Using gold nanoprobes to unlock your genetic profile

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A fast and cost-effective genetic test to determine the correct dosage of blood thinning drugs for the treatment of stroke, heart problems and deep vein thrombosis has been developed by researchers at the Institute of Bioengineering and Nanotechnology (IBN). Using gold nanoprobes, this new technology offers personalized healthcare based on the genetic profile of the patients.

IBN Executive Director Professor Jackie Y. Ying said, "Diseases caused by blood clots can be potentially fatal. Genetic testing can improve the treatment of such medical conditions. By combining our expertise in molecular diagnostics and nanotechnology, we have developed a new genetic test that can determine the appropriate drug dosage to be administered for each patient."

Blood thinning drugs or anticoagulant medication prevent clots from forming in the blood. They are used to treat stroke, irregular heartbeat and deep vein thrombosis.

Warfarin is the most widely prescribed oral anticoagulant drug. But the dosage for each individual is highly variable, and the wrong dosage can cause an adverse reaction. Doctors currently determine the right dosage by monitoring the patients' reactions and adjusting the dosage accordingly.

Studies have shown that the variability in warfarin dosage is linked to genes. Knowing a patient's genetic profile can therefore help doctors to

decide the correct dosage for the patient. This minimizes side effects and improves treatment outcomes.

But current genetic tests are slow and expensive, often requiring over several days to generate results. This means that the initial dosage, which is the most important part of the treatment, may not be the optimal dosage.

Prof Ying and her group member, Principal Research Scientist Dr Yanbing Zu, have developed a faster and more cost-effective genetic test. By using gold nanoprobes, IBN's test kit can recognize three of the most common genetic variations, or single-nucleotide polymorphisms, associated with warfarin response.

In the test, DNA is extracted from blood or saliva of patients. After the DNA is amplified, it is then added to a pink solution of gold nanoparticles. If any of the three genetic variations is present, the solution will remain pink. But if none of the variations is present, the solution will turn colorless. The color change takes place within 10 minutes. This test can be done using standard laboratory equipment.

IBN's test has been validated by the National Cancer Centre Singapore, the National University Cancer Institute Singapore, and the Institute of Biomedical Sciences in Taiwan.

Prof Ying added, "This nanoprobe technology is highly flexible and can be extended to detect other genetic variations. By making molecular diagnostics information more readily available, doctors will be able to provide personalized treatment that is safer and more effective."

This finding was reported recently in the leading nanoscience and nanotechnology journal *Nano Today*.

More information: Yanbing Zu, Min-Han Tan, Balram Chowbay, Soo Chin Lee, Huiling Yap, Ming Ta Michael Lee, Liang-Suei Lu, Chun-Ping Chang, Jackie Y. Ying, "Nanoprobe-based genetic testing," *Nano Today*, Available online 21 May 2014, ISSN 1748-0132, dx.doi.org/10.1016/j.nantod.2014.04.003.