

LAMP TEST SHINES A LIGHT ON NEGLECTED DISEASES

A simple test uses the DNA or RNA of pathogens to **SWIFTLY AND ACCURATELY DIAGNOSE** infectious diseases.

A DNA/RNA test to detect infections, developed by Japan's Eiken Chemical Company (Eiken) more than 20 years ago, is an easy, fast, and accurate alternative to the more well-known polymerase chain reaction (PCR). Now, a team of international researchers is evaluating the feasibility of the 'loop-mediated isothermal amplification' (LAMP) test to detect Chagas disease — a neglected tropical disease most prevalent in Latin America.

LAMP is currently an official diagnostic test for pulmonary tuberculosis endorsed by the World Health Organization (WHO). It is also used to diagnose malaria and neglected diseases such as leishmaniasis, and human African trypanosomiasis, also known as sleeping sickness. Eiken developed these tests with FIND (Switzerland), the global alliance for diagnostics.

"We believe that our business activities and technique towards global health are a powerful contributor to the achievement of universal health coverage and a sustainable society," says Tsugunori Notomi, LAMP's inventor, and president & CEO of Eiken, in Tokyo. Eiken is now looking for a way to use this technique for Chagas disease, which is caused by the parasite *Trypanosoma cruzi* and primarily transmitted via the faeces or urine of insects known as triatomines or 'kissing bugs'. It is also transmissible from a pregnant woman to her baby, resulting in congenital Chagas

disease. Roughly 6-7 million people globally are infected at any one time.

Early diagnosis is the key to recovery. Acute symptoms such as fever and swollen eyes manifest in the first month of infection and can be treated with drugs. But in about one third of cases, chronic symptoms — including heart and intestinal problems — can emerge as long as a decade after the initial infection, and currently have no treatment.

The conventional tests for Chagas disease, including microscopy and serological tests, can be prone to operator error and false results, or require high-tech, expensive equipment. Instead, LAMP offers a relatively simple DNA test with readable higher sensitivity/specificity results in an hour.

ISOTHERMAL AMPLIFICATION

Similar to PCR tests, LAMP replicates specific regions of DNA in order to detect the genetic sequences of a target pathogen. Both techniques replicate strips of DNA to the extent that they become easily detectable. However, PCR requires varied temperatures at different stages of the amplification process, which limits where it can be performed due to the need for high-tech equipment. With LAMP the amplification of DNA takes place at an isothermal temperature between 62.5-67 °C, which makes it easier to use in locations with basic facilities, such as local



▲ A local scientist in Kabole, Zambia using LAMP in his lab.

health centres in developing countries.

LAMP takes advantage of the 'dynamic equilibrium' of double stranded DNA at 62.5-67 °C, meaning that the strands are flexible at this range.

With each specific LAMP test for different diseases, four to six unique primers (pairs of so-called inner, outer, and loop primers), designed for the DNA of the target pathogen, navigate the formation of a DNA strand. They have loops on both ends, and this unique shape enables the recurrence of DNA synthesis: the primers attach to the loop region, initiate a

round of DNA amplification and repeat it. This then happens over and over again, and all within an hour.

"While PCR has a variety of applications from basic research to clinical diagnosis, the LAMP technology focuses on detecting pathogens for diagnosis to take advantage of its high sensitivity, accuracy and swiftness. It provides a viable alternative to a PCR test without the need for technical machines or elaborate methods," Notomi explains.

LAMP FOR CHAGAS

LAMP is a useful tool for the diagnosis and monitoring



▲ Technical supervisors in Chibolya, Zambia, training LAMP operators.

of infections. It does not require complex laboratory infrastructure, which allows for application in healthcare facilities with limited equipment.

To expand the applicability of the LAMP test for Chagas disease to congenital infection, researchers from Eiken have joined in the multi-country consortium organized and led by ISGlobal, Spain, with research institutes including Nagasaki University, Japan, INGEBI-CONICET and Fundación Mundo Sano from Argentina, CEDIC, Paraguay, CEADES, Bolivia and the USA company AI Biosciences which will evaluate the prototype

of the LAMP test for Chagas disease in the ChagasLAMP project supported by the GHIT Fund (Global Health Innovative Technology Fund). Early detection and treatment of new cases, especially mother-to-baby cases, will help reduce the burden of Chagas disease, says Notomi.

SPREAD THE LAMP

"The usefulness of LAMP has been shown in detecting tuberculosis, malaria, and some NTDs. Eiken is working to integrate this technique into a people-centred healthcare system," says Yasuyoshi Mori, executive officer and general

manager of Eiken's Global Business Division.

Promoting LAMP is in line with Eiken's commitment to support the UN Sustainable Development Goals (SDGs), in particular to facilitate universal access to healthcare. To spread the word, Eiken is collaborating with the Center for Innovative Drug Development and Therapeutic Trials for Africa (CDT-Africa) in Addis Ababa, Ethiopia, the KNCV Tuberculosis Foundation in the Hague, the Netherlands and the Pasteur

Institute in Paris, France. To show their commitment, Eiken signed the Kigali Declaration on neglected tropical diseases.

They hope that LAMP will be of interest to the researchers and organizations taking part in the 8th Tokyo International Conference on African Development on 27-28 August 2022, which is co-hosted by the Japanese government, the United Nations, the United Nations Development Programme, the World Bank and African Union Commission. ■