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Visualizing the red blood cell

Atomic force microscopy (AFM) is a relatively recent tool in the hands of material scientists and biophysicists. Described in 1986 for the first time, the method became popular to study surface topographies of inert and biological samples. In essence, the method utilizes the interaction between the atoms on the surface of a material and a suitably-defined tip that is connected to a cantilever. The deflection of the cantilever would be determined by the magnitude and direction of the force experienced by the tip. Accordingly the surface nature could be charted by such an experimental design (*Curr. Sci.*, 2000, **78**, 1445–1457). AFM has been successfully used to study biochemical processes and protein channels. T. Guha *et al.* (**page 693**) used STM to map the surface structures of human red blood cells. They find at least nine 'pit-like depressions' on the outer surface of the erythrocyte that were not visible in scanning electron microscopy images.

Anthrax

Following the events of 11 September 2001, fears of bioterrorism spread rapidly. By October 2001, several places in the USA, India and the UK received specific threats of biological warfare, primarily by intentional releasing of anthrax spores. White powders were viewed with suspicion and thought to be bacterial spores capable of causing anthrax in human beings. All perceived threats of mass destruction are bound to cause mass hysteria, and panic. The disease anthrax, commonly found among cattle and sheep, may be transmitted to humans. There had been two possibilities in the past – spraying of aerosols, and delivery of a dry form, much like a bomb, containing spores of *Bacillus anthracis*. The 'white powdery material', containing spores, is expected to pose a threat to the person(s) directly contacting the material. In contrast, WHO, estimate that about 2% of the human population in an urban area could be killed by spraying 50 kg of anthrax aerosol. To ascertain specifically the nature of the 'powdery material', and material apparently contaminated with pathogenic spores, one has to develop experimental techniques to detect spores of *Bacillus anthracis*. G. S. Agarwal *et al.* (**page 697**) describe methods to detect *Bacillus anthracis* spores using immunofluorescence microscopy.

Passive sampler for NO_2

The World Health Organization and the Central Pollution Control Board (CPCB), India are concerned about the rising levels of NO_2 as an air pollutant. Atmospheric NO_2 is primarily formed as a by-product of the combustion process. Another oxide of nitrogen present in the combustion effluent gases, NO, could be converted to NO_2 by oxidation. NO_2 is known to be harmful to the human health, and phytotoxic with adverse effect on crops. The CPCB runs a network of 298 air-quality monitoring stations located all over India, but air quality measurements are limited to centres around cities for many reasons. One of the problems faced in this regard has been to find reliable samplers that are cheap and not dependable on electric power for operation. Imported equipment requiring technical manpower is an extra burden for the centres. C. K. Varshney and Abhai Pratap Singh (**page 731**) report efforts to devise a new type of passive samplers that are cheap, simple and do not require electric power for operation. This sampler works on the principle of air diffusion. It is fabricated from a 1.1 cm wide acrylic tube with two stainless steel wire meshes, the tube being capped with one coloured and another colourless plastic lid at the opposite ends. The two wire meshes were placed on the coloured cap, and an aliquot of 50 µl of TEA in deionized water, premixed with a wetting agent, was injected onto the wire meshes. The sampler was then exposed to atmospheric nitrogen dioxide by removing the colourless cap, and the pollutant gas was absorbed in the mesh containing TEA. After two weeks of continuous exposure, the samplers were sealed again at both the ends, and sent for analysis in the laboratory. The content of NO_2 absorbed was assayed according to an established protocol using a UV/visible spectrophotometer. This simple mechanism was used to sample from nine locations around the city of Delhi, the capital of India. The locations for sampling were appropriately chosen to facilitate collection of a diverse range of samples. The survey was conducted during November 1998 to June 1999. At 45% of the sampling sites, NO_2 levels were higher than the permissible limit. The record also indicated a seasonal variation, with the winter values higher than the pollutant levels found during the summer months.

Foot assay

Selvin and Lipton (**page 735**) describe the development of a new, simple and rapid assay for detecting antifouling, bioactive compounds. They use the ability, or prevention, of adherence to a hard rocky surface by the common limpet, *Patella vulgata*. Presence of a toxic compound or an anti-fouling agent could interfere with normal adherence when the organism falls off the surface. This system was utilized to develop an *in vitro* assay for bioactive compounds using 100 mm petri plates as substratum. The assay was standardized with methanol extracts of *Holothuria scabra* containing a bioactive compound that completely prevented the foot adherence of the limpet at a concentration higher than 4.2 mg/ml. This sensitive procedure could be completed within

one hour, and requires only a minimal quantity of the test compound.

Microbial detoxification

Toxins: Specific, characterizable, poisonous chemicals, often protein, with specific biological properties, including immunogenicity, produced by microbes, higher plants, or animals. (*US Food and Drug Administration.*)

Usage of 'toxic chemicals' and 'metal toxicity' is quite common in everyday English, but the term 'toxin' has acquired a specialized meaning for the biologists. Several of the bacterial toxins are lethal, as is snake venom. In addition, poisonous mushrooms, 'Todesstuhl' (toad stool) cause food poisoning. Natural toxins are also produced by blue green algae, fungi, insects, aquatic animals and terrestrial vertebrates. The toxins produced by vascular plants are called 'phytotoxins', a term also used to denote any substance that is poisonous for plants, regardless of origin. Malathi *et al.* (**page 745**) report an interesting observation that several bacterial and fungal isolates can neutralize the effects of toxins produced by sugarcane red-rot pathogen, *Colletotrichum falcatum*, that is harmful to the monocotyledonous plant, sugarcane.

In considering toxins and the nature of toxicosis, it is useful to note that toxins may be used as a remedial – for example as a herbicide. Fungi like *Fusarium avenacum* have been used as biological control against several species of *Rubus* in British Columbia, Canada (*Can. J. Plant Pathol.*, 1998, **20**, 12–18). Even botulinum toxin, a bacterial toxin, lethal when consumed with food, can be used as a medicine for treating eye conditions. This deadly toxin was marketed under the trade name 'Botox' in 1989 as a therapeutic (www.fda.gov/fdac/). Toxins then, can have 'beneficial effects' through their 'harmful nature'.

Malathi *et al.* describe an example of complex biological control. The fungi and bacteria that might neutralize the toxins produced by *Colletotrichum falcatum* would have symbiotic value for the sugarcane plant. The exact mechanism of action is still not understood in this particular case. In the case of animals, including humans, several toxins are neutralized through the immuno-response elicited by the toxin themselves. In fact 'toxoid' is the term used to describe the attenuated toxin that retained its antigenicity but lost the lethality. They are like 'detoxified toxins'. Microbial remediation of metal poisons is better understood. But 'microbial detoxification' is a poorly understood process.

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