

Developing a sensor for vitamin B12 deficiency

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Dr Georgios Tsiminis in his photonics laboratory. Credit: University of Adelaide

University of Adelaide researchers have developed a world-first optical sensor that can detect vitamin B12 in diluted human blood – a first step towards a low-cost, portable, broadscale vitamin B12 deficiency test. Vitamin B12 deficiency is associated with an increased risk of dementia and Alzheimer's disease.

Such a device would enable the tracking of vitamin B12 levels in high-risk patients and early intervention – to top up vitamin B12 levels when low - and help overcome the limitations of current testing methods which are time-consuming and costly.

The research, by scientists in the ARC Centre of Excellence for Nanoscale BioPhotonics (CNBP), the Institute for Photonics and Advanced Sensing, and the Schools of Physical Sciences and Medicine, is being presented today at an international biophotonics conference in Adelaide – the inaugural SPIE BioPhotonics Australasia conference. Biophotonics is the science of using light (optical technologies) to analyse and measure biological material.

"Vitamin B12 deficiency has been shown to be a potential modifiable risk factor for dementia and Alzheimer's disease and is associated with cognitive decline," says Dr Georgios Tsiminis, Research Fellow at the University of Adelaide. "Older adults are particularly at risk of B12 deficiency due to age-related reduction in absorbing vitamin B12 received through their diet.

"Our sensor is an early first step towards a point-of-care solution for

measuring and tracking B12 in healthy ageing adults. This would allow doctors to monitor B12 levels and intervene as soon as B12 deficiency was detected."

The sensor is still at proof-of-concept stage but, with development, has wide-reaching potential applications.

"Currently our device could not aid in diagnosing vitamin B12 deficiency in a general practice setting," says Dr Tsiminis. "However, this is the first time a rapid technique based on optical spectroscopy has been shown to be able to detect vitamin B12 in [human blood](#) serum. We believe this is a very promising first step towards achieving this goal."

The optical sensor measurement of B12 in human blood takes less than a minute and requires minimum preparation. This is the first demonstration of vitamin B12 being measured in human blood serum without the need for a full laboratory test.

The sensor uses an optical measuring technique called Raman spectroscopy which produces a unique optical fingerprint of a target molecule, in this case vitamin B12.

"Our method provides a realistic basis for a system that is portable, cost-effective, and affords rapid results, along the lines of the pin-prick test for diabetes," says Dr Tsiminis.

"Time and cost limitations currently mean that regular and frequent B12 measurements are not being carried out. Having such a device could make this testing routine, potentially having a real impact on dementia and Alzheimer's disease."

Provided by University of Adelaide

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