

Portfolio of candidate malaria vaccines currently in development

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Please help IVR keep this document up-to-date and send any updates/comments/changes to Zarifah Reed (reedz@who.int)

Activities completed or ongoing are marked with a bold X
 Support for activities indicated with colour and without an X have been secured
 The various stages are considered as initiated at the steps indicated below:
 Preclinical development stage: serious process development has been initiated
 Phase 1a: first volunteer recruited for phase 1 in industrialized country
 Phase 2a: first volunteer recruited for challenge study in industrialized country
 Phase 1b: first volunteer recruited for phase 1 in disease endemic country
 Phase 2b: first volunteer recruited for phase 2 in disease endemic country
 Pivotal: first volunteer recruited for clinical study leading to licensure

Pre-erythrocytic Vaccines							
	Research	Preclinical development	Phase 1a	Phase 2a	Phase 1b	Phase 2b	Pivotal
CSP							
RTS,S/AS02A MVI/GSK	X	X	X	X	X	X	
RTS,S/AS02D MVI/GSK		X			X	X	
RTS,S/AS01B WRAIR/GSK	X	X	X	X			
HBSAg-CSP VLP (Malarivax Apovia)	X	X	X	X			
RTS,S/AS02 and Modified Vaccinia Ankara (MVA) CSP (Oxford-GSK)	X	X	X	X			
CSP Recombinant adenovirus (NYU)	X						
CSP Recombinant adenovirus (WRAIR/Crucell Holland)	X	X					
CSP Recombinant influenza (NYU)	X						
CSP Recombinant vaccinia (NYU)	X						
CSP Recombinant Sindbis virus (NYU)	X						
CSP Recombinant Yellow Fever virus (NYU)	X						
CSP Long synthetic peptide (Dictagene/University of Lausanne)	X	X	X	X			

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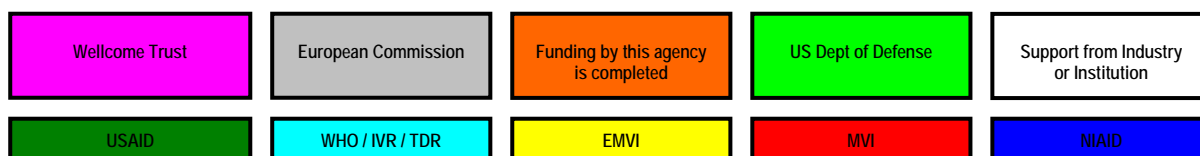
Pre-erythrocytic Vaccines							
	Research	Preclinical development	Phase 1a	Phase 2a	Phase 1b	Phase 2b	Pivotal
CSP DNA immunization (NMRC)	X	X	X				
CSP C-terminus 72 AA Long Synthetic peptide - Vivax (MVDC)	X	X	X				
CSP N-terminus 77AA Long Synthetic peptide - Vivax (MVDC)	X	X	X				
CSP repeat 48 AA Long Synthetic peptide -Vivax (MVDC)	X	X	X				
Other Antigens							
LSA-3 Long synthetic peptide (Institut Pasteur)	X	X					
LSA-3/ AS02 <i>L. lactis</i> expressed recombinant (Institut Pasteur)	X	X					
	X	X					
LSA-3 lipopeptides (Institut Pasteur)	X	X					
LSA-3 <i>E. coli</i> expressed (WRAIR)	X						
LSA-1 <i>E. coli</i> expressed (LSA-NRC) (WRAIR)	X	X					
LSA-1 Adenovirus vectored (LSA-NRC) (WRAIR/Crucell Holland)	X	X					
Modified Vaccinia Ankara (MVA) CSP + LSA-1 epitope (Oxford)	X	X	X				
		X					
Fowl Pox 9 CSP + LSA-1 epitope (Oxford)	X	X	X		X		
		X					
Fowl Pox 9 CSP + LSA-1 epitope/ Modified Vaccinia Ankara (MVA) CSP + LSA-1 epitope (Oxford)	X	X	X	X	X		
DNA MVA prime-boost Multi-epitope(ME) string + TRAP (Oxford)	X	X	X	X	X	X	
Fowl Pox 9 MVA prime-boost ME string + TRAP (Oxford)	X	X	X	X	X		
Fowl Pox 9 MVA polyprotein (Oxford/EMVI)	X	X					

29/04/2005

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Pre-erythrocytic Vaccines							
	Research	Preclinical development	Phase 1a	Phase 2a	Phase 1b	Phase 2b	Pivotal
CSP-SSP2-LSA1 in polyvalent Adeno 5 (GenVec/NMRC)	X						
CSP Recombinant BCG-vectored vaccine + 2 additional pre-erythrocytic antigens (Towson State University)	X						
LSA-1 <i>Drosophila melanogaster</i> expressed (Hawaii Biotech, Inc.)	X	X					
DNA Multi- pre-erythrocytic epitope vaccination (Epimmune/NMRC)	X	X					
Attenuated <i>P. falciparum</i> sporozoite vaccine (Sanaria)	X						

29/04/2005



Blood Stage vaccines							
	Research	Preclinical development	Phase 1a	Phase 2a	Phase 1b	Phase 2b	Pivotal
MSP-1							
MSP-1 19 <i>E. coli</i> expressed (ICGEB)	X	X					
MSP-1 42 <i>E. coli</i> expressed (ICGEB)	X	X					
MSP-1 3D7 Recombinant full length (Heidelberg/WRAIR)	X	X					
MSP-1 FCB1 Recombinant full length (Heidelberg/WRAIR)	X	X					
MSP-1 3D7 + FCB1 Recombinant full length (Heidelberg/WRAIR)	X	X					
MSP-1 19 Baculovirus expressed (Institut Pasteur)	X	X					
MSP-1 42 FUP Baculovirus expressed (U of Hawaii/Antigenics)	X	X					
MSP-1 42 FVO Transgenic mammals expressed (GTC Biotherapeutics/SAIC)	X	X					
MSP-1 19 mutant <i>P. pastoris</i> expressed (Mill Hill)	X						
MSP-1 42 3D7 (FMP-1) <i>E. coli</i> expressed (WRAIR)	X	X	X	X	X	X	
MSP-1 42 FVO (FMP-9) <i>E. coli</i> expressed (WRAIR)	X	X					
MSP-1 42Kd 3D7 <i>P. pastoris</i> expressed (MVDU)	X	X	X				
MSP-1 42Kd FVO <i>P. pastoris</i> expressed (MVDU)	X	X	X				
MSP-1 19/AMA-1 chimera (PfCP2.9) <i>P. pastoris</i> expressed (SMMHS/WHO)	X	X	X				

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Blood Stage vaccines							
	Research	Preclinical development	Phase 1a	Phase 2a	Phase 1b	Phase 2b	Pivotal
MSP-1/ AMA-1 in bivalent Adeno 5(GenVec/NMRC)	X						
MSP1-42/ EBA-175 chimera <i>E. coli</i> expressed (WRAIR)	X	X					
MSP1-19/ EBA-175 F1 <i>E. coli</i> expressed (ICGEB)	X	X					
MSP1 19 <i>D. melanogaster</i> expressed (Hawaii Biotech, Inc)	X	X					
MSP1 42 <i>D. melanogaster</i> expressed	X	X					
BCG vectored (AECOM)	X						
MSP-1 <i>Salmonella</i> -vectored (U. Maryland)	X						
Other MSPs							
MSP-2 Long synthetic peptide (Lausanne)	X	X					
MSP-2 3D7+ (FC27) <i>E. coli</i> expressed (La Trobe)	X	X					
MSP-3 Long synthetic peptide (Pasteur Institute)	X	X	X		X		
MSP-4 <i>E. coli</i> expressed (Monash)	X	X					
MSP-5 <i>E. coli</i> expressed (Monash)	X	X					
MSP-3-GLURP hybrid Long synthetic peptide (SSI)	X	X	X				
AMA-1							
AMA-1 <i>E. coli</i> expressed (Australia)	X	X	X				
AMA-1 C1 FVO/3D7 <i>E. coli</i> expressed (MVDU)	X	X	X		X		
AMA-1 <i>P. pastoris</i> expressed (BPRC)	X	X	X				

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Blood Stage vaccines							
	Research	Preclinical development	Phase 1a	Phase 2a	Phase 1b	Phase 2b	Pivotal
AMA-1 FVO(FMP10) <i>E. coli</i> expressed (WRAIR)	X	X					
AMA-1 3D7(FMP2.1) <i>E. coli</i> expressed (WRAIR)	X	X	X				
EBA-175 and DBP							
Region II Duffy Binding Protein <i>E. coli</i> expressed (ICGEB)	X	X					
EBA-175 F1 <i>E. coli</i> expressed (ICGEB)	X	X					
EBA-175 (F1 +F2) <i>P. pastoris</i> expressed (EntreMed/SAIC)	X X	X					
Other proteins							
GLURP Long synthetic peptide (SSI)	X	X	X				
SE 36/ Alum <i>E. Coli</i> expressed (Osaka University, BIKEN Foundation)	X	X	X				
MAEBL (Notre Dame University)	X	X					
EBP2/BAEBL <i>P. Pastoris</i> expressed (Entremed)	X	X					
RAP-2 <i>E. coli</i> expressed (QIMR)	X	X					
PfEMP1 <i>E. coli</i> , <i>P. pastoris</i> , baculovirus expressed, different domains (various EU groups)	X	X					
PfEMP1 DBL1Q-TM-AS Recombinant Semliki- forest virus(SFV) (Karolinska Institute)	X X	X X					
<i>P. falciparum</i> synthetic GPI toxin (WEHI/MIT)	X X	X					

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Transmission Blocking Vaccines							
	Research	Preclinical development	Phase 1a	Phase 2a	Phase 1b	Phase 2b	Pivotal
PvS25 <i>Saccharomyces</i> expressed (MVDU)	X	X	X				
PfS25 <i>P. Pastoris</i> expressed (MVDU)	X	X					
Recombinant protein PfS48 (MVDU)	X						
Recombinant protein PfS48 (Nijmegen)	X						
PfS25 DNA immunization (JHU)	X						
PvS25 DNA immunization (JHU)	X						
PvS28 DNA immunization (JHU)	X	X					
Recombinant Pfs230 (Loyola University)	X						

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Combination (Multistage) Vaccines							
	Research	Preclinical development	Phase 1a	Phase 2a	Phase 1b	Phase 2b	Pivotal
Multi-epitope recombinant protein CSP, MSP-1, MSP-2, LSA-1, AMA-1, RAP-1, EBA-175 (FALVAC CDC)	X	X					
MVA prime-boost Fowl Pox 9 LSA3/D260; STARP; EXP1, Pfs16, TRAP, LSA-1 (Oxford)	X	X					
	X	X					
DNA in co-block polymer +/- viral boost CSP, SSP2, LSA-1, AMA-1, MSP-1 (NMRC)	X	X					
MVA CSP, SSP2, LSA-1, AMA-1, MSP-1 (NMRC)	X	X					
Recombinant <i>Salmonella</i> -vectored vaccine CSP, SSP2, LSA-1, MSP-1, individually as well as in combination (U Maryland)	X						
Recombinant <i>Shigella</i> -vectored vaccine CSP, SSP2, LSA-1, MSP-1, individually as well as in combination (U Maryland)	X						
Multivalent antigen expression/vaccine for malaria (Lifesensors, Inc.)	X						
Recombinant Adenovirus CSP, SSP2, LSA-1, AMA-1, MSP-1 (NMRC/Genvec)	X	X					
Recombinant FMP-1 plus RTS,S , MSP-1 3D7 + CSP (WRAIR)	X	X	X	X			
Mimetopes delivered on Virosome CSP, AMA-1 (Pevion)	X	X	X				

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