

TECHNICAL RELEASE

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IME JOINS EFFORTS TO FIGHT INFECTIOUS DISEASES WITH ALL-IN-ONE DIAGNOSTIC TEST FOR POINT-OF-CARE DEPLOYMENT

Researchers from A*STAR Institute of Microelectronics (IME) join efforts to fight emerging infectious diseases with their breakthrough total analysis solution that combines sample extraction, ribonucleic acid amplification and detection into one set-up. The new diagnostic test can flag the presence of dengue virus and differentiate it from 4 different dengue serotypes¹ with just a fingerprick amount of blood (80 µL) at a concentration of 10³ pfu/ml². This easy-to-operate viral diagnostic test takes you from sample to answer in less than 4 hours; similar dengue viral diagnostic tests in hospitals can take up to 1 day for results to be obtained. The operational simplicity, sensitivity, accuracy and speed of the IME-developed diagnostic test make it highly suitable for point-of-care deployment in clinics, hospitals and airport gantries. The new test significantly reduces the reliance on labour-intensive and time-consuming routine batch-based laboratory tests that require highly skilled personnel to carry out.

The IME-developed dengue diagnostic test first extracts the dengue virus genetic material i.e. ribonucleic acid (RNA) from blood, makes copies of the extracted dengue RNA via reverse transcription-polymerase chain reaction (RT-PCR), converts the amplified material to single-stranded deoxyribonucleic acid (ssDNA) before the ssDNA of the dengue virus is electrically detected by IME's proprietary silicon nanowire biosensor module with customised electronic readout. The specificity of the detection is conferred by the unique nanowire surface chemistry and the high multiplexing capability. The detection component has successfully realised multiplexing capability, which gives the test its speed, sensitivity, specificity and distinguishing power; the multiplexing capability allows 4 different dengue serotypes to be differentiated from the dengue-infected blood sample, as well as the negative and the positive controls to be analysed in the same run.

Throughout the development of the all-in-one dengue diagnostic test, the IME team worked closely with Associate Professor Ooi Eng Eong of Duke-NUS Graduate Medical School, a trained medical doctor with more than 10 years of research experience in infectious diseases, to identify and address the current challenges of dengue diagnosis.

"Most laboratories rely on manual extraction of nucleic acids from clinical specimens, such as serum, before testing for the presence of the virus by PCR. This step requires trained laboratory staff and increases the likelihood of human errors. While automated nucleic acid extraction systems are also commercially available, these are not incorporated with PCR into a single system, necessitating additional handling by laboratory staff," said Associate Professor Ooi.

On the prospect of the new IME-developed test for dengue diagnosis, Associate Professor Ooi continued, "I believe the dengue diagnostic is only a starting point for the team in IME. The technology has the potential to be expanded to include other pathogens, such as chikungunya, influenza A and B (including those responsible for Avian and Swine flu) viruses, as well as coronavirus (including that which causes Severe Atypical Respiratory Syndrome or SARS)."

"With the promising results, we are looking for industry partners to jointly develop the prototype and at the same time work with clinicians to further carry out studies on blood samples from

¹ Dengue serotype refers to one of the four different strains of the dengue viruses belonging to genus *flavivirus*.

² pfu/ml refers to the concentration of the viruses expressed by the number of plaque-forming units in one millilitre of sample

dengue-infected patients. We are also extending our all-in-one platform technology to diagnose other emerging infectious diseases for point-of-care applications,” said Dr Kang Tae Goo, Senior Research Engineer of IME, who is involved in the development of the all-in-one dengue diagnostic test.

In 2008, a total of 7031 dengue cases were reported in Singapore, with 10 dengue-related deaths reported in the same year³.

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About the Agency for Science, Technology and Research (A*STAR)

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About the Institute of Microelectronics (IME)

The Institute of Microelectronics (IME) is a research institute of the Science and Engineering Research Council of the Agency for Science, Technology and Research (A*STAR). Positioned to bridge the R&D between academia and industry, IME's mission is to add value to Singapore's semiconductor industry by developing strategic competencies, innovative technologies and intellectual property; enabling enterprises to be technologically competitive; and cultivating a technology talent pool to inject new knowledge to the industry. Its key research areas are in integrated circuits design, advanced packaging, bioelectronics and medical devices, MEMS, nanoelectronics, and photonics.

For more information, visit IME on the Internet: <http://www.ime.a-star.edu.sg>.

³ Ministry of Health (2010) Email correspondence, 9 February