Immune response for Malaria detected by novel and a simple biosensing approach

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Malaria is caused by parasites from genus *Plasmodium*. Many *Plasmodium* species exist that may infect mammals. A total of five parasite species have been recognized to cause Malaria in humans. From these, *Plasmodium falciparum* and *Plasmodium vivax* are major threats. *Plasmodium falciparum* is highly prevalent in the African continent, while *Plasmodium vivax* displays wider distribution, predominating in many countries outside Africa[1].

The number of Malaria episodes worldwide is alarming[1,2,3,4]. The most recent WHO estimates (released in September 2015) indicate the occurrence of 214 million cases of malaria in 2015, leading to 438 000 deaths worldwide[1]. Malaria parasites are transmitted through vectors, mostly female Anopheles mosquitoes. The bites of 30 species of these mosquitoes are effective ways of transmission.

The intensity of Malaria transmission is directly related to several factors, such as the parasite (species), the vector (species, lifespan and preferred target for biting), or the environment (climate, related to the number and survival of mosquitoes). The immune response of the human host is also a major factor for a successful transmission. In general, a partial immunity may arise within time, reducing the risk of having a severe malaria infection but never ensuring a full immune protection. This is why young children are a group at major risk in Africa, compared to areas of less transmission and low immunity, where all age groups are at risk. And this is why strong efforts are being made for the production of effective vaccines[5].

The symptoms of Malaria are non-specific and related to acute febrile illness. The first symptoms include fever, chills, headache and vomiting, and may not be directly correlated to a Malaria infection, mostly because these symptoms arise more than 7 days after the mosquito bite. In addition, these symptoms may be linked to other diseases, such influenza fever, gastroenteritis, typhoid or other viral conditions. Still, if improperly treated within two days from such unspecific symptoms, the disease may progress to severe illness and death. An efficient program against Malaria should aim at an integrated vector management and vaccine development[5,6], in conjunction with early and accurate diagnosis.

Among the methods available for malaria diagnosis, the most historically used is the clinical diagnosis, which is ineffective due to the presence unspecific symptoms. Laboratorial methods include microscopic examination of blood samples or polymerase chain reaction (PCR) evaluation for specific oligonucleotide monitoring. Both involve rather sophisticated equipment, unavailable in endemic areas. Serological tests can also be used to detect antibodies against malaria parasites. This can be done either using indirect immunofluorescence (IFA) or enzyme-linked immunosorbent assay (ELISA). However, these tests also require PCR experiments and are therefore coupled to the same drawbacks.

Today, biosensors have met the needs of point-of-care detection, showing several advantageous features compared to conventional methods. These include low cost, portability, good sensitivity/selectivity features, simplicity of use and ability for detection in real time[7].

In this work, a new biosensor is presented for the point-of-care detection of the immune response of each individual against *Plasmodium Vivax*. The simple approach described at NanoPT has yield sensitive responses and is effective when applied to serum samples.

References

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