the initiation site of replicase cistron is base paired in the "stem" with the RNA which specifies amino-acids 24-32 of the coat protein cistron.

If there is one chief conclusion to be drawn from the base sequence of the MS2 coat protein cistron it is surely that the RNA of these coliphages, which serves as both messenger and genome, is a highly structured molecule, a large proportion of which assumes double helical hairpin conformations. To what extent such structures are general features of messenger RNA rather than specific features of an RNA which as well as being translated must self replicate and assume a shape which allows it to be packaged within a small protein capsid will only become apparent when other non-viral messengers have been analysed.

Several groups are, of course, already tackling the analysis of the sequence of such messengers and by the time they have completed their work Fiers and his colleagues may well have sequenced the complete MS2 RNA molecule.—From our Cell Biology Correspondent.

Interspecific Transfer of Nitrogen Fixation Genes

THE high yielding strains of rice, wheat and other cereals which have been introduced during the past few years into many Asian countries and have been widely heralded as the vanguard of a "Green Revolution" have one serious drawback; they need, to yield well, to be fed large amounts of nitrogenous fertilizers. And quite apart from any qualms there may be about the hazards of the excessive use of such fertilizers, this requirement places an extra, and in the long term perhaps insupportable, burden on the economies of nations barely holding their own in the fight to feed their populations.

If the plant geneticists could select high yielding cereals which require little in the way of nitrogenous fertilizers—perhaps by engineering strains with the inherited capacity to fix atmospheric nitrogen in sufficient amounts to meet their own needs—it might, of course, be possible to break out of the vicious circle. And although it would be totally wrong and misleading even to hint that such cereals are on the distant horizon let alone just around the corner, by investigating the genetics of nitrogen fixation in bacteria Professor John Postgate and his colleagues at the ARC Unit of Nitrogen Fixation at the University of Sussex, and other groups in this field, are at least laying the foundations from which the plant breeders may ultimately be able to build high yielding, nitrogen-fixing strains of cereals.

Having already successfully transferred the nitrogen fixation genes (*nif*) from a strain of *Klebsiella pneumoniae*, a bacterium which under anaerobic conditions can fix nitrogen, to a second strain of this species which lacks this ability (*Nature*, **234**, 47; 1971), Postgate and his colleague Dixon now report on page 102 of this issue of *Nature* their successful transfer of the structural and regulatory *nif* genes from *K. pneumoniae* to a strain of the common gut bacterium *Escherichia coli* (*E. coli* C).

Although the precise chemistry of the nitrogenases made in the recipient *E. coli* cells and the nature and origin of the electron transfer proteins which allow the *E. coli* to fix nitrogen have yet to be elucidated, the transfer of functional *nif* genes from one bacterial species to another in a different genus is a considerable and exciting achievement. In what state the *K. pneumoniae nif* genes are stably associated with the *E. coli* cells also has yet to be determined; it would be no great surprise, however, if they were found to persist as a small closed circular piece of DNA independent of the *E. coli* chromosome and if that is the case it may be possible to get the *nif* genes into a plasmid state which would in effect render them infectious. Such a *nif* gene plasmid would be extremely useful, for it would facilitate both attempts to transfer these genes to other species and attempts physically to isolate them. And, once physically isolated, the way is open to investigations of the molecular biology of the *nif* genes in cell free systems.

The success of Dixon and Postgate's experiments stems in large part from their shrewd choice of the recipient strain, *E. coli* C, which lacks the so-called restriction and modification enzymes that are present in most other strains of *E. coli* and no doubt most other species of bacteria. Restriction nucleases can recognize, by virtue of the pattern of modified bases in a DNA, any foreign DNA and degrade it, and modification enzymes mark, by base modification, the DNA replicated in a cell as DNA belonging to that cell which should not be degraded. In short, the restriction and modification enzymes provide a cell with the mechanism for distinguishing foreign DNA from its own DNA and degrading the former and they are obviously a strong barrier against the interspecific transfer of genes.

By selecting *E. coli* C cells as recipients, Dixon and Postgate effectively short-circuited this obstacle and gave the *nif* genes an environment in which they would not be immediately recognized as foreign and degraded. Transfer of these genes to other strains and species of bacteria and to cells of higher plants, which if they do not have restriction and modification enzymes identical to those in bacteria will no doubt be found to possess other mechanisms for dealing with foreign DNA, inevitably will be a far more difficult task. But, great as the obstacles may be, the incentive, ultimately the introduction of nitrogen fixing genes into commercially important plants, is greater.—From a Correspondent.

MARS

Recent Mariner Results

from a Correspondent

ON April 24, at the annual meeting of the US National Academy of Sciences in Washington, a small symposium, convened by Dr William Pickering, director of the Jet Propulsion Laboratory, Pasadena, was devoted to recent findings on the planet Mars obtained by Mariner 9—the first man-made object to orbit another planet. The speakers presented a representative but by no means exhaustive sampling of the preliminary data.

When Mariner 9 arrived at Mars on November 13, 1971, the television cameras revealed a nearly featureless disk. An enormous global dust storm was in progress. The experimenters