

**BROCHURE**

# **Malaria Parasite Bank**

**National *Plasmodium* Repository**



**icmr**  
INDIAN COUNCIL OF  
MEDICAL RESEARCH

**NIMR**  
NATIONAL INSTITUTE OF  
MALARIA RESEARCH

**2023**

website: [www.nimr.org.in](http://www.nimr.org.in)

# National *Plasmodium* Repository

## Malaria Parasite Bank



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## 1. Introduction

Malaria epidemiology in India is complex due to its geographical and ecological diversity. According to the WHO report 2022, India remains the highest contributor of malaria burden in South-East Asia (SEA) region with 79% of reported cases. The two most prevalent species found in India are *Pf* and *Pv*, which are roughly equally distributed here. Other human malaria-causing species such as *P. malariae*, *P. ovale* spp., and *P. knowlesi* exist but are typically neglected due to their low prevalence in the community. Currently, artemisinin-based combination therapy (ACT) is available in India for the treatment of *Pf* infections, while chloroquine (CQ) and primaquine (PQ) are frequently used to treat *Pv* infections.

## 2. The National Institute of Malaria Research (NIMR)

The NIMR is one of the premier institutes under the Indian Council of Medical Research was established in 1977 in response to the increasing burden of malaria in India with mandate on different aspects of malaria research. The institute aims to generate new knowledge, develop new tools and technologies, and provide evidence-based solutions for the prevention and control of malaria in the country through basic, applied, and operational field research.

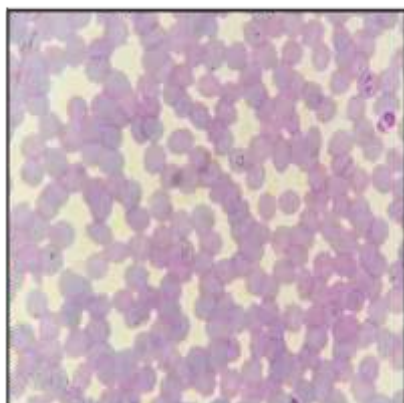
## 3. Malaria Parasite Bank (MPB)

The MPB was initiated and established in 1992 with the financial support of Department of Biotechnology, Ministry of Science and Technology, Government of India; currently it is an intramural activity of the institute. MPB is a repository of

biological materials which collects, maintains, and archives different *Plasmodium* samples collected from different NIMR field units and other geographical regions in the country. It is the first parasite repository in the country with 1500 *Plasmodium* field isolates serves as a resource center for various research institutes and universities in malaria research and maintains human and non-human avian, simian, and rodent plasmodia species.



(A)



(B)

**Figure 1:** (A) - Cryopreservation of malaria parasites in liquid nitrogen.

(B) - *Pf* culture smear showing different asexual blood stages.

### 3.1. Objectives

- To establish a national malaria parasite bank with field isolates at pan-India level.
- To devise a SOP for collection, transportation, culture adaptation and cryopreservation of *Plasmodium* field isolates.
- To culture adapt and characterize parasite field isolates for various molecular markers.
- To perform *in-vitro* antimalarial screening assays.
- Microscopic identification of *Plasmodium* species.
- Hands on training for *in-vitro* techniques.

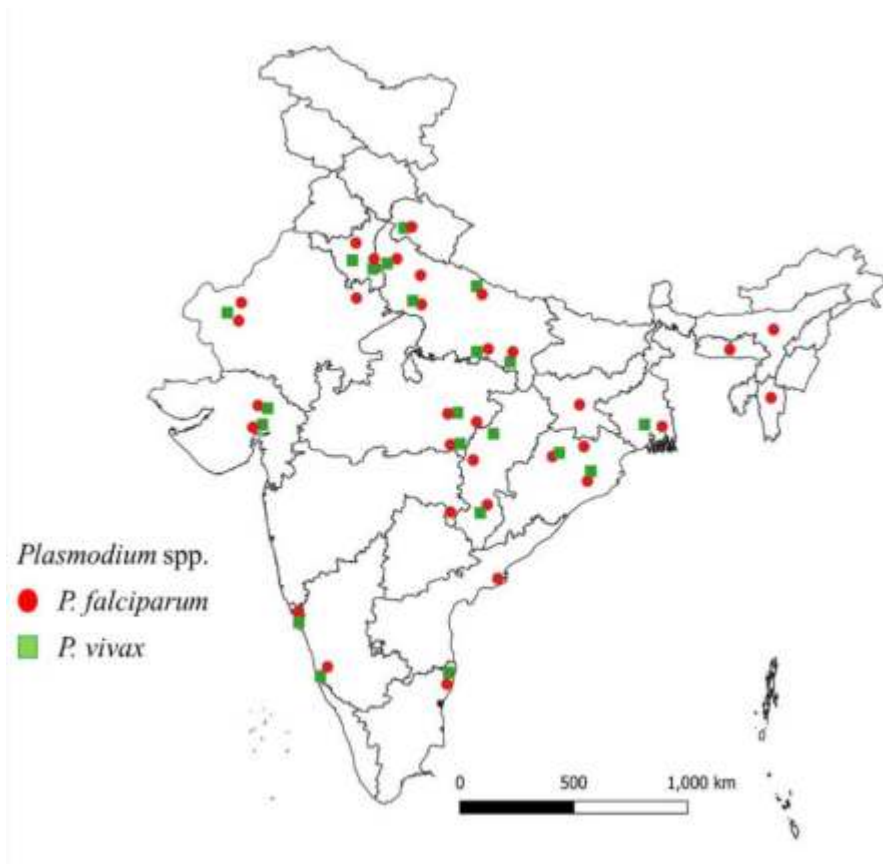
### 3.2. Mission



**Figure 2:** Mission of MPB.

### 3.3. Collection of Parasites

Field samples are collected from various malaria endemic and non-endemic regions of the country. The institute has a total of eight field units located in Bengaluru, Chennai, Goa, Guwahati, Haridwar, Nadiad, Raipur and Ranchi that helps in collection of samples.



**Figure 3:** Map of India showing the sample size and area of collection for *Pf* and *Pv* isolates.

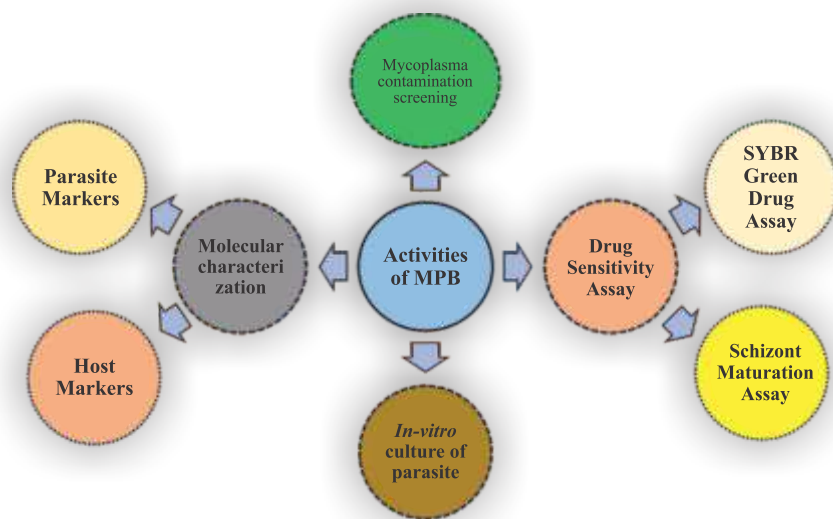
### 3.4. Characterization of parasites

The bank has a comprehensive collection of malaria parasites that includes both laboratory-adapted strains and clinical isolates collected from various regions. The field isolates are carefully characterized by a range of methods, including molecular techniques, microscopy, and serology. Sera or plasma collected from malaria infected individuals is also stored in the bank.

### 3.5. Storage of parasites

Parasites at MPB are cryopreserved in liquid nitrogen which preserves them for long-term storage.

## 4. Current activities



**Figure 4:** Activities of MPB in ICMR-NIMR.



#### 4.1. *In-vitro* culture

In our culture facility, we attempt to culture adapt the *Pf* samples.

#### 4.2. Drug sensitivity assay

By below three methods-

- Schizont Maturation Inhibition (SMI) assay.
- SYBR Green Drug Assay.
- pLDH Qualisa.

#### 4.3. Molecular markers associated with anti-malarial drug resistance.

Characterization of field isolates for drug resistance genes for *Pf* and *Pv* (*dihydropteroate synthase*, *dihydrofolate reductase*, *chloroquine resistance transporter*, *multidrug resistance protein 1* and *kelch*) is carried out along with other molecular markers for parasite and host factors. The characterized *Pf* and *Pv* isolates for various molecular markers range within 350-850 isolates.

#### 4.4. Cataloguing for molecular markers

Molecular markers	Total no. of samples characterised	
	<i>Pf</i>	<i>Pv</i>
<b>Parasite Factors</b>		
<i>Merozoite surface protein 1 (msp1)</i>	229	-
<i>Merozoite surface protein 2 (msp2)</i>	175	-
<i>Glutamate-Rich Protein (GLURP)</i>	148	-
<i>Chloroquine resistance transporter (crt)</i>	361	97
<i>Multidrug resistant transporter 1 (mdr1)</i>	359	202
<i>Dihydropteroate synthase (dhps)</i>	385	190
<i>Dihydrofolate reductase (dhfr)</i>	380	200
<i>Kelch</i>	186	112
<i>Histidine rich protein 2 (hrp2)</i>	87	-
<i>Histidine rich protein 3 (hrp3)</i>	87	-
<i>Apical membrane antigen 1 (ama1)</i>	147	-
<i>Gametocyte genes (Pfg377)</i>	91	-
<i>Gametocyte genes (Pfs25)</i>	218	-
<i>Vir genes</i>	-	117
<i>Var genes</i>	11	-
<b>Host Factors</b>		
<i>Glucose-6-phosphate dehydrogenase (G6PD)</i>	-	46
<i>Interleukin-10 (IL-10)</i>	-	99
<i>Interleukin-6 (IL-6)</i>	-	157
<i>Interferon-<math>\alpha</math> (IFN-<math>\alpha</math>)</i>	-	69
<i>Tumor necrosis factor-<math>\alpha</math> (TNF-<math>\alpha</math>)</i>	-	169
<i>Superoxide dismutase-1 (SOD-1)</i>	-	169

**Table 1:** Total number of samples characterized in MPB for various markers.

## 4.5. Mycoplasma

Mycoplasmas cause serious hindrance in long-term maintenance of *in-vitro Pf* culture. It is important to have culture facilities free of contamination and we regularly check for mycoplasma contamination by PCR assay.

## 4.6. Human Resource Development

Imparting training is one of the mandates of MPB by giving hands on training in *in-vitro* culture techniques for testing new antimalarials. This training can also be used in determining drug resistance mechanisms, studying cytoadherence properties and erythrocyte invasion mechanisms amongst other parasitological, pharmacological, immunobiological biochemical or molecular biology studies.

Sl. No.	Technique
1.	<i>Plasmodium</i> parasite spp. identification through microscopy, PCR, and immunological techniques.
2.	Collection, cryopreservation, revival, and transportation of malaria parasite isolates.
3.	<i>In-vitro</i> cultivation of <i>Pf</i> erythrocytic stages.
4.	<i>In-vitro</i> drug sensitivity assays for <i>Pf</i> .
5.	Molecular characterization of various molecular/bio-markers.
6.	Mycoplasma decontamination through antibiotic treatment.

**Table 2:** List of hands-on training.

## 5. Vision / Future Directions

The MPB in Delhi is an established and evolving repository that continues to adapt to the changing needs of the research community. With continued scientific and technical support, we hope to expand its collection of characterised isolates from varied geographical regions in the country and plan to carry out further research activities.

- Ring Survival Assay (RSA).
- Whole genome sequencing (WGS).
- Cytoadherence/ Rosetting assays.
- *Ex-vivo* schizont maturation assay in *Pv*.

## 6. Academic activities of Malaria Parasite Bank

### Students

#### i) PDF students

- Completed = 3

#### ii) Ph.D. Students:

- Completed = 5
- Ongoing = 4

#### iii) M.Sc. Students:

- Completed = 35

### Projects

Extramural:

- I) Completed = 5
- II) Ongoing = 2

**Papers published till date = 73 Publications**

## Charges for the biomaterial

- Human malaria cryopreserved sample @ ₹1500/vial
- Non-human malaria sample @ ₹1000/vial

## Contact us

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## Our Team



### **Malaria Parasite Bank staff with Director NIMR**

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- **In charge – Scientist** : Dr. Vineeta Singh
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: Mr. A. P. Semwal  
: Mr. Satish K. Chauhan  
: Mr. Krishan Pal  
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