

## Virander Singh Chauhan

Virander Singh Chauhan is the Director of the International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi. ICGEB carries out biomedical research and has a robust programme for developing malaria vaccines. It has carried out phase I trials for a recombinant malaria vaccine. This is the first ever effort by any institution in India where basic research has been taken through developmental stages, including production under GLP conditions to trials in humans. Chauhan informs the readers of *Current Science* about research in the field of malaria and drug development at ICGEB.

### *What is the state of research on malaria in India?*

In the past two decades or so, there has been considerable increase in the number of research groups working on malaria. The major areas of enquiry include understanding the mechanism and pathways involved in the life cycle of *Plasmodium falciparum*. Most of the malaria research in India is focused on the blood stage of the parasite. Scientists are also working on vaccines against malaria in the field of malaria drug development. There are several active groups involved in understanding the mechanism of malaria drugs, development of new molecules as anti-malarials, etc. There are also very active structural biology groups who are working on determining the structures of key targets for drug development. There are major groups at IISc, JNCASR, ICGEB, NII, CCMB, CRI and NIMR.

### *What are the roadblocks to research in malaria in the country?*

Robust collaborations between malaria field research and those involved in molecular biology of malaria are missing. Good quality, field-based malaria research needs to be undertaken. Otherwise, there are no major roadblocks to research in malaria in India. Research funding is relatively easily available and, in fact, on the whole malaria research in India is doing very well.

### *What is the state of research on malaria at the international level?*

A lot of exciting work is being done where modern tools of genomics and proteomics have been used to understand the parasite biology. Also malaria vaccine field is very active in that several vaccine trial sites have been set up in malaria-pandemic areas of Africa. We lag behind in India in some of these areas.

### *What are the major areas of research at ICGEB, New Delhi?*

The Malaria Group at ICGEB has worked on diverse aspects of the biology of malaria parasites. Areas in which it has made important breakthroughs include understanding the mechanism of the action of anti-malarial drugs chloroquine and artemisinin, role of proteases in parasite life cycle, receptor–ligand interactions and signalling mechanisms involved in erythrocyte invasion, and immune responses to malaria parasites in animal models and in humans upon natural infection. Leads from these studies are being explored for both vaccine and drug development.

### *How has ICGEB added value to the existing knowledge of malaria?*

Malaria research at ICGEB has focused on understanding the invasion of erythrocytes by the malaria parasites and its subsequent growth. This focused approach has provided valuable knowledge in understanding these phenomena. In particular, the molecules identified as crucial for innovation have been characterized and developed as blood-stage vaccine candidates. ICGEB scientists have developed a pipeline of vaccine candidates and one combination of two antigens (JAIVAC) has already undergone phase I trials in India. ICGEB scientists have also provided useful information on how some of the existing malaria drugs work. They have also developed high-throughput assays for screening molecules from scientific and natural sources based on pathways specific to the malaria parasite.

### *How long do you think it will take for the vaccine to reach the marketplace?*

The first malaria vaccine candidate developed by ICGEB, JAIVAC-1, which is composed of two recombinant *P. falciparum* blood-stage antigens, PfMSP1<sub>19</sub> and PfF2, is currently being tested in a phase I clinical trial to evaluate its safety and immunogenicity in healthy adults. JAIVAC-1 was manufactured at Bharat Biotech, Hyderabad, using a process developed at ICGEB and is being tested at Lotus Labs, Bangalore. This is the first time that a novel recombinant product developed entirely within India has been tested in clinical trials. Decision to proceed to phase II trials with JAIVAC-1 will be made based on the safety and immunogenicity results of the phase I trial. In addition to JAIVAC-1, ICGEB is developing a pipeline of vaccine candidates for *P. falciparum* and *P. vivax* that will be taken up for clinical development.

Given the highly complex nature of malaria vaccine development, it is difficult to predict how long it will take to bring a malaria vaccine to the market. That said, a sporozoite-stage vaccine developed by an MNC company has already gone to phase III trials, and if the trials are successful, there could be a chance of this being the first licensed malaria vaccine for human use. I must add, however, that this or similar vaccines at present are only partially protected and certainly will need to be further improved.

*They say that there is not enough support and cooperation from the pharmaceutical industries, particularly those in the West, because malaria is a developing nation problem. What do you think?*

In general it appears that large pharma industries, particularly from the West, are not too keen on developing drugs against diseases that are mostly located in developing nations. However, in the recent times there have been collaborations between large funding agencies.

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