli* which had been treated with the drug 'Levallorphan'. They also found that CMF promotes the uptake of calcium ions by sarcomes but unfortunately do not report whether CMF affects the transport of ions other than magnesium or calcium.

Thus the role of CMF is apparently to control magnesium and calcium fluxes across biological membranes. How it achieves this at the molecular level is at present unclear and is likely to remain so until more is known about ion transport mechanisms in membranes. CMF may prove, however, to be a useful tool in elucidating these mechanisms.

Magnetic Variations in Columnar Basalts

COLUMNAR basalts have seldom, if ever, been used for palaeomagnetic purposes, partly for the obvious reason that they occur only infrequently but partly because their peculiar structure induces the suspicion that directions of magnetization may be dependent on factors other than ancient field directions. This suspicion was largely confirmed by Symons (*Geophys. J.*, **12**, 473; 1967) from a very thorough study of a single column from the Giant's Causeway, Northern Ireland, which showed that not only palaeomagnetic properties but also inherent magnetic properties vary greatly throughout a column.

It seemed to Symons that the varying magnetic properties (natural remanence, Curie point, coercive force, bulk susceptibility, saturation magnetization and others) are essentially those which depend on the compositions of the titanomagnetites present and that such compositional variations as there are arise from differences in oxygen rather than from titanium content. And because such magnetic and compositional variations are likely to be the result of the unusual method of formation of columnar basalts, study of these variations could help to solve the vexed question of just what this method is.

Similar conclusions have now been reached by Radhakrishnamurty *et al.*, who in next Monday's *Nature Physical Science* report a study of some of the magnetic properties of columnar basalts from Bombay. Although, unlike the Giant's Causeway, little geological investigation has ever been made of these columns they are known to be hexagonal prisms of coarse-grained basalt about three feet across and up to more than 100 feet in height. No mineralogical variations from the centres to the edges are apparent in either thin or polished section, yet hysteresis loops in a field of 1,500 oersteds show that coercive force increases from the edge to the centre both at 25° C and −190° C. A similar variation of coercive force is found in samples previously heated to above their Curie points, although in each case the coercive force is significantly higher than in the corresponding virgin sample. Changes in the magnetic state clearly take place on heating; and curves of low field susceptibility against temperature show that these changes depend on the position of the relevant sample within a column.

Because in most cases the coercive force and saturation magnetization of virgin samples do not depend on temperature between 25° C and −190° C, Radhakrishnamurty and his colleagues conclude that the operative magnetic mineral is neither magnetite nor titanomagnetite. On the other hand, X-ray diffraction studies indicate the magnetic mineral to be "akin to magnetite". For the heated samples the hysteresis loops indicate the presence of magnetite (mostly) towards the edges of the columns but maghemite towards the centres.

These data, together with hysteresis loop comparisons with synthetic magnetites and maghemites, lead Radhakrishnamurty *et al.* to believe that the operative magnetic minerals in the virgin basaltic columns are intermediate phases in the magnetite–maghemite oxidation chain. To account for this the authors propose that although magnetite formed uniformly throughout the magma during initial cooling, and before columnar jointing, subsequent (radial) temperature gradients would lead to variations in the degree of oxidation within a column.