INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Portable Multiplexed Immunoassay Device for Rapid Traumatic Brain Injury (TBI) Risk Quantification

TECHNOLOGY NUMBERS: 2019-411, 2019-203, 2025-488

Accelerate Blue Foundry - 2025 (Life Sciences)

OVERVIEW

A compact, portable microfluidic system delivers the first-ever solution for quantifying traumatic brain injury (TBI) biomarkers in less than 10 minutes—even in austere, resource-limited environments—by leveraging a uniquely designed channel for high-throughput, multiplexed detection, providing sensitive, rapid, and actionable diagnostic data at the point of care.

DESCRIPTION

The device performs sandwich Quantum Dot-linked Immunosorbent Assays (QLISA) using a sloped microfluidic channel that smoothly narrows in height. Beads of varying size, each size with its own species of probe molecule, are sorted along the narrowing channel by bead diameter. Utilizing quantum dots or other luminescent tags, multiple biomarkers can be detected and quantified optically based on the location of the light emission along the channel. This approach is particularly effective in the detection of traumatic brain injury (TBI) and other conditions requiring multiple biomarkers to accurately diagnose.

This innovative approach enables highly accurate, quantitative biomarker tests in less than ten minutes. The small microfluidic chips, combined with a miniaturized fluorescence detection module (built from off-the-shelf LEDs and photodiodes) constitute a portable, lightweight, point-of-injury biomarker analysis platform suitable for use at home, in the field, remote and austere environments, as well as within the clinic or urgent care facility. The system delivers rapid, highly sensitive quantification of brain injury markers—without the need for expensive lab infrastructure—to quickly assess whether further tests are needed (e.g. a CT scan). This is the only solution capable of bringing TBI biomarker measurement directly to athletes, caregivers, military medics, first responders, and on-site clinicians, closing the gap in TBI monitoring for remote or emergency situations.

Technology ID

2019-411

Category

Medical Devices
Life Sciences
Engineering & Physical Sciences
Accelerate Blue Foundry - 2025/Life Sciences

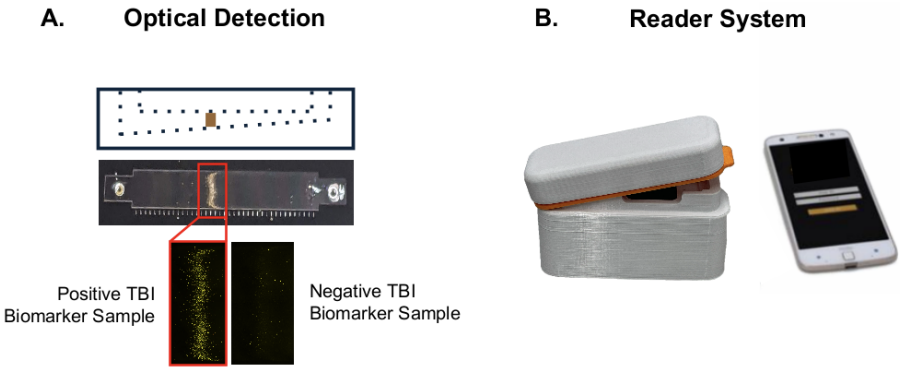
Inventor

Mark Burns
Sanaz Habibi
Zeynep Deniz Lal

Further information

Jeremy Nelson
jernelso@umich.edu

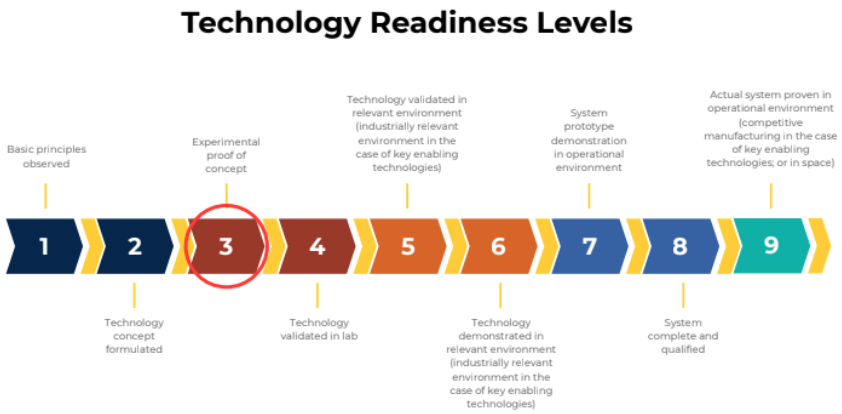
View online



VALUE PROPOSITION

- **Fast, reliable data**: Quantitative, actionable data regarding multiple biomarkers in less than 10 minutes with superior sensitivity and specificity.
- **Frontline diagnosis**: rapid detection of multiple biomarkers to enable objective decision-making on the spot, outside of a clinical environment. Takes the guesswork out of assessing whether CT scans or other additional tests are required.
- **Plug-and-play multiplexing and scalability**: The variable-height channel design allows simultaneous analysis of multiple biomarkers, ensuring the platform remains relevant as new diagnostic targets are identified.

TECHNOLOGY READINESS LEVEL



INTELLECTUAL PROPERTY STATUS

ALL ISSUED PATENTS:

- US11389799
- US11896974

Other patent applications pending.

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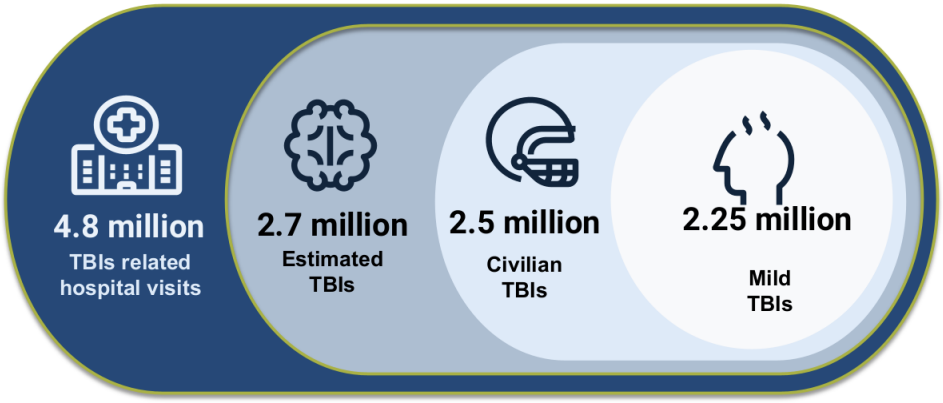
MARKET OPPORTUNITY

This platform technology enables convenient, reliable detection of multiple biomarkers outside of a clinical environment at the point of injury. It is suitable for use by caregivers within a home environment, trained first responders at the athletic facility or accident site, and by medics operating at the military front line or other remote, austere environments. In the U.S., the at-home diagnostics market alone is valued at around $2–3 billion USD annually and is expected to grow at rate of 5–7% over the next five years. The substantial growth in point-of-care technologies and the demand for decentralized diagnostic tools underscores a strong market pull—validated by increasing global emphasis on trauma care, military medicine modernization, and portable health technology.

There is a critical, unmet need for diagnostic devices that quantify the risk of TBI in environments lacking laboratory support. In the U.S., there are 4.8 million hospital visits annually related to TBI, of which almost half are ultimately diagnosed as mild cases of TBI.[1,2] While computed tomography (CT) imaging is commonly used to assess TBI, it can be costly and inconvenient, and is not available at all healthcare sites. This technology could reduce avoidable CT use for suspected mild TBIs by up to 40%. By enabling rapid, actionable measurement of TBI biomarkers directly in the field, this system can dramatically improve triage at the point of injury, treatment, and outcomes for millions of at-risk patients annually.

- This project has participated in Customer Discovery through regional I-Corps.



Reduce avoidable CT use for suspected Mild TBIs by up to **40%.**

[1] Centers for Disease Control and Prevention, "Traumatic Brain Injury in the United States: Epidemiology and Rehabilitation," 2015. [Online]. Available: https://www.cdc.gov/traumaticbraininjury/pdf/tbi_report_to_congress_epi_and_rehab-a.pdf

[2] P. Leo et al., "Translational Research in Traumatic Brain Injury," in Translational Research in Traumatic Brain Injury, 2016, ch. 1. [Online]. Available: https://www.ncbi.nlm.nih.gov/books/NBK326730/

REFERENCES

- "Variable-height channels for microparticle characterization and display"
- "A variable height microfluidic device for multiplexed immunoassay analysis of traumatic brain injury biomarkers"