with cessation of breeding. The increases and decreases were statistically significant.

When various population parameters were examined it was found that home ranges in the breeding season were significantly larger that those in the non-breeding season. Home ranges of over-wintered voles in the breeding season were significantly larger than those of young born in the breeding period. Perhaps surprisingly, there was no significant relationship between an individual's level of aggression and its home range size. Adult voles were more aggressive than young and resident home range holders were more aggressive than non-residents.

All the data collected point to the complicity of rapid change in aggression at the time of most rapid change in population size. Eventual intrinsic control of population could be caused either by a strict spacing behaviour or by an interference with breeding performance in the manner suggested by Chitty. Either way, aggression could be seen to play an important part.

Lidiker's long term work on an island population of *M. californicus* (*Ecol. Monogr.*, **43**, 271; 1973), reported in these columns a few weeks ago (see *Nature*, **246**, 380; 1973), suggested an alternative type of natural control in which no one factor was markedly more important than several others. Quite obviously much more detailed study of the complex processes of rodent population stability is necessary if the answer (if, indeed, there is to be just one answer to a problem which occurs wherever rodents exist) is to be found. One thing is clear. Dynamic stability, or the lack of it, is the result of behavioural and physiological change, not the cause of it.

High spin states of nuclei

from our Nuclear Theory Correspondent

REACTIONS between heavy ions are proving valuable tools for the investigation of high spin states of nuclei at high excitation energies. Heavy ions readily produce such states because they bring energy to the compound nucleus without high velocities; for example, 100 MeV can be brought in by a ^{10}B nucleus or by a single nucleon but the velocity of the nucleon would be much higher than that of the ion and so there would be a greater likelihood of direct reactions or of disintegration of the target nucleus. Furthermore, if the collision takes place non-centrally the compound nucleus is given a large angular momentum, so there is an enhanced probability of exciting high spin states.

This selectivity of heavy ion reactions is important because at moderately high excitation energies there is often a high density of nuclear states. Only a very few of these have high spins and a heavy ion measurement at relatively low resolution is able to pick them out easily whereas a less selective reaction would require much higher resolution to show them with the same degree of clarity.

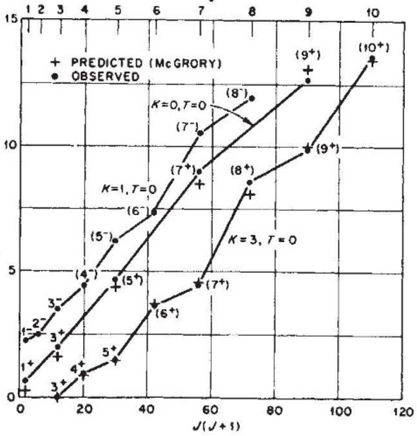
The spin of a particular state may be obtained by comparing the angular distribution of the reaction leading to it with the predictions of the statistical theory of nuclear reactions due to Hauser and Feshbach. This theory predicts that the angular distribution is symmetric about 90° in the centre-of-mass system and gives cross sections that depend quite critically in shape and magnitude on the assumed spin of the final state. The identification of the reaction mechanism may be further checked by studying the characteristic fluctuations in intensity of the emerging particles as a function of incident energy.

This method of studying high spin states has recently been used by Gomez del Campo, Ford, Robinson, Stelson, McGrory and Thornton (*Phys. Lett.*, **46B**, 180; 1973) to determine the energies and spins of rotational states in ^{22}Na by the ^{10}B(^{16}O, α)^{22}Na reaction.

The angular distributions of the alpha particles emitted at energies corresponding to several states of ^{22}Na were found to be very well fitted by the Hauser-Feshbach statistical model calculations, confirming both the assigned spins and the assumed character of the reaction.

These high spin states in ^{22}Na are members of rotational bands and the dependence of their energies on J(J + 1) is shown in the figure. It is clear that the bands can be followed to high spin values, and that there are systematic deviations from the J(J + 1) proportionality. Further confirmation of the spin assignments is provided by the energies given by shell-model calculation, and these are also included in the figure.

This example shows the advantages of heavy ion reactions for studying high spin states, and it is likely that this method will be extensively used in the future.



Excitation energies of states in three rotational bands in ^{22}Na as a function of J(J+1). The dots refer to the measured energies and the crosses to shell model calculations.

Surface changes in transformed cells

from a Correspondent

THE idea that the composition of the cell surface controls to some extent the orderly proliferation of cells in culture now occupies a central position in cell biology. The classical experiments of Aub and his colleagues and later of Burger and Sachs and their collaborators demonstrated surface changes in a particularly simple manner by agglutination with certain lectins. The susceptibility of cells to agglutination could be correlated with the growth characteristics of these cells in culture. Subsequent arguments concerning the basic mechanisms behind the increased agglutination of transformed cells compared with non-transformed cells as induced by concanavalin A or wheat germ agglutinin have left the problem still not completely resolved. But there is general agreement that the changes are essentially small quantitative differences in the amount of receptors at the cell surface able to form attachments with multivalent lectin ligands, or in the topographical distribution of these sites.

Clearly, receptors for wheat germ agglutinin, for instance, are present on normal as well as transformed cells and some progress has been made in their characterisation from both cell types (Jansons and Burger, *Biochim. biophys. Acta*, **291**, 127; 1973). The demonstration of clear qualitative change in the surface membrane composition of cells that can be correlated to growth control would therefore be important. What may turn out to be just such a change in cells and their virus induced transformants is described by Hynes (*Proc. natn. Acad. Sci. U.S.A.*, **70**, 3170; 1973).

What Hynes has done is to treat clones of the hamster fibroblast line NIL, which show normal behaviour in culture, with lactoperoxidase. In this process external proteins on the surface membrane of the cells are iodinated with