well for the future of specific immunotherapy. One possible route to overcoming this problem, as the Kleins have pointed out, is tumour cell modification effected by various artificial means. Another is to concentrate more effort on non-specific immunotherapy. The rationale is fairly simple: a few types of lymphoreticular cell, namely activated macrophages and natural killer (NK) cells, seem capable of spontaneously killing various kinds of tumour cell populations. Because classical antigens are not involved in the recognition process — at least as far as activated macrophages are concerned — variants resistant to this form of effector cell killing may arise far less frequently, if at all. Fidler, for example, has shown that it is possible to derive tumour variant sublines resistant to conventional lymphocyte-mediated killing by progressive selection *in vitro* (Fidler *et al. Cancer Res.* **36**, 3160; 1976); the variants appeared to have lost the tumour antigens (Fidler & Bucana *Cancer Res.* **34**, 3945; 1977). There are no reports (yet) of the derivation of similar macrophage-resistant (Mac^R) variants. Whether this is from lack of trying is not clear, but if Mac^R tumour variants prove to be rare, it would provide a ray of hope in the fight against the forces of tumour progression. □

Stellar rotation in Erice

from Evry Schatzman

EVEN stars of the most classical types, if they are rotating, are extremely complicated. The convection zones of any star are difficult enough to understand; nevertheless, the problems facing astrophysicists begin to multiply when the stars are rotating. The generation of a magnetic field, for example, is certainly related to rotation — but how?

The workshop* was restricted to the problems of the instabilities associated with rotation and to the effect of rotation on turbulence. The problem of magnetic fields, which is itself formidable, was purposely limited to a few basic questions concerning its relation to turbulence and rotation. On the other hand, getting hydrodynamicists and astrophysicists together was a good way of finding out which kinds of astrophysical problems can be approached by laboratory experiments, and of determining how far we can go in applying present hydrodynamical knowledge to astrophysical problems.

It is naturally the duty of the astrophysicists to list the problems which seem to depend on processes associated with rotation. In other words, what kinds of observations inform us directly about the physics of the interiors of stars? These observations can be roughly classified according to the depth at which the processes take place, as follows:

(1) magnetic fields in the filaments at the surface of the Sun (perhaps a few scale heights);

(2) supergranulation (the depth of the convective zone);

(3) symmetry properties between the North and South hemispheres of the Sun (flow throughout the whole convective zone);

(4) lithium depletion by transport from the bottom of the convective zone to the lithium burning level (about one scale height below the convective zone);

(5) $^{12}C/^{13}C$ anomalies in giant stars on the first ascending branch of the Hertzsprung-Russell diagram (region in which ^{13}C nuclear processing takes place in main sequence stars, that is, about 1/3 of the stellar radius in from the surface.

In addition, the problem of the origin of white dwarfs' magnetic fields involves the dynamo process in the convective core before large mass loss and white dwarf formation, and consideration of the properties of angular momentum of stars addresses the problem of transfer of angular momentum in the whole star, during formation and on the main sequence.

Only partial answers can be given to these questions. N. Weiss (University of Cambridge) and Galloway (Boulder, Colorado) presented several aspects of the dynamo mechanism, and it is worth stressing that, after years of optimism, the existence of the turbulent dynamo does not seem to be so firmly established. Galloway described the first results of a very large numerical experiment of Gilman (Boulder, Colorado) to simulate the building of the solar-cycle, the significance of which turns out to be very difficult to determine. F. Busse (University of California, Los Angeles) described the role of boundaries on the production of rolls in a rotating thermally unstable region and suggested very strongly that symmetry properties in the solar hemisphere and in the hemispheres of Jupiter can be due to the presence of these rolls.

All the problems of mass transport can be interpreted in terms of meridional circulation or of mixing associated with various instabilities (Rayleigh, shear flow, thermal enhanced). Busse revived the controversy (between Randers, Temesvary, Roxburgh and Baker-Kippenhahn) about the existence of Eddington-Sweet currents by showing that the only stationary solution for a rotating star is a distribution of angular velocities which balances exactly the force induced by stellar oblateness, and cancels the Coriolis force by the suppression of the meridional velocity. S. Temesvary (Tubingen) showed, after Busse, that all non-stationary stream flows decay with the time scale of viscous dissipation, so that the Sun can have any stream flow.

Similarly, for heavier stars (radiative viscosity, electron scattering), the ratio of the viscous dissipation time to the stellar life time grows like M^{-1}! It seems likely that no star lives long enough on the main sequence to reach the magic stationary situation. Therefore, meridional circulation seems to be there. However E. Schatzman (Observatoire de Nice) showed, using Michaud *et al*'s arguments that, if the meridional circulation is responsible for the lithium depletion in the Sun, this contradicts the fact that there is almost no beryllium depletion. J. P. Zahn (Observatoire de Nice) described the conditions for various shear instabilities and Schatzman showed that a consistent picture can be given, with the same turbulent process, probably related to shear flow instability, which explains a variety of abundance peculiarities for elements nuclearly processed deep inside the stars.

The general properties of stellar rotation on the main sequence are now understood, but the detailed mechanisms remain to be established. Then one would not have to rely merely on phenomenology, as one does in discussions of magnetic field generation.

A discussion on the condition in which angular momentum transport takes place in a turbulent flow showed clearly that this problem is still far from being solved. □

Evry Schatzman is at the Observatoire de Nice

*A workshop on rotating stars was held on 2-10 June in Erice.

A hundred years ago

The Americans have stolen a march upon us in sanitary matters, as they have done in so many other things. In March of this year an Act passed the US Congress organising a Board of Health to look after all matters relating to the public health, and to advise Congress what steps should be taken for the promotion of so all-important a matter. We have just received the first number of the weekly *National Board of health Bulletin*, published by this body, who have 50,000 dollars appropriated to them for salaries and expenses. Besides mortality statistics the *Bulletin* contains a number of rules and regulations with respect to the sanitary condition of ships.

Under the date of April 30, a correspondent of the *North China Herald* at Wladivostock, in Russian Manchuria, writes that, although the mountain tops were still covered with snow, the winter had at length come to an end, the ice in the harbour having on that day broken up and floated out to sea. The winter began in October and has been the severest known for many years. The bay was entirely covered with ice from two to three feet thick. Wladivostock is said to be improving, though slowly, and there are signs of an attempt at road-making.

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