In this issue

How hot will India be in 2040?

Few topics have generated more heat than the study of global warming. The dispute is not so much about whether it is taking place at all (there is more than adequate evidence to convince almost everyone), but about (a) the relative importance of the contributing factors, and (b) the reliability of the predicted magnitudes of the warming. Opinions really span a wide range. At one extreme, one finds a contemptuous dismissal of the whole global warming research as a gigantic fraud (a dismissal not untinged with envy – few subjects have attracted bigger grants than the study of global climatic change). At the other, there are true believers who claim that unless immediate and drastic steps are taken, vast deserts will be our only legacy to our great grandchildren. In any event, the matters are being taken with enough seriousness at the international level, and the control over discussions is slowly but surely being taken over by administrators, diplomats and politicians from scientists (or is it from scientist-administrators, scientist-diplomats and scientist-politicians?).

The scientists, nevertheless, continue to be busy with the task of refining their models by including more and more factors likely to influence this vastly complex system. Parallely, they have also begun examining the patterns of warming on smaller (and thus perhaps more relevant) scales, and also the finer details of the patterns. One such study, by M. Lal, G. Srinivasan and U. Cubasch (**page 746**), deals with the situation concerning India – something which would be of more interest to most readers of *Current Science*.

Lal *et al.* have based their investigations on the data generated by the numerical experiments performed using the European Community Hamburg atmospheric model, coupled to a Large Scale Geostrophic model, which include all such factors as air–sea fluxes of momentum, short and long wave radiation and fresh water. They have used three scenarios – first a control, second one with enhanced CO_2 levels but without sulphate aerosols, and the third which also included sulphate aerosols. Though increased levels of CO_2 cause warming, higher levels of sulphate aerosols are known to cause cooling, thereby moderating the extents to which the temperatures can rise. By comparing the observed rates of warming over the Indian region for the period 1880 to 1989 with those predicted by the models for the three scenarios, the authors demonstrate that only by inclusion of sulphate aerosols can one obtain a satisfactory fit between the data and the model. The observed warming trend of 0.6 degrees per 100 years for the maximum temperature is very well reproduced by the third scenario, which can now be used for predicting the future with a higher degree of confidence.

However, knowing the extent of increase averaged over the entire Indian region will be about as useful as knowing the 'average' depth of a river (for a non-swimmer who wants to cross it). One of the major effects of warming is expected to be on crop productivity, and that varies of course from crop to crop, and therefore from region to region and season to season. With this perspective in mind, Lal *et al.* have investigated the finer details of the pattern of warming. They have primarily looked at the maximum and minimum temperatures, at the annual time scale as well as separately for winter, monsoon, premonsoon and post-monsoon. A curious feature predicted by them is the reduction in the diurnal temperature range. Looking at the spatial patterns, the model predicts no significant increase for the north-east India by 2040, but suggests a rise of 1.5° along the western margin. Prospects for the other regions can also be seen.

N. V. Joshi

Plague: The aftermath

The plague outbreaks in Maharashtra and Gujarat between August and October 1994, were a sharp reminder of 'India's vulnerability to emerging and re-emerging infectious disease'. The plague episode underscored the inability of the government to react swiftly to unexpected crises and to counter mounting public panic in a calm and effective manner. India's image worldwide was badly affected by the unseemly image of foreign air carriers avoiding a country suddenly host to a medieval scourge. While the government and the media contributed substantially to the autumn madness of 1994, Indian science did not come out covered with glory. The uncertain initial response to the plague outbreak was the result of a continued complacency of the medical establishment to the ever-present threat of communicable disease. For a brief period, the deficiencies of our systems to monitor and unambiguously identify the disease were starkly highlighted. For a while there were only questions. Was it plague after all? What triggered the sudden outbreaks? Why was it bubonic plague in Beed, Maharashtra and pneumonic plague in Surat, Gujarat? Why was the spread of the disease so unlike text-book descriptions of plague epidemics of yore? Did the large-scale consumption of antibiotics (tetracycline) influence the pattern of the epidemic?

Now, two years after the event, *Current Science* carries in a special section (pages **781–808**) several technical papers which are the outcome of the work of the Technical Advisory Committee on Plague, constituted by the Government of India. The articles make many key conclusions; the most important being the definitive statement that the organisms isolated from tissue samples of patients in Surat and from rodents and fleas in Surat and Beed are indeed *Yersinia pestis*, the causative agent of plague. Biochemical analysis using PCR methods and ribotyping provide a firm basis for the identification. Some questions still remain. Why was there an extra protein band in the initially observed Surat strains? Was there a direct connection between the bubonic plague of Beed and the pneumonic plague of Surat? The articles attempt to examine the linkages between the ecology of the affected areas and the transmission of the infection. The relationships between the plague episodes and the September 1993 earthquake in Maharashtra and the September 1994 floods in Surat remain unclear. If there is indeed a connection, it is surprising that this disease does not break out more often in a country frequently visited by natural calamities.

The plague committee's report leaves much unsaid. The difficulties of collection of samples, the problems of inter-laboratory interactions and the valuable time that was lost at the height of the outbreak find little or no mention. By the time the committee was formed, the outbreaks had subsided. The work on identification of the causative organism, therefore, had to depend on samples already collected and stored, with contamination being a major issue (**page 782**). In the early days, reports of inadequate collaboration and lack of cooperation between investigating laboratories were written about in the popular press. To its credit, the plague committee successfully coordinated a major exercise in scientific investigation spread out over a wide network of laboratories.

What lessons have been learnt? The government has responded by establishing a National Apical Advisory Committee (NAAC) for National Disease Surveillance and Response System. Clearly more than plague looms on the horizon. Malaria, tuberculosis and AIDS are everpresent threats and indeed in 'lay English usage', plague is a term with a much larger definition (**page 807**). Will the permanent existence of a committee help to combat sudden outbreaks of disease? The dengue fever episode of October 1996 suggests that the lessons of the plague have not really been learnt well. Our public health systems, overburdened far beyond their capacity, are extraordinarily fragile. Our fledgeling biomedical research enterprise is still to come to a stage where quick, state of-the-art responses are possible. With limited scientific expertise spread thinly across the country, coordinated efforts have to overcome formidable barriers. Chronic underfunding and a lack of appreciation for the importance of scientific research in most medical institutions have completely damaged the base of medical research in India.

The premier agency, the Indian Council of Medical Research runs a network of laboratories, which surprisingly do not seem to house much of the expertise needed to tackle the problems thrown up by epidemics like the plague.

The plague articles in this issue should stimulate rethinking on our approach to disaster management, particularly in the area of public health. Should we not have contingency plans and pre-arranged networking of laboratories? Should not the Health Ministry be the domain of health professionals and biomedical scientists? Are institutions like the National Institute of Communicable Diseases and ICMR fully equipped for future challenges? We would do well to heed the warning: 'Because of the capacity of microbes to adapt to new circumstances, there will probably be a continuing battle for many years, a subterranean war in which complacency and lack of determination can result in pain and death'. (D. E. Koshland, *Science*, 1992, **257,** 1021).

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