transmitted dorso-ventrally (as for a quadruped in a normal environment), and the rats were constantly monitored with a television camera.

The results show that there was a significant preference for high gravity for animals reared in high gravity, although this proved to be transitory insofar as 60 per cent of them later exhibited a preference for lower gravity in subsequent tests. Nevertheless, there are grounds for believing that hypergravity is not necessarily aversive, and would depend to a great extent upon the *g* level to which the animals were habituated. This agrees with evidence of other aversive stimuli; for example, prolonged exposure to light, where Walters (*Canad. J. Psychol.*, **17**, 412; 1963) has shown that aversive stimuli can lose their negative properties as a result of prolonged exposure.

McCoy and Jankovitch are cautious of making premature speculations, but point out that these results are in accord with more general theories of adaptation levels (for example, Helson, 1964), and can be interpreted as the "neutralizing" of aversive factors by repeated stimulation. If this is the case, then by analogy a similar effect may still be shown in the case of hypogravity, and be of great use in the habituation of prospective astronauts for long periods in conditions of zero gravity.

OPTICS

Diffraction Gratings

from a Correspondent

A CONFERENCE on diffraction gratings was jointly organized by the Spectroscopy and Optical groups of the Institute of Physics, at Imperial College, London, on April 21, and it is a measure of the interest in this topic that a meeting originally planned to cater for local interests attracted thirty European participants and representatives from most of the principal US manufacturers. The conference was supported by an exhibition of products.

The opening session on classical, that is, ruled, diffraction gratings began with a review by Dr E. Loewen (Bausch and Lomb) who surveyed the art of ruling, and illustrated how recent developments have led to improvements in ruling engines, especially their interferometric control and the building of even larger ones. The purpose is to provide gratings for raman spectroscopy, where the need is for fine pitch combined with minimum ghost intensity and for large gratings for astronomical spectroscopy (this last topic was amplified later by Dr R. C. M. Learner (Imperial College, London) who described the plans for the establishment of a large grating ruling laboratory at the Tucson head-

quarters of Kitt Peak National Observatory). It became clear that concave gratings have assumed greater importance since space astronomy opened up the XUV wavelength region, which no other type of dispersing element can function effectively. Here the chief problems are the generations of grooves that are smooth even in terms of wavelengths one tenth that of visible light and the supply of novel special purpose rulings, for example, multi-partites with varying groove spacing and aspherics.

Dr R. Jarrell (Jarrell-Ash) and Dr H. W. Faust (Carl-Zeiss, Oberkochen) completed the session on classical gratings by reviewing their work on the intensity distributions for blazed gratings (J-A) and the development of a new 6 inch ruling facility at Carl-Zeiss.

The highlight of the meeting centred on developments in the field of interference gratings, in which progress is very rapid. In this technique the fringe system produced by two interfering coherent beams is recorded on photoresist and it is then translated by various processes into the corresponding metallized grating. In contrast to ruled gratings, however, the grating frequency and size are not limited by the problems of diamond wear and optimum width. Furthermore, the fringes, being contours of constant optical path difference, may be created and recorded to give predetermined imaging qualities to the final grating. Dr J. Flamand (Jobin-Yvon) reviewed the general conditions for stigmatism for such gratings and showed how holographic solutions have already been achieved for several applications in astronomy and spectroscopy.

In further practical vein, Dr M. C. Hutley (National Physical Laboratory) discussed the progress of his laboratory in obtaining blazed profiles and high

photometric efficiencies over significant regions of the spectrum. The Littrow mounting was shown to be the most favourable configuration to use to avoid the polarization anomalies that arise from the characteristic sinusoidal profile of interference gratings. The properties of these anomalies drew the attention of several speakers but it was apparent that more data were needed, particularly in the vacuum ultraviolet region. Mr A. Termanis (Rank Precision Industries Ltd) showed the first data of this type in the wavelength region 1670 Å-400 Å. The anomalies are observed as rapid variations in response over short wavelength intervals, but in most cases it seems that the presence of these features would not preclude the use of interference gratings in spectroscopic instrumentation.

The final session dealt with the subject of gratings for X-ray use. Dr A. Franks and colleagues (National Physical Laboratory) showed how development of the NPL phase grating of rectangular groove profile and with optically smooth diffracting surfaces has led to the short-wave performance being extended into the hard X-ray domain. It is now a practical proposition to consider the construction of a focusing X-ray grating spectrograph for the wavelength region 0.1 Å-5 Å (2.5 keV-125 keV).

The session concluded with a summary by Dr R. J. Speer (Imperial College, London) of the new facilities that are available for the standardization and optimization of gratings in the X-ray and soft X-ray regions of the spectrum. This research is in collaboration with the major manufacturing companies and work is well advanced on a reference collection of data for all rulings that are currently available as replicas.

Predicting Structural Distortions

IN next Wednesday's *Nature New Biology* (May 31) Low and Spitz report the results of their attempts to predict whether an amino-acid substitution in human adult haemoglobin will or will not result in a disturbance of the structure (and therefore perhaps to physiological consequences).

The approach is very simple: all amino-acids have been characterized by various authors in terms of helix-promoting potential. Low and Spitz in fact characterize triplet sequences as helix-forming or non-helix-forming. If the central residue of the triplet is replaced, the helix-forming tendency may either change or remain the same. Low and Spitz have examined the substitutions in the 104 human adult haemoglobin variants of known sequence, which they classify into those that

should be unaffected by the substitution, those in which a helix-breaking substitution occurs in a helical region and those with a helix-promoting substitution in a non-helical region.

Fifty-eight substitutions occur in wholly helical regions and thirty-one of these are predicted to cause distortions, whereas among the twenty-two in clearly non-helical regions, eleven cause predicted distortions. In one case a proline is introduced into a long helix, and must without question cause some disruption.

So far only four such predictions can be verified in terms of X-ray structures: in one case a predicted distortion occurs, in another no distortion is expected or observed, and in two further cases disturbance of non-helical regions is predicted but not observed.