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How A Single Molecule May Help and Detect and Treat Brain Injuries

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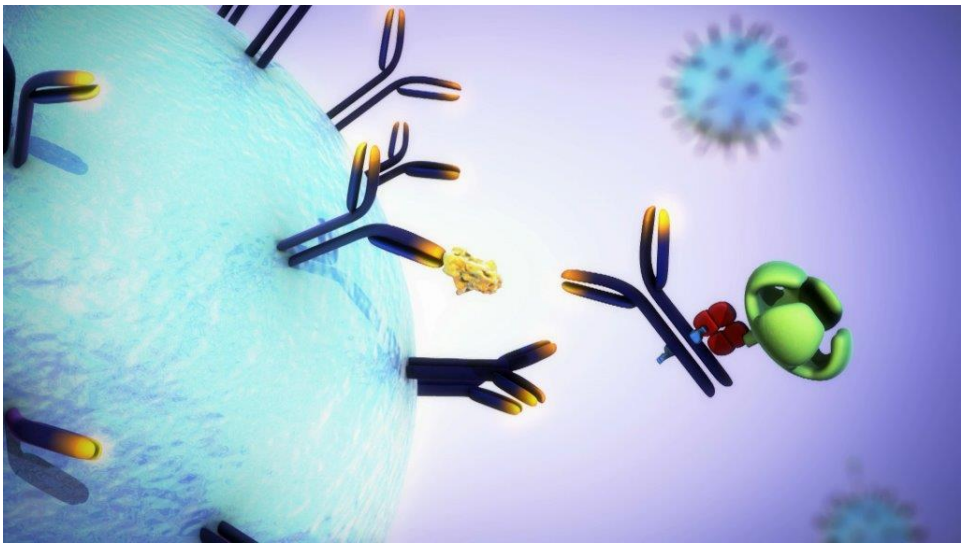
Detection leading the way to prevention

The devastation of a brain injury can be obvious.

Sometimes.

Yet other times, the extent of a traumatic injury is much more difficult to evaluate and quantify. This is particularly the case for mild to moderate injuries that are commonplace among a wide variety of people–from the occasional athlete to the profession soldier. Getting your bell rung is far from an acceptable diagnosis for head trauma. And now, the ability to detect key biomarkers–at the molecular level–can be an important step forward in the management of these all to common injuries.

Today, Quanterix Corporation, a leader in high definition diagnostics, delivering ultrasensitive single molecule measurement for the benefit of human health, has been selected as a winner of the GE and NFL Head Health Challenge from more than 400 entries across 27 countries by a panel of leading healthcare experts in brain research, imaging technologies and advocates for the advancement of brain research. This grant provides funding to help further advance development of tests to quickly diagnose traumatic brain injuries through their ultrasensitive Simoa™ technology that measures molecular signatures (biomarkers) of brain injury in blood.



Capturing an individual molecule. The digital nature of the technique allows an average of 1000x sensitivity increase over conventional assays.

What's interesting about the Quanterix technology is the amazing sensitivity and ability to measure compounds–as small as molecules– in the blood that offer an early and accurate assessment of injury. And it's the establishment of an early injury that than drive action to manage and potentially prevent future (and cumulative) damage that can clinically manifest years into the future. The Quanterix Simoa disc is at the core of the technology – a high-performance optics consumable, designed by Sony DADC. Sony worked with the company exclusively to create a product that meets the requirements of high sensitivity diagnostic testing and high volume production—originally derived from CD, DVD and Blu-ray Discs. The main difference between Simoa and conventional immunoassays lies in the ability to trap single molecules in femtoliter-sized wells (super-tiny) in the Simoa disc, allowing for a digital readout of each individual bead. Each disc has 216,000 wells that enable single molecules to be captured and detected using fluorescence imaging. To better understand the scope and value of Simoa's potential, consider the additional applications:

- **Prostate cancer** – Simoa was used to detect early increases in prostate specific antigen (PSA) – a biomarker commonly used to diagnose of prostate cancer—following removal of the prostate in men with cancer. Earlier detection of these rising levels would allow men with cancer recurrence to immediately undergo more effective treatment for potentially better outcomes.
- **Brain Injury / Alzheimer's Disease** – Simoa has been used to measure brain biomarkers implicated in Alzheimer's disease and traumatic brain injury, where its inherent sensitivity allows those markers to be easily measured in blood, in contrast to today's immunoassays, which require a painful, costly lumbar tap to obtain

cerebrospinal fluid. This important advance will make it possible to easily study patients and may open the door to radical discoveries for better diagnosis and treatment of neurological conditions such as these.

- **HIV** – Simoa can be applied to HIV detection and achieve results with 3,000 times greater analytical sensitivity than conventional immunoassays and at an affordable price – something that hasn't been available to underdeveloped countries. During the acute phase of infection, a patient is particularly contagious as the virus multiplies rapidly before the onset of an immune response. Detection during this phase would be crucial in controlling the spread of the disease.

Detecting brain injuries right on the field

Currently, Quanterix is at work to provide technology that speeds in the diagnosis and detection of traumatic brain injury within a clinical setting and on the sidelines in a sports arena through a simple blood test. Using Simoa technology, they've already successfully measured biomarkers such as Tau and Abeta, in blood which offers the potential to examine a molecular link between the acute phase of traumatic brain injury and chronic outcomes, such as dementia. They are currently working with researchers from the University of Gothenburg in Sweden, where their technology is the backbone of research on short and long-term effects of concussions and brain injury in athletes on the Swedish National Hockey League, as well as in Olympic Boxers.

The reality of stage zero medicine

The trend to early detection of disease is not common and often a central goal in conditions like cancer. Zero stage cancer, for example, is considered "in situ" or completely contained within a specific and excisable area of tissue. But it's the detection of this "mass" at a point earlier and earlier that can make the most impact. The shift from "mass to molecule" may be one of the more important developments that technology has offered clinicians and patients. With the advances of "single molecule" analysis, stage zero moves closer to that magical asymptote that shares a border with prevention. And there you have stage zero medicine taking control of trauma or disease at a point where a host of advantages–from clinical to financial–are within grasp.