period of five years, which converts to an annual recreational use value of city's urban forestry assets to Rs 27.50 millions at 2002–03 prices. A sample size of 2358 residents of the city and Contingent Valuation Method was used for arriving at the above estimate.

Based on a sample size of 904 tourist families and zonal travel cost method, the annual recreational use value of city's urban greenery on the part of tourists coming to the city, was estimated as Rs 92.40 millions. Therefore, total annual recreational use value of city's parks/gardens, boulevards, green avenues, reserved forests, wildlife sanctuary and other green landscape features on 2002–03 prices, comes out approximately to be Rs 120 millions. This value suggests a keen potential role of urban greens in overall environmental conservation in polluted big cities of our country.

1. Chaudhury, P., Valuing recreational benefits of urban forestry – a case study of Chandigarh city, Ph D thesis, Forest Research Institute (Deemed University), Dehradun, 2006.

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Malaria – the cause of heartburn among scientists and funding agencies alike

On 15 September 2006, the World Health Organization (WHO) forcibly instituted the spraying of the insecticide DDT on the interior walls of homes across Africa to stop the transmission of the parasite from the *Anopheles* mosquitoes to vulnerable resident victims in endemic areas. WHO estimates that malaria claims more than a million lives each year, most of them children, with more than 300–400 million infections each year. Globally 40% of malaria infection is caused by *Plasmodium falciparum*, 50% by *Plasmodium vivax*, 7–8% by *Plasmodium malariae* and 2–3% by *Plasmodium ovale*. The major burden of this infection is borne by tropical Africa where 75% of the infection is by *P. falciparum* and is the main cause of all the mortality observed. DDT was used in the early 1950s as an insecticide to control malaria transmission but was then banned due to its many harmful consequences. In addition to affecting the central nervous system and various vital organs like the liver and kidney, there is documented evidence that spraying of DDT results in human sterility.

What has led to this reversal of strategy after billions of dollars spent on a scientific solution to a problem, existing in all probability from BC? The scientific solution is presently non-existent and might in part be used to prevent the disease – as the old adage goes – prevention is better than cure, which should be a regional government initiative. Of all the existing vaccination trials, the combined effort of the University of Oxford, Walter Reed Army Institute of Research (US), GlaxoSmithKline Biologicals, regional Medical Research Councils across Africa and Europe and many others designed a candidate vaccine molecule which unfortunately resulted in barely 30% protection against natural *P. falciparum* infection, the main causative organism of malaria. This protection observed waned over time when assessed for its efficacy in the Gambia. However on a positive note, this protection against *P. falciparum* infection is not strain specific. The vaccine which is pre-erythrocytic named RTS,S/AS02 is assessed to be safe, immunogenic, and is made of the circumsporozoite protein fused to the Hepatitis B virus surface antigen – the first moderately successful vaccine against malaria but still not good enough for mass vaccination programmes.

The WHO has compiled a list of various candidate vaccine molecules designed, with the progress achieved in field studies. Many strategies have been employed with designs of the vaccine ranging from a single protein to multiple proteins administered on various carrier molecules as both DNA vaccines and protein molecules involving different immunization strategies and regimes. In 2005, the WHO documented that there were 94 designed candidate vaccine molecules from around the world comprising of proteins designed to immunize against various stages of the malarial life cycle. Of these, 33 had reached the stage of clinical trials involving challenge studies in both industrialized countries, where 30 candidate vaccine molecules were assessed and in endemic regions, where 13 candidate vaccine molecules were assessed. Subsequent to this enormous labour, effort and million of dollars, now WHO recommends reverting to DDT. This, in spite of its many harmful documented effects both to the population and the environment, is still judged preventive if not protective – but fundamentally the only solution available. Where has the science or more accurately what have the scientists failed to comprehend? The responsibility for this dilemma lies not just with the scientists but also with the funding agencies as scientists are far from being infallible.

The fact that these candidate vaccine molecules resulted in no protection against the infection led to the design of using various carrier molecules such as virosomes, liposomes, and virus-like particles like Hepatitis B virus surface antigen which form 20 nm particles used in the RTS, S/AS02 vaccine, in order to effect the presentation of these candidate vaccines to the human immune system. Unfortunately there is no commendable protection against *P. falciparum* infection. The design of an efficacious protective vaccine against *P. falciparum* infection is of immediate importance and is feasible as individuals in endemic areas who suffer repeated *plasmodium* infection are eventually protected against further infection.

The design of vaccines against many pathogenic infections like Hepatitis C, HIV AIDS, chronic viral and respiratory infections, pneumococcal infections, rubella, tuberculosis, cancerous and neurodegenerative diseases are also proving elusive. Perhaps the problem lies with a lack in the basic understanding of the human immune system. The major cell involved in the presentation of these candidate vaccine molecules is the den-

drocyte and is the targeted cell for most vaccination strategies. However it is well documented that dendritic cells are very inefficient at the uptake of antigen – by the cellular processes of endocytosis and/phagocytosis. Strategies to increase the endocytic capabilities of the cell would increase the presentation of immunodominant epitopes designed into the candidate vaccine molecules. However, to reiterate, dendritic cells are very inefficient at taking up exogenous antigens but excellent at priming the T lymphocyte cells whether $CD4^+$ which mediate humoral immunity or $CD8^+$ cells involved in cell-mediated immunity. Hence, in spite of the inspired design of the immunodominant epitope and using technologically advanced carrier systems, if the dendritic cell puts back it ears stubbornly, antigen presentation and consequently priming of the immune system will not occur leading to a nonfunctional candidate vaccine molecule.

A solution could be the administration of these candidate vaccine molecules with human antibodies which though non-immunogenic would induce endocytosis, thus prompting the endocytosis of the antigen molecule simultaneously. Thus leading to forced phagocytosis of antigen by antigen presenting cells such as the dendritic cell leading to the effective priming of the human immune system. The administration of the candidate vaccine molecules along with antibody and cytokines like interleukin-α should hypothetically lead to cell-mediated priming as interleukins have been shown to increase the cell surface expression of MHC class 1 molecules involved in the activation of a cell-mediated response leading to the killing of infected cells. The physical parameters involved in the endocytosis of the candidate vaccine molecule should be taken into consideration. For instance, tumour cells being highly endocytic at low pH, is a similar situation applicable to dendritic cells, and if so, can it be exploited in this life and death situation? The figures are no exaggeration as WHO estimates on average 110 deaths per min, most of which occur in Africa among the most vulnerable.

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NEWS

Herbal gardens in schools

The Government of India has set up the National Medicinal Plants Board (NMPB) under the Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH) under the Ministry of Health & Family Welfare to coordinate all aspects of medicinal plants sector across the country. Since its inception in November 2000, the Board has been providing financial assistance to various research and development projects under its promotional schemes through research institutes of Central and State Governments, Universities and non-government organizations. NMPB efforts have generated immense interests among different stakeholders of the medicinal plants sector.

Recently, the Board launched a new scheme for involving the school students in the medicinal plants sector. To inculcate a sense of belonging from childhood with surrounding biodiversity and its conservation, especially of medicinal plants, which provide a holistic health care in both traditional and modern systems of medicine, the Board has started to provide financial assistance for setting up herbal gardens in schools. Attempts are being made to select at least 500 schools from all over the country in the initial phase. The scheme seeks to cover schools up to senior secondary/intermediate level.

According to this new scheme, funding will be allocated on per hectare cultivation of medicinal plants. It is presumed that schools may not have much area for medicinal plants cultivation; therefore the funding will be provided for raising herbal garden of about 1/10 of a hectare in each school. For developing one herbal garden of about 1000 sq. m, the financial assistance will be limited to Rs 10,000 for setting up and Rs 4000 for maintenance during the second year. The cost of establishing herbal garden will include

Table 1. State-wise status of proposals received and the amount of funds to be allocated for developing herbal gardens in schools

State/Union Territory	No. of projects received	No. of projects approved for funding	Total amount of approved projects (in Rs)
Andhra Pradesh	1	0	0
Haryana	17	11	11,54,000
Chandigarh	3	3	42,000
Chhattisgarh	32	23	3,22,000
Kerala	133	108	15,12,000
Manipur	1	1	14,000
Madhya Pradesh	43	34	4,76,000
Maharashtra	2	0	0
New Delhi	15	3	42,000
Orissa	63	32	4,48,000
Pondicherry	9	4	56,000
Tripura	5	3	42,000
West Bengal	35	16	2,24,000
Total	359	238	33,32,000