NUCLEOSYNTHESIS

Source of Stellar Neutrons

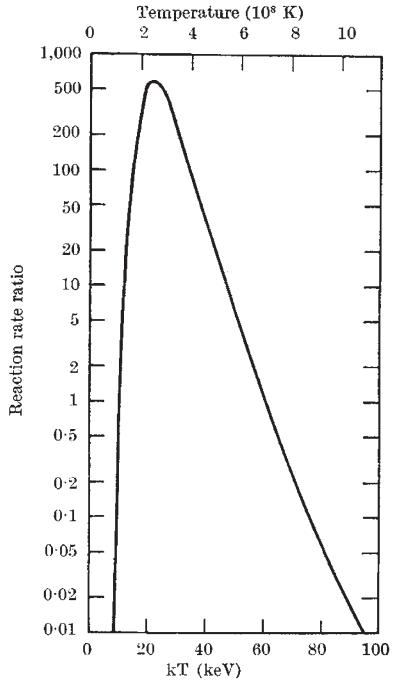
THERE is strong evidence to support the theory that the mechanism for the production of elements heavier than iron in stars is neutron capture by nuclei (for example, Clayton *et al.*, *Ann. Phys.* (New York), **12**, 331; 1961). The nature of the source of these neutrons, however, is uncertain, although there are currently two principal propositions (Marion and Fowler, *Astrophys. J.*, **125**, 221; 1957, and Peters, *Astrophys. J.*, **154**, 225; 1968), both of which involve α-particle reactions with a neon isotope

$$^{21}\mathrm{Ne} + \alpha \rightarrow {}^{24}\mathrm{Mg} + \text{neutron}$$

and

$$^{22}\mathrm{Ne} + \alpha \rightarrow {}^{25}\mathrm{Mg} + \text{neutron}$$

The second reaction is known to proceed by way of the intermediate nuclide ^{26}Mg which is unstable and ejects a neutron to form ^{25}Mg. Experiments carried out at the Lawrence Radiation Laboratory, University of California, by Berman *et al.* (*Phys. Rev. Lett.*, **23**, 386; 1969), with a γ-ray beam and a target of MgO enriched with ^{26}Mg, have shown that the rate of neutron production by the second reaction should be greatly enhanced because of the existence of a resonance at a neutron energy of 54·3 keV. This means that the probability that neutrons will be produced with about this energy may be several orders of magnitude greater than the probability for other energies. Berman *et al.* have shown that the spin and parity of the resonance are such that it is possible for α-particles with an energy corresponding to a temperature of about $2{\cdot}5 \times 10^8$ K to excite the resonance and thus to increase markedly the neutron production by the second reaction. The variation of the ratio of the respective reaction rates with stellar temperature is shown in the figure for an equal abundance of both isotopes; the ratio increases by a factor of about 10^5 as the temperature doubles. Berman *et al.* point out that, in relatively massive stars, the dominant hydrogen burning process leads to the production of ^{14}N, which, by another chain of reactions, produces ^{22}Ne. They consider that this and their own experimental results strongly favour the $^{22}\mathrm{Ne}(\alpha,n)^{25}\mathrm{Mg}$ reaction as the chief source of neutrons for stellar nucleosynthesis.



DRUGS

Living with Parkinson's Disease

THE Department of Health and Social Security announced on August 22 that the drug L-dopa will be restricted to clinical trials and will not be available on prescription to sufferers from Parkinson's disease until it has passed the necessary screening tests.

The symptoms of Parkinsonism, which afflicts up to a million people in the United States and may be as common as epilepsy, are rigid limbs, expressionless faces and tremors in hands and legs. Cures are infrequent.

When it was known that drugs which cause a decrease in amounts of monoamines, such as reserpine, in the brain can also cause Parkinsonism, the concentrations of these amines were investigated in Parkinsonian patients. In particular, dopamine, a neural transmitter in the basal ganglia, was found to be decreased by these drugs. These findings suggested that a rational treatment of Parkinson's disease would be to increase the concentration of dopamine in the brain. Dopamine itself cannot cross the barrier between blood and brain but L-dopa, its immediate metabolic precursor, can, and was used in clinical trials. At first these were not very encouraging, but in 1967 Cotzias, using massive doses (16 g) of D,L-dopa, administered orally, reported an impressive improvement in ten out of sixteen patients. In four of the patients, the treatment was associated with a transient depression in the white blood cell count. This is thought to be caused by the D-isomer, for it is not observed in patients treated with the pure L form (see, for example, D. B. Calne *et al.*, *Lancet*, i, 744; 1969). L-Dopa has other side effects such as nausea, involuntary movement, agitation and lowering of blood pressure; but, if the massive dose is built up slowly, the patients mostly become acclimatized, probably because they feel the drug helping them.

Unfortunately, the drug only helps a proportion, perhaps 50 per cent, of Parkinsonians. It is not known why this is so, and if it were known it might not be possible to do anything about it. It could be a question of absorption from the gut. The drug is not thought to cure the disease—it merely helps sufferers to live with it rather as insulin does for diabetes. Some cures have been reported but the number is small, and probably no more than that for spontaneous recovery. Just as for insulin, therefore, it must be possible to guarantee a continuous supply of the drug to each user, probably for the rest of his or her life. At present this is not possible, for L-dopa is very difficult to make; a particular problem is the last step, the separation of the racemic mixture. At the moment, it can only be obtained, in small quantities, from Japan, although British drug firms are making strenuous efforts to get a large scale synthesis under way. As a result of this shortage, a sordid situation has arisen in the United States and some patients have pretended to be taking L-dopa in order to obtain some and then sold it at a huge profit. The restrictive measures announced by the ministry are clearly designed to avoid this.