

Biological Agent Reference Sheet (BARS)

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BIOLOGICAL AGENT REFERENCE SHEET

Plasmodium species used in research

CHARACTERISTICS	
<i>Morphology</i>	Plasmodium is an apicomplexan parasite. The asexual stage in the vertebrate host needs the red blood cell (RBC) to survive. Various forms develop inside the RBC, namely, trophozoites, schizonts and merozoites. <i>P. vivax</i> and <i>P. ovale</i> , leave dormant forms in the liver called hypnozoites. The sexual stages responsible for transmission to other vertebrate host are the male and female gametocytes which are picked up by the female Anopheles mosquito when drawing a blood meal. The oocysts develop in the midgut of the mosquito and ultimately sporozoites are stored in the salivary glands until the next blood meal.
<i>Growth Conditions</i>	There are adapted strains of <i>P. falciparum</i> and <i>P. knowlesi</i> , which can be continuously propagated <i>in vitro</i> by adding human or rhesus RBCs. Other species may be maintained <i>in vitro</i> for a short period of time.
<i>Genetic background</i>	Transgenic Plasmodium parasites can be generated by double cross-over recombination and insertion of a drug-resistance cassette. The selection drugs are Pyrimethamine and/or PS-15, and the transgenic parasites retain their susceptibility to Chloroquine and Artemisinin derivatives.

HEALTH HAZARDS	
<i>Host Range</i>	There are more than 100 species of Plasmodium, which infect a wide range of vertebrates. Five species are recognized to infect humans: <i>P. falciparum</i> , <i>P. vivax</i> , <i>P. malariae</i> , <i>P. ovale</i> , and <i>P. knowlesi</i> (known to infect macaques, is now recognized to cause a zoonotic infection in humans).
<i>Modes of Transmission</i>	Plasmodium is a blood-borne pathogen and it can be transmitted via an infected mosquito bite, transfusion, and needle stick.
<i>Signs and Symptoms</i>	Initial merozoites are released from the liver into the blood stream to target RBCs. Symptoms appear when new merozoites are released every other day (<i>P. knowlesi</i>), every second day (tertian <i>P. falciparum</i> , <i>P. vivax</i> , <i>P. ovale</i>) or every third day (quartan, <i>P. malariae</i>) Signs include fever, chills, body ache, sweats, headache.
<i>Infectious Dose</i>	The infectious dose depends on the route of inoculation. A minimal number of Plasmodium-infected RBCs is needed to initiate an infection. If the infection is initiated by a mosquito bite, the number of sporozoites to be injected will depend on the species of parasite.
<i>Incubation Period</i>	The liver infection initiated by sporozoites injected during a mosquito bite is asymptomatic and may last up to 30 days, depending on the Plasmodium species.

MEDICAL PRECAUTIONS / TREATMENT	
<i>Prophylaxis</i>	US travelers are advised to follow the CDC recommendations before traveling, during their stay in a malaria endemic area, and after they return to the US.
<i>Vaccines</i>	There is no vaccine available.
<i>Diagnosis & Treatment</i>	The diagnostic tool of preference is the thick blood smear. Antimalarial treatment will be dictated by the species of Plasmodium, the resistance profile of the parasite, the age group of the patient, and severity of disease. If the infection is caused by hypnozoite-causing species, Primaquine will need to be administered to treat these stages, and the individual should be screened for G6PD deficiencies prior to treatment.

<i>Surveillance</i>	Malaria is a reportable disease in the US and territories
<i>Emory Requirements</i>	Report all incidents using PeopleSoft

LABORATORY HAZARDS	
<i>Laboratory Acquired Infections</i>	LAIs have been reported by various human and simian Plasmodium species
<i>Sources</i>	Needle stick injury, barehanded work, contact with open wound, contact with infected blood, infected vector from a mosquito colony

SUPPLEMENTAL REFERENCES	
<i>CDC</i>	https://www.cdc.gov/malaria/BMBL_5th_Edition_Section_VIII-C

CONTAINMENT	
<i>BSL2/ABSL2</i>	All work with Plasmodium-infected samples or propagation of parasites must be conducted inside a Biological safety Cabinet (BSC) Class II. Use face shield for open bench work.

SPILL PROCEDURES	
<i>Small</i>	Notify others working in the lab. Allow aerosols to settle. Don appropriate PPE. Cover area of the spill with paper towels and apply an EPA approved disinfectant, working from the perimeter towards the center. Allow 30 minutes of contact time before disposal and cleanup of spill materials.
<i>Large</i>	For assistance, contact Emory's Biosafety Officer (404-727-8863), or the EHSO Spill Team (404-727-2888)

EXPOSURE PROCEDURES		
<i>Mucous membrane</i>	Flush eyes, mouth or nose for 15 minutes at eyewash station.	
<i>Other Exposures</i>	Wash area with soap and water for 15 minutes.	
<i>Reporting</i>	Immediately report incident to supervisor, complete an employee incident report using PeopleSoft.	
<i>Medical Follow-up</i>	<i>7am-4pm (OIM):</i> EUH (404-686-7941) EUHM (404-686-7106) WW (404-728-6431)	<i>After Hours:</i> OIM NP On Call 404-686-5500 PIC# 50464
	<i>Needle Stick (OIM):</i> EUH (404-686-8587) EUHM (404-686-2352)	<i>Yerkes:</i> Maureen Thompson Office (404-727-8012) Cell (404-275-0963)

VIABILITY	
<i>Disinfection</i>	Plasmodium is susceptible to 70% ethanol and freshly made 10% hypochlorite
<i>Inactivation</i>	Plasmodium is susceptible to heat inactivation
<i>Survival Outside Host</i>	Minimal

PERSONAL PROTECTIVE EQUIPMENT (PPE)	
<i>Minimum PPE Requirements</i>	At minimum, personnel are required to don gloves, closed toed shoes, lab coat, and appropriate face and eye protection prior to working with Plasmodium-infected samples. Additional PPE may be required depending on lab specific SOPs.
<i>Additional Precautions</i>	All procedures that may produce aerosols, or involve high concentrations or large volumes should be done in a BSC. The use of needles, syringes, and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large-scale activities.