

INVITED SPEAKER PRESENTATION

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Origin of the human malaria parasite *Plasmodium falciparum* in gorillas

Weimin Liu¹, Yingying Li¹, Gerald H Learn¹, Rebecca S Rudicell², Joel D Robertson¹, Brandon F Keele^{1†}, Jean-Bosco N Ndjango³, Crickette M Sanz^{4,5}, David B Morgan^{5,6}, Sabrina Locatelli⁷, Mary K Gonder⁷, Philip J Kranzusch⁸, Peter D Walsh⁹, Eric Delaporte¹⁰, Eitel Mpoudi-Ngole¹¹, Alexander V Georgiev¹², Martin N Muller¹³, George M Shaw^{1,2}, Martine Peeters¹⁰, Paul M Sharp¹⁴, Julian C Rayner^{1,15*}, Beatrice H Hahn^{1,2}

From Parasite to Prevention: Advances in the understanding of malaria
Edinburgh, UK. 20-22 October 2010

Plasmodium falciparum is the most prevalent and lethal of the malaria parasites infecting humans, yet the origin and evolutionary history of this important pathogen remain controversial. Here, we used single genome amplification (SGA) strategies to show that wild-living African apes are naturally infected with at least nine *Plasmodium* species, including one that is the direct precursor of *P. falciparum*. Among nearly 3,000 ape fecal specimens collected from 57 field sites throughout central Africa, we found *Plasmodium* spp. infection in chimpanzees (*Pan troglodytes*) and western gorillas (*Gorilla gorilla*), but not in eastern gorillas (*Gorilla beringei*) or bonobos (*Pan paniscus*). Ape plasmodial infections were highly prevalent, widely distributed, and almost always made up of mixed parasite species. To obtain *Plasmodium* sequences not confounded by *in vitro* recombination, we used SGA to amplify fragments of the mitochondrial (956bp of the *cytochrome b* gene; 3.4kb and 3.3kb half-genome fragments), apicoplast (390bp of the *caseinolytic protease C* gene) and nuclear (772bp of the *lactate dehydrogenase* gene) genomes. Among more than 1,100 such sequences from 80 chimpanzee and 55 gorilla samples, we found nine that were related to *P. malariae*, *P. ovale* or *P. vivax*. All others grouped within one of six chimpanzee- or gorilla-specific lineages representing distinct *Plasmodium* species within the *Laverania* subgenus. One of these from western gorillas was comprised of parasites that were nearly identical to *P. falciparum*. In phylogenetic trees of full-length mitochondrial sequences, human *P. falciparum* formed a

monophyletic lineage within the gorilla parasite radiation. These findings indicate that *P. falciparum* is of gorilla origin and not of chimpanzee, bonobo or ancient human origin, and that all known human strains appear to have resulted from a single cross-species transmission event.

Author details

¹Department of Medicine, University of Alabama at Birmingham, Birmingham, Alabama 35294, USA. ²Department of Microbiology, University of Alabama at Birmingham, Birmingham, Alabama 35294, USA. ³Department of Ecology and Management of Plant and Animal Resources, Faculty of Sciences, University of Kisangani, Democratic Republic of the Congo. ⁴Department of Anthropology, Washington University, Saint Louis, Missouri 63130, USA. ⁵Congo Program, Wildlife Conservation Society, Brazzaville, B.P. 14537, Republic of Congo. ⁶Lester E. Fisher Center for the Study and Conservation of Apes, Lincoln Park Zoo, Chicago, Illinois 60614, USA. ⁷Department of Biological Sciences, University at Albany, State University of New York, Albany, New York 12222, USA. ⁸Department of Microbiology and Molecular Genetics, Harvard Medical School, Boston, Massachusetts 02115, USA. ⁹VaccinApe, Bethesda, Maryland, USA. ¹⁰Institut de Recherche pour le Développement (IRD) and University of Montpellier 1, 34394 Montpellier, France. ¹¹Institut de Recherches Médicales et d'études des Plantes Médicinales Prévention du Sida ou Cameroun, Centre de Recherche Médicale, BP 906, Yaoundé, Cameroun. ¹²Department of Human Evolutionary Biology, Harvard University, Cambridge, Massachusetts, 02138, USA. ¹³Department of Anthropology, University of New Mexico, Albuquerque, New Mexico, 87131, USA. ¹⁴Institute of Evolutionary Biology, University of Edinburgh, Edinburgh EH9 3JT, UK. ¹⁵Sanger Institute Malaria Programme, The Wellcome Trust Sanger Institute, Cambridge CB10 1SA, UK.

Published: 20 October 2010

doi:10.1186/1475-2875-9-S2-I6

Cite this article as: Liu et al.: Origin of the human malaria parasite *Plasmodium falciparum* in gorillas. *Malaria Journal* 2010 **9**(Suppl 2):I6.

† Contributed equally

¹Department of Medicine, University of Alabama at Birmingham, Birmingham, Alabama 35294, USA

Full list of author information is available at the end of the article