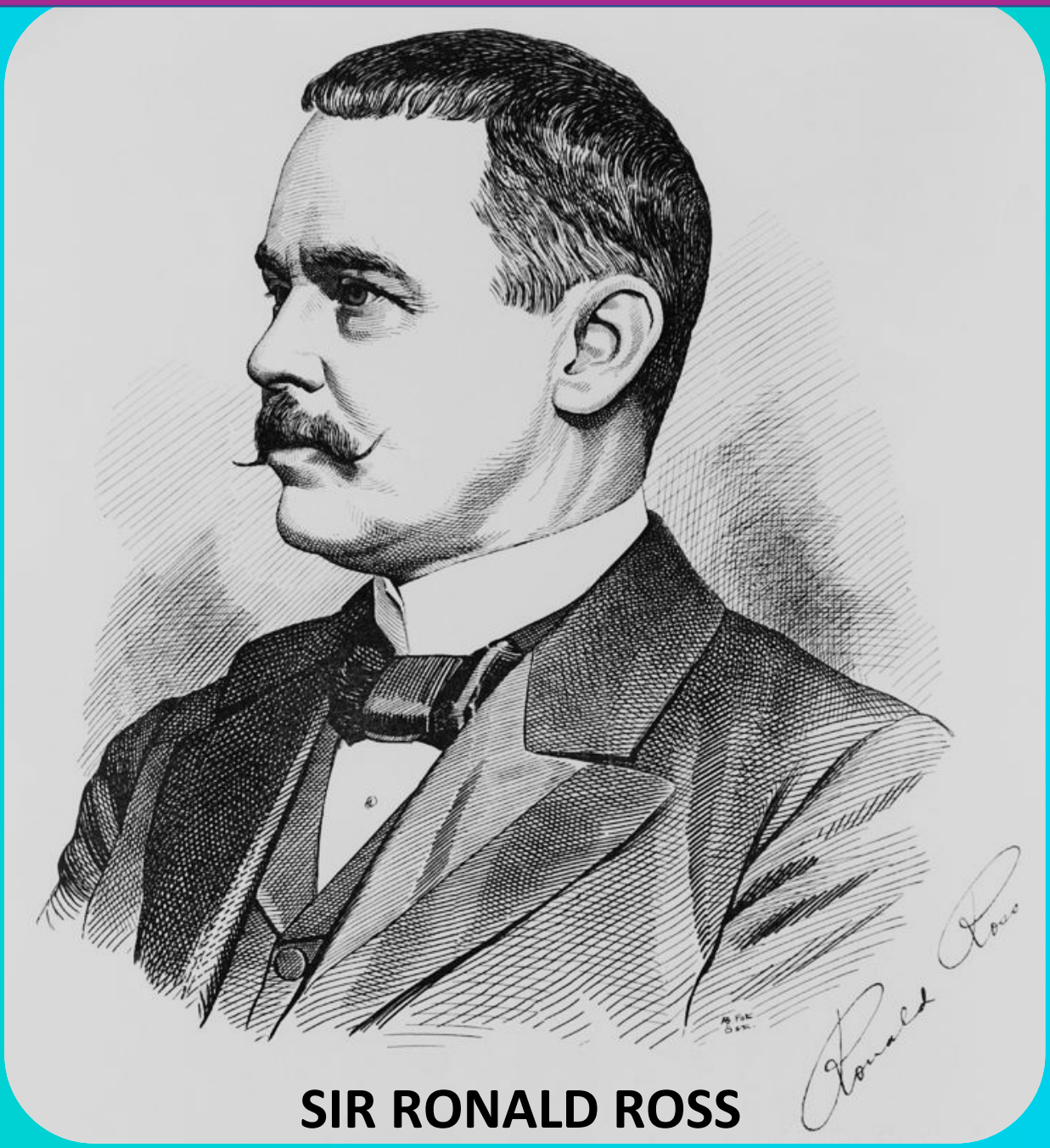
August 20, 2022
Volume: 8
Issue: 1

NAVBD NEWSLETTER

SIR RONALD ROSS COMMEMORATIVE EDITION



SIR RONALD ROSS

1857-1932

Recipient of the Nobel Prize for Physiology or Medicine, 1902

World Mosquito Day 2022

The 20th of August is observed as “World Mosquito Day”. On this day in Secunderabad in 1897, the role of mosquitoes in malaria transmission was unravelled by the British Army doctor Ronald Ross. He was born on 13 May 1857 in Almora, Uttarakhand, India. Ronald Ross was feted with Nobel Prize in Physiology and Medicine in 1902. The British Monarchy also knighted him as ‘Sir’ Ronald Ross.

Ross was inspired by his mentor Sir Patrick Manson. Ross was multi-talented as he wrote poems and novels, and composed songs besides being a passionate malaria researcher and much more. The fact that malaria, one of the deadliest infectious diseases in the world, was spread through the bite of a tiny insect- the Anopheles mosquito was now known. Later, this discovery also brought to the fore that mosquitoes were the single largest killers of humanity causing not only Malaria but also Dengue, Yellow Fever, Japanese Encephalitis, Chikungunya, West Nile Virus disease and Zika. Mosquitoes also cause colossal life-long disability among Lymphatic Filariasis Patients.

The discovery by Sir Ross paved the way for targeting mosquitoes for combating malaria. For example, the use of DDT became the backbone of the global malaria eradication programme of the WHO in the 1950s and in the last two decades, long-lasting insecticide nets (LLINs) are playing a pivotal role in averting millions of malaria cases and deaths in different parts of the globe. Despite the initial resounding success during the 1950s and 1960s, malaria control has seen several highs and lows in the last 7 decades in India, due to the well-articulated techno-administrative reasons. There are regions of the world where malaria has been completely eradicated on one hand, while on the other, it is persisting in the vast expanses of Africa, South East Asia and Latin America, notwithstanding the shrinking map of malaria in the last two decades and the WHO advocating eliminating malaria in at least 35 countries, including India, by 2030.

India launched an aggressive malaria elimination drive in 2016 backed by strong political commitment at the highest level and resource allocation. The three-phase programme was guided by the National Framework for Malaria Elimination (NFME) and National Strategic Plan (NSP) for Malaria Elimination (2017-2022). The significant decline in malaria incidence in recent years in India is encouraging and has been hailed by the WHO. The most impressive gains in malaria elimination have been witnessed in Odisha in recent years. Odisha has been a high-burden state and contributed to the highest morbidity and mortality in India. This is a shining example of an evidence-based malaria elimination campaign covering the most neglected and hard-to-reach areas by twin strategies of parasite control by addressing the reservoir of asymptomatic cases on one hand and vector control by mass distribution of LLINs in every nook and corner of the state. Since this has been driven by state priorities and resource investment by the state and the donors, the state political, bureaucratic and health leadership besides all the stakeholders deserve accolades for this seminal achievement. We should not hesitate to learn from countries which have successfully eliminated malaria in recent years and have been certified malaria-free by the WHO.

India is climatically, geographically, demographically, culturally, politically and economically highly diverse and therefore, the elimination of malaria in this complex country will be quite challenging. The challenges can be overcome by NCVBDC by forging synergy and strengthening partnerships between communities, research organizations, various stakeholders and donors, all striving to achieve a common goal. We need new tools and technology for vector control including next-generation LLINs, short anti-relapse therapy for the radical cure of *P. vivax*, highly sensitive point-of-care diagnostics to fish out asymptomatic carriers, the lone malaria vaccine RTS,S to prevent Pf infections in the targeted population and strengthening health care systems where necessary. Strengthening the entomological capacity of the programme by way of recruiting and training entomologists, supervisors and mosquito collectors are extremely urgent to address not only malaria but also other vector-borne diseases in the Centre and the States.

On World Mosquito Day 2022, to pay rich tributes to Sir Ronald Ross, we need to renew our pledge to work in tandem with all available ammunition to win the war against malaria- to realize the dream of **‘Malaria Free India’** by 2030.

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

FROM THE PRESIDENT'S DESK

Vector-borne diseases account for more than 17% of all infectious diseases, causing more than 700,000 deaths annually. They can be caused by either parasites, bacteria or viruses (WHO). Considering the importance of the Vector Borne Diseases, the World Health Day of 2014 focussed on Vector borne diseases with the theme "Small bite – Big threat". These diseases are commonly found in tropical and sub-tropical regions and places where access to safe drinking-water and sanitation systems is problematic.

The world's fastest growing vector-borne disease is dengue, with a 30-fold increase in disease incidence over the last half century. Other priority vector-borne diseases of public health importance in South East Asia Region are: Malaria, Kala Azar, Japanese Encephalitis, Lymphatic Filariasis, Chikungunya, Schistosomiasis. Now, Malaria, Kala-azar, Lymphatic Filariasis and Schistosomiasis are targeted for elimination. Eliminating these diseases in time will help achieve many aspects of the sustainable development goals.

Most of the vector borne diseases are climate sensitive diseases and therefore, climate change has a significant impact on these diseases. The vectors are Poikilothermic or ectothermic. They cannot regulate their body temperature and are influenced by the environmental temperature. Therefore, global warming has a great role in regulating the development of pathogens in their vectors.

Most of these diseases affects the poor, endemic in low-income groups of the population. They also affect peoples' productivity and social lives including high stigma, discrimination and taboo. All these diseases have high economic impact, but are preventable and curable. There is need for strong political commitment to control and eliminate these diseases with committed donor support.

Padmashree Prof. A. P. Dash
Vice-Chancellor, AIPH University, Bhubaneswar

FROM THE EDITOR'S DESK

The visionary President of the National Academy of Vector Borne Diseases Prof. A. P. Dash called me on the 18th of August expressing a desire to bring out a Newsletter dedicated to Sir Ronald Ross on the occasion of the 125th World Mosquito Day which falls on 20th August every year. The time was very short to get articles and other material from colleagues and the VBD fraternity of the country. Nevertheless, a call was sent out immediately and soon the contributions started pouring in. Incidentally, the President was the first to respond and sent his message in just half an hour. As the work to assemble and compile and design the newsletter picked up steam, Prof. Dash desired articles from the students who won prizes during the competitions at the Asia Institute of Public Health University Bhubaneswar during the weeklong commemoration of World Mosquito Day to be also published which would give students encouragement.

Friends, though a bit late, this Sir Ronald Ross Commemorative Edition is now with you. It has 20 contributions including 12 articles and 8 poems. The articles cover the life of Sir Ronald Ross, the first visualization of the malaria parasite on a dissected mosquito gut, the invasion of *Anopheles stephensi* in Africa and Sri Lanka, mosquito control in the wake of this epic discovery, the malaria elimination research alliance (MERA) to accelerate the efforts of the national programme, one health, morbidity management and disability prevention in LF patients and the impact of climate change on VBDs. The students' articles "To reduce malaria burden" by Rojalin Maharana (1st Prize winner) and "Innovative mosquito repellents in malaria prevention" by Akanksha Kashyap (3rd Prize winner) deserve applause from all. I was pleasantly impressed with the contribution of 8 poems in English and Hindi, from my old and new colleagues which is a befitting tribute to the Poet, Sir Ronald Ross.

Finally, towards the end, you will find some selected photographs showcasing the successful organization of ICOV-14 in Bhubaneswar in 2019. Thanks to Dr M. R. Ranjit for the same.

I wholehearted thank Prof. Dash for the opportunity, and to the contributors of the articles and poems in this Newsletter at such short notice. Dr Srikanth Srirama and Dr J. Jency Priskilla, Scientists at the VCRC deserve all praise and thanks for their assistance in the designing and preparation of this special issue of the NAVBD Newsletter.

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

DAMaN

Dr Madan Mohan Pradhan

Dr Madan Mohan Pradhan is an avid public health researcher, program manager and clinician with rich experience in the following areas:

- National level civil society organisation for literacy, science, education and health.
- Post-disaster Odisha multi disease surveillance system with the support of MSF and WHO.
- Conceptualised and operationalised the DAMaN (Durgama Anchalare Malaria Nirakaran) to eliminate malaria in hard-to-reach remote malaria endemic villages of Odisha.
- Dr Pradhan is also a social worker, involved in school activities, and spiritual movements.
- He has published books in Odia, of both prose and poems.

In my sleep, I entered the fathomless depth,
There, death slept half awake.
I touched,
she murmured with humming sounds.
Wanted to converse,
Before my mouth could open,
she winged out and
flew over my head.
I goaded but could not resist her biting the 'man of farm'.
All my efforts went in vain.
Man was ready to go to his field,
But her bites captured his blood,
he slept sick under his thatched roof.
The greens were waiting for their lover.
And the lover of farm was grumbling under heat and shivering.
Family was disturbed,
as the pain of poverty struck from behind.
Death in the name of malaria reigned the entire village.
The village was out of sight from service providers.
village has its dignity of tradition,
and right to be free from malaria infections.
They resolved to test their blood and treat the unseen germs.
They slept under insecticidal nets.
Germs were killed,
Infected mosquitoes were killed,
new mosquito could not get human skin in the dead of night.
Death bearing mosquito flew but could not inject.
Now the villagers are happy being free from malaria.
They named their action; DAMaN.

The Tenth Mosquito

Dr. P.K. Sumodan

Dr. P.K. Sumodan, M.Sc., Ph.D., is a retired Associate Professor of Zoology, Government College Madappally, Kerala. He started his career as an Assistant Research Scientist at Malaria Research Centre, Goa. He had a short stint as District Malaria Officer, Wayanad District, Kerala from 2001 to 2003. Subsequently he joined Department of Collegiate Education, Government College Madappally in 2003 as an Assistant Professor of Zoology, and retired as Associate Professor in 2020. He has over 35 publications in Indian and International journals of repute. Besides, he authored 15 text books for BSc Zoology, BSc Psychology and BTech.

One day in November 1894, Patrick Manson and Ronald Ross were walking along Oxford Street in London. Suddenly, Manson turned to Ross and asked: "Do you know, I have formed the theory that mosquitoes carry malaria just as they carry Filariae?" The immediate reply of Ross was that he had seen the same conjecture in one of Laveran's books. Ronald Ross was on leave from India where he had been appointed in Indian Medical Service in the year 1881. His intention of meeting Manson was to confirm Alfred Laveran's parasitic theory of malaria. Manson demonstrated Laveran's parasites in several malaria patients. He wanted Ross to pursue the mosquito theory of Malaria in India. Manson thought that when the mosquito sucks the blood, the sexual forms of the parasite enter its stomach, and there, in a few minutes, emit their motile filaments (later identified as microgametes) just as they do on a slide. The motile filaments, he thought, were flagellated spores which next pass through the walls of the mosquito's stomach and take up their abode in its tissues, where they must develop further into some unknown stage and then enter drinking water. Though the last part of the theory was proved wrong later, at that time Ross was excited and decided to follow the filaments in mosquitoes.

After the leave, Ross returned to India in March 1895. His station of duty was in Secunderabad. Immediately after reaching the station, he employed three persons to assist him in the collection of mosquitoes. Unfortunately, Ross had no access to any literature on mosquitoes in general and Indian mosquitoes in particular. He was just a novice as far as mosquito taxonomy was concerned. However, he innovated his own crude method of mosquito classification. He categorised the mosquitoes he collected into three categories:

A. Grey or Barred-back Mosquitoes (Culex)
B. Brindled Mosquitoes (Aedes)
C. Dappled-winged Mosquitoes (Anopheles)

He had diligently performed his experiments for about two years by allowing his mosquitoes to bite malaria patients under bed nets. He found the first and second categories of mosquitoes in abundance, whereas the third one was very rare. Hence, most of his experiments were done on the first two and obviously were failures. Then came August 1897.

Dr. P.K. Sumodan

The Tenth Mosquito

On 15th August one of the three mosquito collectors brought a bottle full of a different kind of larvae. Next morning, the 16 August, when Ross went again to the hospital after breakfast, the Hospital Assistant pointed out a small mosquito seated on the wall with its tail sticking outwards. He caught the mosquito and killed it with tobacco smoke. It was a dappled winged mosquito. The mosquito was immediately dissected but nothing special was observed. While he was doing that exercise, the hospital assistant came running and announced the emergence of dappled winged mosquitoes in the bottle which was brought the day before. Ross was extremely excited and the entire research team came into action immediately. The malaria patient named Husein Khan was made to lie on the bed covered by a bed net and the entire bunch of dappled winged mosquitoes were released. The time was 12.25 PM. Within five minutes ten of the mosquitoes were full fed. At 12.45 PM and 12. 55 PM Ross dissected two of the fed mosquitoes but nothing special was found. By 17th August two of the remaining eight mosquitoes were found dead and two of the survivors were dissected with the same negative result. The same process was continued for the next two days and the results were also the same.

Ross recorded 20th August as a cloudy, dull and extremely hot day. Only two mosquitoes were left- the 9th and the 10th. After the routine duties, Ronald Ross decided to dissect the 9th mosquito. It was one in the afternoon. He was extremely tired. The dissection was excellent, and he went carefully through the tissues, searching every micron. There was nothing. He was totally disappointed and even thought that his theory was wrong. However, the stomach tissue still remained to be examined. Then, suddenly, he saw that. Ross wrote in his memoirs: “Lying there, empty and flaccid, before me on the glass slide, a great white expanse of cells like a large courtyard of flagstones.” They were a group of perfectly circular cells, 12 microns in diameter. “In each of these cells there was a cluster of small granules, black as jet and exactly like the black pigment granules of the *Plasmodium* crescents.” They were indeed the metamorphosed plasmodium crescents (gametocytes). (They were later confirmed as zygotes). Ross was almost convinced that they were malaria parasites. To confirm his conviction one more mosquito was waiting for him in the test tube. The last mosquito, the tenth one. However, he could resist the temptation of dissecting it immediately and deferred it for the next day. To his utmost joy, the very same cells were present in the tenth mosquito too. Moreover, they were grown in a day! That was one more piece of evidence for the metamorphosis theory. Hence, at last, the tenth mosquito proved the mosquito theory beyond any speck of doubt.

Anopheles stephensi:
Rapid spread of the Asian Malaria Mosquito

Dr. A. N. Shriram
Scientist- D
ICMR-VCRC,
Puducherry

Dr. Shriram is a medical entomologist with over 25 years of experience in the field of Vector Borne diseases covering applied and operational research. Among the major projects, contributed towards understanding the epidemiology of the diurnally sub-periodic form of filariasis and demonstrated the operational feasibility of elimination of this form of filariasis in the lone focus of infection in India. His current research interests are understanding mobilities of humans and Aedes mosquitoes, vulnerability and receptivity of urban settings concerning the transmission of malaria and its elimination, bionomics of malaria vector concerning transmission and elimination, the spatial distribution of Ixodid ticks, vector surveillance, evaluation of vector surveillance tools and vector control products and establishing a quality management system for GLP accreditation for evaluation of vector control products.

Anopheles stephensi, is an invasive vector species, considered to have an Asian origin. This mosquito species is competent in transmitting malaria parasites i.e. *Plasmodium falciparum* and *P. vivax* has been one of the key mosquito species involved in transmission of malarial parasites in urban centres across India, Iran and Pakistan including the Arabian Peninsula. This mosquito species was first noticed in the city of Djibouti, Africa in 2012. Since then this mosquito species has been observed to invade and spread in Eastern Africa. Some of the recent observations in Sudan have confirmed the widespread geographical presence of this mosquito, which include the six bordering countries, which had no evidence of this species. This phenomenon has led to serious concerns about the fast spread of *An. stephensi* to regions outside the Horn of Africa. In 2016, this vector was noticed for the first time in Mannar Island in Sri Lanka, five years after the island nation had achieved zero indigenous malaria transmission.

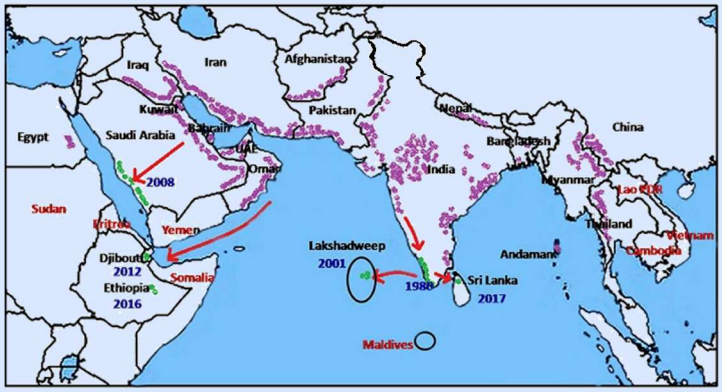
An. stephensi prefers to breed in overhead tanks, containers or cisterns with clean water, construction and curing sites. The vector adapts itself quickly to the local environment i.e. obscure habitats such as deep wells and endures high temperatures during summer, when malaria transmission is at low ebb.

In India, two biological forms of *An. stephensi* – "type" and "intermediate"– have also emerged as efficient vectors in rural areas, besides the cities, due to altering agricultural and water storage practices and urbanization. The third form– "*mysorensis*" – is considered to be a poor vector. The spread of this vector southward in India is ascribed to the cause for recent upsurges of malaria in the customarily malaria free state of Kerala. Continuing the southward expansion of the vector has resulted in the incursion into Lakshadweep islands in the Indian Ocean. The expansion is related to the availability of larval habitats (water storage cement tank). The southward spread of this vector species in India and into Sri Lanka is a classical example of human mobility induced adaptation. There is regular movement of people between Mannar and Rameswaram islands. In all likelihood, the vector could have moved from India in water carried in boats, led to the establishment in the Mannar Island of Sri Lanka.

Dr. A. N. Shriram

Rapid spread of *Anopheles stephensi*, the Asian Malaria Mosquito

The rapid spread and invasive behaviour of *An. stephensi* in India is a cause for concern. The invasion and spread of this vector species could be one of the impending threats with potential to reverse malaria control and elimination efforts. Therefore, efforts are essential to establish relative contributions of *An. stephensi* in different malaria transmission settings and identify important ecological and anthropogenic determinants of the species' spread. Can we think of having an integrated vector surveillance system for *An. stephensi* and *Aedes aegypti*?



Anthropogenic Factors Driving Recent Range Expansion of the Malaria Vector *Anopheles stephensi*

Globe prevalence of *Anopheles stephensi* Recent invasion to new countries Countries at risk

Source: Front Public Health.2019 Mar 14;7:53.doi: 10.3389/fpubh.2019.00053.eCollection 2019

FOOD-FOR-THOUGHT

Are we taking cognizance of the rapid spread of *Anopheles stephensi*, and contemplating to halt its invasion into newer lands?

Further reading:

1. Tadesse FG, Ashine T, Teka H, Esayas E, Messenger LA, Chali W, et al. *Anopheles stephensi* mosquitoes as vectors of *Plasmodium vivax* and falciparum, Horn of Africa, 2019. Emerg Infect Dis. 2021;27:603–7.
2. Faulde, M.K., L.M. Rueda, and B.A. Khaireh, First record of the Asian malaria vector *Anopheles stephensi* and its possible role in the resurgence of malaria in Djibouti, Horn of Africa. Acta Tropica, 2014. 139: p. 39–43.
3. Abubakr, M., et al., The Phylodynamic and Spread of the Invasive Asian Malaria Vectors, Anopheles stephensi, in Sudan. Biology, 2022. 11(3): p. 409.
4. World Health Organization, Vector alert: *Anopheles stephensi* invasion and spread: Horn of Africa, the Republic of the Sudan and surrounding geographical areas, and Sri Lanka: information note, 2019, World Health Organization.
5. Thomas S, Ravishankaran S, Justin JA, Asokan A, Mathai MT, Valecha N, et al. Overhead tank is the potential breeding habitat of *Anopheles stephensi* in an urban transmission setting of Chennai, India. Malar J. 2016;15:274.
6. Sharma SK, Hamzakoya KK. Geographical spread of *Anopheles stephensi*, vector of urban malaria, and Aedes aegypti, vector of dengue/DHF, in the Arabian Sea islands of Lakshadweep, India. Dengue Bulletin. 2001;25:88–91.
7. Ramasamy R, Surendran SN. Mosquito vectors developing in atypical anthropogenic habitats - global overview of recent observations, mechanisms and impact on disease transmission. J Vector Borne Dis. 2016;53:91–8.

MERA-India: Malaria Elimination Research Alliance-India

Steering research for malaria elimination in India

Dr. Manju Rahi, Sachin Sharma, Bhawna Yadav

Dr Manju Rahi, Scientist- F, ECD ICMR, New Delhi, is a medical scientist trained in public health. She has been deeply involved in research programmes on vector borne diseases and zoonotic infections since the last 15 years. She has a keen interest in public health policy issues and has published policy documents on malaria, lymphatic filariasis, and rickettsial infections.

Dr Rahi is steering the research on VBD in Elimination mode including bringing in new vector control products to public health use.

India constitutes the largest population in the world at risk of malaria. However, over the past two decades, India has made impressive progress in malaria control. According to National Center for Vector Borne Diseases Control (NCVBDC), the malaria burden and deaths caused by malaria have declined in India drastically. This success has been made possible because of a strong foundation laid through the commitment by the highest levels of leadership of the Government of India to eliminate malaria in India by 2030. One such initiative was the launch of Malaria Elimination Research Alliance (MERA) India by the Indian Council of Medical Research (ICMR) on the eve of 'World Malaria Day' in 2019 (1). The purpose of MERA-India is to identify, articulate, prioritize and respond to the research needs of the country in a coordinated and combinatorial way for malaria elimination from India. MERA-India aims to bring together researchers working in the field of malaria in the ICMR and non-ICMR Research Institutions, Universities and National Programs and to strengthen the research ecosystem of the country for malaria elimination.

For each MERA-India call for proposals, the priority research and the thematic areas are decided by a panel of experts, after an extensive round of discussions and in light of the learnings from the countries which have successfully eliminated malaria (2). Apart from funding individual studies focusing on operational/translational/implementation and public health research, MERA-India fosters multi-centric studies to provide a platform for pan-India data (3).

MERA-India has funded several projects including studies based on low-density infection detection (LDI); vector bionomics and control, community behaviour determinants for malaria elimination; GIS; and migration themes (3). The salient features of the MERA-India multi-centric projects include mentoring by the experts right from the proposal design stage and throughout the project duration; designing standard common objectives, protocols and methodologies to maintain research quality and uniformity of data generation; and extensive peer-review. Based on malaria epidemiology, types of parasite, vector prevalence and pan-India approach, the multi-centric studies are being conducted in several sites across 08 states (Uttar Pradesh, Rajasthan, Gujarat, Goa, Tamil Nadu, Chhattisgarh, Assam and Tripura).

Dr. Manju Rahi, Sachin Sharma, Bhawna Yadav

MERA-India: Steering research for malaria elimination in India

In 2022, MERA-India launched the second call for proposals in which the proposals were invited under the themes: (a) Artificial Intelligence (AI), surveillance, remote sensing, digital platform for surveillance, GIS nodes identification, mobile apps; (b) Vector control strategies and tools; (c) Compliance, severity and relapses in case of *P. vivax* infections, and, (d) Developing alternative surveillance strategies to capture the malaria caseload in the community including private sectors. With an aim for capacity building, a special call was also announced for the Young Malaria Researchers (YMR), to encourage the early career malaria researchers (less than 40 years of age) to carry out cutting-edge research focusing on malaria elimination.

MERA-India has a team of professionals who provide every possible support to the prospective grant applicants throughout the grant cycle (4). MERA-India also regularly organizes outreach activities, through lectures, training, workshops and competitions for students and researchers. A monthly newsletter 'News & Views' is also published by MERA-India focusing on malaria-centric activities and research. This newsletter is free to access and is widely circulated across the globe. (https://www.meraindia.org.in/newsletter)

MERA-India is thus supporting research with the potential to translate to solutions for gaps and hurdles for malaria elimination and is providing a platform to bring together the experts, researchers and community to work synergistically and complement each other's efforts for building malaria-free India.

References:

1. Rahi M, Anvikar AR, Singh OP, Jambulingam P, Vijayachari P, Das A, et al. MERA India: Malaria Elimination Research Alliance India. J Vector Borne Dis. 2019 Mar;56(1):1–3.
2. Sharma S, Verma R, Yadav B, Kumar A, Rahi M, Sharma A. What India can learn from globally successful malaria elimination programmes. BMJ Glob Health. 2022 Jun;7(6):e008431.
3. Rahi M, Sharma S, Das P, Anvikar A, Pandey M, Sharma A. Connecting the dots to strengthen malaria elimination strategies in India: A Malaria Elimination Research Alliance - India initiative. Indian J Med Res. 2021 Jul;154(1):19–23.
4. Rahi M, Sharma S, Yadav B. Funders Perspective: What the funding body expects from researchers? Springer Nature Grant writing for medical and healthcare professionals. Editors Subhash Parija and Vikram Kate. (In Press)

Ross and the Owe

Dr. Arya Rahul

Dr. Arya Rahul is a medical doctor with an MD degree in Community Medicine. She is working as a Scientist B at ICMR-Vector Control Research Centre, Puducherry. She is trained in epidemiology from renowned institutes and is passionate about medical research and is motivated to teach, learn and grow. Her research credentials are supported by more than 10 publications in high-impact international and national journals and the prestigious Dr. C R Soman award for the best postgraduate dissertation submitted by residents in medical colleges in Kerala for the year 2019-2020. She has also authored a chapter in the research methodology manual by the Indian Association of Pediatrics. Her research interests include behavioral epidemiology and community engagement approaches in the prevention and control of vector-borne diseases, Health economics, Health systems research, training, and capacity building.

We remember this august man named Ross,
For the pivotal discoveries that made science rose.
A polymath; a medical doctor as per father's wish,
Then the Nobel laureate; the first among the British.
That tiny buzzing creature sniffing in the night,
Doctor Ross sensed things were not that right.
He dissected its tummy and was delighted by the sight,
To find the epochal secret- the malarial parasite.
And the poet in him wrote "O million-murdering death"
And the little mosquitoes were now Lady Macbeth.

He showed the modus the parasite transmits,
We won't leave it to burgeon; let us commit
Hiding in the pitch dark, to feast on our blood
She arrives with an opera, let's respond with a thud.
Let no sources acquiesce them to breed,
Let's stamp out their everlasting greed.
Take out the nets and spread them on the beds,
Let the woeful taint hit her naughty head.
Fuel your brain so that she won't creep,
Let the generations to come have a peaceful sleep.

छिड़काव

Dr. Diwakar Singh Dinesh

Dr. Diwakar Singh Dinesh, M.Sc. (Zoology), Ph.D. (Entomology), FISCD, ICMR-International Fellow of Sr. Indian Biological Scientist, NL Kalra awardee has superannuated from the post of Scientist F in December 2021 working for last 35 years on the vectors of Kala-azar and other VBDs at ICMR- RMRIMS, Patna.
He contributed significantly to the elimination program of Kala-azar. The programme has accepted the development of DDT resistance in sandflies.
There are 75 publications to his credit.
Three research scholars were awarded Ph.D. degree under his supervision.
He completed several intramural and extramural projects sponsored by ICMR, WHO, DBT, EU, etc.
He is a life member of several entomological societies and National Academy of Sciences, India

डी० डी० टी० के बदले
एस० पी० का छिड़काव
कारगर है
न दाग न धब्बा न कोई गंध है

घर के अंदर के दीवारों
कोनों , कोठी, बक्से के नीचे
हर लकड़ी , गोयठा के गोदामों में
हर जगह छिड़काव करना लाजमी है

बालू-मक्खी छुपते जहाँ
गोशाला या गोदाम
सोने का घर या
हो दालान
सबको समझो एक समान
वर्ष में छिड़काव का होता इंतजाम

सरकार ही करती छिड़काव
जन जन का सहयोग जरूरी है
काला-जार नियंत्रण में
हर जान की भागीदारी जरूरी है

One Health- a primer

Dr. D. Panneer

Dr. D. Panneer, MVSc, PhD, is a Veterinary Microbiologist by training. He is currently serving as Scientist 'C' at ICMR- Vector Control Research Centre (ICMR-VCRC), Puducherry, and heading the Unit of One Health.

His research interests are development of molecular and immunological tools for the surveillance and diagnosis of vector borne zoonotic diseases. Development of molecular tools for the taxonomical identification of ticks and mites.

One Health is a collaborative, multisectoral, and transdisciplinary approach — working at the local, regional, national, and global levels — with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment (CDC).

While the concept of One Health may not be new, the practice is just now gaining traction. As human population continues to grow, we are limited by the available land. Therefore, more and more areas that were hitherto uninhabited are now being settled into by people. This leads to an increased interaction between humans and the animals in the new environment. Thus, we become more prone to zoonotic diseases (that can be shared between humans and animals) quite easily.

At the same time, human activities like constructions, travel, deforestation, farming, irrigation, storage, etc also leads to increased opportunities for vector breeding. Furthermore, these increased activities along with industrialization and pollution have led to global warming and climate change. These changes also alter the breeding habits of the vectors like mosquitoes, flies and ticks, leading to an upsurge. The interaction between all these elements facilitates the emergence and re-emergence of vector-borne diseases. Better accessibility and faster travel in the face of globalization also plays a key role in faster and wider spread of these diseases.

Focusing on Vector-borne illnesses, many of these diseases also affect animals. Thus, a surveillance of the animals will serve as a warning for an impending human outbreak. Animals are also sensitive to the climatological changes and thus serve as both warnings and resources to study the climate change impacts. Growing body of research is now showing that we might have a larger burden of vector-borne infectious diseases like scrub typhus or rickettsial fevers, which go undiagnosed as they are not being actively screened for in the hospitals. But entomological studies among the rodent population would definitely give early clues about prevalence and transmission of these emerging or re-emerging infections.

Dr. D. Panneer

While One Health might sound like a catch-all phrase, it is not a new buzz-word. Instead, One Health approach relies on the foundations of communication, coordination and collaboration. No one profession can address the One Health issues in isolation. Combined efforts across multiple disciplines like medicine, veterinary, entomology, ecology, sociology, agriculturalists, policymakers, and others are required to tackle One Health issues. Thus, One Health calls for science to take a step back from the highly classified, sub-divided and partitioned specialities. Taking a step back to look at the big picture, the entire planet with all its intricate interactions and to work towards a healthier planet, people, animals and ecosystem.

Thus, it is time to revisit the verse from *Mahopanishad- "Vasudaiva Kutumbakam"* in the context that the entire world, which includes the animals, plants, people and the planet are interconnected and must thus be treated as an interdependent, whole family.

MMDP

Morbidity Management and Disability Prevention of Lymphatic Filariasis: ending the neglect and achieving the target

Dr. Vijesh Sreedhar K
vijeshvcrc@gmail.com

Dr. Vijesh is a medical scientist and is in-charge of the Filariasis Management Clinic of ICMR- Vector Control Research Centre. His research interest is in vector borne diseases especially lymphatic filariasis. He has contributed significantly towards the field trial of the triple drug regimen for LF elimination in India. His team is currently focusing on improving morbidly management of LF, especially understanding the etiology and risk factors for frequent ADL in LF lymphedema. He is in-charge of the newly created MRHRU at Puducherry.

Lymphatic Filariasis (LF), is a vector borne disease transmitted by the mosquitoes mainly Culex and Mansonnia sp and caused by the nematode parasites (mainly *Wuchereria Bancrofti* and *Brugia malayi*). It is an ancient scourge of the human kind. This is the first disease identified as transmitted by mosquitoes by Sir Patrick Manson which led to the birth of the disciplines of medical entomology and tropical medicine. The disease does not result in much mortality, however, leads to extreme disfigurement and disability resulting in social stigma as well. It is the second leading cause of disability world over. LF is a disease of the poor and is also the major disease among the ones termed as Neglected Tropical Diseases (NTD).

LF is a public health problem with significant socioeconomic implications. It is endemic in several countries in Asia, Africa and South America. India alone accounts for 40% of the global infection and is endemic in 328 districts. Clinical manifestations include crippling limb lymphedema, and also hydrocele in men. Considering the public health impact of the disease, the Global Program to Eliminate LF (GPELF) has been initiated nearly two decades ago focusing on mass drug administration (MDA, the first pillar of GPELF)) to interrupt transmission and morbidity management and disability prevention program (MMDP, the second pillar of GPELF) for those who are affected by lymphedema and hydrocele. MDA was initially with DEC (diethylcarbamazine) alone, later albendazole was added and most recently, a triple drug regimen which include DEC, albendazole and ivermectin is employed.

Countries like China, Japan, south Korea, Sri Lanka and a few others have successfully eliminated the disease. However, in India and several African countries the program has been only partially successful and several regions continue to remain endemic, lack of public cooperation resulting in poor drug compliance during MDA campaigns being the major reason.

Dr. Vijesh Sreedhar K

MMDP-LF

Morbidity Management and Disability Prevention of Lymphatic Filariasis: ending the neglect and achieving the target

In contrast to the success of MDA, the MMDP program has been only minimally effective, as enough emphasis was not given to "the second pillar". Currently the focus of GPELF is shifting towards improving MMDP program. Established lymphedema is not curable. However, MMDP practices can arrest the lymphedema progression and improve the quality of life to a great extent. MMDP for lymphedema include limb elevation, limb washing, exercises, massaging, application of crepe bandage and nail care. Lymphedematous limb is susceptible to very frequent bacterial infections. This is termed as ADL (adenolymphangitis) and this requires antibiotic therapy. MMDP practices when performed well, would result in reduction of limb swelling and also reduced frequency of ADL attacks. MMDP program focus upon home-based care where the patients are advised to practice the MMDP procedures at their home. Hydrocele is amenable to surgery and the national program provides for free of cost surgery. Recurrence after surgery is very rare.

A major impediment to the management of lymphedema is lack of awareness regarding MMDP among health care workers as well as patients and care givers. Poor adherence to the practices is yet another problem. In our specialized clinic for management of LF lymphedema at ICMR-Vector Control Research Centre, Puducherry, we counsel the patients well and also insist on regular follow up visits. This is found to be useful in improving patient adherence.

2030 is the target set for elimination of LF. There is a need for commitment by the government, program managers, health care workers as well the community to achieve the goal. Let us be hopeful that with the renewed zeal in the LF elimination program, our country will soon be free of this menace.

Implications of climate change on vector borne diseases

Dr. Manju Rahi
drmanjurahi@gmail.com

Dr Manju Rahi, a medical scientist trained in public health, has been deeply involved in research programmes on vector borne diseases and zoonotic infections since the last 15 years. She has a keen interest in public health policy issues and has published policy documents on malaria, lymphatic filariasis, and rickettsial infections.

Dr Rahi is steering the research on VBD in Elimination mode including bringing in new vector control products to public health use.

Weather is the culmination of several meteorological factors such as temperature, rainfall, wind, humidity, sun shine hours, etc. for a short time period up to days. The term 'climate' encompasses long term pattern of weather conditions for a specific region, usually not less than 30 years. It considers all measures of the weather that occur over a long period in a particular place. As per report by World Meteorological Organization in 2019, the global temperatures are least one degree Celsius above pre-industrial levels and close to "an unacceptable risk". The landmark 2015 Paris Agreement on climate change mentions that it should be below two degrees Celsius, and preferably to 1.5 degrees. But it is anticipated that if the current rates of global emissions prevail, the rise could go above 3° C by 2100 leading to irreversible damage. The 26th UN Climate Change Conference of the Parties (COP26) was held in Glasgow, UK in October-November 2021. The major outcomes were pledging for ending deforestation, reducing methane emissions and leveraging on solar energy and reducing reliance on fossil fuels among others.

The adverse effects of climate change on health is understood to be significant and is multi-dimensional. It can lead to changes in vector ecology and subsequent increases in vector borne infections like malaria, dengue, chikungunya, Lyme disease, Rift Valley Fever, West Nile virus infection, encephalitis etc.; allergies and a rise in incidence of asthma and respiratory illnesses, water and food supply impacts, heat related illnesses, air pollution, environmental degradation leading to migrations and civil conflicts and mental health impacts.

Vector-borne diseases are an important cause of mortality, morbidity and health inequity, a dampener of socioeconomic development, and overburdening already strained health services in developing countries. Vector-borne diseases (especially malaria and dengue) have been indeed researched in the context of climate change because of the huge burden, large geographical and high sensitivity to climatic variations. Temperature has been found to have an association with survival and reproductive rates of the vectors and pathogens. Vectors with aquatic cycle of development for example mosquitoes get impacted by precipitation. Vectors like ticks, mites, sandflies are affected by humidity.

Dr. Manju Rahi

Implications of climate change on vector borne diseases

Evidence suggests that current pattern of climate change will continue to affect the epidemiology of these infections – both endemic to the countries and emerging and re-emerging infections. Hitherto unknown or rarely found diseases and vectors are spreading into temperate regions, including Europe, putting vulnerable populations at risk of imported diseases. The gains made towards disease elimination targets especially for malaria, lymphatic filariasis and visceral leishmaniasis can be undermined by the threat of climate change. Dengue, in the absence of definitive treatment and any effective vaccine continues to create havoc across countries has a strong relationship with climatic variables.

The interactions of climatic and non-climatic variables are complex and far from our complete understanding. Research studies attempting to attribute meteorological changes to diseases rates have been carried out on different disease and settings and some have also explored models based on certain scenarios to project alterations in risk for some specific diseases. At the same time, there is an urgent need to brainstorm on the appropriate research studies to be carried out in order to adequately respond to the above challenges. Policy makers from WHO member states have articulated priorities for climate change research with more applied research questions and direct connection with implementation. Some of the public health priorities include assessments of the risks including quantitative detection, qualitative assessment of vulnerability, evaluation of effectiveness of individual intervention measure and effect of climate change on the intervention, enhanced surveillance tools including climate information to pick up early warning signals of any impending outbreak, assessment of costs including financial, needed to expand VBDs control activities in newer areas. In summary, increased research efforts on climate resilience, linking it to core health policy and implementation programmes.

Ministry of Health and Family Welfare's National Action Plan for Climate Change and Human Health (2018) is a timely step in the direction of mitigation of climate sensitive diseases and vulnerability to climate variability. Some of the key objectives are strengthening capacity building of healthcare system, health preparedness and response, joint and inter-sectoral collaborations with other relevant departments. Strengthening research capacity and to generate evidence on effects of climate change on human health is one of the important objectives. Indian Council of Medical Research, the nodal research body under Ministry of Health and Family Welfare is making efforts in addressing the various research questions in tandem with the National Centre for Disease Control towards the broader aim of minimizing health impacts of climate change.

The Pompous Aedes

Dr. Deeparani K. Prabhu

Dr. Deeparani K. Prabhu is an Assistant Professor (Stage 3) with teaching experience at UG level for 28 years.

She is an executive Committee member on the board of Society for Vector Ecology (Indian Region) / SOVE (Indian Region).

She has also been Ex. Secretary of University College Teachers Association of Goa.

She is a part of organising committee member and resource personnel of Conferences, seminars, workshops at state, national and international level.

She has significantly contributed to the curriculum and has worked towards E-content preparation of project DISHTAVO of Directorate of Higher Education, Goa.

Zika, Dengue, Chikungunya and Yellow fever is my occupation
They are the only four is your notion
Jillion more viruses are in my kitty
Oh human thou I pity!!

Far from my motherland have I traveled
There are many mysteries yet to be unraveled
I am the most beautiful Mosquito
Dapper, dark and slender, long legs and white bands
My insignia is my lyre
Love breeding in a Tyre.

Thou Carbon dioxide, lactic acid, octenol
are so fragrant..
A blood meal is all I seek
That's all it takes to create a new life within

Adaptation is my mantra
From the tree hole to the abandoned pan
Dwelling happily in a puddle is my clan.
By Wolbachia will I be redundant
Let's wait and see
Who is the Victor
Thou or me!
Thou or me!

काला-ज़ार: इतिहास

Dr. Diwakar Singh Dinesh

Dr. Diwakar Singh Dinesh, M.Sc. (Zoology), Ph.D. (Entomology), FISCD, ICMR-International Fellow of Sr. Indian Biological Scientist, NL Kalra awardee has superannuated from the post of Scientist F in December 2021 working for last 35 years on the vectors of Kala-azar and other VBDs at ICMR- RMRIMS, Patna.

He contributed significantly to the elimination program of Kala-azar. The programme has accepted the development of DDT resistance in sandflies.

There are 75 publications to his credit.

Three research scholars were awarded Ph.D. degree under his supervision.

He completed several intramural and extramural projects sponsored by ICMR, WHO, DBT, EU, etc.

He is a life member of several entomological societies and National Academy of Sciences, India

सदियों पुरानी है बात
लम्बे समय की बुखार
कहलाने लगा ज़ार

प्लीहा बढ़ा , वजन घटा
बदन हुआ काला
नाम पड़ा काला-जार!

दो वैज्ञानिकों ने खोजा
उस किटाणु को
जिसने बनाया बीमार

मानव में पलता
बालू-मक्खी से फैलाया जाता
नाम है लेश्मानिया दोनोवानी
यही है इसके आगमन की कहानी |

125th year of the discovery of Malaria- Mosquito association:
A Tribute to Sir Ronald Ross

Dr. Sajal Bhattacharya
Mr. Syamantak Dey

Dr. Bhattacharya is presently the Associate Professor at the Post-Graduate Department of Zoology, Asutosh College (University of Calcutta), India. He has carried out his Doctoral research at the Department of Medical Entomology at the Calcutta School of Tropical Medicine and his Post-Doctoral studies in IHMT, Lisbon. Dr. Bhattacharya has several scientific publications in the field of disease vector eco-epidemiology.
He is an elected fellow of the Royal Society of Tropical Medicine and Hygiene, London (2005).
Dr. Bhattacharya has also published three papers on the life and works of Sir Ronald Ross.
He was conferred the prestigious Lifetime Achievement Award by the Society of Medical Arthropodology (SOMA) at Sir Ronald Ross Institute of Parasitology, Hyderabad.

Mr. Syamantak Dey is a Research student at the Post-Graduate Department of Zoology, Asutosh College (University of Calcutta), India.

Besides the resplendent eve of the 75th year of the independence of our homeland, we also bear witness to the 125th year of the discovery of the malaria-mosquito inter-specificity put forth by one of the unsung heroes of present day, Sir Ronald Ross. Born on May 13, 1857 in Almorah, India , in the backdrop of the vehemence of the glory fighters of India's freedom salvation, merely 3 days after the Sepoy Mutiny commenced in Meerut, the Indian subcontinent was greeted with a blessing in disguise- the birth of a man belonging to the group of imperialists resented on a large scale at that time, who was in fact going to change the destiny of the malaria-mosquito predicament that had been upturning generations of civilisations, for not just the entire country but also the world, forever. At Secunderabad, India, on August 20,1897, while dissecting a brown mosquito with speckled wings (Anopheles species), he saw the transformed malarial parasite with the typical black pigment in the stomach wall cells and made his ground-breaking discovery which in 1898, at Calcutta, he demonstrated the life cycle of- the malarial parasite in the mosquito using avian malaria, and postulated that malaria is directly transmitted from mosquito to man, as it is with birds. He was awarded the Nobel Prize for this revolutionary discovery based on his works of Secundarabad and Kolkata in 1902, thus becoming the first ever Indian, born to a "white mother" who was deemed worthy enough of this prestigious title. Following this ground-breaking discovery, humbled by the presence of an overshadowing existence and the latent magnitude of his discovery, Sir Ronald Ross composed-

"This day relenting God
Hath placed within my hand
A wondrous thing; and God
Be praised. At his command,
Seeking his secret deeds
With tears and toiling breath,
I find thy cunning seeds,
O million-murdering Death.
I know this little thing
A myriad men will save,
O Death, where is thy sting?
Thy victory, O Grave?"

Dr. Sajal Bhattacharya
Mr. Syamantak Dey

125th year of the discovery of Malaria-Mosquito association: A Tribute to Sir Ronald Ross

Growing up Ross, had been perpetually appreciative of culture and literature, and just like a poet's evoked imaginative awareness he had envisioned a dream- An India, free from the malevolent bounds of malaria. Although extensively remembered for his malaria work, this remarkable man was also a mathematician, epidemiologist, sanitarian, editor, novelist, dramatist, poet, amateur musician, composer, and artist. Malaria which is a major social evil in India, also contributes significantly to the overall malaria burden in Africa and Southeast Asia, Africa being the continent facing the even darker side of the malaria terror which has caused massive havoc in the past and continues to do the same in the present. Malaria has not been eradicated despite Ross's identification of its cause and is still present in about more than a 100 countries and sickens about some millions of people per year. Ironically speaking, the country that holds the very existence of the roots of the discovery of the malarial parasite, has not in itself been completely eradicated of the lethal consequence although extensive research and profound practical analytics have been carried out concerning its transmission dynamics, pathogenesis, related factors have been carried out since the time of its very origin. On the contrary, in the continents of Europe and Australia and some other countries around the globe have emerged triumphant in the elimination of malaria on a larger scale, barring a few rare cases of imported malaria which in turn brings us back to the prevalent differences in the socio-economic structure, quality of education, lack of awareness, hidden social evils, thus shedding light on the cracks that lie in the foundation at the niche level as opposing to the countries mentioned previously. However formidable, the goal that now constitutes the highlight is the idea to "eliminate" malaria from India by the end of 2030- a journey that is going to be replete with impediments, but a destination towards we are going to march in full stride. After all this journey will be in the loving memoir of that one visionary, the one who stood out among the masses.

Dr. Ronald Ross-
An untold story of the first Indian Noble Laureate

Dr. R. S. Sharma

Dr. RS Sharma is currently one of the Directors of the Absolute Human Care Foundation. Presently Dr. Sharma is working as National Expert for Bio-pesticides with United Nations Development Organization (UNIDO). Dr Sharma has worked as a Director-grade Scientist, National Vector Borne Diseases Control Programme (NVBDCP) & National Centre for Disease Control, Government of India, Delhi.

He is a UNEP Expert –Stockholm Convention on DDT alternatives- Geneva and a Member of Vector Control Working Group- Roll Back Malaria- Geneva. He has more than 35years of experience and 80 scientific publications and has also developed many operational guidelines for the control of malaria in India. He is a reviewer for several National and International Journals and Editorial Board Member.

Dr Sharma has been conferred several awards such as the "Malaria Vector Control Award" by the National Academy of Vector Borne Diseases-India for his outstanding contribution in the field of vector biology and control, Best Scientist award by Association of Entomologists, Department of Zoology, Patiala university, Dr PS Gill Medal by Indian Society for Malaria and other Communicable diseases.

Ross confirmed that malaria is transmitted from infected birds to healthy ones by the bite of a mosquito, a finding that suggested the disease's mode of transmission to humans. For his findings, Ross was honoured with a Nobel Prize for Medicine in 1902.

Born on 13th May 1857 at Almora, India, he worked in the Indian Medical Service for 25 years. It was during his service that he made the ground-breaking medical discovery. After resigning from his service in India, he joined the faculty of Liverpool School of Tropical Medicine, and continued as Professor and Chairman of Tropical Medicine of the institute for 10 years.

In 1926 he became the Director-in-Chief of the Ross Institute and Hospital for Tropical Diseases, which was established in honour of his works. He remained there until his death.

Early life and education

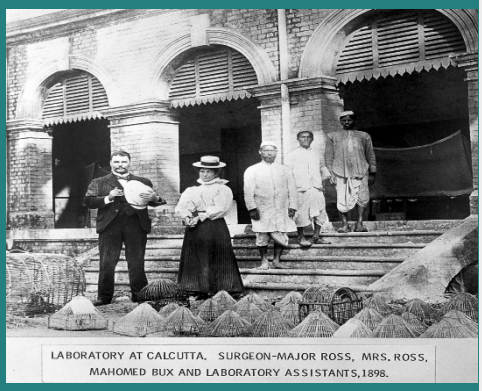
At age eight, he was sent to England to live with his aunt and uncle on the Isle of Wight. He attended Primary schools at Ryde, and for secondary education he was sent to a boarding school at Springhill, near Southampton, in 1869. From his early childhood, he developed a passion for poetry, music, literature and mathematics. At fourteen years of age, he won a prize for mathematics, a book titled Orbs of Heaven which sparked his interest in mathematics. In 1873, at sixteen, he secured first position in the Oxford and Cambridge local examination in drawing. Although he wanted to become a writer, his father arranged enrolment at St Bartholomew's Hospital Medical College in London, in 1874.

Not fully committed, he spent most of his time composing music, and writing poems and plays. In 1879 he had passed the examinations for the Royal College of Surgeons of England, and he worked as a ship's surgeon on a transatlantic steamship while studying for the licentiate of the Society of Apothecaries.

Dr. R. S. Sharma

Dr. Ronald Ross-

An untold story of the first Indian Noble Laureate



LABORATORY AT CALCUTTA. SURGEON-MAJOR ROSS, MRS. ROSS, MAHOMED BUX AND LABORATORY ASSISTANTS, 1898.

Indian journey

Ross embarked for India on 22 September 1881 on the troopship Jumma. Between 1881 and 1894 he was variously posted in Madras, Burma, Baluchistan, and Andaman Islands, Bangalore and Secunderabad.

In 1883, he was posted as the Acting Garrison Surgeon at Bangalore during which he noticed the possibility of controlling mosquitoes by limiting their access to water. In March 1894 he had his home leave and went to London with his family. On 10 April 1894 he met Sir Patrick Manson for the first time. Manson who became Ross's mentor, introduced him to the real problems in malaria research.

Manson always had a firm belief that India was the best place for the study. Ross returned to India on P & O ship Ballarat on 20 March 1895 and landed in Secunderabad on 24 April 1895. Even before his luggage was cleared in the custom office, he went straight for Bombay Civil Hospital, looking for malarial patients and started making blood films.

Ross made his first important step in May 1895 when he observed the early stages of malarial parasite inside a mosquito's stomach. However, his enthusiasm was interrupted as he was deployed to Bangalore to investigate an outbreak of cholera. Bangalore had no regular cases of malaria. He confided to Manson stating, "I am thrown out of employment and have 'no work to do'." But in April he had a chance to visit Sigur Ghat near the hill station of Ooty, where he noticed a mosquito on the wall in a peculiar posture, and for this he called it "dappled-winged" mosquito, not knowing the species. In May 1896, he was given a short leave that enabled him to visit a malaria-endemic region around Ooty. In spite of his daily quinine prophylaxis, he was down with severe malaria three days after his arrival. In June he was transferred to Secunderabad. After two years of research failure, in July 1897, he managed to culture 20 adult "brown" mosquitoes from collected larvae. He successfully infected the mosquitoes from a patient named Husein Khan for a price of 8 annas (one anna per blood-fed mosquito!). After blood-feeding, he dissected the mosquitoes. On 20 August he confirmed the presence of the malarial parasite inside the gut of mosquito, which he originally identified as "dappled-wings" (which turned out to be species of the genus Anopheles). The next day, on 21 August, he confirmed the growth of the parasite in the mosquito. This discovery was published on 27 August 1897 in the Indian Medical Gazette and subsequently in the December 1897 issue of British Medical Journal.

Mosquito Control and the Discovery of Sir Ronald Ross

Dr. Pradeep Kumar Srivastava

Dr Pradeep Kumar Srivastava PhD FRES (1993), FISCD (1990), FSOMA, was the Head of Vector Control & Entomology division of National Vector Borne Disease Control Programme (NVBDCP), Government of India.
He has been a fore runner in combating malaria and filarial at national level. He has worked as Temporary Adviser to WHO on many occasions in Member countries of SEARO and WHO Headquarter Geneva.
He has chaired and co-chaired scientific sessions on Filariasis in USA and France. He has been a part of Indian delegation on Conference of Parties (COPs) 2017 for DDT reduction in vector control. He has more than 50 scientific publications and has authored many guidelines including 'Operational Manual for Integrated Vector Management in India', and chapters in books.
He has been conferred Vestergaard Frandsen Award 2019 by National Academy of Vector Borne Diseases (NAVBD), India. He has supported in Vector Control Need Assessment of India and Timor-Leste with WHO consultancy.

The 'World Mosquito Day' is observed in the memory of Sir Ronald Ross who finally elucidated the actual mode of transmission in 1897, while he was working in a lab of Secunderabad. Sir Ronald Ross demonstrated developing form of malaria parasite in mosquito body with the blood fed on a human being who had the malaria parasite. Since then, the life cycle of malaria parasite became clearer, and it was evident that Anopheles mosquitoes transmit disease malaria parasite. Once the mosquito was involved in transmission of malaria, the control of the disease was targeted to treat the patient by killing the parasite or by killing the mosquito. The approach targeting to control the mosquito was aimed in such a way so that the contact between the infected mosquito is avoided. The malaria parasite carrying mosquitoes are known as vectors of malaria. This also lead to understand the whole life cycle of mosquito. It was known that mosquito needs fresh water for the female mosquitoes to lay the eggs which hatches into larvae. The larvae when mature are converted into pupae - a non-feeding stage and then finally the adult mosquito emerges from the pupa which flies off in the air. This adult mosquito rests for some time and then searches for the food. The male mosquito feeds on nectars and plant juices whereas the female mosquito needs animal or human blood for protein which is required for their egg maturation. Immediately after taking blood the mosquitoes rest for some time mostly on the walls. These habits during life cycle of aquatic forms in the water for some time and then adults taking rest on the walls after taking blood have helped in designing the vector control. The progress has been made in different years with lot of innovations. Initially the control was targeted with minor and inexpensive methods suggested by Sir Ross in 1902. After two years from1904 to 1909 more studies were conducted on an off-line behaviour and Dr Christopher showed that the breeding sites can be treated with kerosene oil which will suffocate the larvae cutting their oxygen supply to drown them. In 1911, it was shown that the extract of pyrethrum from chrysanthemum flowers have insecticidal property and if fumigation is done with these extracts, the adult flying mosquitoes can be killed. While these tools were being used to kill mosquitoes, the major development of DDT came and in 1944, DDT as residual spray on the walls was used first time by British and American army in India.

Dr. Pradeep Kumar Srivastava

Mosquito Control and the Discovery of Sir Ronald Ross

Based on the experience, the National Malaria Control Programme (NMCP) was launched with DDT as main tool to control malaria. There have been many more compounds in different groups of insecticides tested and tried for killing the adult mosquitoes either in their resting phase or in their flying phase as a fogging operation. The common insecticides used to kill the adult mosquitoes were Benzenehexachloride (BHC) which was banned in 1997; malathion which is still in operation but because of its bad odour its acceptance is very poor and the third category came as a synthetic parathyroid which include a number of insecticides like deltamethrin, cyfluthrin, lambdacyhalothrin, alphacypermethrin and bifenthrin etc. Some of these are used as spray on the walls as indoor residual spray (IRS) while some are also used in treating the nets. Such insecticide treated nets serve dual purpose by protecting the person sleeping inside as well as killing the mosquitoes approaching the person for feeding. There are more compounds still under trial and may show their usefulness in malaria control or elimination. DDT being persistent organic pollutants raised a concern and was banned in agriculture long back and is in the process of being phased out from the health also under the Stockholm convention. Larval control has also been explored by many tools and many new compounds have also been introduced. The major ones are temephos, insect growth regulators and bio-larvicides. Bio-larvicides initially used was Russian strain but now indigenous strains have been developed in India. There are many larvivorous fishes which eat larvae and sustain the mosquito control at larval stages itself. The major names are Gambusia and Guppy but many other local smaller larvivorous fishes are also used by the local bodies. Personal protection, screening the houses making it mosquito proof like using grills, nets, using coils repellents and creams etc are used by the community of their own to protect themselves from the mosquito bite. Peoples' habit becomes very important in protecting themselves from the mosquito bite for example their sleeping habits must be changed. If someone sleeps outside without any protection, the chances of exposure to mosquito bite are more and if mosquitoes are infected, they will get the malaria parasite. Further the water storage practices and avoiding the creation of breeding sites for mosquitoes should be understood by all. So, the discovery made by Sir Ronald Ross and efforts made thereafter by many scientists need to be understood by all, disseminated among everyone in different style language with communication skills to protect from the mosquito bite and protect from all kinds of mosquito borne diseases.

सामाजिक भागीदारी

Dr. Diwakar Singh Dinesh

Dr. Diwakar Singh Dinesh, M.Sc. (Zoology), Ph.D. (Entomology), FISCD, ICMR-International Fellow of Sr. Indian Biological Scientist, NL Kalra awardee has superannuated from the post of Scientist F in December 2021 working for last 35 years on the vectors of Kala-azar and other VBDs at ICMR- RMRIMS, Patna.

He contributed significantly to the elimination program of Kala-azar. The programme has accepted the development of DDT resistance in sandflies.

There are 75 publications to his credit.

Three research scholars were awarded Ph.D. degree under his supervision.

He completed several intramural and extramural projects sponsored by ICMR, WHO, DBT, EU, etc.

He is a life member of several entomological societies and National Academy of Sciences, India

समय से पहले हो जानकारी
तब तो होगी छिड़काव में भागीदारी
माइक या पोस्टर से हो प्रचार
जिस दिन छिड़काव का हो विचार
लोग रहेंगे वैसे ही तैयार
न कोई करेगा छिड़काव से इन्कार

भरोसा है बालू-मक्खी रहेगी भागकर
इस तरह नियंत्रण में भागीदारी जानकर

डरने की कोई बात नहीं
कीट नाशक हानिकारक नहीं
न दाग न धब्बा,
ख़ुशी होगी जानकर
मारेगा जरूर बालू-मक्खी
इसे चलें मानकर

A Crusader in My City

Dr. Sajal Bhattacharya

Dr. Bhattacharya is presently the Associate Professor at the Post-Graduate Department of Zoology, Asutosh College (University of Calcutta), India. He has carried out his Doctoral research at the Department of Medical Entomology at the Calcutta School of Tropical Medicine and his Post-Doctoral studies in IHMT, Lisbon. Dr. Bhattacharya has several scientific publications in the field of disease vector eco-epidemiology.

He is an elected fellow of the Royal Society of Tropical Medicine and Hygiene, London (2005).

Dr. Bhattacharya has also published three papers on the life and works of Sir Ronald Ross.

He was conferred the prestigious Lifetime Achievement Award by the Society of Medical Arthropodology (SOMA) at Sir Ronald Ross Institute of Parasitology, Hyderabad.

River of faith flowing in the City of Joy,
where I got my first freedom and touched
the divinely inspired soil
Champagne, music and dance
left behind in the white man's town,
Filth, flies, lime traders and noisy crows
in the native's colony,
Unknown enemies flying in the dark,
their singing swarms in a stinging swoop
drunk on wine-red blood murdering millions,
seeking out a crusader alone in an alien land,
who struggled with tears and toiling breath
to unravel the mystery behind the massacre,
with Calcutta as witness and muse.

To reduce Malaria burden

Rojalin Maharana

Ms. Rojalin Maharana is an MPH student at AIPH University, Bhubaneswar.
She secured the First Prize in Poster Competition on World Mosquito Day 2022.

Malaria is an acute febrile illness caused by Plasmodium parasites, which are spread to people through the bites of infected female Anopheles mosquitoes. There are 5 parasites species that cause malaria in humans, and 2 of these species – *P. falciparum* and *P. vivax* poses the greatest threat. The World Health Organization Global technical strategy for malaria 2016-2030, updated in 2021, provides a technical framework for all malaria-endemic countries. According to the latest world malaria report there were 241 million cases of malaria in 2020 compared to 227 million cases in 2019. The estimated number of malaria deaths stood at 6, 27, 000 in 2020 – an increase of 69,000 deaths over the previous year.

PREVENTION:
Over the last 2 decades, expanded access to WHO recommended malaria tools and strategies – including effective vector control and the use of preventive anti-malarial drugs has had a major impact in reducing the global burden of malaria.

Vector control:
It is a vital component of malaria control and elimination strategies as it is highly effective in preventing infection and reducing disease transmission.

There are 3 core interventions as given below:
1.Insecticide – Treated Nets (ITNs): ITNs take advantage of the indoor feeding (endophagic) and indoor resting (endophilic) behaviors of some anopheles mosquitoes and work by repelling and killing or decreasing the life span of mosquitoes, as well as providing a physical barrier between mosquitoes and user.

2. Long Lasting Insecticide Nets (LLIN): These days effectiveness of LLIN is being threatened by mosquito behavioral change and resistance of mosquito vectors to insecticides on the nets. Sleeping under long-lasting insecticidal nets (LLINs) is its major control strategy.

Rojalin Maharana

To reduce Malaria burden

3. Indoor Residual Spraying (IRS): IRS involves coating the walls and other surfaces of a house with a residual insecticide. For several months, the insecticide will kill mosquitoes and other insects that come in contact with these surfaces.

Some other important aspects to reduce malaria burden are:
1. Knowledge on vector behavioural ecology, and
2. Monitoring Programs.

Some tips to prevention and to reduce Mosquito Bites:
1. Wear light- coloured long sleeved shirts and trousers
2. Sleep under nets
3. Use screens or mosquito nets in windows and doors
4. Get rid of stagnant water from placed where mosquitoes breed (such as old containers, flower pots, used tires)
5. Use Insect Repellents (That contain DEET or also called ICARIDIN or PICARIDIN)
Chemoprophylaxis: - Preventive chemotherapy includes perennial malaria chemoprevention (PMC), seasonal malaria chemoprevention (SMC), intermittent preventive treatment of malaria in pregnancy (IPTp) and school-aged children (IPTsc), post-discharge malaria chemoprevention (PDMC) and mass drug administration (MDA). Since October 2021, WHO also recommends broad use of the RTS,S/AS01 malaria vaccine among children.

STRATEGY:
The strategy sets ambitious but achievable global targets, including:
1. Reducing malaria case incidence by at least 90% by 2030
2. Reducing malaria mortality rates by at least 90% by 2030
3. Eliminating malaria in at least 35 countries by 2030
4. Preventing a resurgence of malaria in all countries that are malaria-free.

CONCLUSION: Hence we conclude that LLIN, ABCD, IRS, ITNs, prevent mosquito bites are the effective measure to control the malaria and also prompt identification of the person suffering with the malaria, prompt diagnosis and treatment are the effective measures to control the malaria burden.

Innovative mosquito repellents in Malaria Prevention

Akanksha Kashyap

Ms. Akanksha Kashyap is an MPH student at AIPH University, Bhubaneswar.
She secured the Third Prize in Poster Competition on World Mosquito Day 2022.

Nowadays, growing rate of mosquito population due to environmental favouring conditions and increased tourism has led to increased breeding of the vector and thus rise in cases of diseases like malaria, encephalitis, dengue, kala-azar, filaria, Japanese encephalitis and yellow fever. Malaria is potentially a life-threatening disease caused by parasite that is transmitted through bite of infected female Anopheles mosquito. Malaria cases have seen a rise to 241 million cases in 2020 as compared to 227 million cases in 2019. With a subsequent increase of 69,000 deaths, World toll sets to 627000 in 2020. India represents 3% of the global burden (World Malaria Report 2019). Being a preventable and treatable disease various measures are taken around the country.

Traditional practices hide gems from mother nature used as treatments, remedies and cures. With a growing trend in sustainable lifestyle and developing ideas closer to natural concepts like going vegan, healthy living, rise in naturopathy and going local, aromatherapy has created a huge trend among people. As a result, for preventive measures taken against Malaria, a need to develop more eco- friendly measures against these gruesome vectors while keeping in mind their multifocal benefits of being organic and at the same time be kid, pets and senile friendly. There lies a challenge in developing these technologies that contribute in making life tranquil and prolific for the present as well as for future generations.

DEET, used as an active ingredient in insect repellent sprays, a slightly yellow liquid that showed maximum efficacy to repel insects when used in high concentration (30%-78.5%). But on long term go this must not be recommended as it can lead to rashes, eye irritation, low blood pressure and even reported to lead to seizers, occasionally.

Akanksha Kashyap

Innovative mosquito repellents in Malaria Prevention

An urge to replacing such harmful chemicals, ethnobotanical studies have sourced in development of natural product, commonly perceived as ''safe'' in comparison to long-established synthetic repellents. Since there is a need to develop standardized repellent under WHO Pesticide Evaluation Scheme guidelines, eco-friendly repellents can be further tested as better repellent which offer better consumer safety.

Plants based repellents and essential oils can be an environmentally friendly option. Planting herbs like lemongrass and peppermint helps to keep the mosquitoes at bay. Clove and citronella oil can be diffused to repel these insects and easily available garlic can be burnt along with camphor shows great amount of repellence effect. Studies showed extract of *L. sinense* showed highest repellent effect of 9.1 h and followed by eucalyptus, carotin, cinnamon oil, rosemary, violet, soybean bite blockers, olives, juniper, galbanum, and C. longa have good repellency for about 8 h completely against different Anopheles genus. Mexican marigold and citrosa confirmed their broad-spectrum chemicals were effective against *A. aegypti* mosquitoes in another study.

Thus, Bio sourced repellents represents an interesting and alternative tool of protection against these vectors. Despite the advances in techniques and products used in its control, mosquitoes continue to pose serious public health problem. Surrounded by world with varieties of plant species, more should be explored in this field.

Thus, we conclude that the organic repellents which are made from extracts of different herbs, flowers, roots and leaves whether in a spray form or essential oils needed to be diffused are cost effective, eco-friendly and acceptable to the people. This organic repellent can be switched against the chemical repellent such as Deet, which are used in large doses can lead to skin blisters, headaches, shortness of breath, eye irritation, rash and various other symptoms and thus prevent the disease i.e., Malaria in a safe way.

The Malarial Fight

Dr. Srikanth S.

Dr. Srikanth is a preventive health specialist. He is an experienced education professional with 3 years of experience as an Assistant Professor concurrently with a 6-month experience as a hospital administrator at PESIMSR.

He is currently Medical Scientist (B) at ICMR-Vector Control Research Centre working on vector-borne disease burden in AUFI and Kyasanur Forest Disease.

Epidemiology, nutrition, biostatistics, ethical research principles, and communicable diseases (prevention and management) are his forte.

Rational use of technology in medical and public health systems, and systems approach to elimination of public health threats are his passion.

The battles of life against the unknown
are all too well known and aeons old.
The stalwarts stood on science's shoulders
and found these bugs under the microscopes.

The reasons for deaths-
Small bites and big threats posed
The sly worm, a master of pain
A 'million-murdering Death'
riding on the winged reaper.

Today, we fight on myriad fronts,
we fight the vector, the parasite and the world.
We start with self and start at home
we keep an eye forever open.
We come together to battle the tiny foe-
we shall prevail, we shall prevail.

We have battled the bugs with bottled cures
and when resisted- with better cures.
Clinics, PHCs and Hospitals abound,
with trained manpower to counter the worm.
And as foretold, myriad men were saved.

In a hundred years we've almost won twice,
and learned our lessons from the DDT fright.
We have conquered and culled the vector, but
we've been humbled by the resilience of nature.

Dr. Srikanth S.

The Malarial Fight

But the fight to survive-
an unending dance with death
The one we've known
from aeons and more.

Although we speak in many tongues,
as one people, we have come together-
in partnerships and community actions,
in communication and sharing of knowledge,
in surveillance and the latest tools,
to stand fast against the tiny foe-
we shall prevail, we shall prevail.

The end is here, within our sight,
but to falter now is a bigger plight,
avoid the temptation of laxity and rest
we must strike when the iron is red.

The end is not the final frontier,
look beyond, we must, to fully deliver,
the fellow man from its inflicted sufferings.
To lend a hand to the lives trodden down,
by the tiny plasmodia- that have cast
a long shadow on the development of mankind.

We fight till Malaria's a threat no more.
Then we must fight to right the score,
To balance the scales of malarial poverty.
And in this fight too, with tenacity-
we shall prevail, we shall prevail. .

Glimpses of the 14th International Conference on Vectors and Vector Borne Diseases (ICOV-14)

Organised by NAVBD & ICMR

9-11 January 2019, Bhubaneswar, Odisha, India

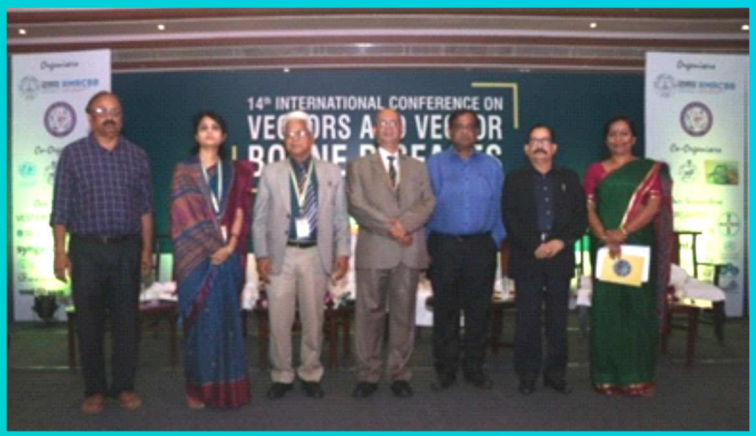





Image used in Cover Art:
https://m.media-amazon.com/images/I/71gPPC6B04L._AC_SL1000_.jpg

Concept:
Dr. Ashwani Kumar,
Director, ICMR-VCRC, Indira Nagar, Puducherry, India

Design:
Dr. J. Jency Priskilla, Scientist- B
Dr. Srikanth S., Scientist- B
ICMR-VCRC, Indira Nagar, Puducherry, India

Poem by Sir Ronald Ross on the evening of his discovery of the malaria causing mosquito. The anniversary of this day is celebrated as the '**World Mosquito Day**'.

20th August, 1897

This day relenting God
Hath placed within my hand
A wondrous thing; and God
Be praised. At His command,
Seeking His secret deeds
With tears and toiling breath,
I find thy cunning seeds,
O million-murdering Death.
I know this little thing
A myriad men will save.
O Death, where is thy sting?
Thy victory, O Grave?

National Academy of Vector Borne Diseases
Head Office: Regional Medical Research Centre
Chandra Sekharpur, Bhubaneswar-751023
Orissa, India