

Editorial

NIMR Activities

- Workshop on Low-Density Infection Detection
- Distinguished Lecture- Prof Phillip Rosenthal
- Lecture Series on Infectious Diseases- Prof Dominic Kwiatkowski

Interview



Dr Siraj A. Khan
Scientist F, ICMR-RMRC,
Dibrugarh, Assam

**Resource for
Malaria Researchers:
MalariaGEN**

Upcoming Event

Lecture Series on
Infectious Diseases

Lecture 06:
22nd November, 2021



Prof Shyam Sundar

Distinguished Professor
of Medicine, IMS,
BHU, Varanasi, India

**Research
in Spotlight**

Malaria Elimination Research Alliance



/meraindiaicmr

Editorial

Dear readers,

MERA-India team brings to you the thirteenth issue of our newsletter.

Under the 'NIMR' activities section, we have written about the Low-Density Infection Detection workshop organized for MERA-India fellows at ICMR-NIMR, Delhi. We have provided a brief summary of the third lecture of the "Distinguished Lecture Series" delivered by Professor Philip Rosenthal, from the Department of Medicine at the University of California, on the topic "Antimalarial drug resistance in Africa and other regions - are ACTs in danger". The fifth lecture of the "Lecture Series on Infectious Diseases" was delivered by Professor Dominic Kwiatkowski, Head of the Malaria Genetics Group at the Wellcome Trust Sanger Institute, UK, on the topic "Uncovering host-parasite genetic interactions in *Plasmodium falciparum* malaria", and a brief summary is provided in this issue.

For the 'Malaria Scientists to Watch' section, we interviewed Dr Siraj A. Khan (Scientist F, ICMR-Regional Medical Research Centre, NE Region, Assam). We hope that the readers would find this interview inspiring.

Four recent malaria research articles have been highlighted in the 'Research in Spotlight' section. In the article published in Science by Patson R *et al.*, the authors have studied the risk and age-pattern of severe malaria in East Africa. In an article by Kamiya T. *et al.*, published in eLife, the authors have studied the host factors contributing to the resilience against malaria infection. In an article published in Nat Comm., by Larsen M D *et al.*, the authors have highlighted the difference in the glycosylation status of the IgG antibodies produced in response to natural malaria infection and vaccine-mediated, leading to varied levels of protective ability against the malaria infection. In the article by Gallalee S *et al.*, published in Sci Rep. the authors have looked into the factors leading to decline of malaria in Ayeyarwady region of Myanmar.

We have started a new section "Resource for Malaria Researchers", in which we will be highlighting a valuable tool/resource for the researchers working in the field of malaria. In this issue, we have highlighted Malaria Genomic Epidemiology Network (MalariaGEN).

In the 'Upcoming Event' section we have provided details about the sixth lecture of the "Lecture Series on Infectious Diseases" which will be delivered by Professor Shyam Sundar, Distinguished Professor of Medicine at Banaras Hindu University, India on 22nd November 2021, on the topic Visceral Leishmaniasis.

We hope you will find this issue enjoyable and informative to read. For any feedback or suggestions towards the content of the newsletter, please write to us at meranewsletter@gmail.com.

With best wishes
MERA-India team

NIMR Activities: MERA-India Workshop on Low-Density Infection Detection



Low-Density Infection Detection Workshop
27th - 30th September 2021
Venue: ICMR-NIMR, Delhi



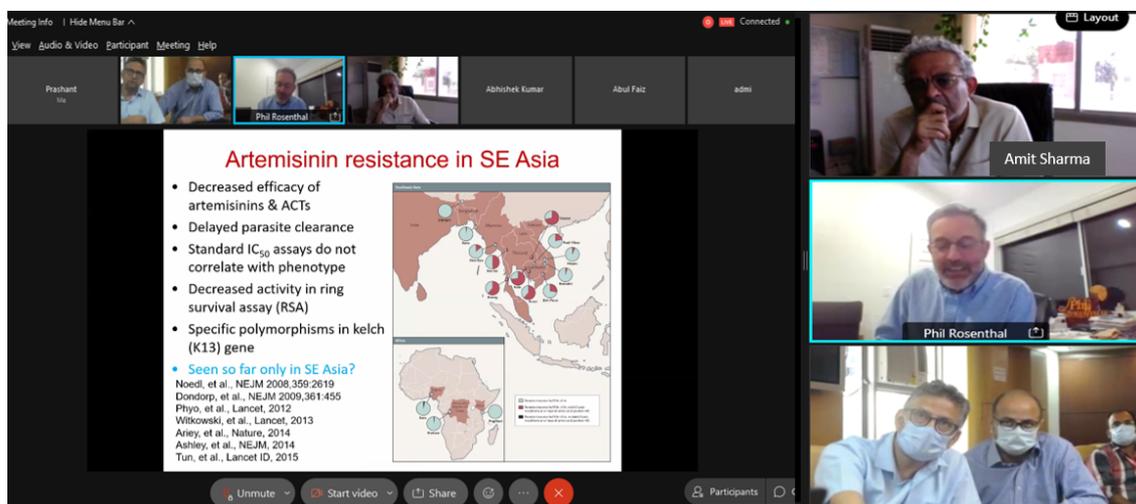
MERA India
Malaria Elimination Research Alliance India
One Platform, One Goal

During September 2021, MERA-India organized a four-days training workshop at ICMR-NIMR, Delhi for the Principal Investigators (PIs)/co-investigators, and the associated project staff in the MERA-India funded Low-Density Infection (LDI) Detection project theme to train about the different diagnostic methods used for *P. falciparum* and *P. vivax* LDI detection. To know about the real malaria burden, it is essential to detect the LDI or sub-microscopic infections which are likely to be missed by the conventional diagnostic methods for parasite detection like microscopy and RDT. One of the objectives of the MERA-India funded projects, carried out at seven different sites across India, under the LDI theme is to determine the prevalence of low-density malaria parasite infections by undertaking a cross-sectional study during high and low transmission seasons using differential diagnostic methods.

The mentors and experts for this workshop were Dr Dhanpat Kochar (SP Medical College, Bikaner), Dr Arun K. Sharma (Director, ICMR-NIIRNCD, Jodhpur), Dr Pravin K. Bharti (Scientist-E, ICMR-NIMR, Delhi), Dr Nafis Faizi (Scientist-E, ICMR-NIMR, Delhi), Dr Mradul Mohan (Scientist-B, ICMR-NIMR, Delhi), Dr Ruchi Singh (Scientist-E, ICMR-National Institute of Pathology), Dr S. Selvaraj (Director, Helini Biomolecules), Mrs Bina Srivastava (Senior Technical Officer, ICMR-NIMR, Delhi), and Mr Naseem Ahmad (ICMR-NIMR, Delhi). There were lectures on parasite life-cycle, blood elements, morphology of malaria parasites, importance of diagnostic methods in LDI, use of loop-mediated isothermal amplification (LAMP) for malaria diagnosis, using GIS for infection surveillance, and clinical *vivax* malaria. The principal investigators and the project staff were given hands-on training to prepare and stain blood smear slides for malaria parasite detection, DNA extraction from blood, and malaria infection detection using microscopy, RDT, LAMP and real-time PCR amplification.



Distinguished Lecture by Professor Phillip Rosenthal



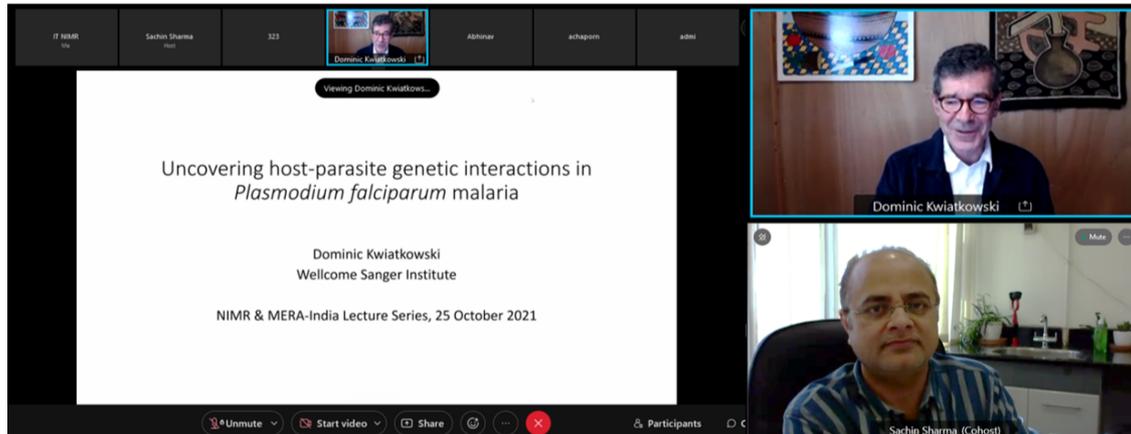
The third lecture of the “Distinguished Lecture Series” was delivered in October by Professor Philip Rosenthal from the Department of Medicine, University of California, USA. Professor Rosenthal currently serves on the Board of the Infectious Diseases Data Observatory, is Chair of the Scientific Advisory Committee of the Worldwide Antimalarial Resistance Network, a member of the Medicines for Malaria Venture Expert Scientific Advisory Committee, and a member of the World Health Organization Guideline Development Group for Malaria Chemotherapy. Dr Amit Sharma, the Director NIMR, introduced the speaker and thanked him for accepting the invitation to deliver the lecture.

Professor Rosenthal’s lecture was entitled “Antimalarial drug resistance in Africa and other regions - are ACTs in danger”. He talked about the progress and challenges with malaria elimination. He described about the various malaria control measures, including drugs, personal protection and vaccines. He mentioned that Africa has a huge *P. falciparum* malaria burden and thus the antimalarial drug resistance in Africa is a major concern. Further, he described the studies conducted across different regions showing the delayed parasite clearance and decreased efficacy to artemisinin and ACTs. He next described the reported *K13* gene mutations in the parasite, and their role in development of artemisinin resistance. He also talked about the resistance to ACT partner drugs reported in various studies in different parts of the world. He next shared the results from the various studies done in Uganda by his group, which provide evidence for loss of ACT efficacy, and spread of *K13* mutations. He also highlighted the novel malarial drug candidates in pipeline.

The lecture was followed by answers from the speaker to the questions from the audience. The lecture concluded with a note of thanks from Dr Sachin Sharma, Chief Consultant, MERA-India, to the speaker and the attendees.

The recording of this lecture is available on the MERA-India website (<https://www.meraindia.org.in/lecture-series>).

Lecture 05 of Lecture Series on Infectious Diseases



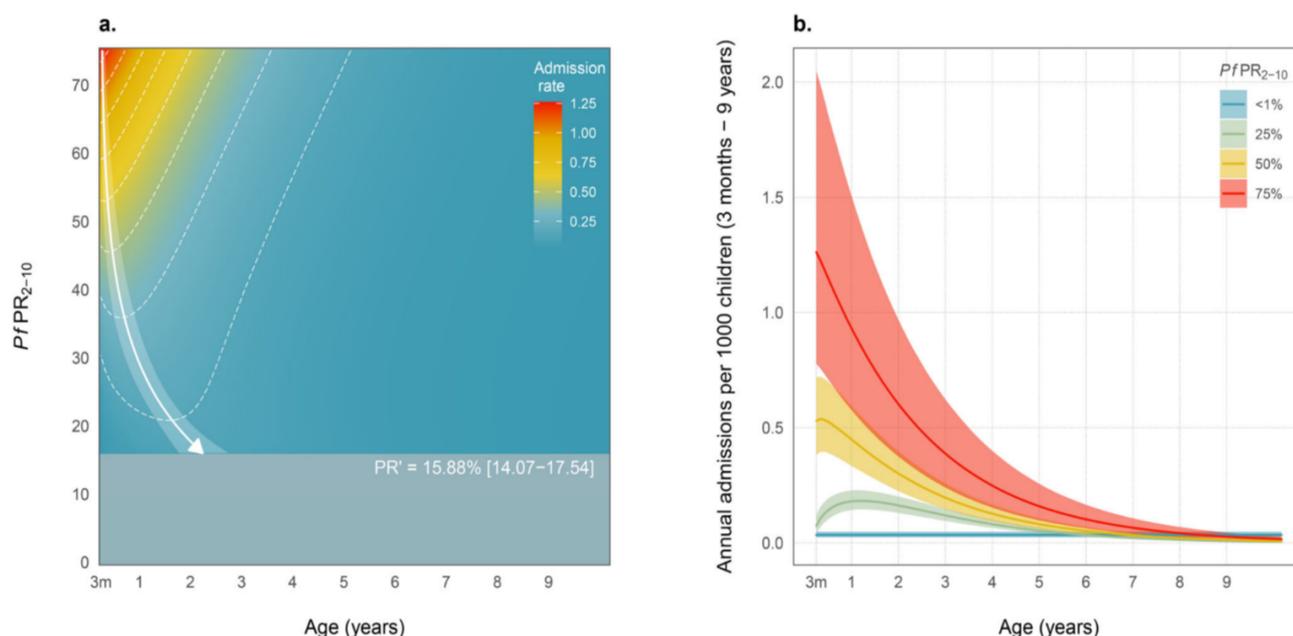
The fifth lecture of the NIMR & MERA-India “Lecture Series on Infectious Diseases, was delivered by Professor Dominic Kwiatkowski, on the topic entitled “Uncovering host-parasite genetic interactions in *Plasmodium falciparum* malaria”. Professor Kwiatkowski holds a joint appointment as an MRC Clinical Research Professor at Oxford University, and as head of the Malaria Programme at the Wellcome Trust Sanger Institute, UK. He is director of the MRC Centre for Genomics and Global Health, which is a joint research program of Oxford University and the Sanger Institute. Dr Sachin Sharma welcomed everyone and introduced the speaker.

In the lecture, Professor Kwiatkowski talked about a study carried out across 11 countries to decipher the novel human genetic factors and variations which affected the resistance/susceptibility to severe *Plasmodium falciparum* malaria. These factors were found to be localized to the human RBC’s with the most significant being HbS, Dantu blood group, ATP2B4 calcium channel and blood group O. He next described the study which focused to understand how the malaria parasite evolved to overcome the protective effects of the host genetic factors. The *P. falciparum* genome from about 5,000 severe malaria cases from Gambia and Kenya were sequenced. By comparing the genetic associations between human and parasite genetic variants, three parasitic loci variants were found to be strongly associated with human HbS. These loci are termed as “*Plasmodium falciparum* sickle-associated loci”, and the patients with parasites having these variants did not have any protective effect of HbS. He further talked about MalariaGEN network, and stressed about the importance of equitable data sharing for collectively working towards the goal and challenges of malaria elimination in the endemic countries.

The lecture was followed by answers to the questions from the attendees. The session ended with a note of thanks from Dr Sachin Sharma to the speaker and the attendees. The recording of this lecture is available on the MERA-India website (<https://www.meraindia.org.in/lecture-series>).

Research in Spotlight

Paton S R. *et al.*, *Science*, 2021: Malaria infection and severe disease risks in Africa

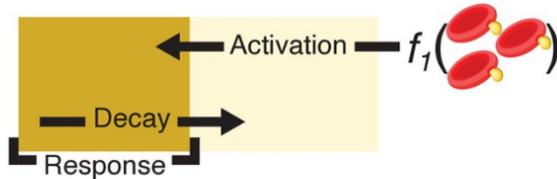


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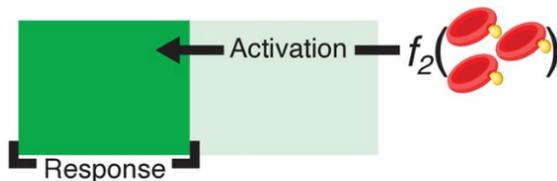
In East Africa, the understanding of the relationship between the parasite (*Plasmodium falciparum*) prevalence, and malaria mortality is limited due to the lack of empirical evidence. Authors of this [article](#) studied the risk and age-pattern of severe malaria with the quantity of parasite exposure in the community in order to optimize the malaria control effects. They analyzed active surveillance data from 13 hospitals over 35 time-site periods (2006 – 2020) that contained 6506 malaria admissions in children (3 months – 9 years). For each time-site period, three common phenotypes *i.e.* severe malaria anaemia (SMA), respiratory distress (RD) and cerebral malaria (CM) were modelled and Bayesian procedure was implemented. A strong positive association *i.e.*, with 25% increase in parasite prevalence, a 2-fold increase was found in malaria admission rate while the peak shifted towards young children. Overall this study shows that severe, life-threatening malaria is predominantly concentrated in 3 to 59 months old children hence, they should be the focus of disease prevention control.

a. Regulation of host responses

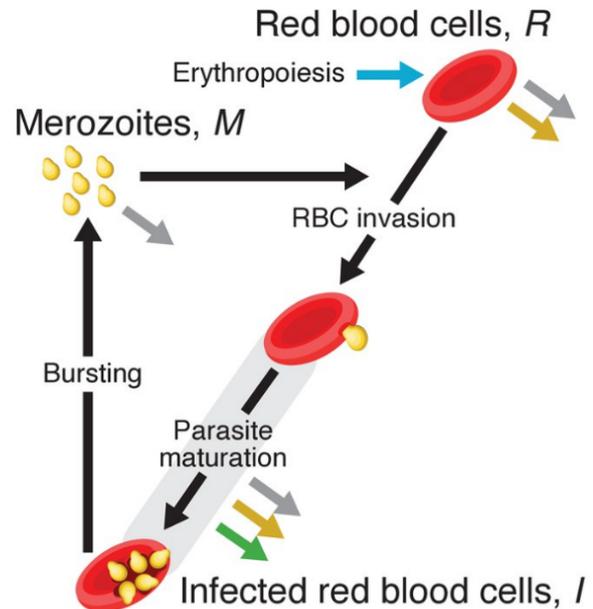
General RBC removal



Targeted iRBC removal



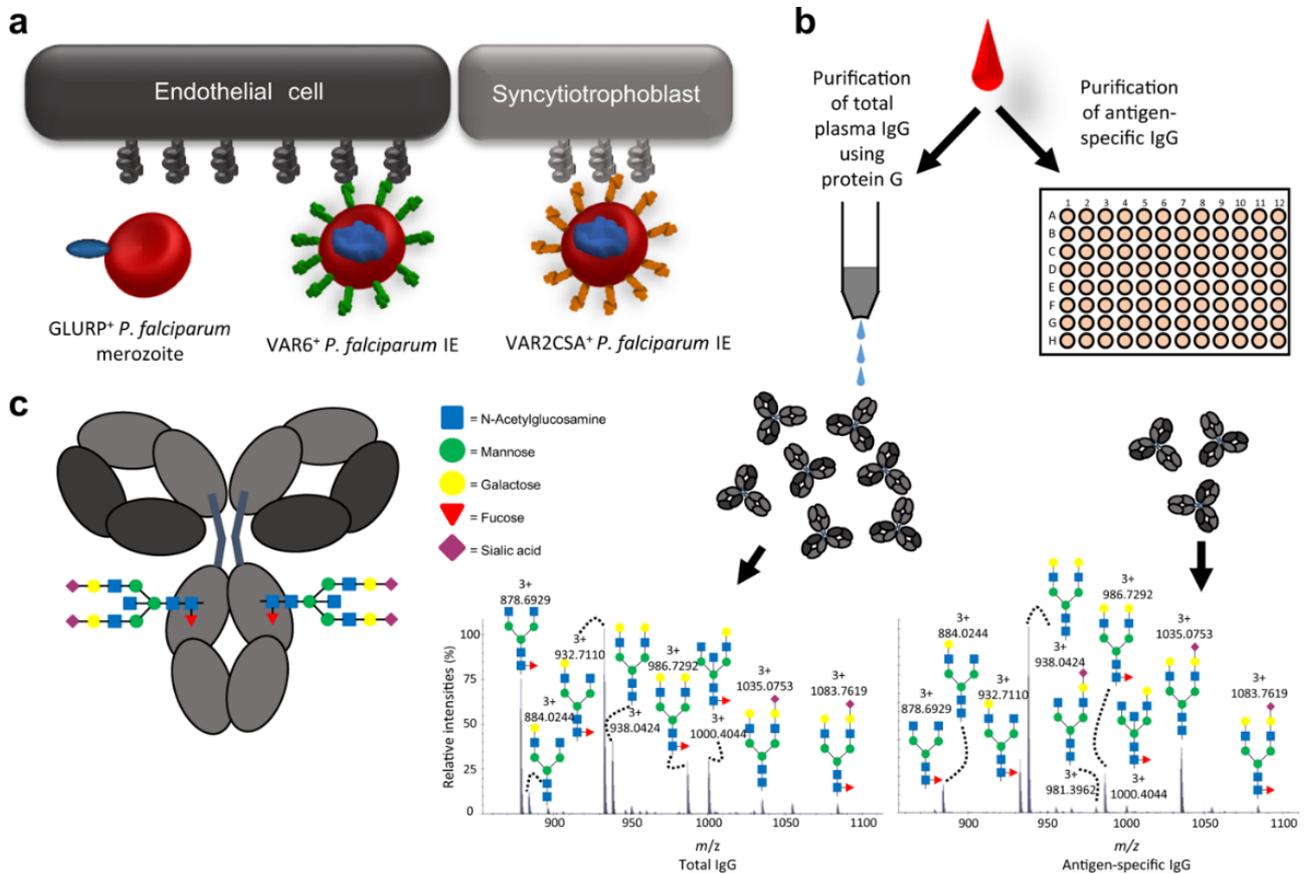
b. Within-host infection ecology



Source: <https://pubmed.ncbi.nlm.nih.gov/34636723/>

Variation in host response and malaria disease outcomes has been observed, however, the causative factors remain to be identified. During the acute malaria stage, the host innate immune system clears the infected RBCs as well as the uninfected RBCs. A balanced host immune response is critical for host recovery and survival. In this [study](#), the authors used eight genetically diverse murine hosts to understand the effect of host genetics on host-parasite interactions and the variation in host resilience and disease outcomes. The authors challenged the mice with *P. chabaudi* and made longitudinal measurements of the parasite levels and the RBC density for 15 days, as well as cytokine expression analysis. However, the mice with poor immune response, or a high pro-inflammatory response lead to poor outcomes because of insufficient response to clear infected RBCs or an indiscriminate response leading to uncontrolled destruction of uninfected RBCs. Thus a balanced host immune response and cytokine expression, which are determined by the host genetics, are key factors influencing the host resilience to malaria infection.

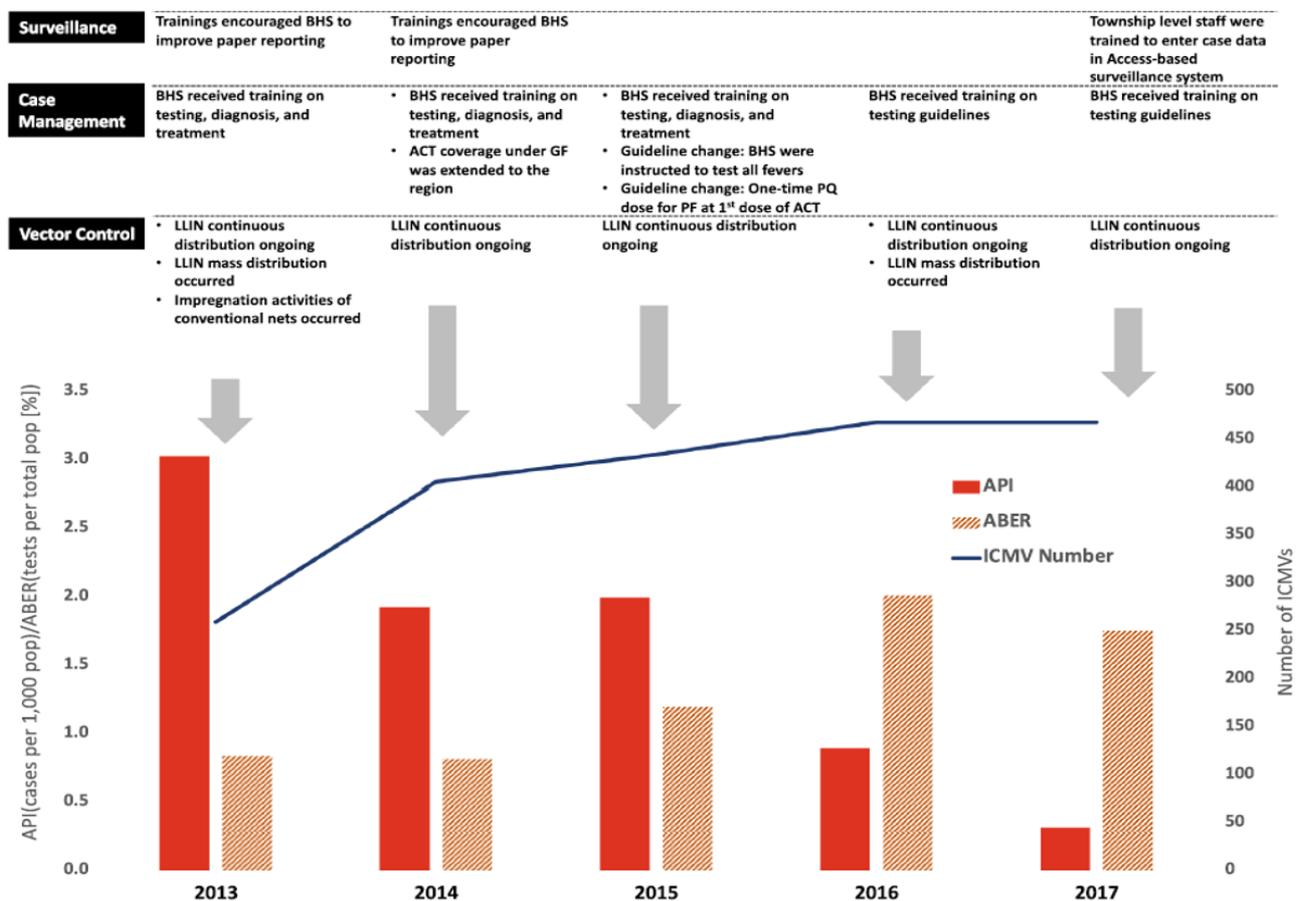
Larsen M D. *et al.*, *Nat Comm.*, 2021: Afucosylated *Plasmodium falciparum*-specific IgG is induced by infection but not by subunit vaccination



Source: <https://pubmed.ncbi.nlm.nih.gov/34611164/>

P. falciparum mediated sequestration of the infected erythrocytes (IEs) to the host receptors is one of the virulence mechanisms leading to placental malaria or cerebral malaria. *P. falciparum* erythrocyte membrane protein1 (PfEMP1) mediates the sequestration of IEs, however, host IgG specific against PfEMP1 prevents IE sequestration, and also mediates phagocytosis and lysis of IEs through IgG-Fc Receptor interaction. While the host IgG is mostly fucosylated, the IgG against PfEMP1 is afucosylated. The afucosylated IgG has 40-fold higher affinity for Fc γ R than the fucosylated form. The authors show that while natural *P. falciparum* infection produces afucosylated IgG, immunization with PfEMP1 subunit (VAR2CSA) produces fully fucosylated IgG, thus highlighting the difference between the vaccine-mediated immune response and against natural infection.

Gallalee S. et al., *Sci Rep.*, 2021: Factors associated with the decline of malaria in Myanmar's Ayeyarwady region between 2013 and 2017



Source: <https://pubmed.ncbi.nlm.nih.gov/34650123/>

In Ayeyarwady region of Myanmar, the reported malaria cases decreased 86% between 2013 and 2017. In order to find out the major factors responsible for change in the malaria epidemiology in Ayeyarwady, the authors of this [study](#) explored the quantitative and qualitative information on environmental factors and malaria control interventions such as ecological factors, funding, surveillance, case management, and vector control. Among the three ecological variables (temperature, rainfall and forest cover) that could affect the transmission dynamics, an inverse relationship was observed between deforestation and malaria burden in three townships (with the largest malaria caseloads) along the western forest fringe area of Ayeyarwady. Additional studies are required to understand the mechanisms driving this correlation. A shift from aggregate to case-based reporting of malaria cases allowed targeted intervention in villages with high risk. Increased funding, improved surveillance, diagnosis and treatment (case management) and distribution of LLINs (as a part of vector control) during this period have also been the key interventions for reduced malaria burden. Thus as Myanmar works towards malaria elimination, surveillance and case management still play major role.

Malaria Scientist to Watch

An interview with Dr Siraj A. Khan



Dr Siraj A. Khan

Scientist F (Deputy Director, Sr Grade)
HoD, Medical Entomology, Arbovirology and Rickettsial Diseases
I/C Apex Referral Laboratory for AES/JE NE Region (NVBDCP)
ICMR, Regional Medical Research Centre, NE Region,
Dibrugarh, Assam

1. Please share with our readers your journey from being a young science student to your current role at ICMR-RMRC, Dibrugarh.

A fresh pass out in MSc Life sciences with specialization in entomology during 1988, the exotic world of insects always fascinated me. The huge campus of Dibrugarh University with its natural landscape and undisturbed lush green natural vegetation was a heaven for numerous insect species as well as birds. During our post-graduation, Prof Basanta Kr Behura (Late), an eminent entomologist and former Vice-Chancellor of the Utkal University, Orissa used to visit as a guest professor in entomology. The Life Sciences Department of Dibrugarh University was then headed by an eminent entomologist, Prof Ruma Handique (Late) who had made immense contributions in the field of sericulture. Prof Behura would always carry a cloth bag hanging on his shoulder with small paper bags and a hand lens and would forage into the bushes to look for insect specimen, pack them tenderly in the paper packets and bring them to the class for demonstration and teach us how to identify them. I would accompany Sir now and then and many a times we would visit the University library to identify the insects by referring to “Fauna of British India” series as well as other taxonomy reference books available. Sir’s hand lens used to be our humble equipment for magnification of 10X. My association with Sir continued even after my post-graduation (his neatly written postal inland letters are still my prized possession) and Sir would always motivate me to pursue research in medical entomology. He introduced me to scientists at RMRC, Bhubaneswar that included another stalwart in medical entomology, Prof AP Dash (now VC, Central University of Tamil Nadu) and suggested a topic for my doctoral research “Mosquitoes of coastal Orissa” that however did not materialize. At that time, I had joined the Life Sciences department of Dibrugarh University as a JRF in a project entitled “Effect of oil pollution on Muga worms (*Antheraea assamensis*)” under Prof Handique.

In August 1989, I joined ICMR-RMRC, Dibrugarh (RMRC) as a JRF under the local manpower development scheme and I happen to be the first JRF recruit of this centre. I was attached to the Malariology Division then headed by Dr Prafulla Dutta. Dr LP Dutta, Director of the institute was kind enough to send me to the Defense Research Laboratory at Tezpur, Assam (DRLT) just after my selection for a two-week training on-field activities and identification of malaria vectors as DRLT had made good contribution in studies on malaria and Japanese encephalitis (JE) vectors. Subsequently, I started my research work for PhD entitled “Studies on the mosquito fauna of some areas of Dibrugarh District with special reference to *Mansonia (Mansonioides) annulifera* (Theobald), a reported vector of Japanese encephalitis (JE) from the Dibrugarh District of Assam” under joint mentorship of Prof. Ruma Handique, Department of Life Sciences, Dibrugarh University and Dr. LP Dutta, Director, RMRC.

Dr Satyanarayana joined as Director, RMRC in 1992. Dr Satyanarayana made me visit the national institutes under ICMR carrying out research on mosquitoes. Accordingly, under his instructions and recommendation, I had the opportunity to visit many institutes and discuss with stalwarts working on various aspects of vectors and vector-borne diseases. I visited NIV, Pune and discussed my work with Dr HR Bhat, Dr AK Mishra, Dr DT Mourya and Shri MA Ilkal. Then I visited VCRC, Puducherry field unit in Cherthala (previously: Shertallai), Kerala where the Filaria control program (FILCO) was underway and I discussed my research topic with Dr S Sabesan and Dr N Pradeep Kumar.

My next halt was VCRC, Puducherry where I met and discussed my work with Dr. Vijay Dhanda, Director VCRC, Puducherry and with Dr SG Suguna, a classical taxonomist whose painstaking research impressed me a lot. My last stop was Centre for Research in Medical Entomology (CRME), Madurai (now merged with VCRC, Puducherry) where I had the opportunity of meeting and learning from the renowned entomologist of our country Dr. R Ruben, the founder Director of CRME.

I joined ICMR-RMRC, Dibrugarh as Research Assistant in June 1991 in the Malariology division, later renamed as Entomology and Filariasis division, and served for 8 years in this post. I joined the scientist cadre as Research Officer in April 1999 and gradually moved on to the present position in 2018 as Scientist F and am now serving as Head, Division of Medical Entomology, Arbovirology and Rickettsial Diseases (MEARD). Since my joining, I have been actively engaged in research in the field of applied entomology pertaining to epidemiological and molecular aspects of Malaria, Filariasis, JE, West Nile, Dengue, Chikungunya, Rickettsial diseases; identification and bionomics of vectors of major vector-borne diseases and their management and control in NE states of India. I was awarded ICMR Prize for Biomedical Research conducted in underdeveloped areas during the year 2012.

I would like to share a small experience related to malaria control in NE in which I was involved. During 1989 under the Integrated Disease Vector Control (IDVC) program initiated by Malaria Research Centre (MRC), New Delhi, we undertook impregnation and distribution of Deltamethrin impregnated bed nets in Jairampur, Arunachal Pradesh. The program was inaugurated by Dr. VP Sharma, Director MRC, Delhi in presence of Dr LP Dutta, Director of RMRC, Dibrugarh and many dignitaries and prominent political figures from the state of Arunachal Pradesh. As this region was highly malaria endemic, RMRC had a satellite malaria control unit under IDVC stationed in the civil hospital, Jairampur. *Anopheles dirus* (later identified as *An. baimaii*) was the prominent malaria vector. It is quite heartening to share that this region is almost free from malaria now.

2. *What has been your most surprising research finding?*

- In the context of malaria research, we were successful in developing an effective module for the prevention of malaria morbidity in forest fringe areas of NE region. The Insecticide Treated Mosquito Nets (ITMNs) in conjunction with Mosquito repellent (MR) - DEET were found to be most effective in preventing malaria followed by ITMN alone and MR alone in order of declining malaria morbidity in 2006.
- We conducted a study on Spatial Correlations of Malaria Incidence Hotspots with Environmental Factors in Assam. Historical morbidity pattern of malaria in terms of API (Annual Parasite Incidence) in the state of Assam were used for delineating the malaria incidence hotspots at health sub-centre (HSC) level. Strong spatial autocorrelation among the HSCs were observed in terms of API. Spatial correlation of malaria incidence hotspots with physiographic and climatic parameters across 6 agro-climatic zones of the state revealed the types of land cover pattern and the range of elevation contributing to the malaria outbreaks. Analysis showed that villages under malaria hotspots had more agricultural land, evergreen/semi-evergreen forests with abundant waterbodies. Statistical and spatial analyses of malaria incidence showed a significant positive correlation with malaria incidence hotspots and elevation; villages under malaria hotspots had average elevation ranging between 17 to 240 meters above mean sea level (MSL). This conforms to the breeding characteristics of the two primary vector mosquito species in the state *An. minimus* and *An. baimaii* that prefer slow flowing streams in the foot hills and forest ecosystems respectively.

3. *If you were to pick one scientific discovery that has been crucial to our current understanding of malaria, which one would that be?*

Assam has a long history of suffering due to tropical diseases including malaria, viral fever, tuberculosis and typhoid. Malaria created havoc in the north-eastern states during the 19th century. Problems due to malaria were first observed by Dr. H.J. Grover and Dr. G.C.V. Ramsay, the Medical Officers of British Raj Labac Hospital, located in Labac Tea Estate, Silchar, Assam. In 1898, Dr. Ramsay invited Sir Ross, who was conducting research on various aspects of malaria in Secunderabad, India, to study the problem of malaria in the Barak Valley, Assam. In 1892, Sir Ross first established that malaria was caused by mosquitoes, contrary to the common belief that bad air caused malaria. Later in 1897 while working in Secunderabad, Sir Ross discovered that female *Anopheles* mosquitoes transmitted malaria (Ross, 1897). By the year 1898, Sir Ross also included to his discovery that the salivary gland of female *Anopheles* mosquito was the storage site of malaria parasite that used to get released to healthy hosts (human beings) during biting. Due to his discoveries on malaria, Sir Ross was conferred the Nobel Prize for Medicine in 1902.

So, the discovery that female *Anopheles* mosquito is the vector for transmission of malaria was definitely a major step towards an understanding of malaria.

4. What are the challenges for malaria vector surveillance in India?

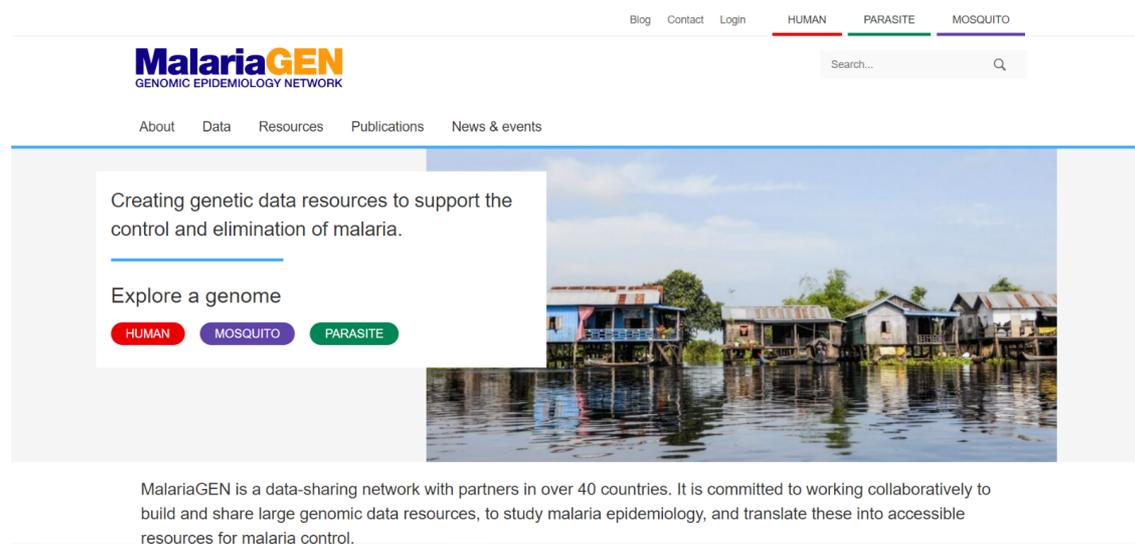
- Various Insecticides are used in multipronged approaches for vector control. Though in the beginning, IRS with DDT was found remarkably effective for mosquito control but *An. culicifacies* (primary vector in other parts of India except north-east) became the first mosquito species to develop resistance against this insecticide. Malathion and deltamethrin were introduced as IRS to manage *An. culicifacies* as endpoint replacements but resulted in the development of multiple resistances creating a roadblock in malaria elimination. Further, *An.culicifacies* comprises of five sibling species and each responds differently to insecticides and has different malaria transmission potential making their control more complicated.
- The primary vectors of malaria in north-east India are *An. minimus* and *An. baimaii*. However, studies on *An. culicifacies* in north-east India are very limited and no concrete assumptions or conclusions regarding establishment of this species as a primary vector or replacement of a long-established primary vector like *An. minimus* can be drawn. Ecological changes in NE region like deforestation, change in land-use and land-cover patterns, advancements in agriculture with construction of irrigation channels, etc., have brought about changes in the *Anopheles* composition and could be creating a favorable niche for proliferation of *An. culicifacies*. In order to establish the presence or absence of *An. culicifacies* and if present to determine its prevalence, distribution, vectorial potential and biology in north-east India, a project has been funded by MERA-India.
- An inadequate number of entomologists and other health workers and program staff in malaria control are a major bottleneck. Additionally, there is a shortage of qualified entomologists in the country leading to poor vector surveillance and a lack of robust data on entomological aspects of malaria. Recently, ICMR has undertaken various commendable steps to inculcate interest in entomology among young students and is also envisaging opening of post-graduate courses on Public Health Entomology in some of its centres (ICMR-VCRC, Puducherry has been running this course for a decade with an annual intake capacity of 12).

5. What significance do you see for MERA-India in achieving India's malaria elimination target?

India has embarked on an ambitious plan of eliminating malaria by 2030. The planning and control of malaria in India post-independence has been a long journey involving continuous evaluation and

changes in control approach based on diagnosis, treatment, drug resistance, vector distribution, development of resistance to insecticides and changes in vector bionomics. India contributed 2.44% (5.6 million) of the total global malaria cases in 2019. However, a decade ago (2010) malaria cases in India stood at 20 million; hence a 72% reduction in case numbers in 10 years is commendable (World Malaria Report, 2020). This reduction may be attributed to various factors including vector control and improved surveillance of cases, prompt diagnosis and treatment. Thus, MERA India has a great role to play through research inputs so that Malaria elimination target can be achieved by 2030.

Resource for Malaria Researchers The Malaria Genomic Epidemiology Network (MalariaGEN)



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Creating genetic data resources to support the control and elimination of malaria.

Explore a genome

HUMAN MOSQUITO PARASITE

MalariaGEN is a data-sharing network with partners in over 40 countries. It is committed to working collaboratively to build and share large genomic data resources, to study malaria epidemiology, and translate these into accessible resources for malaria control.

MalariaGEN, established in 2005, is a global community with partners in around 40 countries, who are working collaboratively to collect and share the genomic and epidemiological data for the malaria parasites, vector (mosquito), and in the host (human). The integration of this data from multiple sites is aimed to contribute towards identifying and developing a better understanding of the role of genetic variations in the host-parasite and vector in the epidemiology and biology of malaria, and to apply this information for the development of tools for malaria control and elimination. Some of the applications for this data resource include use in surveillance for drug resistance and insecticide resistance, and in the identification and validation of new drug and vaccine targets.

To learn and explore more about MalariaGEN and the available data, visit <https://www.malariagen.net/>

Upcoming Event

Lecture Series on Infectious Diseases: Lecture 06 by Professor Shyam Sundar



NIMR & MERA-India present
Lecture Series on Infectious Diseases

Lecture: 06

“Visceral Leishmaniasis - An Update”

Professor Shyam Sundar,
Banaras Hindu University, India

Lecture link: <https://bit.ly/3mcFQUO>

Monday, 22nd November, 2021 | 14:30 IST



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Professor Shyam Sundar, Distinguished Professor of Medicine at Institute of Medical sciences, Banaras Hindu University, Varanasi, India would be the next speaker in the “Lecture Series on Infectious Diseases”. He has made seminal contributions in the field of Visceral Leishmaniasis (VL) and currently figures among world’s top 2% scientists in Tropical Medicine. He is a fellow of the Royal College of Physicians of London, National Academy of Medical Sciences, India, and all the three science academies of India.

Professor Sundar will be delivering the lecture entitled “Visceral Leishmaniasis – An Update” on 22nd November 2021, in which he will talk about the advances in diagnosis and treatment of VL.

To join this lecture, please click here: <https://bit.ly/3mcFQUO>

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