those genotypes that escape capture. The concept of genetic feedback regulating population number and bringing about stability in interactions has been extended and championed by Pimintel (*Science*, **159**, 1432; 1968). What happens is that high predator density creates strong selective pressures on the prey. This selection alters the genetic complexion of the prey to make it more resistant to attack. Such resistance feeds back negatively to limit the feeding pressure of the predator and so stability gradually results. Van den Ende's study provides a neat insight into how this process actually works.

NUCLEAR PHYSICS

New Giant Resonances

from a Correspondent

IT has been known for a long time that a giant electric dipole resonance can be excited in all nuclei by photonuclear experiments of the (γ,p) and (γ,n) type. This resonance has an excitation energy of order 70 to 80 $A^{-1/3}$ MeV (where A is the mass number of the nucleus) and a width of a few million electron volts. It is visualized as the protons and neutrons oscillating in bulk against one another. There have been speculations that other giant resonances with other multipolarities might exist; for example, quadrupole motions in which the nucleon distributions oscillate between prolate and oblate shapes with quadrupole deformations. Two types of each might exist, the isoscalar, with isotopic spin quantum number $T=0$, in which the neutrons and protons move together in phase and the isovector ($T=1$) in which they move out of phase. The latter type is expected to have a higher vibrational frequency and hence a higher energy. In order to qualify as "giants", the excitation strengths of these resonances must exhaust a large fraction of certain sum rule limits.

An exciting development recently has been the experimental discovery of a giant isoscalar quadrupole resonance in all the nuclei in which it was looked for (and, in some cases, possibly an isovector one also). One reason the isoscalar one had escaped detection before is that its excitation energy is close to that of the giant dipole (about 2 MeV lower). Furthermore, because its excitation requires electron quadrupole (E2) radiation rather than electron dipole (E1), it is difficult to observe in photonuclear work.

The experimental studies of the past few years have been pursued in two parallel and initially independent ways, namely, inelastic electron scattering and inelastic hadron scattering. The electron measurements have been made principally at Darmstadt (Buskirk *et al.*, *Phys. Lett.*, **42B**, 194; 1972) and at Tohoku University (Nagao and Torizuka, *Phys. Rev. Lett.*, **30**, 1068; 1973). About twelve nuclei have now been studied, ranging from ^{40}Ca to ^{208}Pb. In each case the spectra of inelastic electrons show a peak for excitation of the giant dipole and just below it another peak whose angular distribution is compatible with E2 excitation. The strength of the lower resonance exhausts most of the quadrupole sum rule limit. Also seen in some cases are indications of another peak at roughly twice the excitation ($\sim$120 $A^{-1/3}$ MeV), also compatible with E2, and it is speculated that this is an isovector resonance.

This new resonance was first excited by strong interactions in proton inelastic scattering. It was first discovered at Oak Ridge National Laboratory in the spectra of inelastically scattered particles obtained from bombardment of the nuclei by 60 MeV protons; the peak due to excitation of the giant dipole resonance was, of course, also observed (Lewis, Bertrand and Horen, *Phys. Rev.*, **C8**, 398; 1973). Later it was realized that it had been seen 15 years earlier in the spectra from bombardment by 180 MeV protons! At that time the observed peaks had been identified solely with the giant dipole resonance whose position was not known so precisely at that time. The excitation strengths observed are in approximate agreement with the corresponding electron measurements. Meanwhile the new resonance has also been seen in many nuclei by the inelastic scattering of ^{3}He ions and alpha particles.

The angular distributions measured in the electron scattering experiments could not distinguish between E2 and E0 transitions; further the observed strengths were compatible with the sum rule limits for either interpretation. (The E0 would be visualized as a breathing mode or radial oscillation in density.) These two alternatives would not be decisively distinguished by these early proton measurements although the later measurements favour the E2 choice. The ^{3}He and alpha scattering measurements, however, strongly indicate that the resonance has a quadrupole character. The theoretical predictions for the cross-sections for monopole excitations which exhaust the sum rule are an order of magnitude smaller than those observed, whereas the predictions for the quadrupole are in agreement with experiment. These conclusions have been confirmed by recent studies using polarized protons. The consequent left-right asymmetries are predicted to be of opposite signs for E0 and E2 and the measurements are in agreement with E2.

The ^{3}He and alpha experiments also provide evidence for the isoscalar nature of the resonance. The alpha particle, being isoscalar itself, would only weakly excite an isovector state, whereas the ^{3}He ion suffers no such inhibition. The two ions, however, excite the resonance with comparable strengths.

Naturally the discovery of this isoscalar quadrupole resonance has aroused new interest in finding other such phenomena. The possibility of an isovector quadrupole state at a much higher excitation energy has already been mentioned, and there have been some indications of this from photonuclear experiments also. Electron scattering has also shown evidence for giant magnetic dipole excitations at lower energies. Preliminary work suggests that there may be fairly strong E3 excitations present as well. Of particular theoretical interest (because it relates to the compressibility of nuclear matter) would be the discovery of a giant isoscalar monopole or E0 state. A major difficulty that the experimenters have to face is that the spectra from reactions corresponding to these high excitations show large "background" components on which these giant resonances are riding; in most cases they are only giant in the sense that they take up a large part of the corresponding sum rule limits, not that their cross-sections are giant!

Clearly the existence or non-existence of such giant resonances must have implications for other nuclear phenomena, and a number of these have been explored. Such states may be virtually excited during other processes; only, however, the effective charges needed for the description of electromagnetic transitions between low excited states are mentioned.

POLYPEPTIDES

Corrigendum

from our Molecular Biology Correspondent

IN writing about conformation of synthetic polypeptides recently (*Nature*, **244**, 254; 1973), I unaccountably mis-stated utterly one of the results of Rao and Miller (*Biopolymers*, **12**, 835; 1973). This concerns the optical effect of incomplete removal of protecting groups. I should have said that this leads to negative ellipticitv, where the fully deprotected polymer has a positive Cotton effect, not the other way round. Also, in the second paragraph, "dilute salt solutions" should have read "diverse salt solutions". Apologies to those concerned and those confused.