The looming threat of smallpox

When a colonial governor spoke about the regrettable spread of venereal disease among the natives in Africa, with reference to the great pox or syphilis, Winston Churchill dismissed it as 'Pox Britannica'. But today, a much deadlier pox – smallpox – might find mankind across the whole world a fertile medium to spread, given that most of us have no immunity against it.

Smallpox is regarded as one of the world's most dreaded plagues. It is as ancient as mankind. Its tell-tale signs can be seen even in the mummies of one or two Egyptian Pharaohs who died thousands of years BC. When the disease erupted in France and Italy in 570 AD, Bishop Marius referred to it by its scientific name Variola, which in Latin means 'spotted'. Smallpox differs from chicken pox in that the rash comes up all at once. Being a virus, it needs a host to survive, and the host is man. It can however move from one host to another, and seems to have made such a trans-species jump into man from an unknown animal, either in the Nile Valley or in Mesopotamia or in the Indus Valley. As Richard Preston (author of *The Demon in the Freezer*) explains, the smallpox virus needs a population of about 200,000 people living within a 14-day travel time from one another, or else it will not survive. 'Those conditions,' according to Preston, 'didn't occur in history until the appearance of settled agricultural areas and cities.' The smallpox is therefore 'the first urban virus', and the disease itself is presumably contracted by inhaling the virus.

As a virus causes smallpox, antibiotics have no effect against it. Prevention is by means of isolation and vaccination. In the late 18th century, Edward Jenner, an English country physician, noticed that dairymaids who had contracted cowpox from cows were somehow immune to smallpox. In a historic experiment that was to have a profound impact on human health, Jenner scratched the arm of an eight-year-old boy named James Phipps on 14 May 1796 to introduce tiny droplets of cowpox pus that he had obtained from a blister on Sarah Nelmes, a milkmaid. In the following July, he scratched the boy's arm once again, but this time with the deadly pus from a smallpox patient. The boy showed immunity against the disease. This was how Jenner discovered the vaccine against smallpox.

The last case of smallpox was not in Africa, Asia or South America, but in England. In 1978, Henry Bedson a virologist, was Professor of Medical Microbiology at Birmingham University, where he continued his research on smallpox virus despite the displeasure of WHO over safety standards. On 11 August, a medical photographer named Janet Parker whose room stood just above Bedson's poxvirus lab, suddenly developed headache, nausea and muscular pain. Subsequently, she developed spots and was admitted to the hospital on 24 August, where she was diagnosed as having contracted smallpox. She became infected by a strain of smallpox virus that was kept in the lab below by Bedson. The virus had leaked into her room via a ventilation duct. Janet Parker died on 11 September. The next day, Bedson slit his throat.

By 1979, WHO declared that the world was rid of smallpox. Thus smallpox remains the only disease that has ever been eradicated in nature. The credit for eradicating smallpox in nature must go to the American Donald A. Henderson and his team. With the eradication of the disease in 1979, mass vaccination for smallpox came to a halt across the world, and today many people have no immunity at all. Although smallpox was eradicated from the Earth, the deadly virus was kept in frozen form in two laboratories: one in USA and the other in Russia. Understandably, people are worried if some of it has already fallen into unscrupulous hands.

Following the tragic events of 11 September 2001, smallpox has re-emerged as the biggest potential bio-terrorist threat to the world. But the use of germ warfare can be traced to a much more distant past. In the 14th century, the Tartars were known to have hurled plague-ridden corpses as 'weapons of mass destruction' into the enemy camp. Europeans introduced offensive germs – most notably smallpox, typhus, measles and cholera – into the New World in the 16th century. This led to the extermination of almost 80% of the local population.

The white settlers in America have done things to the native Indians that might almost make them blush. They used smallpox as a weapon of ethnic cleansing when they cleared the land occupied by native Indians. Lord Amherst is credited with having gifted overcoats infected with the virus to the Pontiac tribe in 1763! The British colonists praised the Lord and passed the pox to the hapless natives whose land they stole. A smallpox epidemic raged in America from 1780 to 1782, in which most of the sedentary horticulturists and almost half the nomads (who rode on horses) perished.

A recent study code-named 'Dark Winter' carried out in USA predicts that in the event of an attack by bio-terrorists using smallpox virus as a weapon, there would be a million people dead and twice as many infected within just two months. However as Hugh Pennington argues, although a determined person with a reasonable degree of technical knowledge and possession of live variola major and vaccinia virus (to immunize themselves) could grow substantial amounts of the virus quickly and cheaply, disseminating it would prove difficult, as the virus is 'heat-sensitive and dies as it dries'. The WHO has at its disposal some 200 million doses of the smallpox vaccine, but most of them are old and have been kept frozen for many years, and hence their effectiveness on human beings remains untested. A recent plan by the US Government to test the smallpox Dryvax vaccine on small children aged 2–5 years was opposed by critics who claimed that it was potentially harmful. Even if people were to be vaccinated against smallpox today, many would die from its complications as from the disease itself.

Hindus in India have had a long local tradition of smallpox variolation, associated with goddess Sitala. As Naveen Patanaik points out (see *The Garden of Life: An Introduction to the Healing Plants of India*, Double Day, New York, 1993), an image of the folk goddess Sitala can often be seen suspended from a branch of the Margosa (or neem) tree, where she guards against smallpox, once the killer of the Indian countryside. Under Pax Britannica, vaccination was promoted across India. But the importation of cowpox from Britain produced powerful native resistance to vaccination

in deference to the sacred cow. Despite the fact that vaccination was widely practised in the 1960s, smallpox still remained endemic in Chennai. As Pennington points out, the key to effective disease control is speed: speed of detection, speed of isolation of cases, and speed at which they are vaccinated. Today, we are as vulnerable to the pox as the Indians were when Columbus and his men descended on them. We live at a time when modern technology has made it possible to create mayhem where we least expect it. While we hope for the best, it looks as if we must prepare for the worst.

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NEWS

MEETING REPORT

The Academy Meeting 2002*

The 68th Annual Meeting of the Indian Academy of Sciences, Bangalore, was attended by about 130 Fellows out of the fellowship of nearly 860. After the formal introduction of Fellows of the Academy present at the meeting, K. Kasturirangan delivered his Presidential Address titled 'X-ray astronomy as a probe of the universe'. In this address, he noted that the Universe can be probed using particles (charged and neutral) or by electromagnetic radiation. The former, such as charged particles, has practical difficulties of loss of direction due to interactions with galactic and intergalactic magnetic fields. Neutral particles such as neutrinos are hard to detect. Whereas by using electromagnetic radiation, processes of particle interactions with fields and their spectra could be used to understand the universe. Both soft and hard X-rays could act as probes.

The history of X-ray astronomy dates back to the first X-ray view of the sun in 1949, followed by several X-ray missions and more recently, the Chandra and XMM Observatories for high angular resolution spectroscopy. With development of better imaging capabilities, recent missions have discovered X-ray emission from accreting binary systems. This has aided the discovery and detailed studies of neutron stars and black holes. X-rays form an ideal tool to study regions of strong gravity, strong magnetic field and high temperature. Kasturirangan detailed India's efforts in this important area of space research. ASTROSAT, India's space mission for probing the universe, scheduled for launch in 2006, is special because it would carry multi-wavelength on-board instruments. These instruments are capable of measuring the UV and X-ray energy range. In a combined effort involving several Indian institutions and the Indian Space Research Organization (ISRO), an Indian X-ray astronomy experiment for timing studies of X-ray binaries and gas-filled large proportional counters has been planned. The challenges are to be met with the indigenous designing and production of focusing X-ray mirrors, hard X-ray imagers, all-sky monitors, star sensors and soft X-ray telescopes with large-area, xenon-filled proportional counters, etc. ASTROSAT's contributions would be long-duration observations, high angular resolution UV survey, simultaneous broad-band spectrum and simultaneous timing at multi-wavelengths, according to Kasturirangan. The country is all set to take the next step in its efforts: a 'multi-wavelength observatory', he added.

In addition to several lecture presentations by Fellows and Associates, there were two public lectures, two special lectures and two symposia. In the following, a brief resume of these technical activities is given:

In his Public Lecture, Mohan Maharishi, Panjab University, Chandigarh, spoke on '*Rasa siddhanta*' and its social significance. Maharishi was worried about the yardstick used to recognize art forms. For example, an institute near Trichur, Kerala could not be given the status of a deemed university of the University Grants Commission for reasons such as inadequate basic qualifications, although this institute is an UNESCO Heritage Centre. Following this lecture was a rendering of Girish Karnad's *Agni aur Barkha* performed by Department of Indian Theatre, Panjab University.

The second public lecture was by M. S. Raghunathan, Tata Institute of Fundamental Research, Mumbai titled 'Artless innocents and ivory tower sophisticates: Some personalities on the Indian mathematical scene'. He laced his talk with anecdotes, lending a personal and human touch to mathematicians of the likes of S. Ramanujam, G. H. Hardy, K. Ananda Rau, S. S. Pillai, T. Vijayaraghavan, André Weil, Sarvadaman Chawla, Rev. Fr. C. Racine, S. Minakshisundaram, Harish Chandra, C. P. Ramanujam, Vijay Kumar Patodi and Komaravelu Chandrashekaran.

The special lecture by P. K. Kaw, Institute for Plasma Research, Gandhinagar, was entitled 'Collective modes in a strongly coupled dusty plasma'. The micrometre-sized particles contained in the dusty plasma feel both electron and ion flux and the ratio of coulomb interaction energy to thermal energy is large. The shielded Coulomb forces are the Yukawa forces, with the dust component in the plasma in a strongly coupled state. In this Yukawa fluid, dust interacts with strong correlation and the description of the dust component is of great interest. Experimental examples of dusty plasma are seen in processing plasma containing erosion of surface dust, plasma torches, edge plasma in fusion machines and in the near environment of planets.

Dust particles exhibit motion with low-frequency collective modes that are affected by strong correlation effects. Kaw has derived a dispersion relation for these modes using a generalized hydrodynamics model. A non-local viscoelastic operator using velocity in space and

*A report on the 68th Annual Meeting of the Indian Academy of Sciences, Bangalore held at Panjab University, Chandigarh during 8–10 November 2002.