addition, the shape of the melting curves shows that there is strong compositional polarization in the chains. These curious mitochondrial DNA species are evidently to be correlated with the observed cytoplasmic mutations.

NUCLEOSIDES

Syn Expected and Unexpected

from our Biomolecular Structure Correspondent

Anti and *syn* denote the two stereochemically preferred ranges in the orientation about the covalent bond linking sugar and base in nucleosides. Most nucleosides and nucleotides crystallize with the *anti* conformation, and this is also the conformation in the DNA double helix. But the observation by Travale and Sobell (*J. Mol. Biol.*, **48**, 109; 1970) that 8-bromoadenosine and 8-bromoguanosine crystallize in the *syn* conformation is by no means unexpected, for even a crude analysis with space-filling models shows considerably more steric-hindrance between the bromine atom and the sugar for the *anti* range than for the *syn*. A much more unexpected member of the select group of nucleosides and nucleotides which crystallize in *syn* (and the only pyrimidine) is 4-thiouridine (Saenger and Scheit, *Angew. Chemie*, **8**, 139; 1969).

Uridine itself and its 5-substituted derivatives all crystallize with the *anti* conformation and the peculiarity of 4-thiouridine must be attributed to intermolecular interactions, suggesting that although there may be a considerable energy barrier between the *syn* and *anti* ranges their conformational energies are not very different. Several workers have suggested that the conformation about the glycosidic link is correlated with the pucker of the sugar ring. The sugar ring is most frequently puckered with C2 and C3 about 0·5 Å out of the best plane through the other four atoms of the ring. C2 endo indicates that C2 is out of plane on the C5 side of the sugar ring and C2 exo that it is out of plane on the O1 side and similarly C3 endo and C3 exo. Lakshminarayanan and Sasisekharan (*Biopolymers*, **8**, 475; 1969) have calculated conformational energies for purine and pyrimidine nucleosides with all four idealized sugar puckers as a function of the orientation about the sugar-base bond. They conclude that for pyrimidines with a C2 endo sugar there is an energy minimum in the *syn* angular range of comparable energy to that in the *anti* range. Although the sugar conformation in 4-thiouridine approximates to C2 endo, the observed orientation about the sugar-base bond is some 30° outside the allowed range proposed by Lakshminarayanan and Sasisekharan. This is not a serious discrepancy and can be attributed to the pucker in this structure departing from the idealized C2 endo, but it emphasizes that preferred orientations predicted from such calculations should be treated with caution.

As in deoxyguanosine (which also has the *syn* configuration), 8-bromoadenosine and 8-bromoguanosine have an intramolecular hydrogen bond between the 5′OH of the sugar and the base N3. This is the only type of intramolecular bond which has been observed in a nucleoside or nucleotide crystal from a sugar hydroxyl to either a base or a phosphate atom. Intramolecular hydrogen bonds from the 2′OH to N3 purine, O2 pyrimidine and to a phosphate oxygen have been proposed to account for observations in solution but have never been observed in the crystal.

The observation of the *syn* conformation for 4-thiouridine is of considerable interest, particularly because Scheit and Gaerter (*Biochim. Biophys. Acta*, **182**, 10; 1969) have evidence that in solution both the monomer and single stranded homopolymer assume the *anti* conformation. One of the chief stimulants to studying 4-thiouridine was its occurrence in transfer RNA and no doubt the army of model builders addicted to this molecule will be taking a new look at their creations. But it is hard to escape from the fact that the significance of the *syn* conformation in 4-thiouridine is for pyrimidine structures as a whole, which have hitherto been almost universally assumed to have the *anti* conformation in polynucleotides.

CELL CULTURES

Stable Haploid Line

from our Cell Biology Correspondent

THE fusion of plant cell protoplasts, reported a fortnight ago (*Nature*, **225**, 1016; 1970), raises none of the alarums which have come to surround similar experiments with animal cells. The next step, fusing a plant cell with an animal cell, is another story, however. Imagine the evening papers emblazoned with "Human Cabbages" or "Bacon with the Beans" and science fiction writers will have a field day populating planets with green men for whom a sunbathe is an epicurean treat.

Mercifully all that is still in the future, although the day when plant and animal cells are fused may not be so very distant to judge from the rate at which somatic cell genetics progresses. Freed and Mezger-Freed, for example, have recently isolated two stable haploid cell lines which point the way to analysis of recessive mutants (*Proc. US Nat. Acad. Sci.*, **65**, 337; 1970). These two lines arose in cultures of explants from haploid androgenetic embryos of *Rana pipiens* obtained by removing the female nucleus from the fertilized frog's eggs. For more than fifty subcultures, or at least 150 mitotic generations, these haploid cells have outgrown diploid variants, which, arising by endomitosis or cell fusion, usually overgrow haploid cells. Presumably on rare occasions, as a result of segregation, the frog sperm nucleus contains in a haploid karyotype all the genes necessary for vigorous growth in culture. Of course Freed and Mezger-Freed cannot rule out the possibility that duplications of small but crucial regions of the genome have occurred to account for the stability of their two lines, but such duplications cannot involve much of the genome. The haploid lines have almost exactly half the DNA of diploid cells, half the volume of diploid cells and the haploid chromosome number in 85 per cent of the cells in one line and 95 per cent in the other. There are, however, small but significant differences in the length of the chromosomes of the haploid cell lines compared with the standard karyotype.

Once auxotrophic mutants have been isolated, and this is apparently under way, it should be possible to exploit these two lines for mapping both dominant and recessive mutations, but the really important consequence of this work lies in the stimulus it should give to attempts to isolate haploid lines of mammalian