IIHMR UNIVERSITY | SD GUPTA SCHOOL of PUBLIC HEALTH

# PHRAME

Public Health Round-up on Actions, Measures and Evidence

*An Initiative by SD Gupta School of Public Health, IIHMR University*

**Look around, Think, Share, Connect**

PHRAME - 2024 | Jan - Apr | Vol. - 02 (01) | Pages 01 - 36

Theme - Vector Borne Diseases

**Vector borne diseases are one of humankind's greatest adversaries, chiseled to perfect alignment by Evolution.**

*We look at the exciting prospect of using evolutionary strategies as a tool to combat vector borne diseases, review the dengue situation in Nepal and India, and much more*

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# Message

I am delighted to learn that the latest issue PHRAME is being released. The theme, focusing on vector-borne diseases, has been very appropriately chosen, to reinforce the priority and focus required to control such a diverse group of pathogens and transmitting vectors.

Vector-borne diseases, including malaria, dengue, chikungunya, kala azar, and Japanese encephalitis, present significant challenges to public health not only in India but also in numerous other regions where these diseases are prevalent. Addressing these challenges demands a concerted effort to prioritize research, prevention, and control measures.

As we navigate the complexities of combating these diseases, it is imperative that we adopt a proactive and innovative approach. We must remain vigilant in our efforts to understand the dynamics of transmission and to implement effective strategies for prevention and mitigation.

At IIHMR University, we are deeply committed to fostering academic excellence and innovation, particularly in areas that intersect with the critical needs of public health and health management. The content presented in this issue reflects our dedication to advancing knowledge and addressing real-world health challenges. PHRAME also offers very interesting avenues like crossword, poetry and historical accounts of exceptional contributors in the field of public health which makes up for holistic reading experience.

I congratulate the entire team of PHRAME for their dedication and hard work in bringing forth this insightful issue. I am confident that the engaging and informative content will resonate with our readers and contribute to our collective efforts in combating vector-borne diseases.

**Dr. P R Sodani**
President
IIHMR University

# Purple Hues

Purple Hues are here again! Just look up at the clear blue skies and as the gaze enters the endless expanse, you see the enormity of masses for whom Public health strives to achieve the Pink of Health. Pink of Health for the Masses and Sky is the Limit! Mix Blue and Pink and you get Purple. Purple symbolizes Public Health for us at PHRAME and inspires us to spread the Purple Hues across, immersing everyone in the stories that engage, smearing the dash of new research, mystifying with questions that some may ask, etching the portraits of some immortals from the field , enjoying with snippets, puzzles, poetry while painting the skies with innovations and perspectives ; that's world of PHRAME we bring to you!

Theme of this edition of PHRAME features Vector borne Diseases (VBDs). Vector Borne Diseases are a group of infections caused by pathogens ranging from viruses, bacteria and protozoans which are transmitted mostly by bloodsucking arthropods referred to as vectors. Vector borne diseases account for almost 17% of all infectious diseases and it is estimated that VBDs account for 7,00,000 deaths worldwide annually. 80% of the world's population is at risk of contracting VBDs. Mosquito borne diseases (MBDs) form the greatest chunk of VBDs .

This issue of PHRAME covers a unique perspective of evolutionary strategies which have perfected the life forms to survive in the world we live today and pokes you to look at some remarkable ways to use these very strategies in our combat our formidable adversaries – the vectors and the agents transmitted by them. We also have a special review article on dengue which compares the situations in Nepal and India. In our tribute to honour remarkable contributions related to the theme this time we look at the various dimensions of life and contributions of Sir Ronald Ross who pioneered the efforts to elucidate the complex life cycle of malaria parasite. We also honour our inquisitive audience who have asked us intriguing questions in our section Queriosity while those with a penchant for puzzles can try their luck with LogPHRAME. Looking glass wraps up snippets of latest research from prominent journals on related aspects.

We have great pleasure in bringing this exciting issue for you and hope this will make up an interesting read.

*May the purple hues prevail!!*

**Dr. Vinod Kumar SV**
Dean In-Charge, SD Gupta School of Public Health, IIHMR University, Jaipur
On Behalf of the PHRAME Team

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# Perspective

## *Man, Mosquito and Malaria Parasite The fascinating Trilogy of Adaptation crafted by Evolution*

Dr Vinod Kumar SV[a]

*In this narrative, we trace the key milestones of evolutionary developments of Man, Mosquito and the Malaria Parasite and try to look at the intricate relationships of this trilogy. Understanding their evolutionary adaptations could have profound implications in the eventual control of malaria and other mosquito borne diseases. Someday, these evolutionary perspectives could serve as an immensely powerful weapon to fight some of the formidable diseases like malaria.*

Over the years life evolved on our planet and diversified into more than 2 million species in the current era. It is believed that the earliest forms of life appeared on Earth as early as 4 billion years ago. Life on earth has been an interplay of selection pressures and adaptations explained so beautifully by Charles Darwin described as Natural Selection in his monumental work 'Origin of Species [1]'. Evolution has fueled an extraordinary journey of adaptations among the lifeforms to strive for perfection, which has been awe-inspiring in its true sense. We are just beginning to gain some knowledge about them and much needs to be unraveled. It has been a fascinating journey for the humankind to have evolved to eventually become the dominant species on this planet. Alongside the humans we also had some interesting companions, like the tiny buzzing mosquitoes and plasmodium, a miniscule parasite causing malaria, which evolved with us through the millennia. In this narrative, we trace the key milestones of evolutionary developments of Man, Mosquito and the Malaria Parasite and try to look at the intricate relationships of this trilogy. Understanding their evolutionary adaptations could have profound implications in the eventual control of malaria and other mosquito borne diseases. Someday, these evolutionary perspectives could serve as an immensely powerful weapon to fight some of the formidable diseases like malaria.

## Humans - Walking on two limbs to dominate the planet

Its been more than 6.5 million years when the earliest humans diverged from the their ancestral cousins; the apes [2]. The human transformation with distinct characteristics including bipedalism (moving on two limbs), orthograde stance (upright posture) and cognitive development has led our species to a point where we are exceptionally distinct from our evolutionary ancestors. It might be worth pondering as to what would have promoted these extreme differences. Although our evolutionary history is a matter of intense research, there is little consensus on the clear lineage of human origins. Existing research does provide us some of the possible reasons which led human evolution to the present state. It appears that bipedalism evolved earlier to

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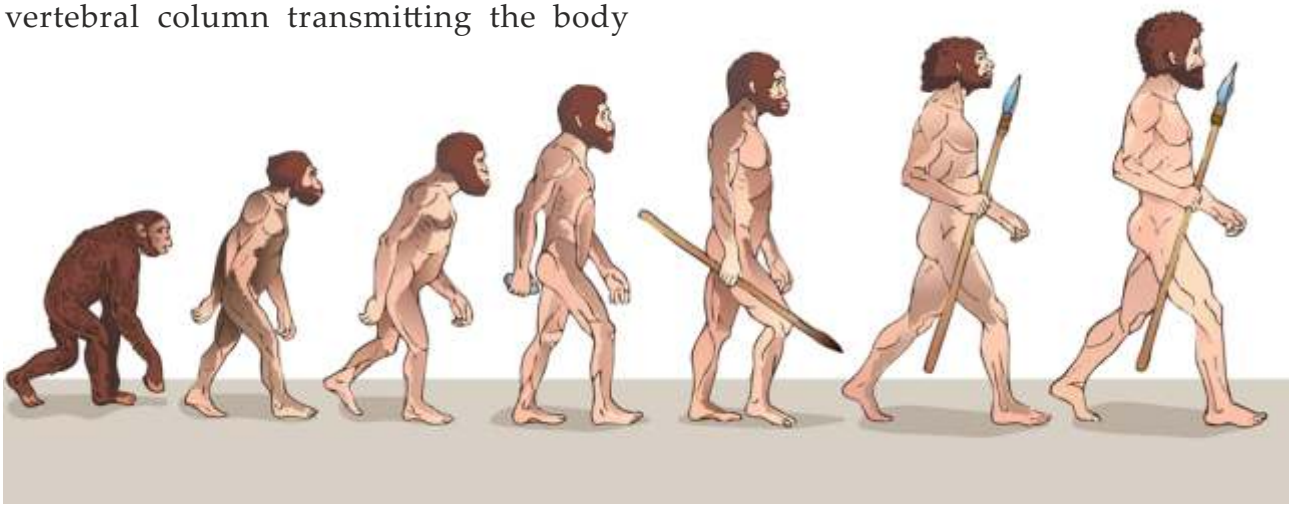
facilitate suspension (on trees etc.) and later to travel in the long grasslands, where standing upright would give good view and free hands could hold tools! But bipedalism didn't come off easy. The body had to adjust to gravity. Evolution refined the human body with lots of adaptations as we developed the orthograde stance. Our spines got modified with a slightly curved upright vertebral column transmitting the body weight straight down the legs. The narrow pelvis of human body was an outfall of upright stance and with it came the necessity for flattening of face and still the risk for complicated childbirth.

Yet, the upright gait of bipedalism may not stand the competition with quadrupeds. The bipeds cannot match them in running, as it takes a lot of energy for the upright stance to run fast. This can be seen in modern day human running speed when compared to other animals. Beware though, we miserably fail in sprinting, but humans can beat most animals in long distance running!

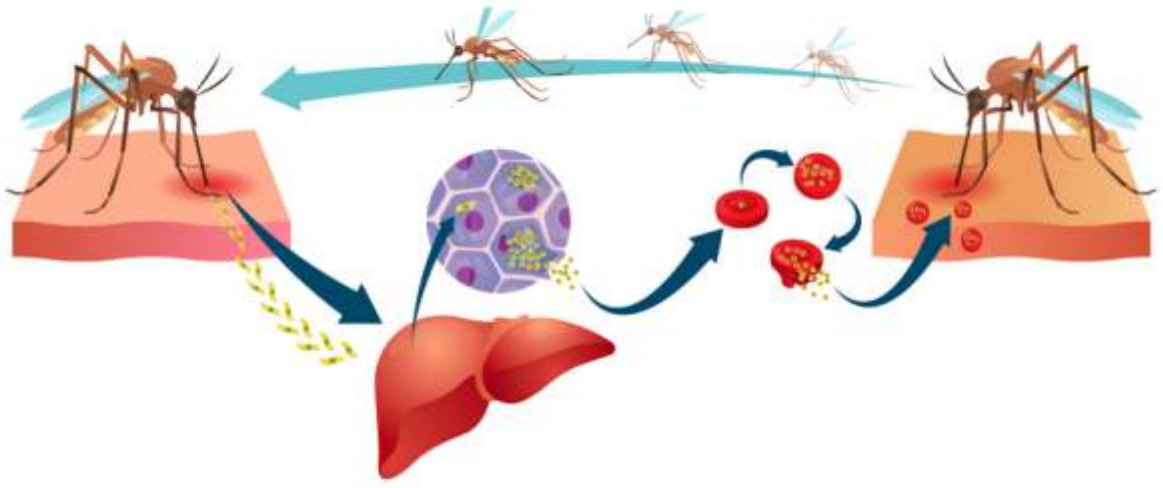


However, despite these seeming imperfections in evolving to the bipedal gait, which distinct qualities helped humans become the rulers of the planet? The answer probably lies in the development of cognition which gave a distinct selection advantage as humans evolved curiosity, superior thinking and developed communication, language and tools. Bipedalism and orthograde stance then became real assets. Free hands with opposing appendages were ideal for use of tools while the remaining two limbs were sufficient for walking. This dimension of human evolution sets the context for necessities of survival and the challenges thrown by nature which leads organisms to adapt and evolve strategies and mechanisms to survive and thrive.

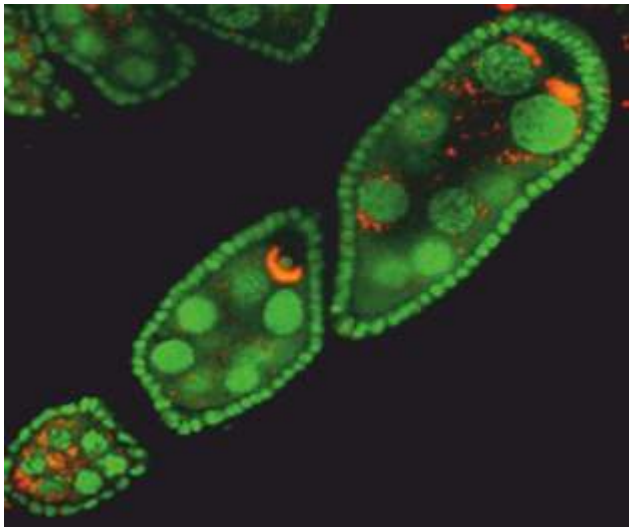
When malaria challenged humankind, the species responded by multitude of adaptations. As humans started colonizing and settling down in habitations, malaria adapted to the human host. Gradually the disease took its toll to become a scourge costing a heavy loss of lives. As malaria became a powerful selection pressure for the human species, response was inf the form of various genetic adaptations, many of which were related to development of erythrocyte and hemoglobin variants which conferred resistance to malaria infection. Glucose – 6 Phosphatase (G6PD) deficiency, Thalassemia Trait, Sickle Cell anemia and Duffy negative blood groups were all examples of such adaptations.

## Mosquitoes - Buzzing around to perfection

Mosquitoes have been around on Earth much earlier than humans. It is believed that the earliest mosquitoes appeared 200 -300 million years ago in the Jurassic period[3]. The mosquitoes are related to the house fly and evidence indicates that the ancestors of modern-day mosquitoes were upto three times larger. Another interesting observation in some of the oldest fossils which date back 120 million years is that among the earliest mosquitoes, both males and females used to have blood meal. Male mosquitoes then evolved to survive of plant juices and nectar, while the fertile female mosquitoes require blood meal for the eggs to mature. The reason for the male mosquitoes moving away from blood meal could be because bloodsucking from a living animal could be a risky process and for survival attractive safer alternatives (like Plant sap and nectar) are available! The real evolutionary importance in context of mosquitoes turning towards humans is very intriguing. It must be noted that not all mosquito species prefer human blood. Several research studies have pointed out that preferring human blood may have offered no evolutionary advantage to mosquitoes until some 10 thousand years ago. It was around this time that humans began to settle down in habitations[4] Recent research on Aedes mosquitoes in Africa has revealed that human biting most likely evolved as the human settlements had provisions for water storage [5,6]. Mosquitoes can't breed without water and man-made storage arrangements provided the only means of survival for these mosquitoes in



arid conditions. It is very likely that increasing human settlements and dense urbanization is going to further intensify this evolutionary momentum and more mosquito species could adapt to live with humans and thrive on human blood. The possibility seems ominous and unwelcome since the increasing mosquito menace would be the harbinger of emerging and reemerging diseases. This underscores the critical role of institutionalizing strong mechanisms to prevent mosquito breeding in human habitations. Mosquitoes have evolved in many other aspects too. The advent of insecticides revolutionized vector borne disease control programs worldwide.[7] The insecticides used against mosquitoes belong to one of the six classes - organochlorines, organophosphates (OP), carbamates, pyrethroids, pyrroles, and phenyl pyrazoles[8]. DDT (Dichloro Diphenyl Trichloro ethane) was the first insecticide used for mosquito control. Insecticides were immensely successful in the initial period of their use and some regions achieved remarkable control of mosquito borne diseases to the extent that there was optimism that many of these diseases would soon be eradicated. But as the mosquito population dwindled, evolutionary mechanisms played their part in scripting a resurgence through selection pressures. The mosquitoes with inherent resistance to insecticide had a survival advantage and over generations their progeny got better and better in their mechanisms to evade destruction by these. Today insecticide resistance is an area of intense research. We are gaining insights on the mechanisms and pathways leading to development of insecticide resistance which will eventually help us find solutions to develop strategies to



delay or suppress development of insecticide resistance[9].

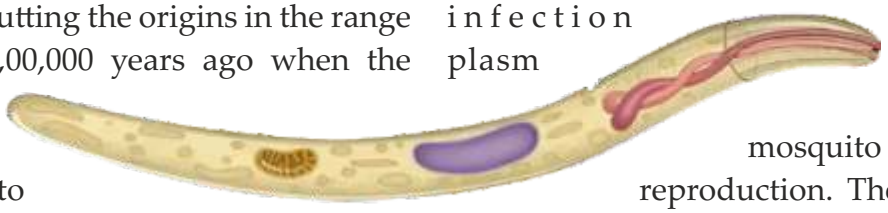
## Plasmodium – Parasitic adaptation par excellence

There are about 156 species in the genus of Plasmodium which infect various vertebrates. Of these, only six are of concern for humans ; namely Plasmodium falciparum, Plasmodium vivax, Plasmodium Malariae, Plasmodium ovale curtisi, P. ovale wallikeri and Plasmodium knowlesi[(10)].

P knowlesi has been the newest addition , discovered in India in 1931 and the first naturally acquired infection demonstrated in 1965. Although direct human to human transmission through mosquitoes has yet not been demonstrated for this species and it remains mainly a pathogen of the primates, P knowlesi causes large number of human infections in South East Asia and is also known to cause severe and fatal disease akin to the severe falciparum malaria.

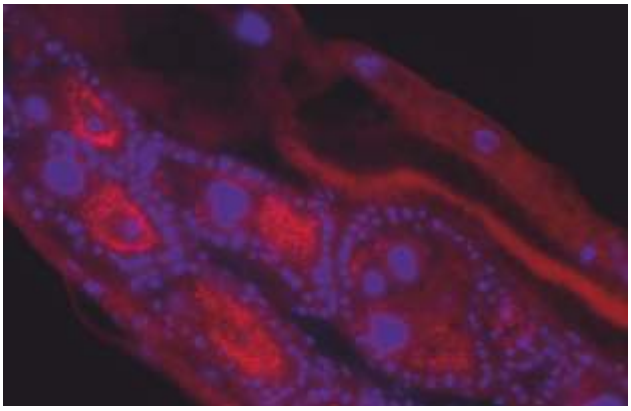
The evolution of Plasmodium to the present-day life cycle between the animal hosts and mosquito vectors is a remarkable journey of evolutionary transformation, most of which

is still waiting to be unraveled. Scientific community is divided on the timelines and origins of the two most important plasmodium species, Falciparum and Vivax. It is believed that Plasmodium falciparum adapted to humans through multiple transfer events from Gorillas. The timing of transfer has been a matter of debate, and the current evidence indicates the event to have occurred around 10,000 years ago. P Vivax is believed to have existed much earlier, with some studies putting the origins in the range of 83,000 to 2,00,000 years ago when the parasite adapted from the great apes to human ancestors[11].



Plasmodium's adaptation for causing disease in humans and their survival mechanisms in mosquitoes needs to be studied in depth to reveal some of the traits which could have great bearing on malaria epidemiology, virulence and effectiveness of malaria treatments.

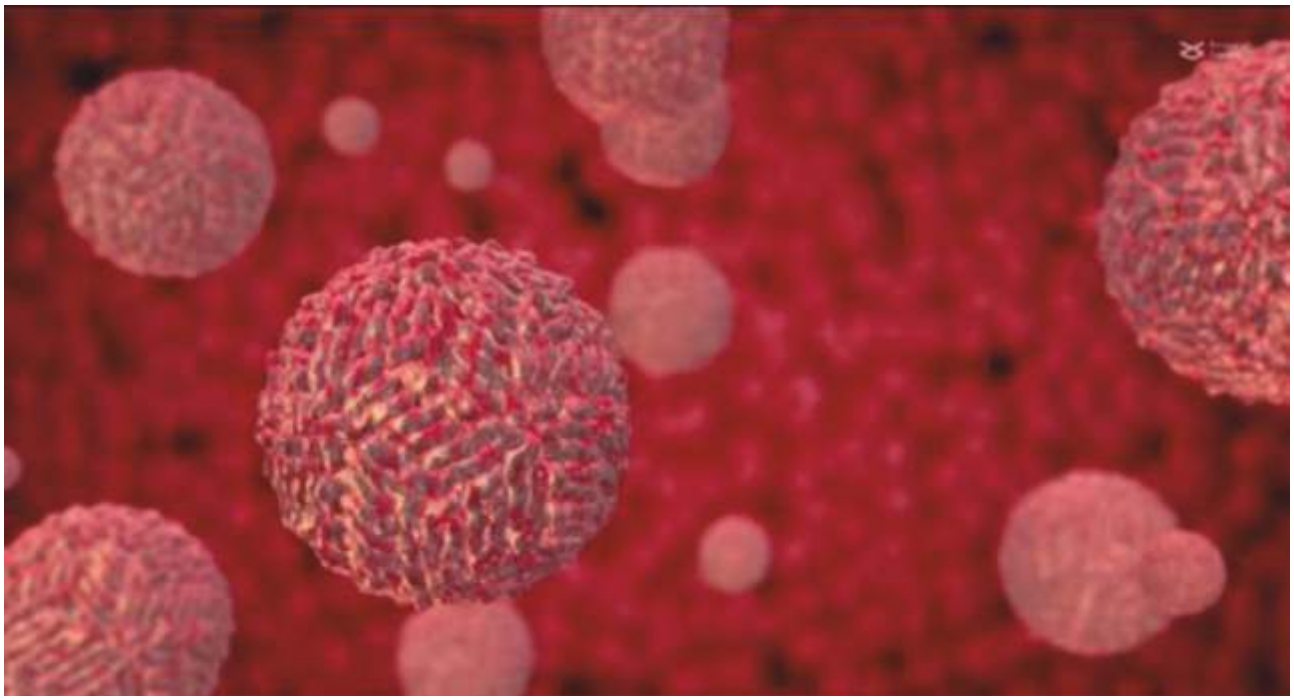
Parasite and vector associations are not just a mere coincidence. Behind the association we see today is a story running thousands of years back in time , a story of trade offs between the cost of infection and mutual benefits. As plasmodium infects mosquitoes, it would result in a burden on the infected mosquito affecting its fitness in terms of survival (life span) and fertility (number of eggs laid) apart from sharing of resources (nutrient share snatched by parasite for its multiplication) (12) . In retaliation the mosquito would institute its defense mechanisms by mounting an immune response and reducing the parasite load. The remarkable evolutionary adaptations between plasmodium and anopheles mosquitoes has resulted in a harmonious relationship which balances the burden of infection (caused by plasmodium) with mosquito survival and reproduction. There has been limited research which indicates that effects of plasmodium infection in reducing mosquito survival and egg production have decreased overtime and in return the effect of mosquito immune response for controlling the parasite multiplication has also reduced. There is evidence to show that usually heavy plasmodium load reduces mosquito survival but infected mosquitoes seem to have survival advantage in periods of starvation[13]. Study of these adaptations is very important from two dimensions. Firstly, any strategies to impact mosquito survival or reproduction could have consequences on parasite transmission, and secondly we could gain insights into innovative mechanisms to dampen the survival advantage to have long standing impact on malaria control in years to come.



## Evolutionary Strategies as a weapon against Diseases

Evolution has tested all the organisms on this planet. Life has been a ruthless game in which selection pressures bring out the best

from the winners and the losers perish. Understanding the adaptive mechanisms developed against selection pressures could be a promising avenue for potent control strategies in near future. We are just beginning to understand these mechanisms in greater detail and it is encouraging to see some of these insights are already being put to use against malaria and other vector borne diseases.



### 1. Wolbachia Strategy

Wolbachia are common intracellular bacteria which infect many insects and nematodes. These bacteria can pass to the next generation through eggs and they can cause several effects in the infected insects, like Male infertility, feminization, sperm egg incompatibility and inhibition of other pathogens[14,15]. The bacterium can infect mosquitos too. Dengue virus cannot replicate in Wolbachia infected Aedes mosquitos. Similarly, some studies indicate that Wolbachia infected mosquitoes also dampen plasmodium multiplication. The technique holds promise for elimination of dengue and future research can focus on adapting it for other mosquito borne diseases like malaria. The technique offers an evolutionary approach since it confers a survival advantage to Wolbachia.

The results of this strategy hold promise. The World Malaria Program under the Monash University, Australia has established projects based on Wolbachia technique across 14 countries. The efficacy of the technique was demonstrated in a cluster randomized trial held in Indonesia, the results of which show a protective efficacy of 77% against infection and 86.2% reduction in hospitalization rates due to dengue[16].

Indian Council of Medical Research-Vector Control Research Centre (ICMR-VCRC) has engaged with Monash University, Australia to develop local strains of Aedes infected with Wolbachia to investigate the effect in

reduction of dengue transmission in Puducherry.

## 2. Duffy Negative Blood Group and Development of Malaria Vaccine

Plasmodium Vivax infection requires Duffy binding antigen on the red blood cells. Duffy binding protein (PvDBP) on P vivax undergoes and interaction with a receptor on human red blood reticulocyte surface which is crucial for plasmodium vivax to infect humans. It was observed that individuals with Duffy negative blood groups are resistant to Plasmodium Vivax infection. Duffy negative blood group developed as an evolutionary response to vivax malaria infection. This led to the hypothesis that the antibodies against the Duffy antigen could confer protection against P vivax infection[17,18]. This is an area of intense research for there is scope for potential vaccines, although success still eludes an effective vaccine and there are still many hurdles to clear[19].

Leveraging evolutionary strategies to combat mosquitoes is an exciting area which needs more exploration. We are struggling with insecticide resistance. We also know that mosquitoes have evolved indoor biting preferences to take blood meal in human habitations. However indoor residual sprays are now being challenged by resistant mosquitoes. Could we induce a survival advantage in mosquitoes by pairing a repellent with an effective insecticide? Research indicates that combining an indoor residual insecticide with a repellent which repels only some mosquitoes could eventually induce what we may call a 'survival lane' whereby the mosquitoes which got repelled would survive triggering a selection pressure in favour of misquotes which get repelled by the chemical. Eventually, the repellent would get better and better in that population and the mosquitoes may prefer to remain outdoors! (20)

We can conclude that the portraits of present-day humans as well as every other organisms on this planet has been painted by the selection pressures and the evolutionary adaptations. This trilogy of Man, Mosquito and the Malaria parasite goes on to highlight some of the inherent advantages each of these species possess individually and in their mutual interactions. We have also seen how each of them has evolved strategies to emerge victorious in their constant fight for survival. The immense potential of evolutionary biology must be realized and its use in conjunction with epidemiology, pathophysiology and entomology could unlock a whole new set of strategies in our fight against malaria and other vector borne diseases.

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# Interesting Facts about Mosquitoes

- Average weight of a mosquito is just 2.5 milligrams , but a mosquito can drink upto 5 µl while taking a blood meal! A human equivalent would be something like a 60 kg man drinking 12 litres of water!

52,000,000,000

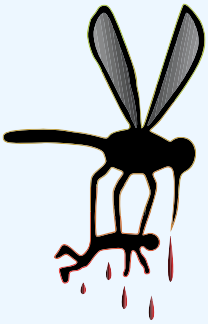
- Over the course of 200,000 years, 108 billion people have lived on Earth. And nearly half, 52 billion, have been killed by mosquitoes.

110,000,000,000,000

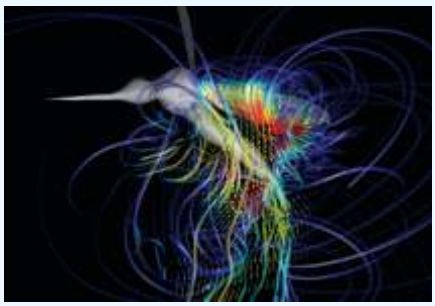
- We have 110 trillion mosquitoes across nearly all of the planet, and we've had them for over 200 million years.

- Mosquitoes flap their wings upto 800 times per second ie 800 Hz !! Mind boggling

- Like most insects, mosquitoes have two compound eyes, each of which contains thousands of six-sided lenses that point in all different directions and move independently.



- Mosquitoes fly about 1.5 miles per hour, which is very fast for such a little animal. For humans, that's the equivalent of running at 200 miles per hour.



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# Review Article

## *Community Engagement: The Neglected Pillar of Action for Dengue Prevention*

Nilanjan Bhor[a], Ganga Marasini[b], Randa Elghandour[c]

Abstract

*Dengue is a re-emerging preventable vector borne disease. Due to the lack of effectively implemented prevention strategies, it is threatening many lives in India and Nepal. Community engagement interventions have shown high potential in dengue prevention. Global and national level policies of India and Nepal also encourage community engagement in dengue response. Therefore, to eliminate dengue by 2030, dengue prevention and control program in India and Nepal must implement community engagement interventions in response to dengue prevention.*

### Dengue and its burden

Dengue has become a recurrent and emerging public health problem. In the 21st century, dengue, a vector borne preventable disease, is claiming lives especially in the developing countries, like India and Nepal. India and Nepal have experienced frequent outbreaks of dengue in the last decade. As per the data from Government of India (Table 1), the trend between 2017 to 2022 showed highest reporting of dengue cases and deaths in 2021 and 2022 i.e., confirmed cases of 193245 during 2021 and 233251 during 2022, and deaths reported 346 during 2021 and 303 during 2022. But the case-fatality has reduced from 0.17 during 2017 to 0.13 during 2022.

Simultaneously, as per the data from Government of Nepal (Table 1), Nepal has faced multiple outbreaks from the first case of dengue reported in 2006 till 2022. The number of cases and deaths reported between 2017 to 2022 showed fluctuations in number of cases and deaths including very high reporting of cases in 2017, 2019 and 2022. The number of cases has been reported highest during 2022 compared to previous years, which was considered as a severe outbreak. There was a surge in cases i.e., 54784 cases reported with 88 deaths, and the case fatality rate was 0.16. All 77 districts of Nepal have been reported with dengue cases in this year.

**Table 1 . Dengue cases and Deaths – India & Nepal**

| Year | India | | | Nepal | | |
|---|---|---|---|---|---|---|
| | Cases | Deaths | CFR (%) | Cases | Deaths | CFR (%) |
| 2017 | 188401 | 325 | 0.17 | 2111 | 3 | 0.14 |
| 2018 | 101192 | 172 | 0.17 | 811 | 3 | 0.37 |
| 2019 | 157315 | 166 | 0.11 | 17992 | 6 | 0.03 |
| 2020 | 44585 | 56 | 0.13 | 630 | - | - |
| 2021 | 193245 | 346 | 0.18 | 640 | - | - |
| 2022 | 233251 | 303 | 0.13 | 54784 | 88 | 0.16 |

Note: (-) data is not available. CFR – Case Fatality Rate Source: (I) NVBDCP, MoHFW, Government of India[1] (ii) Annual report 2021-2022, Department of Health Services, Nepal[2]

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To address this increasing burden of dengue, there is a need for reviewing the existing dengue policy/program in these countries. The World Health Organization (WHO) report on Global Vector Control Response 2017-2030[3] – that aim to reduce the vector-borne diseases burden and threat through effective locally adapted sustainable vector control – suggested community engagement and mobilization as one of the pillars of action for vector response. Therefore, countries must adapt, align, and implement community engagement and mobilization to accelerate response to dengue prevention.

## Why community engagement?

To achieve healthy lives and well-being for all, the WHO report on Global Action Plan[4] – developed with a goal to help countries accelerate progress on health related SDGs by strengthening collaborative and coordinated effort to support countries owned and led national plans and strategies – called for (i) three approaches: align, accelerate and account, and (ii) seven accelerators i.e., Sustainable financing, Frontline health systems, Community and civil society engagement, Determinants of health, Research and development, innovation and access, Data and digital health, Innovative programming in fragile and vulnerable states and for disease outbreak response to accelerate progress towards the health-related Sustainable Development Goal (SDGs). Given very limited progress has been made to achieve health-related targets of the SDG by 2030, it is essential that the government take ownership to strengthen these accelerators.

This article discusses one of these accelerators i.e., the community engagement in dengue prevention in India and Nepal. Community engagement is defined as 'a process of developing relationships that enable stakeholders to work together to address health-related issues and promote well-being to achieve positive health impact and outcomes'.[5] Community engagement is very essential in reducing or eliminating the presence of disease vectors and studies/interventions have proven the effectiveness of community engagement through changes in behavior and practices in the community in promoting health including dengue prevention. Therefore, community engagement ensures ownership of the activities through healthy behavior change, and it is also the cost effective and sustainable activities for dengue prevention and control.[6]

## Does current dengue policy/guideline feature community engagement?

The WHO roadmap for neglected tropical disease 2021-2030[7] has prioritized dengue as a neglected tropical disease, a disease of poverty. As being neglected, many endemic countries are ill-prepared for prevention, control and management of dengue outbreaks. However, as a step forward, few countries including India and Nepal have brought dengue (and other vector borne diseases) prevention, control and management under an integrated vector borne disease control program.

At global level, the dengue guidelines for diagnosis, treatment, prevention and control[8] by WHO suggest community engagement in dengue prevention and control activities. Further a global strategy for dengue prevention and control[9] was developed based on this guideline. As documented in this strategy and Rigau-Pérez and Clark[10] have proposed community engagement and participation in dengue prevention and control as one of the ten priority areas for dengue emergency response.

The National guideline on prevention and control of dengue is available for both India and Nepal. Indian guideline [11] has suggested vector control as the only method of dengue prevention, which can be addressed by proper environmental management like practicing proper solid waste disposal, storing of water with covered containers through community-based programs. In addition, the guideline also emphasized community involvement as a strategy for source reduction, clearing domestic and peri domestic areas of unused containers, tyres, coconut shells, broken glassware etc. which can collect water and personal protection through conducting Information Education and Communication (IEC) activities and awareness generation.

Nepal's guideline on prevention, management and control of dengue[12] suggested different actions at household and community for dengue prevention and control. The suggested household actions were personal protection measures, use of mosquito repellants, use of tight fitting meh/screens on windows and doors, and regular cleaning of water tanks/garden. At community level, the guideline has encouraged communities to empower and engage in dengue control programs with adequate knowledge on mode of transmission, vector control options, availability of services and proper treatment which helps in taking timely and appropriate actions. The actions to be taken at the community level were group formation to execute the household level actions, identifying commercial activities that promote space for the larvae/vector, and initiating awareness campaigns for preventing mosquito breeding and bites. Further activities suggested against mosquito breeding were cleaning and covering of water containers and surroundings such as weeds and tall grasses etc. including sanitation, and promoting use of mosquito coils, bed nets or burning neem leaves.

Though these guidelines encourage community involvement or engagement through the above-mentioned actions/activities, there is no clear instruction on how to engage the community and no implementation plan is available for community engagement, indicating likely a gap in implementing the activities by involving or engaging the community.

**What evidence reveals?**

There are successful interventions from around the world implemented using community engagement approach for dengue prevention and control. The community engagement intervention from Sri Lanka in dengue prevention and control, that aimed at educating the high-risk community on eliminating dengue mosquito breeding sources, reduced hospital admission by 60% for dengue fever.[13]This intervention also successfully led to collaboration between community and public health workers/local authorities. It has reduced the mosquito breeding sources with increased knowledge on creating and sustaining mosquito free environments. (13) Other studies on dengue prevention through community engagement from America[14], Cuba[15], Singapore[16], and Vietnam[17] showed effective community engagement in vector control strategy. The study conducted in Indonesia by Tana et.al. [18] concluded that community engagement needs a lot of effort initially but has good prospects for sustainability.

The study conducted by Gopalan et.al. [19] in Kerala, India found two major observations from their research that indicates that community engaged interventions work in dengue (and other vector borne diseases) prevention and control: (i) community is essential and must be

part of dengue and other diseases prevention and control efforts. Community is willing to participate in these efforts when they perceived the threat from dengue and other diseases. (ii) the groups/committees formed in the community facilitated by health workers have strengthened community engagement activities.

## Conclusion

There is an urgent need for sustainable action to mitigate the dengue burden in India and Nepal. Given the prevention activities are given very less importance by the health system, it is important that the dengue program must integrate and implement community engagement, which is still not adequately considered, as a strategy for its prevention activities. In fact, community engagement is of utmost importance in dengue vector control as mosquito breeding sources are located in and around the households, thereby geographical diversity and socio-cultural practices must be considered in community engagement interventions. Overall community engagement promotes healthy behavior, which in turn becomes part of the social system, and also promotes ownership of the community to prevent and control of the vector intra-household and surroundings.

Improving community behavior is integral to community engagement. Studies have shown that community behavior towards dengue prevention is not up to the mark: the study by Rajapaksha et.al[20]. found that community behavior towards dengue prevention such as management of indoor and outdoor breeding places, water storage, roof gutter, household waste was highly inadequate. Further association of dengue prevention behavior with the age (age group between 45 to 70 years), occupation (i.e., employed individuals), and number of family members (families have less than four members) indicates the socio-economic and cultural differences. In addition to these factors, gender (male members) and duration of stay (especially those living for long duration) also showed better dengue prevention behavior. [21] Further Baral et.al. [22] found that poor dengue prevention practice was evident where there was no community participation. Baral also highlighted the pivotal role of the health system in organizing community participation i.e., supporting the community to initiate dengue prevention practices and its proper management by concerned health authorities.

Therefore, it is essential to promote more research on dengue prevention practices through community engagement. An evidence-based dengue program implementation by addressing the barriers has high potential to sustain the practices by the community. Frontline health workers must be trained in behavior change communication to facilitate community engagement activities, and encourage community participation. Strengthening the bond between the health system and community must be a continuous process rather than targeted approach like during outbreaks. To achieve the sustainable development goal target for neglected tropical diseases by 2030, the dengue program must engage the community to accelerate its prevention activities and its elimination, and sustain the community engagement effort through community ownership and support in sustaining the elimination.

It is important to end the neglect of dengue and consolidate the efforts towards prevention, control and management. Strengthening dengue prevention efforts through community engagement may not only bring healthy behavior change of the community for preventing

dengue but will also help in preventing other vector borne tropical diseases. It is important to address the socio-economic and environmental factors associated with dengue prevention in sustaining community engagement actions.

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# Looking Glass

## 1. Efficacy of Wolbachia-Infected Mosquito Deployments for the Control of Dengue [ORIGINAL ARTICLE]

Utarini A, Indriani C, Ahmad RA, Tantowijoyo W, Arguni E, Ansari MR, Supriyati E, Wardana DS, Meitika Y, Ernesia I, Nurhayati I. Efficacy of Wolbachia-infected mosquito deployments for the control of dengue. New England Journal of Medicine. 2021 Jun 10;384(23):2177-86.

This study aims to assess the prevalence of adverse mental health symptoms among individuals diagnosed with acute COVID-19 in the general population of six developed nations.

- The study highlights the novel technique of controlling malaria by biological intervention at the level of vector mosquitoes. The paper explores the risk reduction of Aedes aegypti mosquitos getting infected by the Arboviros if deliberately exposed to wMel strain of Wolbachia pipientis.
- Cluster-randomized trial approach was adopted, involving 12 control and 12 intervention clusters. In intervention clusters, wMel-infected A. aegypti mosquitoes were released. All background characteristics of both types of clusters were similar in terms of mosquito-control measures. Patients were both types of cluster regions were analysed. About thirty-seven hundred were enrolled in the intervention group and about forty-four hundred in the control group.
- Results showed that VCD (Virologically Confirmed Dengue) prevalence was 2.3% in the intervention group. Whereas for the control cluster group 9.4% (318 of 3401). The two groups have statistically significant differences in incidence.
- The odds ratio for VCD was found to be 0.23 at a 95% confidence level in the intervention group.
- The protective efficacy of this intervention strategy was about seventy-seven percent (at 95 % CL). For the dengue virus serotypes, the protective efficacy was reported to be the same.
- It was reported that VCD-led hospitalization incidence was significantly lower in the intervention group i.e. 0.4% as compared to the control group, i.e. 3.0%.
- A cutting-edge strength of this approach to control dengue is that it does not require reapplication and does not need alteration in the mosquito population.

*Dr. Fahad Afzal,* Research Fellow, IIHMR University, Jaipur

## 2. Low-dose Subcutaneous or Intravenous Monoclonal Antibody to Prevent Malaria [ORIGINAL RESEARCH]

Wu RL, Idris AH, Berkowitz NM, Happe M, Gaudinski MR, Buettner C, Strom L, Awan SF, Holman LA, Mendoza F, Gordon IJ. Low-dose subcutaneous or intravenous monoclonal antibody to prevent malaria. New England Journal of Medicine. 2022 Aug 4;387(5):397-407.

This study aims to assess the prevalence of adverse mental health symptoms among individuals diagnosed with acute COVID-19 in the general population of six developed nations.

- Malaria-related morbidities and mortalities have always been a public health concern globally. The study shows a novel method of malaria control by the development of antibodies in human beings by administering L9LS (antimalarial monoclonal antibody).
- The researcher conducted a phase-1 clinical trial involving an intervention group (17 participants) receiving L9LS (malaria antibodies) and a control group (6 participants). Both groups were subjected to Anopheles mosquitoes infected by Plasmodium falciparum (strain used 3-D7).
- Results indicated this method is completely safe and has the potential to provide prolonged immunity.
- Fifteen participants out of 17 (88%), who received one L9LS dose, didn't show any sign of pathogenic infection after controlled exposure. Parasitic infection was not reported in any intervention group participant who received between 5 to 20 mg/Kg L9LS.
- This method has the potential to complement as well as substitute malaria vaccination. If found successful in later phases of the trial, it could be a game changer, especially in equatorial and tropical countries.

## 3. Surfactants alter mosquito's fight and physical condition [ORIGINAL RESEARCH]

Kato-Namba A, Iida T, Ohta K, Suzuki M, Saito K, Takeuchi K, Sakamoto M, Kazama H, Nakagawa T. Surfactants alter mosquito's flight and physical condition. Scientific Reports. 2023 Feb 9;13(1):2355.

This study aims to assess the prevalence of adverse mental health symptoms among individuals diagnosed with acute COVID-19 in the general population of six developed nations.

- Insecticides have been widely used around the world and are quite successful at controlling mosquitoes. Chemicals in insecticides have adverse effects on biodiversity as it affects other insects and animals also. Further, some mosquitos develop resistance against such chemical compounds.
- The research explores a new way of controlling mosquito populations by limiting the physical ability of mosquitos to fly and stick to the walls. The study involves the addition of surfactants (such as sodium dioctyl sulfosuccinate) in breeding and resting water for mosquitos in a lab setting.
- Results reported, when a mosquito comes in contact with surfactant-treated water, the mosquitos are not able to stick to the wall and are quickly knocked down. Further, if the surfactant treated water on the body of the mosquito or the wing, either they are not able to fly, or their flight pattern gets hampered. The study also reported that at higher concentrations, surfactants are even capable of directly knocking down the mosquitos.
- This approach is aimed at limiting the mosquito to find the host and mating partner.
- At a community level such chemicals could be spread to resting water bodies as the primary level of prevention. However, the safety of consuming that water needs further research.

## 4. Does COVID-19 lockdowns have impacted on global dengue burden? A special focus to India [REVIEW & META-ANALYSIS]

Sharma H, Ilyas A, Chowdhury A, Poddar NK, Chaudhary AA, Shilbayeh SA, Ibrahim AA, Khan S. Does COVID-19 lockdowns have impacted on global dengue burden? A special focus to India. BMC Public Health. 2022 Jul 22;22(1):1402.

This study aims to assess the prevalence of adverse mental health symptoms among individuals diagnosed with acute COVID-19 in the general population of six developed nations.

- The study provides evidence that the reduction in human mobility and economic activities during lockdowns can cause a decline in the transmission of dengue. The study highlights the potential benefits of COVID-19 lockdowns in controlling dengue and emphasizes the need for continued efforts to control dengue, particularly in regions where the reduction in cases during the lockdown period was minimal.
- PRISMA methodology adopted and a systematic search was conducted on multiple databases (namely Medline, Pubmed, PAHO, WHO, CDC, etc.). In this meta-analysis, the researchers compared dengue incidence during the lockdown period with the same period in the previous year in India and globally.
- India showed a similar trend, with a significant reduction in dengue cases during the lockdown period compared to the previous year. The reduction in dengue cases during the lockdown period was attributed to a decrease in human mobility and economic activities that reduced the transmission of dengue. The study also found that the reduction in dengue cases during the lockdown period was not uniform across India, with some regions showing a greater reduction than others.
- The statistical association revealed an inverse association between lockdown duration and dengue incidence.

## 5. Lessons Learned from the Japanese Encephalitis Vaccine Introduction in India That Supported the Introduction of Ivermectin–Diethylcarbamazine–Albendazole for Lymphatic Filariasis Elimination [NARRATIVE & POLICY REVIEW]

Ghosh RS, Haldar P, Jacobson J. Lessons learned from the Japanese encephalitis vaccine introduction in India that supported the introduction of ivermectin–diethylcarbamazine–albendazole for lymphatic filariasis elimination. The American Journal of Tropical Medicine and Hygiene. 2022 May;106(5 Suppl):48.

- The study discusses how the successful introduction of the Japanese Encephalitis (JE) vaccine in India provided important lessons that supported the introduction of other public health interventions such as mass drug administration (MDA) for lymphatic filariasis elimination.
- These lessons include the importance of strong partnerships, effective communication strategies, community engagement, and a strong monitoring and evaluation system to measure impact and identify potential issues.
- The article emphasizes the importance of political will and financial commitment in supporting the introduction of new public health interventions. The researchers suggest that a sustained effort is required to secure the necessary resources for the successful implementation of MDA for lymphatic filariasis elimination.
- The study emphasizes the importance of involving communities and engaging with them to build trust, address concerns, and improve acceptance and uptake of interventions.

## 6. Malaria Vaccines: Progress to Date [NARRATIVE REVIEW]

Stanisic DI, Good MF. Malaria Vaccines: Progress to Date. BioDrugs. 2023 Nov;37(6):737-56.

- The article discusses challenges in developing an effective malaria vaccine, attributing the difficulty to factors like the complexity of the parasite's life cycle, stage-specific immune response targets, and the parasite's ability to evade the human immune system.
- Authors illuminated numerous challenges in the clinical evaluation of malaria vaccination. These encompass the intricate nature of vaccine evaluation, the constraint of limited sample size in CHMI studies, the variability in endpoints for pre-erythrocytic and blood-stage vaccine candidates, and the potential influence of pre-existing immunity in malaria-endemic areas. These challenges collectively underscore the complexity of developing and assessing malaria vaccines, urging a nuanced approach to address these intricate issues.
- The authors also discuss the potential of various types of vaccines in malaria prevention and the challenges associated with each type of vaccination, such as asexual blood-stage vaccine challenges, which include selecting appropriate antigens and facing antigen production difficulties.
- Similarly, for sub-unit vaccines, challenges involve the identification of invariant, biologically relevant proteins with non-redundant functions, utilizing a multi-allelic/multi-protein vaccine approach, and identifying and using new adjuvants to maximize the induction and persistence of high-titer antibodies.

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# Queriosity

*Compelling Questions asked by the readers*

**Can 'Scientification' of Traditional or ethno- Medicine be the answer for Malaria control? What are the impediments in implementing such initiatives in India?**

*[Dr Yeshwant Sonnathi, Student, Master of Public Health (Implementation Science) Cohort 1, IIHMR University]*

While traditional medicine is practiced and passed on through generations mostly through oral traditions, ethnomedicine has a greater scientific dimension and extends beyond just the practice of traditional remedies to cross cultural comparisons of the diseases, illness, terminologies, social adaptation. Not going into the intricacies, for this context we are using the term traditional medicine to denote them collectively. Scientification of traditional medicine is one of the avenues which must be promoted. There is no doubt that traditional remedies and herbal ingredients used therein have the potential to unlock many potent active principles which might be very effective in treating diseases. It is worth mentioning that close to 25% of modern medicines have descended from plants that were first used traditionally.

Extraction of highly potent antimalarial Artemesinin from the Chinese herb Artemisia annua in 1967, extraction of another antimalarial drug quinine from Cinchona bark in 1820 and extraction of potent anticancer drugs Vincristine and Vinblastin from Vinca Rosea are classic examples of the treasures within the traditional remedies.

Once such active principles are isolated and characterized, it opens a whole new avenue of group of molecules with more and more refined properties and efficacy. This is again showcased by the artemisinin derivatives which stemmed from the original isolation of artemisinin. Ironically though, deeply established traditions and rituals which are integral to the practice of traditional medicine augment the aura and mystique of such treatments at the expense of becoming empiric and stopping short of discovering the active molecules.

There is an urgent need to promote robust research in traditional medicine and alternative systems of medicine to generate new knowledge, which is credible, actionable and high on the strength of evidence. The major challenge is to break to confines to extend the boundaries of traditional wisdom and knowledge and integrate it with more research.

There are many opportunities to explore this in India. Ministry of Ayush, Government of India has been promoting research in Traditional and Alternative systems of Medicine. Recently, in March 2024, AYUSH-ICMR Advanced Centre for Integrated Health Research has been launched at AIIMS, under which 5 Advanced Centers for Integrative Health Research (Gastro-intestinal Disorders , Women and Child Health , Geriatric Health -at two Institutes and Cancer Care) will be functional at 4 designated AIIMS ( AIIMS Delhi, AIIMS Jodhpur, AIIMS Nagpur and AIIMS Rishikesh). These initiatives are a welcome step towards more systematic generation of evidence which can pave way for effective discovery and characterization of active principles in future.

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# जिज्ञासा

## पाठकों द्वारा पूछे गए रोचक सवाल

### क्या मलेरिया का नियंत्रण पारम्परिक चिकित्सा अथवा नृजाति चिकित्साविज्ञान (एथनोमेडिसिन) के वैज्ञानिकीकरण में निहित है ? भारत में इस तरह की पहलों के क्रियान्वयन में क्या बाधायें हैं ?

(डॉ. यशवंत सोन्नति , एमपीएच (इम्प्लीमेंटेशन साइंस) प्रथम कोहॉर्ट छात्र, आई आई एच एम आर विश्वविद्यालय, भारत)

अगर हम शुरुआत इन दो शब्दों के संक्षिप्त वर्णन से करें तो उपयुक्त होगा। पारम्परिक चिकित्सा पद्धतियाँ जहाँ पीढ़ी दर पीढ़ी प्रयोग तथा मुँह बोली जानकारी के आदान प्रदान से चलती आई है , नृजाति चिकित्साविज्ञान (एथनोमेडिसिन) का एक अतिरिक्त वैज्ञानिक पहलू भी है जिसमे पारम्परिक दवाओं के प्रयोग से कहीं बढ़कर अलग अलग समाज व संस्कृति में प्रचलित इलाज की तुलना , बीमारियों , शब्दावलियों तथा सामाजिक अनुरूपन का भी अध्ययन और शोध शामिल है। दोनों विषयक्षेत्रों की बारीकियों में न जाते हुए वर्तमान संवाद में हम 'पारम्परिक चिकित्सा' शब्द का उपयोग यहाँ पर इन दोनों को सामूहिक तौर पर सम्बोधित करने के लिए करेंगे। पारम्परिक चिकित्सा का वैज्ञानिकीकरण एक ऐसा पहलू है जिसे निश्चित रूप से बढ़ावा दिया जाना चाहिए। निःसंदेह पारम्परिक उपचार और इनमे उपयोग में लाई जाने वाली औषधीय जड़ी बूटियों में कई ऐसे सक्रिय रसायन होंगे, जो अनेक बीमारियों के सफल इलाज की कुंजी साबित हो सकते हैं। यहाँ यह जिक्र करना उचित होगा कि आधुनिक चिकित्सा में उपयोग में लाई जाने वाली लगभग 25 दवाओं का उद्भव पारम्परिक जड़ी बूटियां ही रहीं हैं।

1967 में चीनी जड़ी बूटी आर्टिमिसिया अन्नुआ से आर्टीमिसिनिन नामक अत्यंत असरकारक मलेरिया रोधी दवा की प्राप्ति, 1820 में सिन्कोना नामक पेड़ से मलेरिया की चर्चित दवा कुनीन को गुणवर्णन और चिन्हित कर उपयोग हेतु निकाल पाना तथा विंका रोसिया (सदाबहार ) नामक सुलभ रूप से उगने वाले पौधे में से विनक्रिस्टिन एवं विनब्लास्टिन नामक शक्तिशाली कैन्सर रोधी दवाओं का आविष्कार पारम्परिक चिकित्सा पद्धतियों में छिपे इस खजाने के उत्कृष्ट उदाहरण हैं।

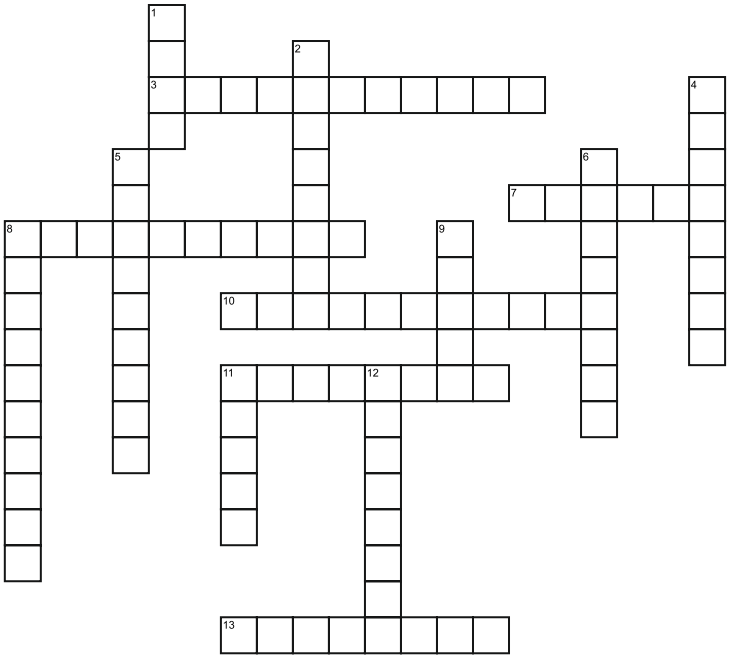
एक रोचक पहलू यह भी है कि एक बार किसी ऐसे सक्रिय रसायन अथवा अणु की खोज और गुणवर्णन की प्रक्रिया होने पर उससे मिलते-जुलते अनेक अणुओं पर अन्वेषण तथा सृजन की संभावना खुल जाती है और हमें और प्रभावशाली अथवा कम दुष्प्रभाव वाली नई दवाएँ बनाने का अवसर मिल जाता है। इसका उदाहरण अनेक आर्टीमिसिनिन यौगिक हैं जो कि आर्टीमिसिनिन को पहली बार जड़ी बूटी से निकालने के बाद हुए शोध में बनाये गए तथा आज मलेरिया के इलाज में सबसे असरकारक दवाओं में शामिल है।

लेकिन यह एक विडम्बना है कि गहन और स्थापित परम्पराएं तथा रीति रिवाज, जो कि पारम्परिक चिकित्सा का अभिन्न अंग है, इन पद्धत्तियों को अद्भुत तथा तिलिस्मी आवरण भी प्रदान करतीं हैं। इस वजह से ये पद्धतियाँ अनुभववादी बन कर रह जाती हैं और उनकी रीतियों और परम्पराओं के आगे शोध और सवाल करने का अवसर कम होता है। पारम्परिक तथा वैकल्पिक चिकित्सा पद्धत्तियो के क्षेत्र में ठोस एवं व्यवस्थित शोध की अत्यंत आवश्यकता है जिससे इन क्षेत्रों में नई जानकारी और ज्ञान का सृजन हो सके जो कि विश्वसनीय, काम में लाने योग्य और प्रामाणिक हो। मुख्य चुनौती है रीतियों के बंधन से निकल कर अनुसंधान को बढ़ावा देना , जिससे पारम्परिक बुद्धिमत्ता और ज्ञान की सीमाओं को बढ़ा कर हम नया ज्ञान अर्जित कर पाएं।

भारत में इसके कई अवसर हैं। आयुष मंत्रालय, भारत सरकार पारम्परिक और वैकल्पिक चिकित्सा पद्धत्तियों में शोध को प्रोत्साहित करता रहा है। हाल ही में मार्च 2024 में आयुष - आई सी एम आर अडवांस्ड सेंटर फॉर इंटीग्रेटेड हेल्थ रिसर्च की शुरुआत AIIMS में की गई है , जिसके अंतर्गत 5 उन्नत सेंटरों (उदर सम्बन्धी रोग , महिला एवं बाल स्वास्थ्य , वृद्ध जनस्वास्थ्य - 2 सेंटरों पर, तथा कैंसर सेवा एवं देखभाल ) स्थापना 4 AIIMS संस्थानों (दिल्ली, जोधपुर,नागपुर, तथा ऋषिकेश ) में की जायेगी। ये पहल निश्चित रूप से व्यवस्थित शोध और आंकड़े जमा करने की ओर एक शुरुआती कदम है जिससे आगे चलकर हम प्रभावी रसायन और दवाओं के आविष्कार और गुणवर्णन करने के रास्ते खोल पाएंगे और न सिर्फ मलेरिया अपितु अन्य कई बीमारियों के इलाज में भी महत्वपूर्ण उपलब्धियाँ हासिल कर सकेंगे।

# LogPHRAME

## *The PHRAME Crossword #3*



Get, Set and Fill UP!
PHRAME brings you a stimulating crossword , themed on Vector borne diseases in this issue. Use the clues for filling up the grid in "across" and "down" boxes provided to complete the words . You may send us the scanned copy of the completed crossword (digital or Print editions) by mailing us on phrame@iihmr.edu.in ; putting your Name / contact details. We'll publish the names of all readers who send in the correct entries !

### CLUES

**Across**

3. The term Dengue originated from this Swahili phrase _ _ -_ _ _ _ _ _ _ _ _ (2,5,4)
7. Transmi ed by the bite of infected Fleas, this bacterial disease was a scourge killing millions of people around the globe till the advent of antibiotics and remains a threat for reemergence even today. (6)
8. This Swiss scientist received the Nobel prize for discovering an insecticide which was a major turning point in Malaria control.(4,6)
10. This arboviral disease transmitted by aedes mosquito causes severe joint pain and fever with consequent long standing arthritis like complications. (11)
11. The mite larvae which transmit the causative organism of scrub typhus are commonly known as _ _ _ _ _ _ _ _ (8)
13. _ _ _ _ _ _ _ _ Forest Disease is a tick borne haemorrhagic fever native to southern parts of India. (8)

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**Down**

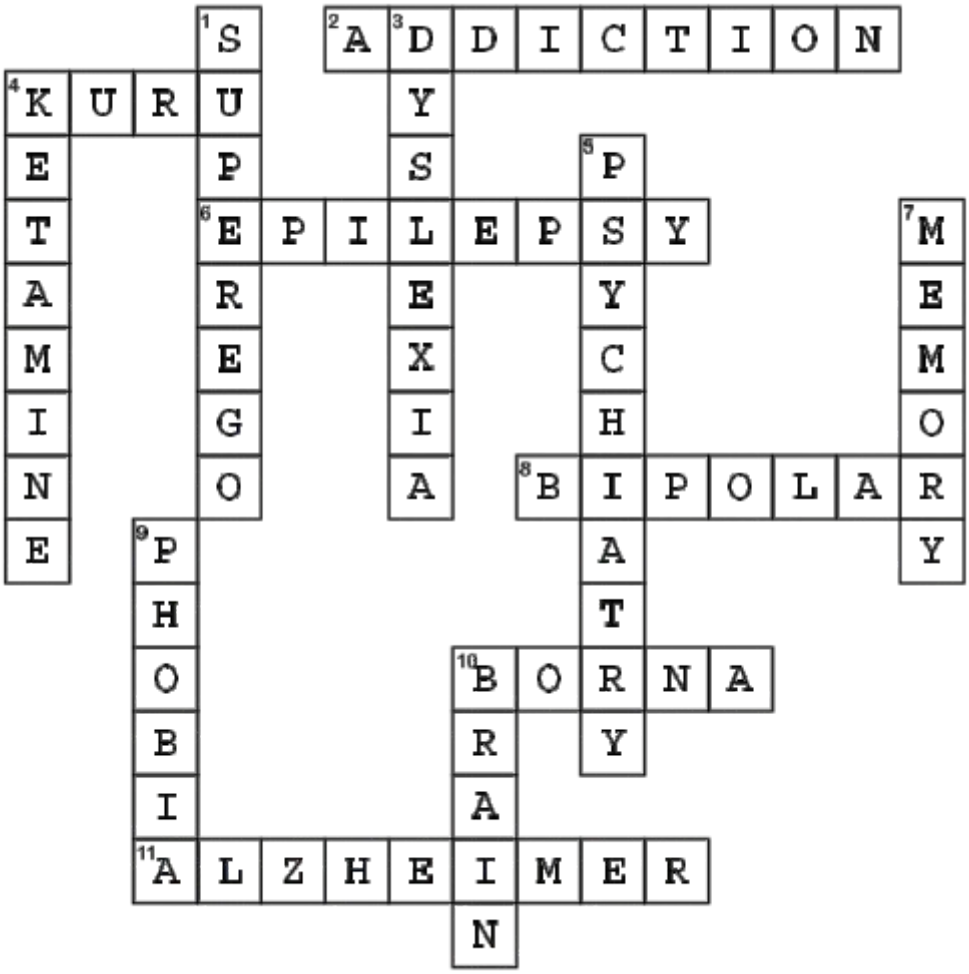
1. Named after a forest in Uganda, this virus can cause Birth defects in the developing child if infection occurs in pregnancy.(4)
2. Plasmodium _ _ _ _ _ _ _ Parasite causing malaria in primates , now recognized as the fifth species of importance in humans. (8)
4. This larvicide is used to prevent mosquito breeding in drinking water. (8)
5. Name this bacterium which prevents dengue transmission by mosquitoes infected with it.(9)
6. Sand fly is a vector for this disease known commonly as _ _ _ _ _ _ _ _ (4,4)
8. Dried flowers of Chysanthemum yield this powerful class insecticides, used in vector control. (10)
9. Aedes mosquito is popularly known as _ _ _ _ _mosquito.
11. Vector for Filariasis is _ _ _ _ _ mosquito. (5)
12. This fish is the most widely used biological agent for malaria control. (8)

Name ----------

Contact No. ----------

Email ----------

## *PHRAME Crossword #2 solution :*




Winners out of tons of responses from our readers, three winners are randomly selected.


**Ms. Snigdha Pareek**
Clinical Psychologist
Jaipur

**Mr. Paras Kumar**
IT Assistant
IIHMR University, Jaipur

**Ms. Jewel Jenifer Noronha**
Business Analyst
Unthinkable Solution, Gurgaon

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# Public Health Hall of Fame

## Sir Ronald Ross

*In every issue we select a personality who has made outstanding contribution to the area of public health related to the theme. This is our tribute to remember the pioneering efforts of these legends who excelled in their disciplines.*

Presented by : Dr Vinod Kumar SV

Sir Ronald Ross, KCB, KCMG, FRS, FRCS; was a British Medical Doctor. He was born in Almora, India in 1857. He was the eldest among ten children born to the family of Sir CG Ross, a general in the Indian Army and Matilda Charlotte Elderton. He was sent to England to pursue studies from very early age and he completed his basic education from there. Ross had interest in Arts and was passionate for poetry, music, literature and mathematics. He won may awards and recognition during his studies for Mathematics as well as drawing and poetry.

Ross wanted to be a writer but his father wished him to join the Indian Medical Service. So he studied medicine from St. Bartholomew's Hospital Medical College, London and cleared the examination of for the Royal College of Surgeons of England in 1879. He entered Indian Medical Service in 1881. Most of his time was devoted to the military duties and during his tenure he was stationed at many places across the country and nearby countries, Including Madras, Mysore, Vizinagaram, Baluchistan, and Berhampur. He took part in the Burma War and also served in the Andamans.. Around this time Ross became interested in Malaria but the earlier papers indicate the limitation of not having seen the causative agent of malaria although it was over a decade since the malaria parasite had been discovered by Laveran in 1880. He obtained a year of furlough leave in 1888 and returned to England and completed a Diploma in Public Health.

After a service of 12 years , in 1893 he attained the rank of Surgeon Major but there was still no indication of the phenomenal contribution he would eventually make in the field of Public Health. His second leave during 1894 marked a turning point. He approached Alfredo Kanthack, a Brazilian-born microbiologist and pathologist who worked in England. Kanthack suggested Ross to meet Sir Patrick Manson. Sir Patrick Manson, GCMG, FRS was a Scottish physician is considered the founder of the discipline of tropical medicine and had made important discoveries in parasitology and had made remarkable contributions to research on filariasis.

It was Manson who showed Ross the Blood films containing malaria parasites. This was the first time Ross saw them. Staining the malaria parasites was demonstrated to Ross by Kanthack. Manson could be considered as the primary mentor of Sir Ronald Ross. He fired the passion as well as the ambition in Ross to unravel the mystery of the etiology of Malaria. Manson in fact did meticulous observations during his work on Filaria, doing experiments on his gardener, Hin Lo, who was infected with filaria. He was a firm believer in mosquito-malaria theory which suggested that the agent that causes malaria is spread by mosquitoes. Manson published an article in the British Medical Journal in 1894 titled 'On the Nature and Significance

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of The Crescentic and Flagellated bodies in Malarial Blood'. Manson states, "the mosquito, having been shown to be the agent by which the filaria is removed from the human blood vessels, this or similar suctorial agent must be the agent which removes from the human blood vessels those forms of the malaria organism which are destined to continue the existence of this organism outside the body."

Manson also encouraged Ross to continue his research in countries like India, because of the abundance of Mosquitoes. Ross retuned to India with the determination to solve the enigma. The ensuing correspondence between the Manson and Ross is documented as one of the most legendary collaborations in the history of medicine. The compilation on the conversations is available in published form. Ross returned to India in 1895 and continued his work on Malaria ,balancing with his regimental duties. Ross tried his luck with feeding mosquitoes on Malaria Patients and then dissecting the mosquitoes to study for malarial parasites. His work on dissections of mosquitoes freshly fed on human patients did reveal lot of transformation in the parasite which led him to communicate to Manson in 1896 that he is increasingly starting to believe that the malaria is transmitted by mosquito bites.

He worked with the parasites of Malignant Malaria (Falciparum). On 20 Aug 1897 he was able to feed some mosquitoes on blood of a malarious patient and successfully demonstrate pigmented cysts in the mosquito 4 days after its blood meal. He also captured various changes in the morphology of the malaria parasite. Owing to the difficulties in convincing as well as getting malaria cases for fed mosquito experiments, Ross shifted his research onto malaria in birds , mainly sparrows and larks. It was in birds that Ross did many infection experiments using mosquitoes and demonstrated the transmission of Malaria. The results of Ross's classical work were presented by Manson in meeting of the British Medical Association at Edinburg on 24 Jul 1898. In 1902, Ronald Ross was awarded the Nobel Prize in Physiology or Medicine in recognition of his work to elucidate the life cycle of plasmodium. He was the first British to receive the coveted prize.

Ross's professional life and work had lots of ups and downs and was never without controversies. There were critics who questioned the scientific rigour of his observations and in particular mention must be made of the contemporary work of Battista Grassi , Professor of Zoology at Catania. Grassi did some pioneering work on proving connection of Anopheles mosquito in malaria transmission around the same time when Ross was establishing the role of mosquitoes as vector of the disease . Grassi was a qualified zoologist and had a more scientific approach while Ross was a meticulous observer and very persistent and brilliant documentation. There was a fierce debate with both claiming the priority of their work . Ross should be credited to have first identified mosquito as the vector for transmitting malaria which he mentioned as “the Grey mosquito with dappled wings”. Grassi on the other hand did more scientific research and identified Anopheles as the vector and also proved the transmission to a human volunteer. The Nobel committee however, finally decided the prize in favour of Ross.

The dispute between the two personalities highlights drive for personal ambition, quest for academic and national limelight which undermine the long term scientific interests. Eventually although Grassi never got the Nobel Prise, the scientific community recognizes the pioneering efforts of both men in furthering the research on Malaria. Their works also gives us many important learnings – Firstly seizing the opportunity at the very outset, second persistence and perseverance : although Ross was ridiculed and commented lighly upon many times by his colleagues , 'Malaria Ross' continued his work despite thousands of mosquito dissection not revealing any findings until he struck success and finally meticulous observation, discipline and recording of findings which both Ross and Grassi did to stimulate the debate as well as generate interest of the scientific community for furtherance of research in the area.

August 20 is observed as Mosquito Day to commemorate the discovery of malarial parasite's developmental stages in the gut of mosquito by Ross. He was knighted in 1911. Sir Ronald Ross became the first director of Ross Institute and Hospital for Tropical Diseases was opened in 1926 on Putney Heath by the Prince of Wales. Ross died on 16 Sept 1932 after prolonged illness and an attack of acute asthma.

Sir Ronald Ross was not only a Physician but a polymath being a multitalented personality. He was considered very strong and forceful to drive his ideas but at the same time he was a gifted poet, novelist, mathematician and songwriter!

***To commemorate the eureka moment on the day he observed the parasites in gut of the mosquito Ross penned down this poem :***

*"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?"*

References:
The beast in the mosquito: the correspondence of Ronald Ross and Patrick Manson. Clio Med. 1998;51:II-XXXV, 1-528.

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# पब्लिक हेल्थ हॉल ऑफ फेम

## सर रोनाल्ड रॉस

प्रत्येक अंक में हम एक ऐसे व्यक्तित्व का चयन करते हैं जिसने विषय से संबंधित सार्वजनिक स्वास्थ्य के क्षेत्र में उत्कृष्ट योगदान दिया हो। यह उन दिग्गजों के अग्रणी प्रयासों को याद करने के लिए हमारी श्रद्धांजलि है जिन्होंने अपने विषयों में उत्कृष्ट प्रदर्शन किया।

हिंदी रूपांतर एवं प्रस्तुति: डॉ विनोद कुमार एस वी

सर रोनाल्ड रॉस , एक ब्रिटिश चिकित्सक थे। उनका जन्म 1857 में भारत के अल्मोड़ा शहर में हुआ। पिता सर सी जी रॉस और माँ माटिल्डा शरोलेट एल्डेर्टोन के दस बच्चों में वे सबसे बड़े थे। उनके पिता भारतीय सेना में जनरल थे। रोनाल्ड को बचपन में ही पढाई के लिए इंग्लैंड भेज दिया गया , जहाँ से उन्होंने अपनी बुनियादी शिक्षा ली। रॉस का शुरू से कला की तरफ गहरा रुझान रहा। शिक्षा के दौरान उन्होंने गणित ,चित्रकला और कविता में अनेक उपलब्धियाँ हासिल कीं।

रॉस एक लेखक बनना चाहते थे पर पिता की इच्छा थी की वे इंडियन मेडिकल सर्विस में चिकित्सक बनें। अत: रॉस ने सेंट बार्थोलोम्यु अस्पताल और मेडिकल कॉलेज लंदन से मेडिसिन की पढाई की और 1879 में रॉयल कॉलेज ऑफ़ सर्जन्स , इंग्लैंड की परीक्षा उत्तीर्ण कर 1881 में आर्मी की इंडियन मेडिकल सर्विस से जुड़ गए। यहाँ उनका अधिकतर समय सेना के कार्यों में गुजरता और इस दौरान उनकी तैनाती भारत और पडोसी देशों के कई शहरों में रही जिनमे मद्रास , मैसूर , विज़िनगरम , बलूचिस्तान और बरहामपुर प्रमुख थे। रॉस ने बर्मा युद्ध में भाग लिया और अंडमान में भी उनकी नियुक्ति रही।

इसी समय रॉस की रूचि मलेरिया में होने लगी, हालांकि उनके शुरुआती शोध पत्रों में उनके मलेरिया जीवाणु को अपने से देखने का अनुभव न होने का परिपेक्ष्य झलकता है। ज्ञात हो कि इस समय मलेरिया जीवाणु यानी प्लाज़्मोडियम की अलफ़ॉन्ज़ो लेवरान 1880 द्वारा खोज हुए करीब दस वर्ष बीत चुके थे। इस बीच 1880 में रॉस ने एक वर्ष की छुट्टी ली और इंग्लैंड जाकर डिप्लोमा इन पब्लिक हैल्थ कर लिया।

1893 में रॉस ने आर्मी डाक्टर के रूप 12 वर्ष की नौकरी के बाद सर्जन मेजर की रैंक हासिल कर ली, लेकिन अभी तक जनस्वास्थ्य के क्षेत्र में उनके द्वारा होने वाले अविस्मरणीय और अभूतपूर्व योगदान के कोई संकेत नहीं थे !1894 में उन्होंने एक बार फिर से छुट्टी ली। यह उनके जीवन का निर्णायक समय साबित होने वाला था। इंग्लैंड जाकर वे अल्फ्रेडो केंथाक से मिले , जो कि ब्राजीलियाई मूल के माइक्रोबिओलॉजिस्ट (सूक्ष्म जीव विज्ञानी ) और पैथोलॉजिस्ट ( विकृति विज्ञानी) थे। केंथाक ने रॉस को सर पैट्रिक मैनसन से मिलने की सलाह दी। सर पैट्रिक मैनसन , GCMG , FRS स्कॉटलैंड मूल के चिकित्सक थे जिन्हें ट्रॉपिकल मेडिसिन का जनक माना जाता था और उन्होंने फ़ाइलेरिया (हाथीपाँव ) रोग पर उल्लेखनीय शोधकार्य किया था तथा पैरासाइटोलॉजी (परजीवीविज्ञान ) के क्षेत्र में कई खोज और उपलब्धियाँ उनके नाम थीं।

मैनसन ने ही रॉस को मलेरिया परजीवी युक्त रक्त पट्टिकाएं (ब्लड स्लाइड ) पहली बार दिखाई। मलेरिया परजीवी को स्टैन करना (रंगना ताकि वह माइक्रोस्कोप में आसानी से दिख सके) उन्हें केंथाक ने सिखाया। वास्तव में मैनसन को रॉस का मुख्य मेंटर (मार्गदर्शक ) कहा जा सकता है। मैनसन ने ही रॉस में मलेरिया के मूल कारण की खोज करने का जूनून और

महत्वाकांक्षा जगाई। दरअसल मैनसन ने फ़ाइलेरिया पर अपने कार्य के दौरान अपने बागबान पर अत्यंत बारीक अन्वेषण करे जो की इस बीमारी से ग्रस्त था। मैनसन को दृढ़ विश्वास था कि मच्छर की मलेरिया फैलाने में अहम भूमिका है।

मैनसन ने रॉस को भारत जैसे देशों में अपना शोध जारी रखने को प्रेरित किया क्योकिं यहाँ मच्छरों का बाहुल्य है। इस गुत्थी को सुलझाने के दृढ़ निश्चय के साथ रॉस भारत लौटे। 1895 में रॉस भारत वापस आये और लगातार पत्राचार के द्वारा मैनसन से जुड़े रहे। यह पत्राचार संकलन के रूप में उपलब्ध है और चिकित्सा विज्ञानं के चर्चित संवादों में शामिल है। इस दौरान रॉस से अपनी नौकरी और शोध में संतुलन बैठाने का प्रयास किया और समय मिलने पर मलेरिया पर अपना काम जारी रखा। इस दौरान रॉस ने मच्छरों को मलेरिया के मरीजों का रक्तपान करा कर ऐसे मच्छरों का विच्छेदन कर मलेरिया परजीवियों को देखने के लिए सूक्ष्म परिक्षण करना प्रारम्भ किया। इस कार्य से रॉस को मलेरिया परजीवी के मच्छरों के शरीर में होने वाले विकास और बदलावों के बारे में बहुत जानकारी मिली जिसे उन्होंने 1896 में मैनसन को पत्राचार से सूचित किया। अब उनका यह विश्वास गहराने लगा कि मलेरिया मच्छर के काटने से फैलता है।

रॉस ने अब मलिग्नैंट मलेरिया (फाल्सीपेरम मलेरिया) के परजीवी के साथ अन्वेषण शुरू किया। साथ ही रक्तपान के तुरंत बाद विच्छेदित कर परीक्षण के बजाय कुछ दिन के अंतराल पर इन मच्छरों का अन्वेषण प्रारम्भ किया। 20 अगस्त 1897 को रॉस ने एक मलेरिया के मरीज पर कुछ मच्छरों का रक्तपान करा कर उन्हें 4 दिन पश्चात विच्छेदित किया और उनके अंदर मलेरिया परजीवी की संरचना में बदलाव और विकास की अवस्थाओं का पता लगाया। मच्छरों का मरीजों पर रक्तपान करा कर उनका अवलोकन करना आसान नहीं था। इस कारण रॉस ने शोध की दिशा पक्षियों की तरफ मोड़ दी। पक्षियों में भी मलेरिया परजीवी संक्रमण करते है हालांकि इन परजीवियों की प्रजाति इंसानों की प्रजातियों से अलग होती हैं। पक्षियों में रॉस ने अनेक संक्रमण प्रदर्शित करने वाले प्रयोग किये और मच्छरों द्वारा मलेरिया संक्रमण को साबित किया।

रॉस के इस उत्कृष्ट कार्य को मैनसन ने 24 जुलाई 1898 में एडिनबर्ग में आयोजित ब्रिटिश मेडिकल एसोसिएशन की बैठक में प्रस्तुत किया। 1902 में रोनाल्ड रॉस को इस उत्कृष्ट कार्य के लिए चिकित्सा विज्ञान के क्षेत्र में नोबेल पुरस्कार से सम्मानित किया गया। वे इस प्रतिष्ठित पुरस्कार को पाने वाले पहले ब्रिटिश नागरिक बने।

रॉस का पेशेवर जीवन उतार चढ़ाव से भरा रहा और अनेक विवादों से भी वे घिरे रहे। उनके कई आलोचकों ने उनके प्रयोगों और विश्लेषणों की वैज्ञानिक वैधता पर सवाल उठाये। विशेष रूप से उनके समकालीन इटैलियन बतिस्ता ग्रासी के बारे में यहाँ बताना अनिवार्य है। बतिस्ता ग्रासी इटली के कटानिया में जीव विज्ञान के आचार्य थे। रॉस ने जब अपना शोध कार्य किया लगभग उसी समय ग्रासी ने भी मलेरिया के संचरण में एनोफेलीज मच्छरों की भूमिका पर अग्रणी स्तर पर अन्वेषण किया था। ग्रासी एक कुशल जीवविज्ञानी थे जिन्होंने अपने शोध में मानक वैज्ञानिक दृष्टिकोण अपनाया जबकि रॉस एक उत्कृष्ट प्रेक्षक थे जिसकी दृढ़ता और प्रलेखन (डाक्यूमेंटेशन) अतिउत्तम था।

नोबेल पुरस्कार के सन्दर्भ में दोनों में बहुत गहन विवाद हुआ, कि किसने वास्तव में मलेरिया संचरण की गुत्थी सुलझाई। रॉस को इस बात का श्रेय तो जाना ही चाहिए कि उन्होंने सबसे पहले अपने अवलोकन से मच्छर को मलेरिया फ़ैलाने वाले माध्यम के रूप में प्रस्तावित किया और कई प्रयोगों से इसके सबूत भी पेश किये। इस दौरान उन्होंने इस मच्छर का ब्यौरा 'स्लेटी / ग्रे रंग का और चितकबरे पंख वाले मच्छर' के रूप में दिया। दूसरी तरफ ग्रासी ने बेहतर वैज्ञानिक दृष्टिकोण अपनाते हुए एनोफेलीज प्रजाति के मादा मच्छर की मलेरिया के वेक्टर के रूप में पहचान की और एक इंसान में इसके संचरण के प्रदर्शित भी किया। नोबेल कमिटी ने अंतत: रोनाल्ड रॉस के योगदान को पहला और महत्वपूर्ण मानते हुए नोबेल पुरस्कार के लिए उन्हें चुना।

इन दो व्यक्तित्वों के बीच हुआ विवाद व्यक्तिगत महत्वाकांक्षा एवं शैक्षिक तथा राष्ट्रीय स्तर पर ख्याति की चाह का इंसानी परिपेक्ष्य में एक तीव्र प्रेरक शक्ति के रूप में उभरना दर्शाता है ; जिससे वैज्ञानिक प्रगति पर नकारात्मक प्रभाव पड़ता है। अंतत: बतिस्ता ग्रासी को नोबेल पुरस्कार तो नहीं मिला लेकिन वैज्ञानिक समुदाय दोनों वैज्ञानिकों के मलेरिया शोध के क्षेत्र में अभूतपूर्व योगदान को कृतज्ञता से याद रखेगा। इन दोनों का काम हमें कई सीख देता है। पहला , मौके को बिना गवाएं हासिल करना , दूसरा दृढ़ता और विफलताओं के बावजूद डटे रहना। रॉस के कई आलोचक थे , लेकिन 'मलेरिया रॉस' जैसे टाइटल के बावजूद वे अपने काम पर डटे रहे और तीसरा अत्यंत गहन विश्लेषण , अनुशासन और अभिलेखन जिसमे रॉस और ग्रासी दोनों परिपक्व थे , जिससे वैज्ञानिक समुदाय में उन्होंने इस विषय पर रूचि और संवाद पैदा किया।

# Innerspace

## *VECTOR BORNE DISEASE*

Dr. Muskan Jaswal

*Vector borne disease spread with ease,*
*Through the bite of mosquitoes and the ticks,*
*Bloodsucking creatures small and grand,*
*Spread the disease with a bite by chance.*

*Dengue, malaria and zika have afflicted the population,*
*Other diseases can cause chronic sufferings and condemnation,*
*Prevention is the key to keep them at bay,*
*Use repellants and nets to keep them away.*

*But it's not just these pests we must beware,*
*Climate changes can make it severe,*
*With more and more people at risk every year,*
*Let's join hands to keep a check and fight without fear.*

*Vector borne disease are threat to all,*
*So spread awareness to make the number fall,*
*Protect our families and our community,*
*Let's work together to gain the immunity*

Second Year Student: MBA Hospital and Health Management, IIHMR University, Jaipur

# ON A MISSION ....

## Master of Public Health (MPH) Program

at IIHMR University in cooperation with Johns Hopkins University

Those who aspire to become true leaders in Public Health must join this unique program which brings the very special blend of Johns Hopkins excellence in Public Health and IIHMR University's pioneering experience in the field of Health and Hospital management. This is a very special cooperative program delivered by the Johns Hopkins Bloomberg School of Public Health in cooperation with IIHMR University. As part of a full time two year's Masters Degree program the Students spend one year on IIHMR University Campus taking in person lectures, as well as online lectures delivered by the Johns Hopkins Faculty alongside with interactive Labs, quizzes , assignments and presentations which define a truly rigorous coursework found in very few such programs. The students also get to visit Johns Hopkins University at Maryland USA for two weeks to attend the Summer School to earn credits for a couple of scheduled courses at the Bloomberg School of Public Health as part of this curriculum. The second year is spent in a field oriented practicum experience in which the students engage in hands on experience completing a field assignment with research and field work related to public health.

The program is specially designed to cater to aspirants from Southeast Asia and is offered at one third of the actual tuition at Johns Hopkins.

The core competencies of this program extend much beyond the basic core subjects and focus on developing the persona of the aspirant to groom them as true public health leaders adept with theoretical knowledge, communication as well as crucial attributes which give an edge in public health like leadership, management, team work, community engagement and negotiation skills.

The students of this program are inducted into the Johns Hopkins alumni group with more than 27000 alumni which opens a vast avenue of public health career and networking opportunities. The alumni of this elite program are bringing laurels to the institution with their eminent contributions in prestigious organizations across the world.

If you have a flair for Public Health, you wont want to miss the opportunity to know more about this program. Visit the website on this link https://mph.iihmr.edu.in/or scan the QR code.

# Our Alumni - Our Pride

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# Our Alumni - Our Pride

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| 2 | I | Dr. Geetanjali Kapoor | One Health Trust, India (formerly CDDEP) | Head |
| 3 | I | Mr. Gowthamghosh B. | Institute of Health Management Research (IIHMR), Bangalore | Assistant Professor |
| 4 | I | Dr. Hemant Sharma | Chief Minister Free Drug and Investigation Scheme, Rajasthan Medical Service Corporation Limited, Jaipur | AGM (Assistant General Manager) |
| 5 | I | Dr. Prasad Bogam | Fortify Health, Pune, Maharashtra, India | Director of Research Monitoring & Evaluation |
| 6 | I | Dr. Prashant Tiwari | Ministry of Health & Family Welfare, India | National Consultant Digital Health, Ayushman Bharat Digital Health Mission (ABDM), National Health Authority (NHA-IQVIA) |
| 7 | I | Dr. Rahul Pathak | Community Medical Center, oms River, New Jersey, United States | Consultant, Cardiac Unit |
| 8 | I | Dr. Richa Sharma | Ocean County Health Department, Toms River, New Jersey, United States | Public Health Epidemiologist |
| 9 | I | Dr. Shubham Maheshwari | Government of Rajasthan | Doctor |
| 10 | I | Dr. Vatsna Rathore | Neuroequilibrium, Rajasthan | Research Consultant |
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# Upcoming Issue

Upcoming issue of PHRAME will focus on loneliness. PHRAME welcomes articles, reviews, updates, creative content including poems, thoughtful essays, sketches, cartoons, paintings related to the theme from interested readers.

You can submit content for publication to us on phrame@iihmr.edu.in

Contributors are requested to refer to guidelines for submissions to PHRAME on the following link:

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**Public Health Round-up on Actions, Measures and Evidence**