uators may control expression of the *E. coli ilv* operon and the *S. typhimurium his* operon (Kasai, *Nature*, **249**, 523–527; 1974).

The parallel between the *trp* attenuator and λ terminators overridden by N function is strengthened by the finding that polarity suppressors allelic to *su*A partially relieve attenuation. The original *su*A mutants are, however, relatively inefficient in this respect. Again different alleles of *su*A differ in their effectiveness at suppressing polarity at different terminators. The ubiquitous association of *su*A mutants with a failure to terminate transcription coupled with the selectivity of different *su*A alleles argues that ρ may indeed be the product of the *su*A gene.

This strong suspicion is confirmed by two observations of Ratner (this issue of *Nature*, page 151). First, affinity chromatography analysis of ρ protein from different *E. coli* strains reveals that different *suA* mutations affect ρ in disparate ways: one destabilises ρ, a second apparently increased the molecular weight of the polypeptide, while others which are presumed to be missense mutations overproduce ρ. Finally by making use of a molecular weight difference between ρ isolated from different *E. coli* strains Ratner shows that the ρ gene is tightly linked to the *suA* locus. Together these experiments make it almost certain that the *suA* locus defines the structural gene for ρ and not a modifier of ρ protein.

Solar seismology

from Nigel Weiss

THE detection of normal modes of vibration in the Sun provides the first proper check on the theory of stellar structure and evolution. By astrophysical standards, this theory is well established and precise: it predicts the properties of main sequence stars and the qualitative features of their later evolution. These successes are obtained after calibrating the theory to fit the mass, radius, luminosity and age of the Sun, all of which are known. The single other measurement that could be used to check the theory was of the solar neutrino flux. Unfortunately, this is an order of magnitude less than theory had predicted. In the last six months, however, three independent groups have announced the discovery of solar oscillations and the periods of these oscillations offer a means of probing the internal structure of the Sun.

About 10 years ago H. A. Hill set up the Santa Catalina Laboratory for Experimental Relativity by Astrometry, in Arizona, with the aim of measuring precisely the gravitational deflection of light by the Sun. To do so required an accurate technique for locating the edge of the solar disk. The SCLERA group were then able to measure the Sun's oblateness and to show that it was consistent with the observed rotation rate at its surface. In addition they discovered regular oscillatory displacements of the edge of the Sun with a period of about 48 min, together with nine higher frequencies of oscillation.

At the Crimean Astrophysical Observatory, A. B. Severny has for many years studied magnetic fields and velocities in the solar photosphere. He has also compared stellar magnetic fields with the net field that would be measured if the Sun could not be resolved In this issue of *Nature* (page 87), Severny, Kotov and Tsap report the result of comparing the line of sight velocity at the solar surface near the equator with that around the poles. This enables them to estimate the radial velocity and they have discovered regular oscillations, persisting for at least 7 months, with a period of 2 h 40 min±0.5 min.

This remarkable result has been independently confirmed (page 92) by a group from the University of Birmingham. Brookes, Isaak and van der Raay were attempting to measure the gravitational redshift from the Pic-du-Midi Observatory, using a resonance scattering method. Their results, also reported in this issue, show oscillations with a period of 2 h 39 min ± 2 min. The agreement is far too close to be fortuitous; the methods are so different that systematic erors have to be excluded. Thus the Sun seems also to be pulsating with a period more than three times greater than the longest period detected by the SCLERA group. (Hill's procedure was limited to periods less than about 1.5 h.)

In a third article in this issue (page 89), Christensen-Dalsgaard and Gough, from the University of Cambridge, attempt to identify the normal modes observed and relate them to those derived from theoretical solar models. Stellar pulsations can be classified as acoustic (p) or gravitational (g) modes. The fundamental mode of radial pulsation for a typical solar model has a period of approximately an hour, while the fundamental quadrupole mode has a period of 46 min. In general, the period of an acoustic mode decreases with increases either in the number of internal modes or in the degree of angular dependence. The computed periods for p modes are in fair agreement with the SCLERA observations, though it is not yet certain how they are excited.

This leaves the problem of explaining the 2 h 40 min oscillation. The observers suggest that it is indeed a fundamental radial pulsation of the Sun. If so, this measurement would upset the established theory of stellar structure and, with it, many astrophysicists. Despite the anomalous neutrino flux, it seems unlikely that the accepted theory could be so far wrong. The theorists prefer to interpret this long period oscillation as a high order gravitational mode, for the g modes have periods that increase with the number of internal modes.

Christensen-Dalsgaard and Gough also review the exciting prospects opened up by these new observations. It should soon be possible to identify the modes directly and to determine their frequencies with great precision. These frequencies can then be used to establish the properties of the solar interior and, in particular, the variation of chemical composition with radius. Such combinations of exact measurements with detailed computations are changing the nature of solar physics. This inversion procedure is similar to that used in deriving the Earth's structure from the frequencies of its normal modes (of which over 1.000 are now known). The structure of the Earth had, however, already been established by seismic observations: in the Sun, though we think we know the relevant equations, the structure has not yet been probed. Solar seismology introduces a new precision into astrophysics. □

Two more biologically active tetrapeptides

from A. J. S. Davies

THE search for chemically defined mediators of interactions between mammalian cells is an arduous process. The lymphocytologists, flushed with success at their identification of T and B cells, have been trying valiantly but, aside from a long list of somewhat risible acronyms (MIF, MAF, SMAF, LIF, LAF and so on) little of repute has yet emerged. The chalone concept has been put forward but is tending to founder on the lack of support consequent upon failure of chemical characterisation of the putative medi-