in tumour cells which allows formation of microvilli and hence agglutination.

Using dark field microscopy these workers found that the transformed cells examined had many hairlike microvilli on their surfaces, and normal cells (in this case 3T3 cells) had none. But when 3T3 cells rounded up in mitosis or were treated briefly with trypsin numerous microvilli could be seen. These are precisely the conditions where cyclic AMP levels are low and the cells agglutinate readily. The concept that cyclic AMP could regulate agglutinability through microvillus formation was tested directly by incubating transformed cells for extended periods with dibutyl cyclic AMP, then examining their surface for microvilli and measuring agglutinability. After 24 h treatment the cells had few microvilli and were far less agglutinable. But the decreased agglutination of tumour cells after prolonged incubation with dibutyl cyclic AMP may have more to do with expansion of the G2 phase of the cell cycle (Smets, *Nature new Biol.*, **239**, 123; 1972) where transformed cells are less agglutinable (Smets and deLey, *J. Cell Physiol.*, **84**, 343; 1974) than any genuine reversion to a more normal phenotype. Also dibutyl cyclic AMP has been reported to affect the syntheis of some cell surface components (Goggins *et al.*, *J. biol. Chem.*, **247**, 5759; 1972), and it is possible that it interferes with agglutination through its effect on these molecules rather than by any direct action on microvilli.

Better evidence for the direct role of cyclic AMP in agglutination comes from the use of prostaglandin E_1 or the phosphodiesterase inhibitor isobutyl methyl xanthine. Brief treatment of transformed cells (L929) with either compound leads to a rapid increase in cyclic AMP as well as a decrease in microvilli and a decrease in agglutination. When the cells are washed free of these componds cyclic AMP levels drop and microvilli and agglutinability return.

The idea that transformed cells are agglutinable because they have numerous microvilli is only the most recent of a long series of explanations, most of which have been oversimplified or erroneous. However, the theory does have the merit of being easy to test. It should be pointed out that not all tumour cells are more agglutinable than normal cells and not all cells that agglutinate have numerous microvilli. There is no reason to suppose that a single difference between cells is the reason for the difference in their agglutinability. It seems far more likely that agglutination is a very complex process involving factors such as microvilli, surface charge and density and mobility of lectin receptors and only in a few model systems will one factor predominate. Perhaps only when agglutination is understood in simple cells such as the erythrocyte will factors that control agglutination in more complex cells be understood.

Around the world ballooning for dust

from David W. Hughes

BALLOONS have been used by scientists ever since the pioneering work of Etienne and Joseph Montgolfier in 1783, either to investigate the atmosphere or to lift apparatus above most of it. Modern plastic balloons provide an inexpensive vehicle that can lift thousands of kilograms above 99% of the atmosphere (to heights of ~33 km) or hundreds of kilograms above 99.9% (to ~50 km) and can carry the weight there for days.

One of the latest experiments, named Magellan, is jointly organised by Wlochowicz of the National Research Council of Canada, Ottawa and Hemenway, Hallgren and Tacketh of the Dudley Observatory, Albany, New York. Preliminary results were given at the IAU Colloquium no. 31 on Interplanetary Dust and Zodiacal Light recently held at Heidelberg. Magellan is designed to fly at an altitude of about 30 km and to collect relatively large solid particles, diameter 50–300 μm (mass 10^{-7}–5×10^{-5} g), as they fall through the atmosphere.

As the flux of particles is low the experiment must have a large collecting area exposed for a long time, but the particles must be concentrated in a much smaller area for easy counting, photography and chemical analysis. To do this the Magellan balloon payload has a vertical conical mylar funnel (like an umbrella) the wide end being uppermost and 50 m² in area. The funnel apex has an angle of 60° and particles falling into the funnel slide down the sides into a sampling pan at the bottom. The payload has three sampling pans which can be exposed for pre-set periods of time and then sealed. The funnel is hung from a 300 m nylon line below the balloon to minimise contamination. The payload weighs 385 kg and contains an electronics package for tracking and for activating the cut-down mechanism.

In two engineering flights from Australia using a 20 m diameter superpressure balloon one payload went all the way round the world and was cut down and eventually recovered within 15 km of the launch site. The second payload was not so well behaved, circling the Southern Hemisphere twice and staying up for 210 days before finally falling into the Pacific ocean. Two short-duration flights from the NCAR Balloon Flight Station at Palestine, Texas, showed that about nine particles per hour were collected by the system. These particles are now being analysed to give incident flux, mass distribution and composition.

As in all new techniques there are problems. First, the particles can have different origins. They could be micrometeoroids (particles which do not reach boiling point on atmospheric entry and are retarded and fall slowly to Earth); they could be fragments of much larger meteoroids which disintegrated on entering the atmosphere; or they could be terrestrial contaminants which have fallen off the balloon or been blown up to 30 km from lower down Only the micrometeoroid flux is known as this can be inferred from spacecraft data. The second problem is political. It is hoped that the work will not be hindered by nations reticent about balloons flying across their territory and that multinational cooperation will soon allow Northern Hemisphere flights to start.

Two-scale mantle convection

from Peter J. Smith

ALTHOUGH convection currents in the Earth's mantle have been the subject of extensive theoretical study and speculation, experimental investigations of convective models have been surprisingly few. Yet as Richter and Parsons (*J. geophys. Res.*, **80**, 2529; 1975) point out, laboratory studies have a crucial part to play in testing the stability of analytical and numerical models, especially of three-dimensional systems. In spite of previous work suggesting that the conditions for stable convection may be quite restrictive, the question of stability is all too frequently ignored—a situation which Richter and Parsons claim, somewhat wryly, "may in part be responsible for the proliferation of mantle convection models that bear little resemblance to one another".

Some years ago, for example, Busse (*J. Math. Phys.*, **46**, 140; 1967) showed that two-dimensional convective rolls in a fluid layer between rigid stationary boundaries are only stable for Rayleigh numbers less than 13 times critical. At higher Rayleigh numbers, a second set of rolls develops at right angles to the original one, giving a rectangular pattern when viewed in plan (bimodal convection); and at Rayleigh numbers about 100 times critical, instability develops, giving a plan pattern which