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NEWS & VIEWS

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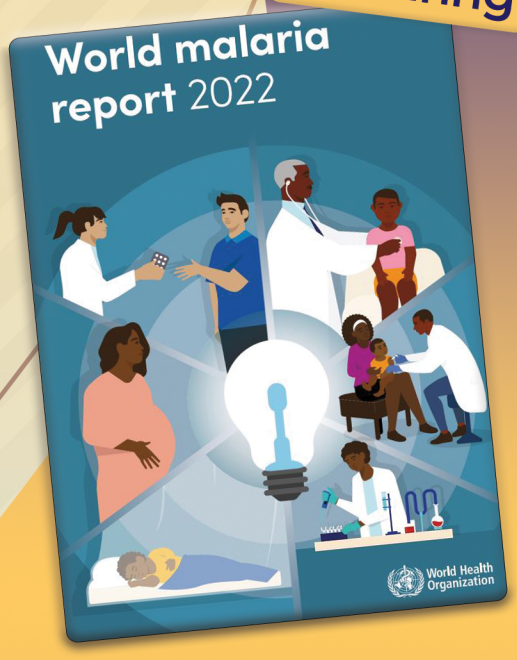
Featuring



INTERVIEW

Dr Ashwani Kumar
Director, ICMR-Vector Control Research Centre, Puducherry

UPCOMING EVENT

Distinguished Lecture | 19th December 2022
Dr John Oommen, Honorary Consultant, Christian Hospital, Bissamcuttack, Odisha

EDITORIAL | NIMR & MERA-INDIA ACTIVITIES
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MALARIA THROUGH THE LENS OF RESEARCHERS | UPCOMING EVENT

Editorial

Dear Readers,

MERA-India team brings you the twenty-sixth issue of our newsletter, “News & Views’.

With the year 2022 coming to an end, we take this opportunity to look back at our endeavours in the past year to support India’s malaria elimination goal and to connect with the researchers and community. MERA-India’s second round of funding was launched in 2022, with proposals received from across India to build novel solutions for malaria surveillance using artificial intelligence (AI), diagnostics, vector control, and also included a special call for young malaria researchers. Our existing funded projects are progressing well towards the objectives, and in the coming year, we look forward to sharing the outcomes from these studies. Several lectures, training, workshops, and competitions were organized last year to facilitate an exchange of ideas, increase networking among the researchers, for capacity building through the training of young researchers and students, and spread awareness in the community about malaria prevention and control. In the coming year, we hope to continue with these ongoing initiatives with the same zeal.

Last week, the World Health Organization (WHO) released the much-awaited World Malaria report 2022, with a detailed account of global malaria incidence and deaths. The report serves as a grim message to all that despite medications, vaccines, vector control tools, and advances in science and technology, we continue to see deaths due to a preventable and treatable disease, malaria. Sustained and collective efforts are required to make the available interventions accessible for the most vulnerable population and in hard-to-reach areas, along with continued investments in research and development to build new tools to mitigate the risk of vector-borne diseases with emerging challenges such as climate change and the increased risk to due to invasive vector species. In this issue, we highlight the key messages from this report.

In this issue, you will find the highlights of the Annual Day 2022 celebrations of ICMR-National Institute of Malaria Research (NIMR). Glimpses from India | EMBO Lecture Course organized by ICMR-NIMR are also given in this issue. In the “Malaria Scientist to Watch” section, an inspiring interview of Dr Ashwani Kumar, Director, at ICMR-Vector Control Research Centre, Puducherry, India is featured.

In the “Research in spotlight” section, we have highlighted three recent articles describing the LLIN effectiveness assessment in Burundi by Bortel WV *et al*.; trace metal detection for rapid malaria diagnosis by Musyoka WD *et al*., and the genetic population of *Plasmodium knowlesi* in Thailand by Sugaram R. *et al*.

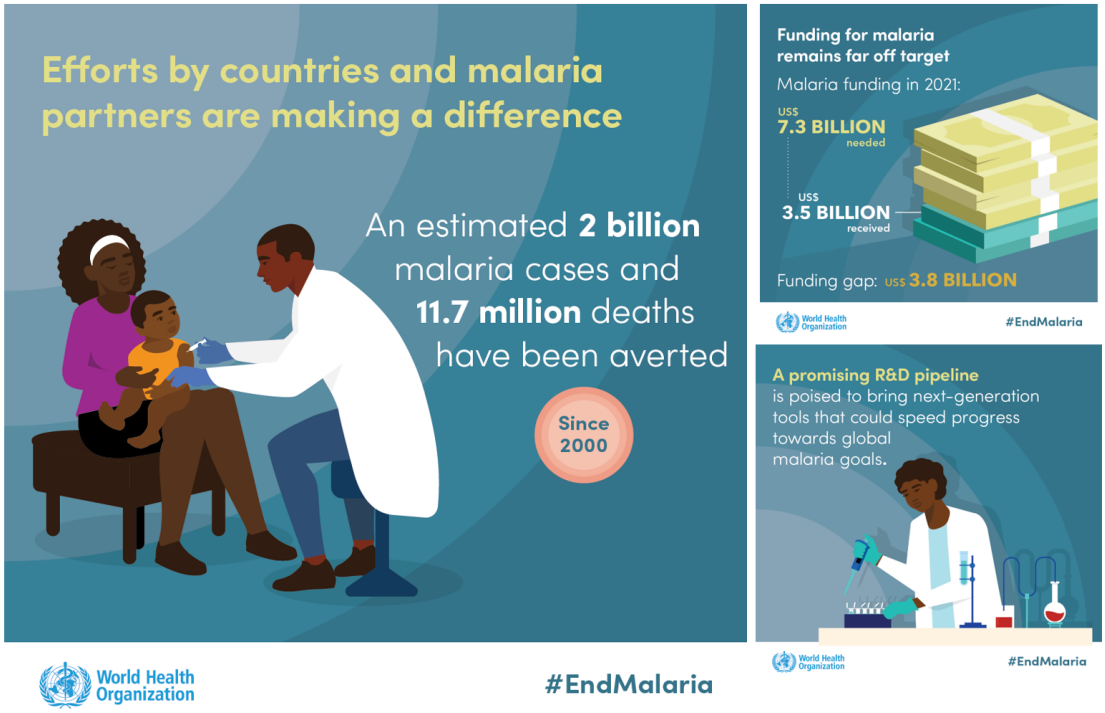
In the “Malaria through the Lens of Researchers” section, we have featured the second winning entry of the MERA-India Image Competition 2022, submitted by Ms Aastha Varshney, a PhD student with Dr Satish Mishra at CSIR-Central Drug Research Institute, Lucknow, India.

In the “Upcoming Event” section, we have given details of the next Distinguished Lecture on 19th December 2022 by Dr John Oommen, Honorary Consultant at the Christian Hospital in Bissamcuttack (CHB), south Odisha. We invite all our readers to attend this lecture about stories and reflections from a 25-year journey of people’s movement against malaria.

We hope that you will find this issue engaging and fascinating. Please write to us for any feedback or suggestions regarding the newsletter’s content at meranewsletter@gmail.com.

With best wishes,
MERA-India team

Malaria News: WHO World Malaria Report 2022



Source: https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022/social-media-tiles

The WHO recently released the World Malaria Report 2022, with the global malaria control and elimination trends for the year 2021 and giving a direction to the way forward for meeting the emerging challenges. According to the report, while the rate of increase in malaria cases was slower between 2020 and 2021, still 247 million malaria cases and 619,000 malaria-deaths worldwide were estimated in 2021. The WHO African Region continued to bear the highest malaria burden and accounted for 95% of global malaria cases and 96% of deaths, respectively.

The WHO South-East Asia Region showed a decreasing trend for malaria cases and deaths contributing to about 2% of the global malaria cases. India accounted for a total of 79% estimated malaria cases and 83% estimated malaria deaths in this region. *Plasmodium falciparum* remained the dominant parasite species in India.

The report states that with the current interventions, an estimated 2 billion malaria cases and 11.7 million deaths have been averted since 2000. The report also highlights the threats to the fight against malaria, including insecticide resistance, anti-malaria drug resistance, and the spread of invasive vector species such as *Anopheles stephensi* in Africa. The report has also highlighted the reduced available funding for malaria research (US$ 3.5 billion received as compared to the required US$ 7.3 billion), and has stressed upon the need for continued research & development to build newer tools, including diagnostics, drugs, vaccines, and vector control methods, etc. for attaining the malaria elimination goals.

The full report can be accessed here: https://www.who.int/publications/i/item/9789240064898.

ICMR-NIMR & MERA-India Activities:

ICMR-NIMR Annual Day 2022

ICMR-NIMR Annual Day 2022

Panel Discussion

ICMR-NIMR celebrated its annual day on 01st November 2022. On this occasion, a panel discussion on the theme “Research to Augment National Malaria Elimination” was organized, in which eminent scientists including Dr BS Das (Former Adviser DBT and Emeritus Medical Scientist, ICMR), Dr Ravi Kumar {Sr. Regional Director (Retd.), National Centre for Vector-Borne Diseases Control (NCVBDC), Karnataka} Dr Amit Sharma (Former Director, ICMR-NIMR and Group Leader, Structural Parasitology, ICGEB), Dr Ashwani Kumar (Director, ICMR-VCRC) and Dr Tanu Jain (Director, NCVBDC) shared their views. The discussion was moderated by Dr Manju Rahi (Director in-charge, ICMR-NIMR). Dr Shiv Lal (Chairperson, Scientific Advisory Committee, ICMR-NIMR) and Dr Rinku Sharma (Deputy Director, National Center for Disease Control, Delhi) were also present on the occasion. During the discussion, various points about long-term/short-term research priorities and the effectiveness of current vector management tools were put forth by the speakers. The need for joint efforts from the national programme NCVBDC and research bodies like ICMR towards disease management and implementation of available tools to accelerate the malaria elimination efforts was also discussed.. The recording of this discussion is available on the MERA-India (https://meraindia.org.in/video_gallery) and ICMR-NIMR websites (https://nimr.icmr.org.in/media-nimr/video-gallery).

Cultural Programme

After the panel discussion, a cultural event was organized where NIMR PhD students and staff showcased their talent through captivating performances, like dancing, singing, poetry, and rangoli competition. An exhibition of images shortlisted for MERA-India Image Competition was also held.

India | EMBO Lecture Course
Malaria molecular epidemiology, population genetics, and evolution: Principles to practices

ICMR-NIMR organized the prestigious India | EMBO Lecture Course from 17 to 23 November at Delhi. The course's main objective was to collate and transfuse the state-of-the-art principles, practices, and understanding of the central theme between the experts in malaria (and beyond) and the current and future torchbearers of malaria elimination (and, finally eradication). This course was designed in an interactive way with multi-directional and multi-dimensional perspectives to provide ample opportunities for interactions between senior and junior scientists from across the globe and working in multiple disciplines. In addition to the lectures, the participants benefited from hands-on exercise, networking sessions for scientific writing, work-life balance, and career guidance.

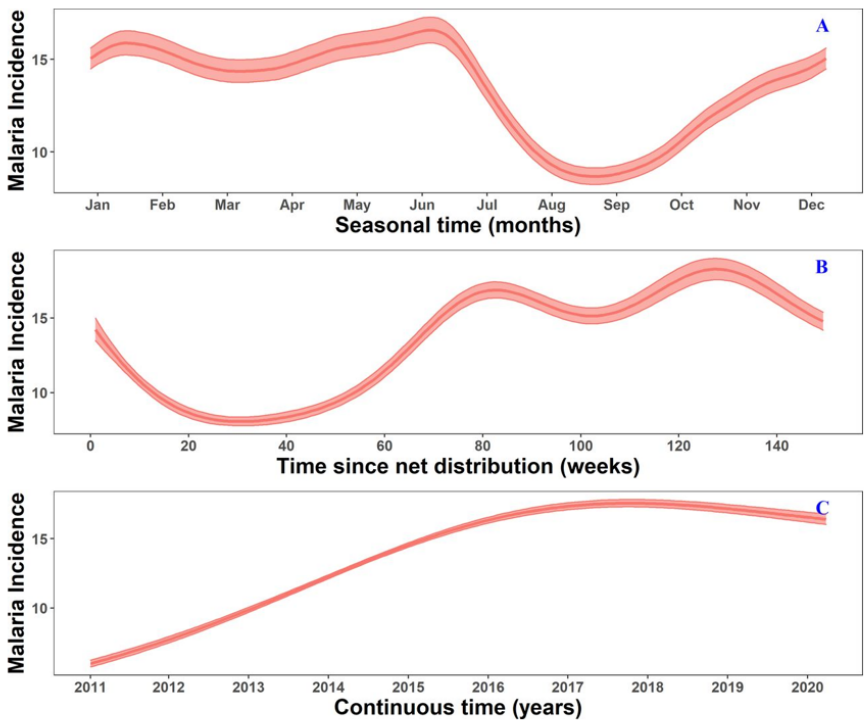
The course was deliberated by 13 stalwarts in Malaria molecular epidemiology, population genetics, and evolution including Alyssa Barry (Australia), Ananias Escalante (USA), Aparup Das (India), Catherine Walton (England), Julio Gallego-Delgado (USA), Kristan Schneider (Germany), Lisa Ranford-Cartwright (Scotland), Lucio Luzzatto (Italy), Marcelo Ferreira (Brazil), Maria Andreina Pacheco (USA), Rasmus Nielsen (USA), S Noushin Emami (Sweden) and Sudhir Kumar (USA).

This India | EMBO Lecture Course was aimed at PhD students, postdoctoral researchers and young researchers, however, researchers from academia and industry interested to learn and apply the knowledge were also encouraged to apply. More than 150 applicants from across the world applied for the course and 50 participants from 21 countries were selected for the course. These participants presented 8 turbo talks and 42 posters. Abhinay Ramprasad (England), Thomas Stabler (USA) and Anaswara Sugathan (Sweden) won the top 3 prizes for best turbo talks. Elizabeth Riana Dwi (Thailand), Megan Michel (USA), Priya Agrohi (India) and Xiomara Alexandra Gaitán (Brazil) won the best poster prizes in that order.

The course was organized by Dr Abhinav Sinha (ICMR-NIMR, India), Dr Lisa Ranford-Cartwright (Scotland), Dr Kristan Schneider (Germany), and Dr Lokesh Kori (ICMR-NIMR, India) with support from Dr Sinha's lab members. This course was funded by EMBO, DBT/Wellcome Trust India Alliance (India Alliance) and various other commercial sponsors.

Research in Spotlight

Bortel WV. *et al.*, *BMJ Global Health* 2022: Long-lasting insecticidal nets provide protection against malaria for only a single year in Burundi, an African highland setting with marked malaria seasonality



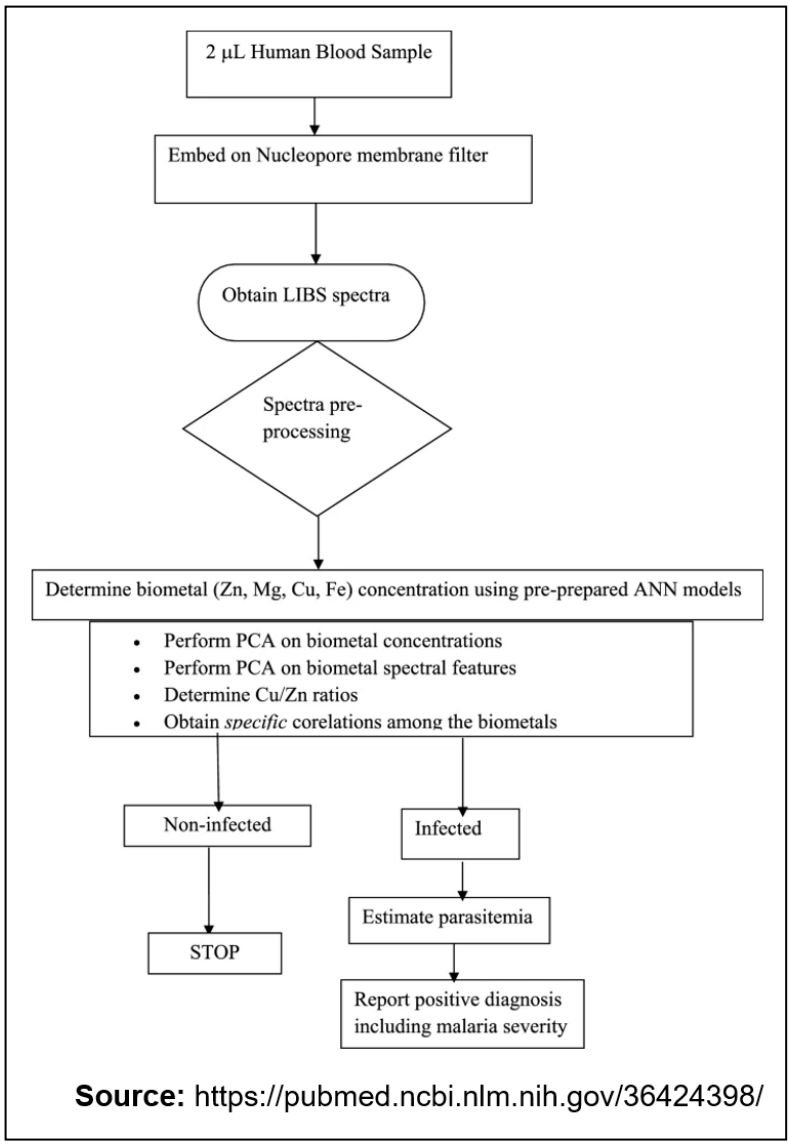
Source: https://gh.bmj.com/content/7/12/e009674

Long-lasting insecticidal nets (LLINs) have proven to be one of the crucial interventions in contributing to the global decline in malaria incidence. However, their impact depends on several factors, including availability, correct use, and maintenance. In this study, the authors have assessed the duration and magnitude of the impact of LLIN on the malaria incidence in Burundi by looking at the malaria cases between 2011- 2019, following mass LLIN distribution campaigns in 2014 and 2017, aimed at providing LLIN access to all citizens. The authors report that during the first year of LLIN mass distribution, there was a steep decline in malaria incidence, with the highest effect observed between weeks 20 and 40 post-distribution. However, after week 40 of LLIN distribution, the malaria cases increased and reached pre-distribution levels in week 65 and in the second and third years even further to levels higher than before LLIN distribution. The authors also analyzed the

malaria incidence in relation to the seasonal variations and changes in climatic conditions, such as day and night temperatures and rainfall. The study reports that the malaria incidence was seasonal in nature, with an increase 2-4 weeks after the rainy season (September-November) and a decrease after the dry season (June-August). A non-linear malaria incidence increase coincided with an increase in night temperatures towards 16°C, the minimum temperature required for *Plasmodium falciparum* sporogony.

While the effectiveness of LLINs for vector control can vary between households and with features such as net types, WHO recommends the replacement of LLINs every three years. However, this study reports that the functional efficacy of LLINs, in reducing malaria incidence, declines just after one year of distribution. Therefore, more such evaluations must be conducted in malaria-endemic regions to plan LLIN replacements and mass distribution campaigns for effective malaria control and prevention through LLIN usage.

Musyoka WD. *et al*., Sci Rep. 2022: Rapid diagnosis of malaria by chemometric peak-free LIBS of trace biometals in blood



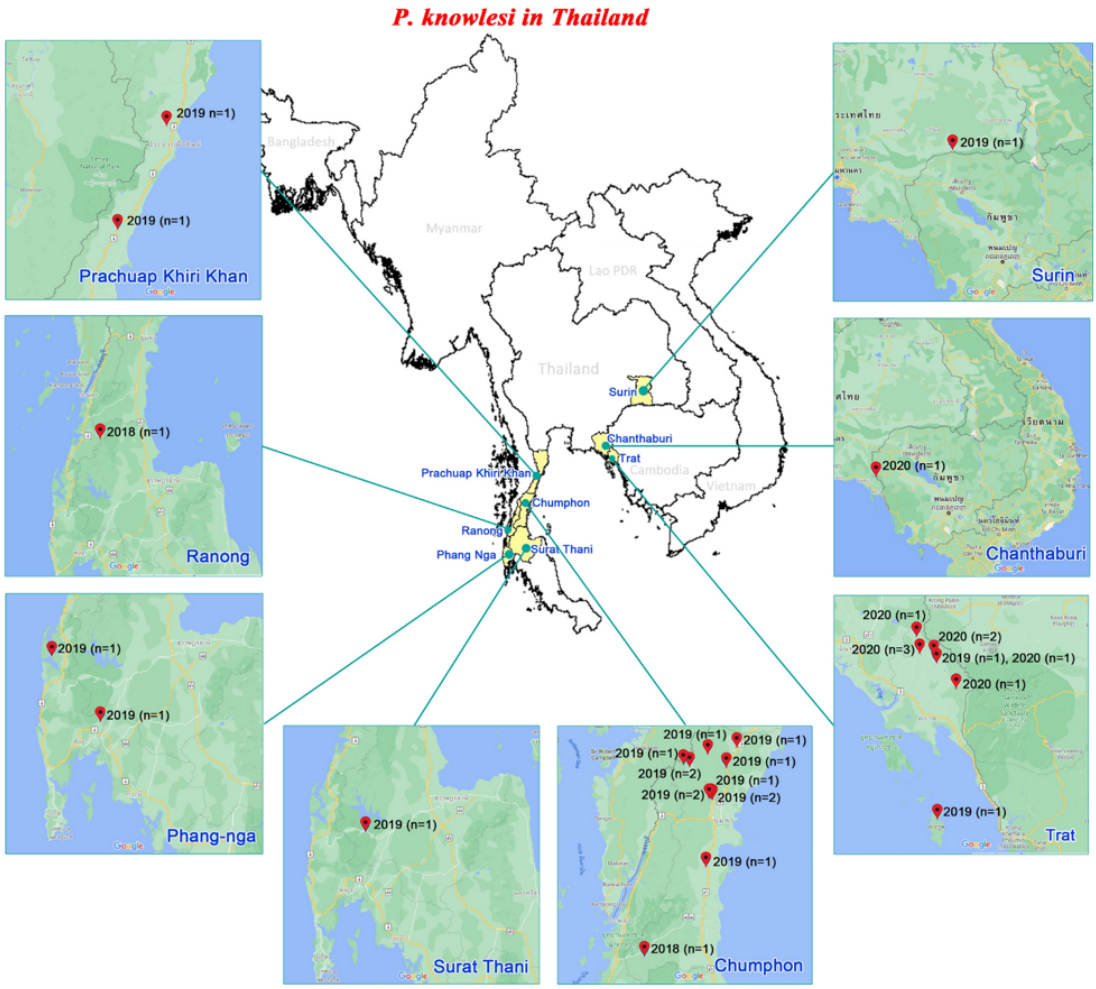
Source: https://pubmed.ncbi.nlm.nih.gov/36424398/

Rapid and sensitive diagnosis is the need of the hour to accelerate the efforts of malaria elimination. In this study, the authors are introducing chemometric peak-free LIBS (Laser Induced Breakdown Spectroscopy) based technique to detect the trace biometals in the blood for malaria diagnosis.

LIBS is a technique in which a high-beam laser focuses on the sample and creates a temperature microplasma to break the sample into ions and atoms. The concomitant emission act as the analytical signal for the quantitative determination of the elemental composition of the sample. But as the precursor biomolecules remain in low quantities in the body fluids, the authors used the chemometric technique to reduce the dimensionality of the spectral data and extract biomarkers information. In the present study, the authors used this technique to explore the variation of the trace biometals, i.e., Zn, Fe, Mg, and Cu concentrations in the *Plasmodium*-infected and uninfected human blood samples, in relation to the pathogenesis and malaria onset. They have found that the concentration of these biometals changes predictably during the onset and progression of malaria

pathogenesis. They have observed that during *P. falciparum* infection, the ratio of Cu/Zn can be seen as the indicator of oxidative stress. Using PCA (Principal Components Analysis), they have also classified the profile of biometals according to the parasite developmental stages and degree of infection. Authors claim this is an efficient and robust method for rapid diagnosis of malaria, as it will take less than 2min/sample for analysis and require a minimal amount of dried blood as a sample.

Sugaram R. *et al*., Malar J., 2021: Genetic population of *Plasmodium knowlesi* during pre-malaria elimination in Thailand



Source: https://pubmed.ncbi.nlm.nih.gov/34861860/

The increase in *P. knowlesi* cases poses a significant challenge to malaria control and preventive measures in Thailand. In this study, *P. knowlesi* mono infections were confirmed by nested PCR and DNA sequencing from the malaria patient samples collected between 2018 and 2020. Further, the authors carried out cluster analysis using microsatellite markers and *P. knowlesi* merozoite surface protein 1 (*pkmsp1*) gene to understand the lineages of these parasites. The results revealed that the *P. knowlesi* parasites belong to

the same lineages as those isolated in Cambodia and Malaysia. They also analyzed mutations in the *P. knowlesi* pyrimethamine resistance gene dihydrofolate reductase (*pkdhfr*) and assessed the effect on resistance to pyrimethamine drug by homology modelling. The parasites were found to be sensitive to pyrimethamine because mutations were located distant from the inhibitor-binding pocket. The overall findings provide important information regarding the sources and transmission of *P. knowlesi* infection in Thailand.

Malaria Scientist to Watch: An interview with Dr Ashwani Kumar

Dr Ashwani Kumar

Director & Scientist G,

ICMR-Vector Control and Research Centre,

Puducherry, India

1. Please share with our readers your journey from being a young science student to your current role as Director, ICMR-VCRC, Puducherry.

Zoology, being my favourite subject, was very close to my heart in the 11th standard, and my love for the subject only grew further during the 12th standard. After BSc (Honours) in Zoology with Gold Medal, I chose Entomology and worked on predatory Cicindelids under the guidance of Professor HR Pajni in MSc (Honours). I further pursued PhD in Entomology in Department of Zoology at the Punjab Agricultural University (PAU), Ludhiana, under the guidance of Professor VC Kapoor in 1983. During my PhD, I worked on the taxonomy and bio-ecology of Syrphid flies (hoverflies), the adults of which actively pollinate several crops while the maggots devour aphids which are pests on the same crop. This was truly a learning experience and career formation years during the tough period when extremism was at its peak in Punjab during the mid-1980s. I was awarded PhD degree in 1987 at the hands of the chief guest Dr Norman E. Borlaug the Nobel laureate who was the architect of green revolution in India. Thereafter, I was selected as Research Officer, in the first interview that I faced in 1987 in the ICMR-Malaria Research Centre (MRC - now NIMR), New Delhi. Here I had the fortune to work with Director, Dr VP Sharma who was truly a legend and a visionary leader. This marked the beginning of my very exciting and rewarding career of research in ICMR on a major human scourge *i.e.*, malaria. I had the privilege to work in Berhampur on coastal malaria and forest malaria in Rourkela in Odisha from 1987-1989.

In mid-1989, I was tasked with the opening of a Field Station of MRC in Goa where a severe epidemic was raging in the Panaji. It was an extremely challenging task for a young man who had to recruit his fresh team, fully train, equip and deploy them to tackle the epidemic head-on. By 1992, the epidemic was brought firmly under control in the city.

Unfortunately, beginning 1994, another severe outbreak of malaria occurred in the tourism belt, which was also quickly brought under control by 1996. Following these successes, the Government of Goa urged the ICMR to make Goa Field Station a permanent centre of MRC. After these experiences on urban malaria control on the ground, several different research studies were taken up, which included product evaluations, vector bionomics and vector control in large establishments like airports and Goa Port. Mosquito-proofing of Konkan Railways Project in the second half of the 1990s was another milestone which was hailed as a major national contribution by the Goa field station. Several research studies on vector and Plasmodium resistance and trials with new therapeutics were undertaken in collaboration with Goa Medical College and Hospital. Other major projects included malaria burden estimation studies, proteo-genomics of malaria and dengue vectors, and a host of molecular-epidemiological studies under the NIH-sponsored International Centre of Excellence for Malaria Research with the establishment of state-of-the-art molecular laboratory. I am fortunate to receive wide recognition at the national and global level by way of many awards and membership of several national and international committees, including GMP and VCAG of WHO. In the year 2019, I was selected as Director of the ICMR-Vector Control Research Centre (VCRC) at Puducherry, which is a premier institute of ICMR engaged in research on several vector-borne diseases (VBDs) and is WHO collaborating centre on research and training in lymphatic filariasis and integrated vector management (IVM).

2. Humankind has been battling malaria for ages. Several countries have successfully eliminated malaria and many others are on the path to achieving malaria-free status. In your opinion, which approaches/interventions have played the biggest role in our fight against malaria?

Humanity has had to deal with malaria since time immemorial. Historically, almost all continents of the world were endemic to malaria between 55^{o}N and 32^{o}S, beyond which, being very cold, the transmission of the disease was impossible. It might surprise you that in 101 countries situated on all the continents, malaria has either disappeared or been eradicated since the 1950s and 1960s or eliminated in the recent times. Of these, interestingly, Maldives and Sri Lanka, the two island nations, are in our neighbourhood. The most potent tools used historically were the filling up or the draining of marshes towards the beginning of the 20^{th} century followed by extensive use of DDT during the eradication (1950s-) and post-eradication eras, and larval source management for vector control. Since the advent of synthetic pyrethroids and their use in Indoor Residual Spray (IRS) and LLINs, they have played a key role in vector control globally thereby in the prevention of malaria transmission. These two interventions are responsible for averting millions of cases and deaths due to malaria, especially in Africa which continues to be the most malaria-affected region of the world. The WHO and the NCVBDC advocate IVM for vector control by combining several tools, but the primary reliance has been on the IRS and LLINs. The other approach has been the detection and treatment of malaria with an active and passive collection of blood smears among fever cases and treating the confirmed cases of malaria with chloroquine, primaquine and ACTs as per the treatment guidelines issued from time to time. The complicated cases are admitted and treated in hospitals with rescue drugs and clinical management. Despite decades of research and field evaluation of RTS,S, a malaria vaccine for public health use has eluded mankind so far. Potent anti-sporozoite vaccine (against both *P. vivax* and *P. falciparum*) and transmission-blocking vaccine, especially against Pf, will be the game changers in preventing malaria morbidity and mortality,

especially in children under five years of age, and pregnant women and the communities worldwide.

In recent times, WHO has come up with Global Technical Strategy for Malaria 2016-2030, which was endorsed by the World Health Assembly in 2015 with the ambition to eliminate malaria in 30 countries by 2030. India has also embarked upon the path to eliminate malaria by 2027 and desires to attain a malaria-free status by 2030.

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

Vector control is utmost essential in averting morbidity and mortality due to malaria. For appropriate vector control, strong evidence is needed for the integration of different control methods in a given geographical area for undertaking effective interventions yielding high impact. Hence, a situational analysis should always precede vector control measures. For this, routine vector surveillance must be in place with adequate, well-trained, and motivated manpower at the block, district, and state levels. Field teams need adequate mobility. Public Health Entomologists are needed for undertaking routine vector resistance studies against commonly used insecticides. Unfortunately, much needed entomological capacity is either non-existent or very weak in the country at a time of malaria elimination, when it is most needed. That is currently a big challenge. Hence, as advocated by the WHO Global Vector Control Response (GVCR 2017), we need to build and strengthen entomological capacities in every nook and corner of the country to meet the challenges posed by different VBDs and to help achieve and sustain not only malaria but also lymphatic filariasis and visceral leishmaniasis elimination.

4. How have the research opportunities changed now for early-career researchers as compared to when you started your research career?

Undoubtedly, there are far better opportunities now for the young researchers as compared to 1980s and 1990s in terms of availability of resources and the modern equipment for research. In our times, we were aiming to control malaria, while now we are targeting its elimination. Hence, there is a paradigm shift in thinking and action because disease elimination is a time-bound process. There were several classical eco-epidemiological studies that we undertook in the field, which taught us the fundamentals of the disease dynamics encompassing vector, parasite, human host, and the environmental determinants. We must remember that, like anything else, research is constantly evolving. Today, the thrust has changed to employ molecular approaches in addition to the age-old and time-tested methods of disease prevention and control. What is needed is the right balance between the classical and modern epidemiological approaches, which would help in achieving the final goal of malaria elimination and achieving the Sustainable Development Goals (SDGs). The new generation of researchers has to adjust to these realities at a time when there is no dearth of opportunities. For example, MERA-India has funded a large number of studies in the last couple of years, benefiting the young and mid-career researchers the most. These are welcome initiatives to bolster malaria research in recent times in the country.

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

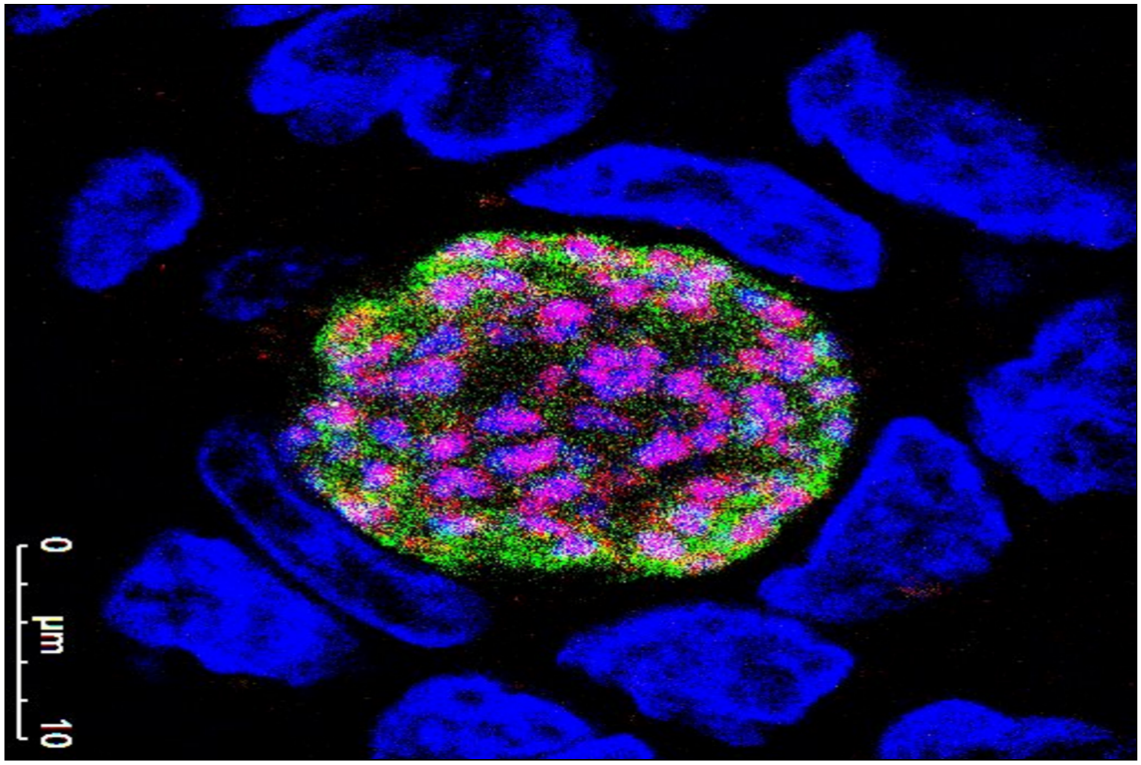
Being a major and dedicated research initiative, MERA-India can assist national efforts for the elimination of malaria by identifying gaps and providing research-based evidence for public health action against malaria. It has the opportunity to serve as the research arm of the National Vector Borne Disease Control Programme of NCVBDC in the true sense. I have no doubt that, given the right leadership, this timely initiative will meet these

aspirations in the coming years. For this, MERA-India must brainstorm from time to time and identify the critical areas of research bringing together researchers from a broad spectrum and the national programme officials for a cross-talk. Another initiative MERA-India can think about is capacity building by initiating training workshops for programme officials targeting malaria elimination. Research projects on the operational and implementation of the programme interventions may also be given thrust covering various stakeholders. With these initiatives, MERA-India can prove to be a game changer.

Malaria Through the Lens of Researchers

In this issue, we are highlighting the **second prize winning entry** of the MERA-India Image Competition 2022.

This image entitled “Malaria parasite infected liver cell showing DNA ligase expression in the nucleus” was submitted by **Ms Aastha Varshney**, PhD Student with Dr Satish Mishra in the Molecular Microbiology and Immunology group at **CSIR-Central Drug Research Institute, Lucknow**.



A brief description of the image is as follows:
This is the representative image showing hepatoma cancerous cell line hepG2 infected with DL-3X-HA-mCherry parasite harvested at 40 h.p.i. The infected HepG2 coverslips were fixed at 40hr by treatment with 4% PFA. The fixed cover slips were washed with PBS twice for 5min. Permeabilization was done using chilled methanol at 40°C for 20 min. Coverslips were washed twice by PBS and blocked with 1% BSA/PBS for 1hr at room temperature. For the staining of cells, anti-HSP70 (green) and anti-mCherry (red) were used. The signals were revealed using Alexa 594 anti-rabbit IgG and Alexa 488 anti-mouse IgG respectively. The nuclei were stained by Hoechst 33342.

Upcoming Event:
Distinguished Lecture by Dr John C. Oommen

We are pleased to announce that Dr John Cherian Oommen, presently working as an Honorary Consultant at the Christian Hospital in Bissamcuttack (CHB), south Odisha, will be our Distinguished Lecture speaker in December 2022. His main area of work has been as Team Leader of the Mitra Community Health program of CHB, working with the people of 54 predominantly tribal villages towards the dream of health, education and dignity for all. Since 1995, the Mitra team has been engaged in community malariology, seeking to combat endemic malaria through community based effort, evolving ideas and approaches that have fed into policy and strategies at a wider level. He now looks back on the stories, experiences and lessons learnt.

He will deliver the lecture entitled "A People's Movement Against Malaria: Stories and Reflections from a 25-Year Journey", on 19th December at 1100 hrs IST.

To join this lecture, please click on this link: https://bit.ly/MI-DL-Dec22.

To receive regular updates about the events being organized by MERA-India, subscribe at https://www.meraindia.org.in/event_sub.

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