to sarcomeric actin in the myofibril. Additionally, a direct costamere–myofibril coupling need not be invoked to explain the data of Padro *et al.* It is equally plausible that the observed coupling of two striations may arise from the presence of transverse filamentous linkages between plasma membrane and Z- and M-lines of the underlying sarcomere; and that the observed stretchiness of the costamere may arise from its close association with the elastic extracellular matrix. This alternative explanation, however, leaves open the question of why the vinculin-containing costamere is striated, and why it overlies the I band.

The significance of the striated membrane skeleton in skeletal muscle cells goes beyond support for the membrane. It may have an important bearing on muscle development. It has been known for a long time that during muscle development, before myofibril assembly, nascent sarcomeres are initiated and attached to electron-dense patches of the plasma membrane of the myotubes[17]. The existence of sarcomere attachment and assembly sites on the inner surface of the membrane has always been assumed, but the molecular nature remains mysterious. In light of the presumed role of vinculin in nucleating the assembly of sarcomere-like microfilament bundles in fibroblasts, it will be very interesting to see when and where vinculin is expressed during myofibrillogenesis of developing muscle. In particular, the order and manner in which the striations of the membrane skeleton and of the sarcomere appear may shed light on the important question of whether the striated membrane skeleton directs the formation of striated sarcomeres, or vice versa. Similarly, in light of the role of spectrin in modulating the dynamic distribution of cell-surface receptors which are important in cell–cell interactions[1], the expression of spectrin-containing membrane striation may be significant in understanding fusion events during development. □

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Ecology

Acid precipitation and the Black Forest

from Kenneth Mellanby

REPORTS in the press and on television on the ill effects of acid rain have implied widespread damage to trees, directly caused by sulphur output from industry. But by the end of a recent international meeting* at which no less than 50 papers were delivered on the topic of acid precipitation, it was apparent that these simplistic views were neither accurate nor supported by scientific investigation.

The first half of the meeting dealt with chemical and physical topics — an assessment of emissions, the way in which oxides of sulphur and nitrogen are transformed to acid and how these acids are dispersed and deposited on soils, vegetation and water, and the techniques used to measure these pollutants. Although much accurate information is now being collected on a world scale, comparison with earlier data is difficult, as many older figures were obtained using techniques since shown to be inaccurate.

The remainder of the papers dealt with biological topics. I was not alone in eagerly awaiting the papers by German scientists, including W. Knabe, H. Schroter, U. Arnt and W. Oblander (Institute for Ecology, Rechlinghausen), and by K.E. Rehfuess, K.D. Jung and B. Prinz (Institute for Air Pollution Control, Essen) on the situation in the German forests. Although a recent excellent paper on acid rain and forest decline in West Germany by W.O. Binns and D.B. Redfern (British Forestry Commission; Research and Development Paper 131, 1983) had indicated that the situation was much less alarming than popular accounts had suggested, some concern is clearly well founded. The German scientists reported that damage, particularly dieback in fir (*Abies abies*) and spruce (*Picea abies*) was only local, but it was impossible not to face the possibility that it might spread rapidly.

The cause of the damage was not agreed. There were few supporters for the view that acid precipitation had been proved to be the only or even the main culprit. The general consensus suggested that the most likely cause was the combination of a cold winter, a dry summer, fungal disease, elevated ozone levels with, possibly, raised aluminium levels in the soil water arising from the effects of acid precipitation. However there seemed little support for the views of B. Ulrich (Institute of Soil Science and Forest Nutrition, Göttingen) that, at present, this effect of precipitation on soil aluminium is the major cause of damage to trees in Germany. Elsewhere, as in Scandinavia, reports of forest destruction have clearly been serious overestimates.

It is generally accepted that many rivers and lakes, particularly where the water has little buffering capacity, have become more acidic in the last thirty years, and that fisheries have been seriously affected. The reasons for the increased acidity appear to be complex. I. Th.Rosenquist (University of Oslo), as a result of work on ion exchange in soil and fresh water, queried many of the generally accepted results, and showed that acidification was often dependent on changes in land use rather than on precipitation. He showed that the phenomenon of acidification was not new, and incidents had occurred long before the output of oxides of sulphur and nitrogen from industry reached the present levels.

In my opinion some of the speakers still failed to distinguish between the effects of dry deposition of sulphur dioxide, and the deposition of acidic substances in precipitation. The distinction was clearly demonstrated by S. Luckat (University of Dortmund), who spoke on the effects on materials, stonework in particular. Here dry deposition by SO_2 in cities has long been known to cause serious deterioration, while acid rain has had little effect. This is partly because the concentration of pollutants often falls as the period of precipitation continues — the first rain washes out much acid, the last part of the rain to fall may be comparatively pure. Thus the statues are washed clean by this rain, which may also remove some of the toxic products of dry deposition.

After the conference I took the opportunity of a conducted tour of the Black Forest. This was a revealing experience. Far from the widespread devastation highlighted in a recent television programme shown in Britain, the ordinary tourist, or even the visiting scientist, could travel for days without seeing any serious damage. There are indeed damaged areas, and we were taken to some of them. Even here, it was generally individual trees that were affected, and, when asked, our guides were unable to demonstrate a single tree that had actually died recently. That is not to deny that some are probably doomed, and the rapid development of symptoms in spruce, a species previously relatively immune from dieback, is clearly worrying. The damage seems to be confined to high altitudes, where the trees, growing near the tree line, must be under stress.

One thing is certain. The damage in the Black Forest cannot be the result of SO_2 emissions in the Federal German Republic. Levels of SO_2 in the forest are very low indeed, as is demonstrated by the wealth of foliose and leafy lichens, particularly on moribund firs. If sulphuric acid is to blame, the time taken for its production in the atmosphere is such that its origin must be more distant. So the policy of the German government, spurred on by the Green Party, to reduce sulphur output from their industry to low levels, at a very considerable expense, may be, on a global scale, very altruistic, but it will not do any good (or any harm) to the trees of the Black Forest. □

*An international conference on 'Acid Precipitation', organized by the Verein Deutscher Ingenieure's Commission on Air Pollution, met in Lindau, on Lake Constance, FRG from 7 to 9 June.

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