protection against acute cardiovascular collapse, but these animals die shortly after the controls, with similar renal and lung pathology.

Tracey *et al.* measured only acute lethality; animals surviving for 10 hours were treated with an antibiotic to abort the infection. The straightforward interpretation of the results is that *E. coli* LPS induces TNF and that TNF either directly or indirectly causes the acute circulatory collapse and organ damage. Baboons, like mice, are highly resistant to LPS (about 10^6 times more resistant than humans[8]), and so other *E. coli* products could have contributed to eliciting toxic levels of TNF, or the pentobarbital anaesthesia for 10 hours could have augmented LPS or TNF (or their combined) toxicity. Whatever the mechanism, these results certainly justify exploring the effects of TNF antibody in comparable clinical situations.

Experimental exploration

Recent work clearly shows that prostaglandins are involved in the toxic actions of TNF, as indomethacin, an inhibitor of prostaglandin synthesis, provides protection of rats against TNF-induced shock and lethality[9]. For this reason, clinical trials of indomethacin in septic shock will also be of considerable interest. The link between TNF, IL-1 and other mediators, and the multiple actions of LPS, need further exploration in experimental systems. The rabbit, that paragon of virtues for workers on LPS, is probably the animal of choice, not only because of its extreme sensitivity to LPS and the long history of relevant studies in these animals, but also because a monoclonal antibody against rabbit TNF is available[13].

The discovery of the polypeptide mediators has had great impact, and much of the interest in LPS has now shifted to the study of LPS mediators such as TNF and IL-1. Cast in this new light, the old problems about endotoxin, particularly how to harness beneficial activities while modulating toxicity, continue to challenge and fascinate. □

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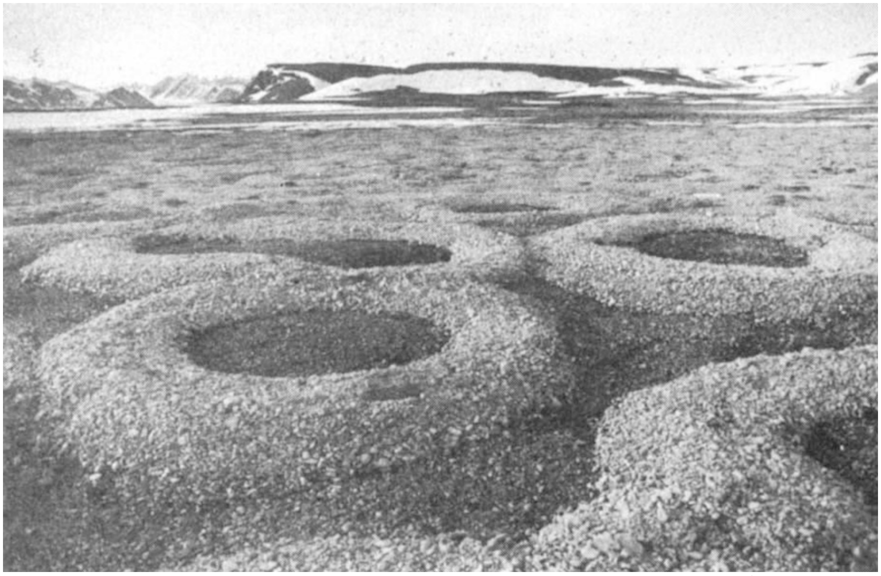

THESE 'sorted circles' at Spitsbergen, an island 600 miles north of Norway, are a natural formation of gravel and large stones that surround mounds of soil. In between the stone rings are depressions of soil that are relatively free of stones. The mechanism by which the circles are formed is unknown. Professor Bernard Hallet of the University of Washington, Seattle, in collaboration with the Norwegian Polar Research Institute, has recently been testing the hypotheses put forward to explain the circles, and believes that convection, a theory dismissed 30 years ago, is the most likely explanation.

Although the temperature gradient in the stone circles is too weak to cause convection, the moisture gradient, Hallet says, is not. Sorted circles are found throughout the world in alpine or periglacial regions wherever clays or silts are exposed to moisture and seasonally frozen and thawed. Hallet believes that the water in soil at the top of the mound, which thaws first, moves downwards because it is denser than the water in the soil below it. The soil below is thus forced to move upwards. At the same time, the tops of large rocks in the soil freeze first and are pulled upwards by inflated frozen soil. When the water in the soil thaws, the rocks settle down but not as deep, with the result that over several years they move up to the surface and out to the sides of the mound. □

Theoretical physics

Cosmology from nothing

David Lindley

A DISMAYING feature of general relativity, to students and researchers alike, is how frequently space-time metrics which look quite different turn out, through simple coordinate transformations, to represent exactly the same geometrical structure. Not only are novel solutions to Einstein's equations hard to find, but when they are found it takes some extra effort to prove that they are not familiar space-times in complicated disguises. Conversely, it sometimes happens that different space-times can be mathematically manipulated so that their metrics have similar (but obviously not identical) forms. On page 621 of this issue, E. Gunzig, J. Géhéniau and I. Prigogine discuss cosmological models based on what has become known as the conformal degree of freedom.

A conformal factor is any function of the three-space and one-time coordinates which multiplies the remainder of the metric. The simplest example is to take the standard metric for the empty vacuum, the Minkowski metric $ds^2 = -dt^2 + dx^2 + dy^2 + dz^2$, and multiply it by an arbitrary function $F(t,x,y,z)$ to give a more general form $ds^2 = F^2(-dt^2 + dx^2 + dy^2 + dz^2)$. Any metric which can be cast in such a form is said to be conformally related to Minkowski space. But it should be stressed that two space-times related in this way are in general physically quite distinct. For example, it is not hard to show that the three kinds of Robertson–Walker metric, representing open, flat or closed universes, are conformally equivalent to each other and to Minkowski space.

At its simplest, conformal equivalence can be regarded as a device of computational rather than geometrical significance; for instance, the Riemann curvature tensor of a class of conformally equivalent metrics can be written as the curvature of the parent space-time