In this issue

How heavily does it rain in India?

Which place in India holds the record for the heaviest rainfall – Cherrapunji, Bombay or Mawsynram? Almost all of us will mark Cherrapunji as the correct answer. However, as described by P. R. Rakhecha and P. R. Pisharoty in their article on **page 179** of this issue, all the three places can legitimately vie for the first position.

One can talk of rainfall at various temporal scales – an hour, a few days, or the whole season; and interestingly, three different places qualify for the top slot in these three categories. Using the rich collection of the data at the India Meteorological Department, Rakhecha and Pisharoty have brought out some fascinating aspects of the heavy rains seen in the Indian monsoon season. Particularly intriguing are the depth–area–duration values associated with cyclonic storms. Even one look at a typical entry is enough to conjure up visions of a 100 km × 100 km area, completely covered to a depth of over half a meter of water in a matter of a couple of days.

Thunderstorms, responsible for heavy rains lasting for an hour or two, on the other hand, focus their attention on a much smaller area. Furthermore, thunderstorms of different intensities seem rather arbitrarily distributed across India. Who would have imagined the rainiest hour recorded in Hyderabad to be wetter than the one recorded in Kodaikanal or in Trivandrum or in Mahabaleswar? See **page 179** for more such surprises.

N. V. Joshi

Fighting the common cold

To sufferers of the common cold, the inability of the pharmaceutical industry to develop either a vaccine or an efficient cure has always been a source of puzzlement. Grandmother's remedies and benign neglect are frequently the best course of action, although Pauling's followers still insist that vitamin C works wonders. Has modern biology contributed to understanding this widespread and most annoying affliction? On **page 193**, Michael Rossmann reviews the spectacular success of crystallography in delineating the structure and receptor interaction of a human rhinovirus, which belongs to a family of causative agents that are responsible for common colds. As far as biological organization is concerned, viruses are amongst the simplest organisms; however their atomic level structures are easily the most complex to have been determined by crystallography so far.

The rhinovirus structure reveals a 'deep crevice or canyon' on its surface which is the site for recognition by a cell surface viral receptor; permitting entry of the sub-viral particle or viral genome into the host cell. Here, the viral genes can be replicated, eventually leading to viral multiplication, resulting in a new generation of infectious particles. Rossmann's story is rich and detailed, providing insights into virus–receptor interactions. For the rhinovirus, the cellular receptor, which permits the infectious agent to home in, is the intercellular adhesion molecule-1 (ICAM-1), a complex membrane bound protein belonging to the immunoglobin superfamily. The 'canyon hypothesis' for the receptor binding site on the virus immediately suggests possibilities for blocking the pocket and hence promises rational development of new anti-viral agents. Unfortunately, drug-resistant mutations can quickly develop, where the virus modifies the residues on the canyon walls and floor to preclude binding of potential therapeutics. The importance of the 'canyon' on the rhinovirus for receptor binding also rationalizes the inability of viral antibodies to efficiently inhibit virus–receptor interactions. The virus is cleverly able to hide the crucial binding site from immune surveillance. The battle against pathogenic organisms is clearly unending, with the enemy displaying formidable capacities for deviousness. In the case of the common cold, the advantage undoubtedly still rests with the rhinovirus.

P. Balaram

Microbe–drug wars

Drug resistance is a growing public health threat, with pathogenic organisms quickly learning to cope with the challenges posed by therapeutic agents. The strategies used by microorganisms include enzymatic degradation of the drug molecule, as in the case of penicillin resistance, where β-lactamases break down the antibiotic. Alternatively, clever microbes even alter the target structure as exemplified by vancomycin-resistant bacteria, which have modified cells walls containing lactic acid instead of alanine. This simple device eliminates a stabilizing hydrogen bond to the antibiotic, preventing its binding to cell wall precursors. A third stratagem involves membrane bound proteins which function as pumps and extrude the drug from the target cell. The problem of multidrug resistance in bacterial infections and cancer chemotherapy stems from the ability of the target cells to use the membrane bound pump as a 'hydrophobic vacuum cleaner' to sweep largely apolar organic drugs out of the cell. The understanding of multidrug resistance genes and their protein products has been growing, as reviewed by Rajendra Prasad *et al.* on **page 205**. Indiscriminate use of antibiotics and other therapeutics, compounds the drug resistance problem. The importance of developing new generation therapeutics cannot be over emphasized.

P. Balaram