

J. Edwards (Birmingham Maternity Hospital) stressed the non-eugenic nature of genetic counselling conceding its value in assisting individual families.

Genetic engineering was discussed widely. P. A. Marks (Columbia University) described the use of avian myeloblastic virus reverse transcriptase in the production from natural mRNA of DNA coding for alpha and beta globin chains. The major portion of globin structural genes were synthesised and could in turn be used in heterologous cell free systems or intact oocytes to synthesise the appropriate globins. C. Merrill (National Institute of Mental Health, Bethesda) described possible means of introducing new genetic material into intact cells using the examples of prokaryotic genetic exchange. In a workshop on "Advances of Treatment of Hereditary Metabolic Disease" A. G. Bearn (New York Hospital, Cornell Medical Center) reviewed the use of organ transplantation, particularly the apparently successful use of renal allotransplantation in Fabry's disease, but was quite properly cautious about advocating liver transplants in Wilson's disease treatable by less heroic methods.

Of particular interest was the suggestion by P. E. Polani (Guy's Hospital, London) that mucopolysaccharidosis might be controlled by small skin grafts. H. W. Rudiger (University of Hamburg) described the 'Hunter corrective factor' and discussed how it might be produced from urine for therapeutic purposes. It is curious that earlier pyrogenic samples were most efficient in inducing mucopolysacchariduria.

R. G. Edwards (University of Cambridge) reviewed advances in reproductive biology and their implications and discussed the partial success achieved in the selection of X or Y bearing spermatozoa and *in vitro* fertilisation of human ova. There is no doubt that meiotic and early post-fertilisation studies would greatly assist in explaining non-disjunction and polyploidy. It is astonishing how much interference morulae and blastocysts will tolerate and still (in the mouse) develop into a normal foetus. It had proved possible to disaggregate and mix cell lines for study and to cut embryos in half using one half for study and the other half after implantation develops normally. The rarity with which malformed foetuses resulted from the implantation of animal ova fertilised *in vitro* will no doubt encourage those who would do the same in humans.

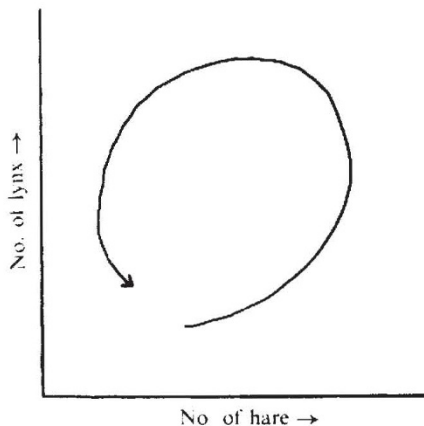
The moral and ethical issues in biomedical research were brilliantly reviewed by A. G. Mutoulsky (University of Washington) who avoided most of the clichés in considering the implications of the present rapid expansion of technology.

## POPULATION ECOLOGY

### Hare-Eats-Lynx Effect

from our Animal Ecology Correspondent

MOST biologists are familiar with the concept of population cycles and in particular with the well known and often quoted Canadian lynx-snowshoe hare interaction (MacLulich, *Univ. Toronto, Stud. Biol. Ser.* No. 43; 1937, *inter alia*). The provisions of the Lotka-Volterra equations, developed to describe the dynamics of predator-prey interactions, dictate that peaks of predator density must, temporarily, succeed peaks of prey density. When this dynamic arrangement is depicted according to Rosenzweig and MacArthur's graphical predation theory (*Amer. Nat.*, 97, 209; 1963), with the numbers of predator on the ordinate and numbers of prey on the abscissa, the representation of one complete cycle of interaction is a quasi-circular figure progressing in a clockwise direction (see figure).



It comes as a considerable surprise to read the results of Gilpin's subjection of MacLulich's data to Rosenzweig and MacArthur's graphical analysis (*Amer. Nat.*, 107, 727; 1973). He reveals that, for the 30 years 1875-1906 at least, the figure follows an anti-clockwise direction. This presents a severe interpretational problem because hares simply do not eat lynx. Other 10-year interactions, however, had the expected phase relationship. Gilpin and his colleagues (*Theoretical Population Biology*, in the press) have developed a predator-prey model in which growth rates of low density single species, interspecies coupling constants, intraspecific social interactions and intraspecific interference are considered. This model is much more flexible than the Lotka-Volterra one since it assumes that intraspecific factors are important. When the 30-year lynx-hare data in question were examined by this model the regression fit was poor. So poor that the signs of interspecies coupling constants were reversed. The model reinforced the findings of the graphical analysis that the hare was the predator. How, then,

can the anti-clockwise figure be explained?

Gilpin argues that hares could "kill" lynx if, for example, they carried a disease to them. He investigated the possibilities of this by writing an "epidemic" into his model which took effect only when a certain threshold density of hares had been reached. The "disease" was non-fatal to hares but took its toll of lynx. The results of the "epidemic" on the interaction when expressed graphically closely resembled the plot of the interaction during the 30 unexplained years. This explanation seems to be plausible but for the fact that no such disease has been found to occur in reality. Epidemic disease fatal to hares but not to lynx has, however, been identified (Chitty, *J. Anim. Ecol.*, 17, 39; 1948).

The uniqueness of the series of data on the lynx-hare interaction lies in the number of years over which it was collected. Methodically logged by the Moravian Mission in Ungava since early in the last century, the figures for both species are the number of those trapped, skinned and put up for sale. Perhaps Gilpin has hit the nail on the head when he considers that fur trappers themselves are that elusive "disease". During lean years they turn their attention to chores other than trapping and head for the trap lines only when hares are again abundant. If, once at the lines, they turn a disproportionately large amount of their time to lynx trapping (which is infinitely more profitable and therefore reasonable to assume), they would return bags not inconsistent with the data that produce the curious hare-eats-lynx effect.

MacLulich's classic data may constitute the largest series of its kind on record but, as an indicative statement of actual population densities, their validity may be seen by this model to be in doubt. The model may yet be found to be of widespread ecological use, but the test of it will be as good as the test data.

## AIR POLLUTION

### Ozone and Wild Plants

from our Plant Ecology Correspondent

MOST of the concern surrounding air pollution in western Europe has centred on sulphur dioxide. In North America ozone has long been recognised as an important phytotoxic pollutant produced in the lower atmosphere by photochemical oxidation of certain products of combustion, especially nitrogen dioxide. The production of ozone is therefore particularly prevalent in urban environments where fossil fuels are combusted in large quantities, especially by automobile engines. Nitrogen dioxide formed in this process is split by ultra-