Nanotechnology device aims to prevent malaria deaths through rapid diagnosis

September 26 2012

(Phys.org)—A pioneering mobile device using cutting-edge nanotechnology to rapidly detect malaria infection and drug resistance could revolutionise how the disease is diagnosed and treated.

Around 800,000 people die from malaria each year after being bitten by mosquitoes infected with malaria parasites. Signs that the parasite is developing resistance to the most powerful anti-malarial drugs in south-east Asia and sub-Saharan Africa mean scientists are working to prevent the drugs becoming ineffective.

The €5.2million (£4million) Nanomal project – launched today – is planning to provide an affordable hand-held diagnostic device to swiftly

detect malaria infection and parasites' drug resistance. It will allow healthcare workers in remote rural areas to deliver effective drug treatments to counter resistance more quickly, potentially saving lives.

The device – the size and shape of a mobile phone – will use a range of latest proven nanotechnologies to rapidly analyse the parasite DNA from a blood sample. It will then provide a malaria diagnosis and comprehensive screening for drug susceptibility in less than 20 minutes, while the patient waits. With immediately available information about the species of parasite and its potential for drug resistance, a course of treatment personally tailored to counter resistance can be given.

Currently for malaria diagnosis, blood samples are sent to a central referral laboratory for drug resistance analysis, requiring time as well as specialised and expensive tests by skilled scientists. Additionally, confirmation of malaria is often not available where patients present with fever. Very often, drug treatments are prescribed before the diagnosis and drug resistance are confirmed, and may not be effective. Being able to treat effectively and immediately will prevent severe illness and save lives.

The Nanomal consortium is being led by St George's, University of London, which is working with UK handheld diagnostics and DNA sequencing specialist QuantuMDx Group and teams at the University of Tuebingen in Germany and the Karolinska Institute in Sweden. It was set up in response to increasing signs that the malaria parasite is mutating to resist the most powerful class of anti-malaria drugs, artemisinins. The European Commission has awarded €4million (£3.1million) to the project.

Nanomal lead Professor Sanjeev Krishna, from St George's, said: "Recent research suggests there's a real danger that artemisinins could eventually become obsolete, in the same way as other anti-malarials.

New drug treatments take many years to develop, so the quickest and cheapest alternative is to optimise the use of current drugs. The huge advances in technology are now giving us a tremendous opportunity to do that and to avoid people falling seriously ill or dying unnecessarily."

QuantuMDx's CEO Elaine Warburton said: "Placing a full malaria screen with drug resistance status in the palm of a health professional's hand will allow instant prescribing of the most effective anti-malaria medication for that patient. Nanomal's rapid, low-cost test will further support the global health challenge to eradicate malaria."

The handheld device will take a finger prick of blood, extract the malarial DNA and then detect and sequence the specific mutations linked to drug resistance, using a nanowire biosensor. The chip electrically detects the DNA sequences and converts them directly into binary code, the universal language of computers. The binary code can then be readily analysed and even shared, via wireless or mobile networks, with scientists for real-time monitoring of disease patterns.

The device should provide the same quality of result as a referral laboratory, at a fraction of the time and cost. Each device could cost about the price of a smart phone initially, but may be issued for free in developing countries. A single-test cartridge will be around €13 (£10) initially, but the aim is to reduce this cost to ensure affordability in resource-limited settings.

In addition to improving immediate patient outcomes, the project will allow the researchers to build a better picture of levels of drug resistance in stricken areas. It will also give them information on population impacts of anti-malarial interventions.

Clinical trials of the device are expected to begin within three years, after which it will be brought to market. The technology could be

adapted afterwards for use with other infectious diseases.

More information: The Nanomal website can be found at www.nanomal.org

Provided by St. George's University of London