

Traumatic Brain Injury

Complex problem – Creative solution

March 2024

Confidential

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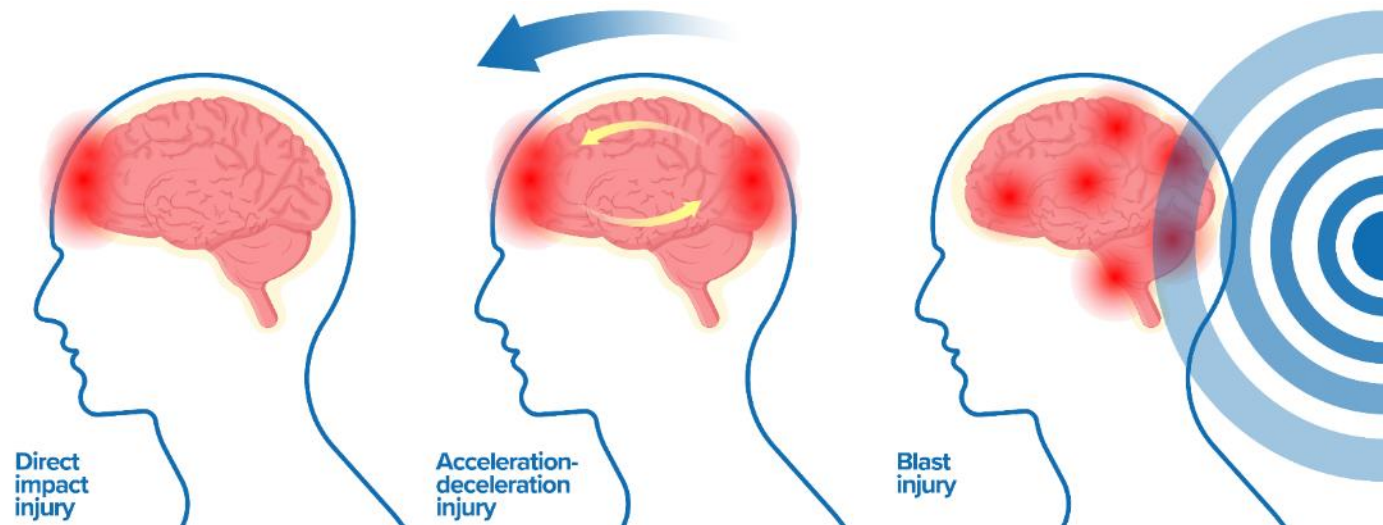


Introduction to the TBI Problem and Our Solution

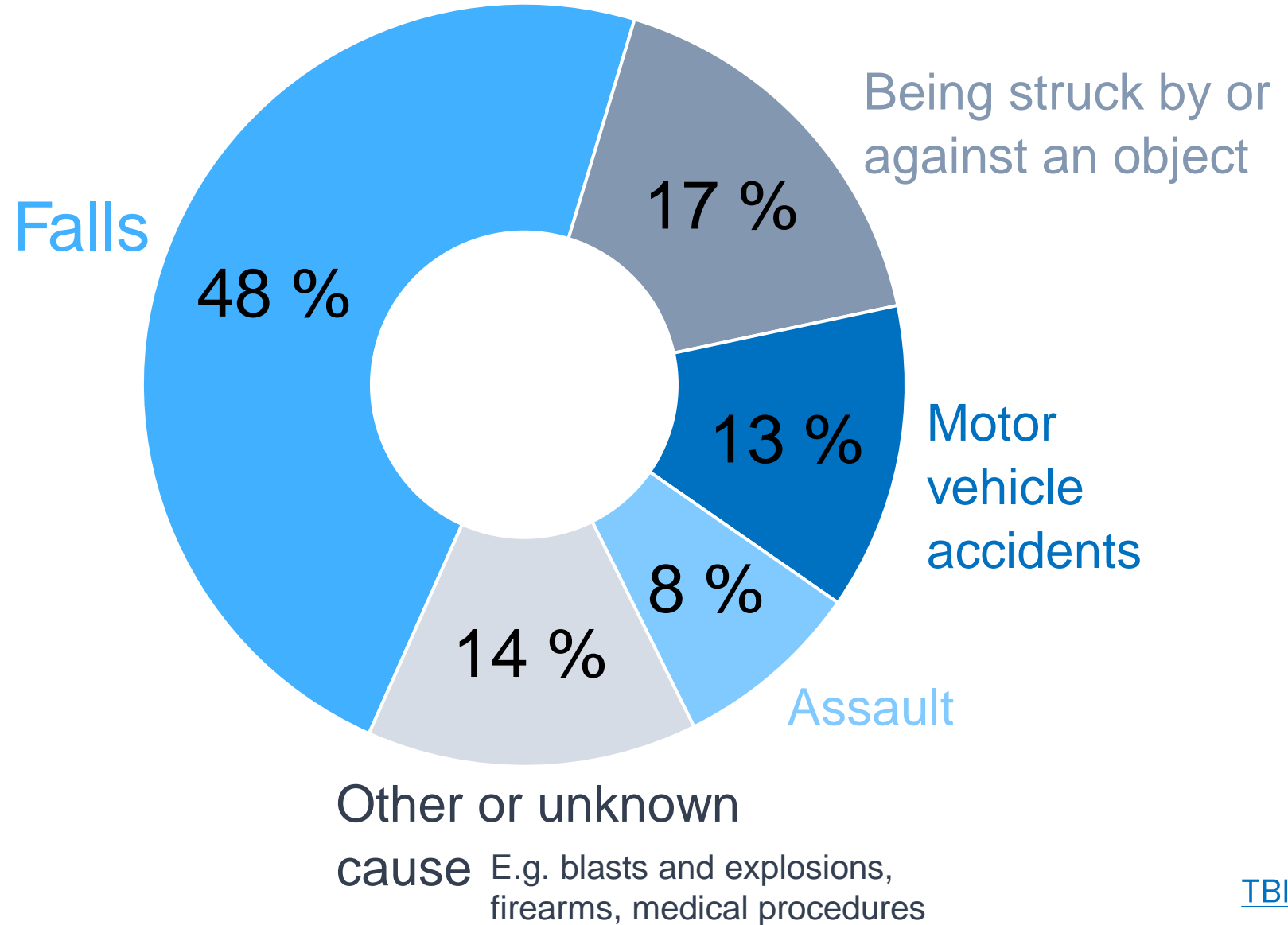
Traumatic Brain Injury (TBI)



- TBI occurs after a hit to the head
 - For example in falls, vehicular accidents, contact sports, and blasts
- It causes immediate physical damage to brain tissue
- However, it also exposes the healthy part of the brain to metal ions, free radicals and inflammation
 - Sets off a cascade of chemical reactions that damages surrounding healthy tissue



Leading Causes of TBI



TBI – A Global Problem

New cases each year

- Around 69 million TBI cases globally *
 - 2.8 million in the US **
 - 2.5 million in Europe ***
 - 0.6 million in Australia
 - 0.5 million in Canada
- Most cases are closed head injuries
 - Difficult to detect, potentially risky situation
 - ~90% of cases are categorized as “mild TBI”
- **The Need:** Accurate and rapid detection of head injuries



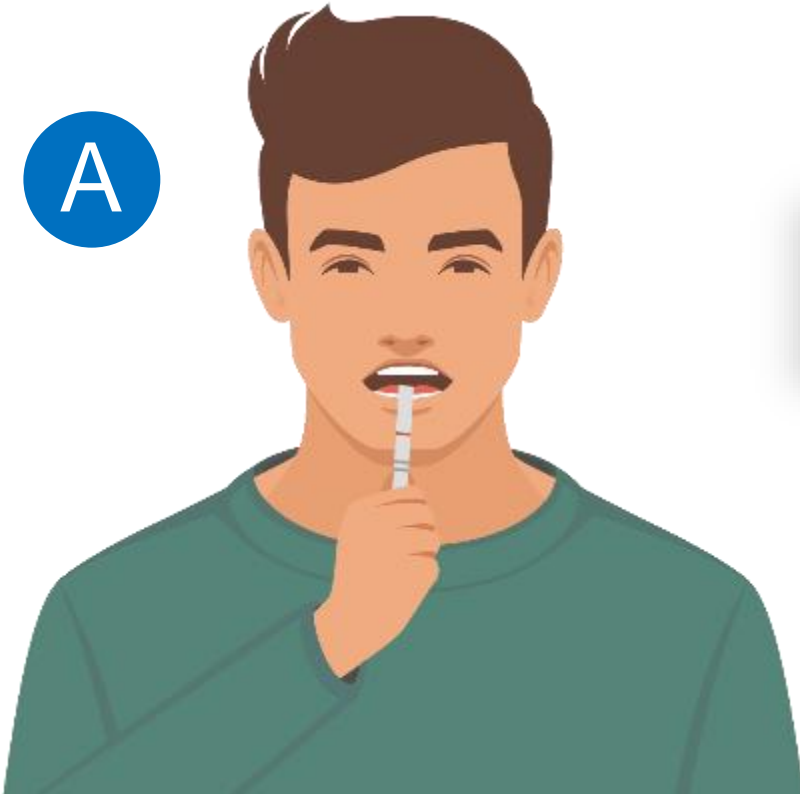
* [Dewan et al. \(2019\) J Neurosurg 130: 1080-1097](#)
** Centers for Disease Control and Prevention (CDC)
*** CENTER-TBI EU

Our Solution for Diagnostics



A test strip is dipped in **saliva** (IndicateTBI) or **urine** (ProbTBI™)

A



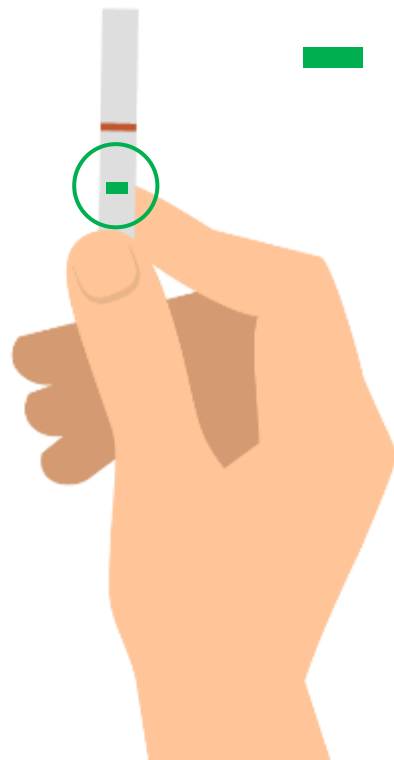
B




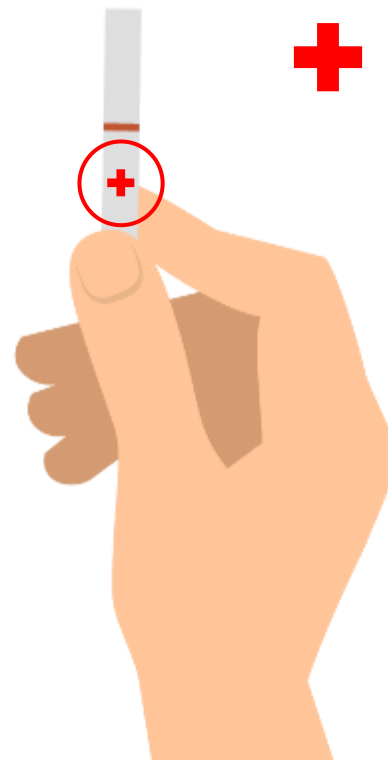
Hand-held, Rapid, Easy-to-read




The biochemical test responds to biomarkers that appear in urine and saliva shortly after brain injury



 Negative – no brain injury



 Positive – brain injury has occurred

Why Is the Test Needed?

- Currently, diagnosis is based on description of injury event and patient's symptoms
 - Glasgow Coma Score (3 - 15)
- Computer tomography (CT) and Magnetic resonance imaging (MRI) cannot detect mild injuries
 - Require hospital environment
 - Expensive procedures
 - Exposure to irradiation (CT)
 - Potential anaesthesia/sedation, especially for children
- **A reliable laboratory test to support / confirm / exclude the diagnosis is not available**



- Medicortex is developing a biomarker test based on saliva or urine samples which are less investigated for this purpose
- These biomarkers are glycans and degradation products released to the circulation after the brain cell damage
- Medicortex has the know-how to capture and identify these glycans and breakdown products

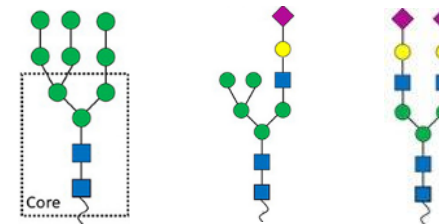


Illustration. Different glycan structures.

The background of the slide is a deep blue color with a complex, glowing pattern of white and light blue lines. These lines resemble a neural network or a web of connections, with some lines being thicker and more prominent than others. There are also small, bright yellow and white dots scattered throughout the background, giving it a sense of depth and activity.

Research and Development: Performed and Planned

Three Clinical Studies – Published Results



1st Clinical trial: Proof-of-Concept

Patients	
Patients with suspected TBI	12
Healthy controls	12



Results published:

Kvist M, Välimaa L, Harel A, et al. (2021) Glycans as Potential Diagnostic Markers of Traumatic Brain Injury. *Brain Sciences* **11**:1480.
<https://doi.org/10.3390/brainsci11111480>

2nd Clinical trial: TBI vs. Healthy & Orthopedic trauma

Patients with suspected TBI	24
Patients with orthopedic injury	16
Healthy controls	29



Glycan Profiling in Saliva and Urine: Exploring Potential Biomarkers for Mild Traumatic Brain Injury.
[Manuscript under preparation](#)

3rd Clinical trial: Children

Children with suspected TBI	28
Healthy control children	30



Results published:

Kvist M, Välimaa L, Harel A, Malmi S & Tuomisto A (2023) Glycans as Potential Diagnostic Markers of Traumatic Brain Injury in Children. *Diagnostics* **13**:2181. <https://doi.org/10.3390/diagnostics13132181>

Clinical Trials – Conclusions



- Biomarkers showed **statistically significant** differences between injured and healthy subjects – correspondence with prior animal data results
- Biomarkers were recognized by their ability to bind to several lectins
- Individual glycan profiling by mass spectrometry revealed several structures that were different between injured and healthy subjects
- Medicortex reached a significant milestone -> **a proof-of-concept**



Analysis of the samples collected in the second clinical trial was enabled by a grant received from the US Department of Defense (DoD) / U.S. Army Medical Research and Materiel Command.



Analysis of the samples from the third clinical study was supported by Business Finland.

Biomarker Detection on a Strip

Demonstration of biomarker detection on a nitrocellulose strip using colloidal gold label

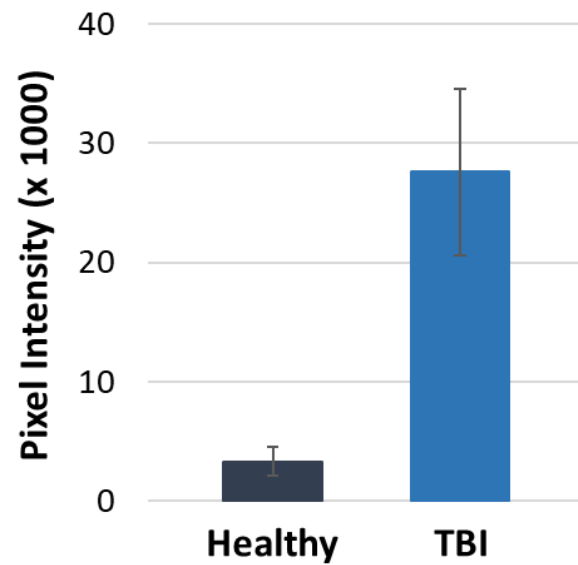
Saliva samples

Visual outlook

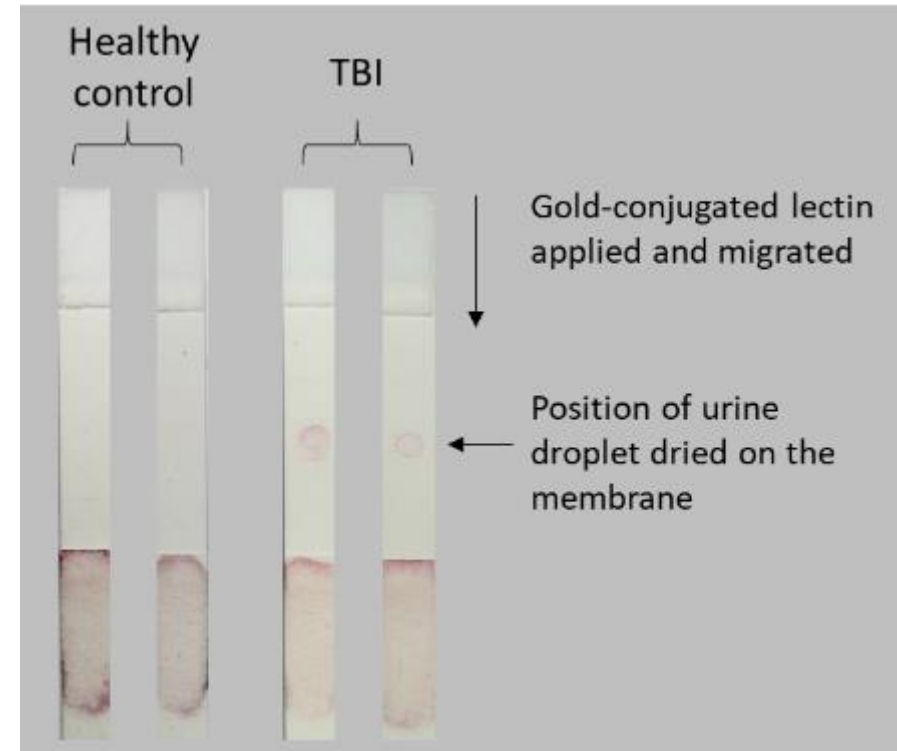


Healthy TBI

Measured darkness of spots



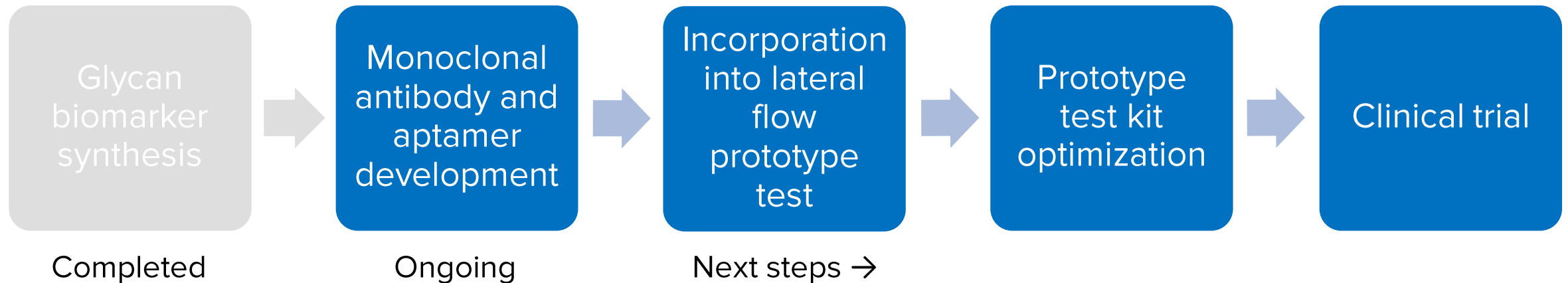
Urine samples



Biomarker Synthesis and Binder Development



- Medicortex has resolved the structure of the biomarker and produced an equivalent synthetic structure for antibody generation and assay development
- Monoclonal antibodies and aptamers are currently developed as binders of the biomarker



R&D Plan for the Strip Test Development



	2023/Q3	2023/Q4	2024/Q1	2024/Q2	2024/Q3	2024/Q4	2025/Q1	2025/Q2
Strip test development for mTBI								
Prototype kit assembly								
Evaluation of the prototype								
Initiation of regulatory process								
Production of prototype batch								
Clinical evaluation of the final product								
New patent applications								

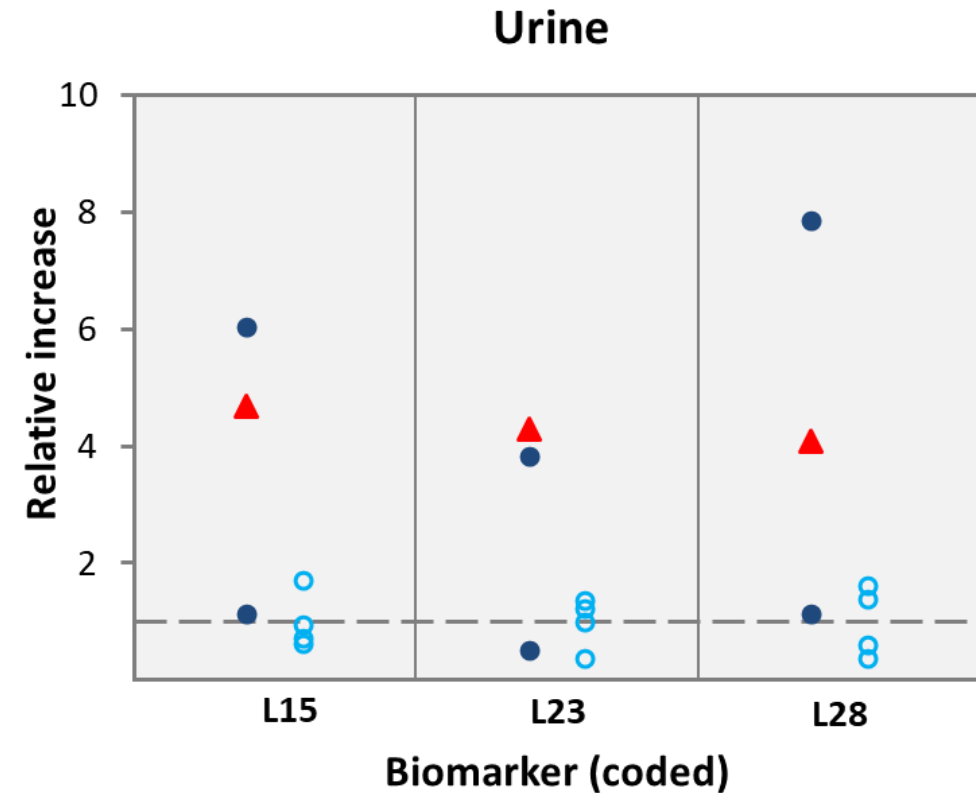
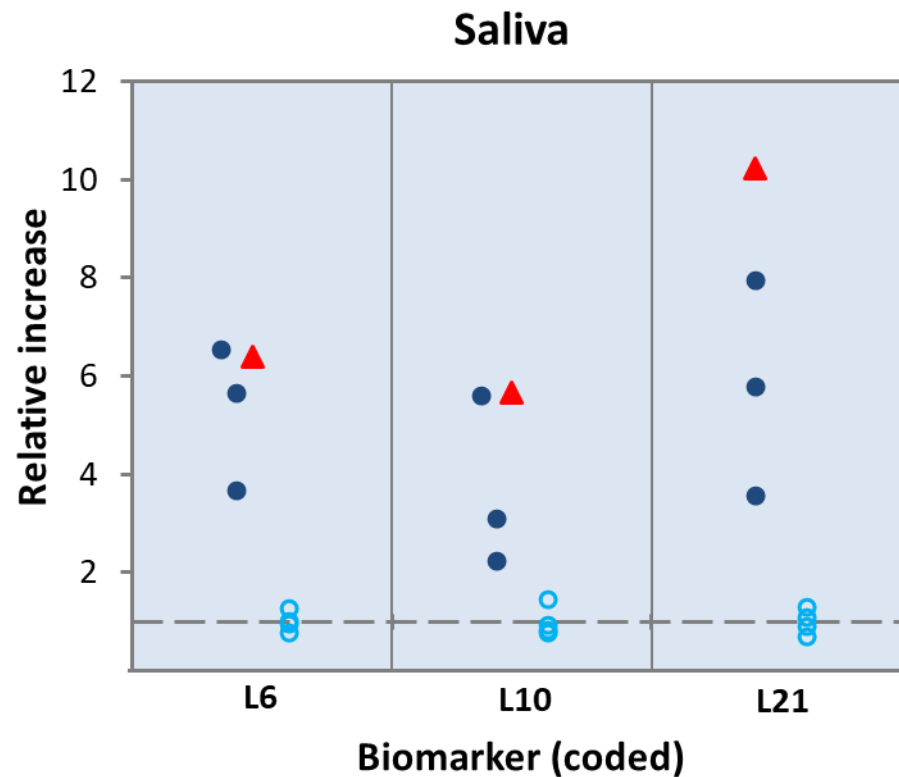
Case Study – Testimonial



- It's winter in Turku, Finland
- A person is jogging, slips on the icy sidewalk and hits his head, losing consciousness for a few minutes
- Magnetic Resonance Imaging (MRI) is performed immediately after the injury at the local hospital
 - No clinical observations of recent brain injury were found
 - The “healthy” patient was sent home
- Medicortex performs biomarker analysis on patient's urine and saliva
 - High levels of biomarkers are detected, similar to those of confirmed TBI-patients (see next slide)

Case Study – Biomarker results

Example on three biomarker levels in saliva and urine; relative increase over the average healthy level



▲ Suspected TBI-case ● Confirmed TBI-patients ○ Healthy Controls

Case Study – Second MRI

MRI scanning was repeated after the biomarker results

- MRI showed frontal cranial hemorrhage and minor blood degradation products that were not detected in the first MRI
- Radiologist stated that alterations may be related to the recent head injury

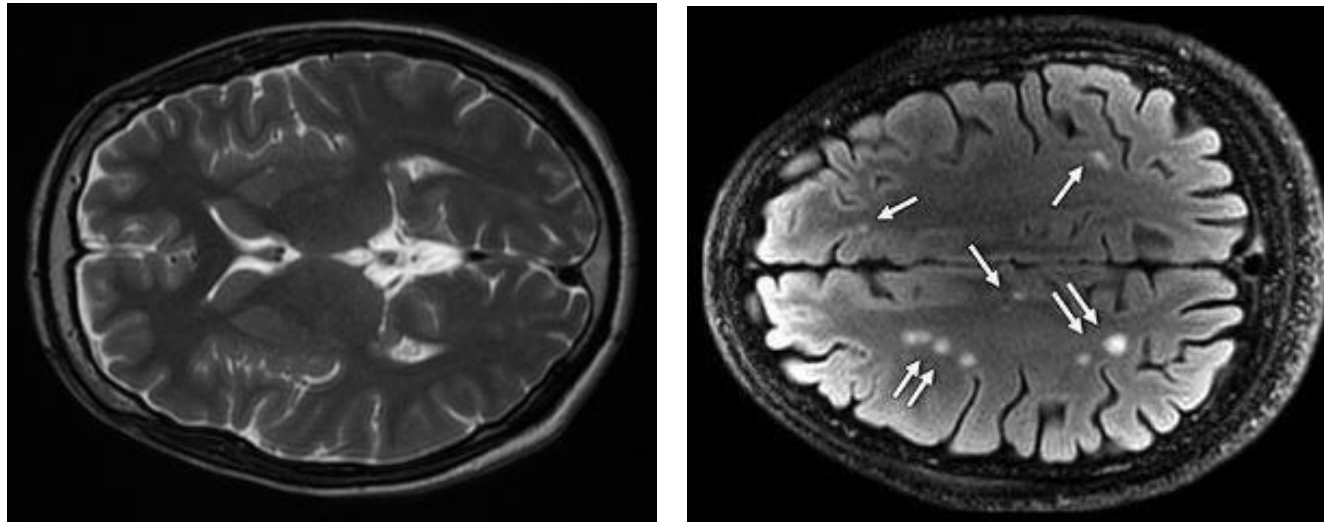


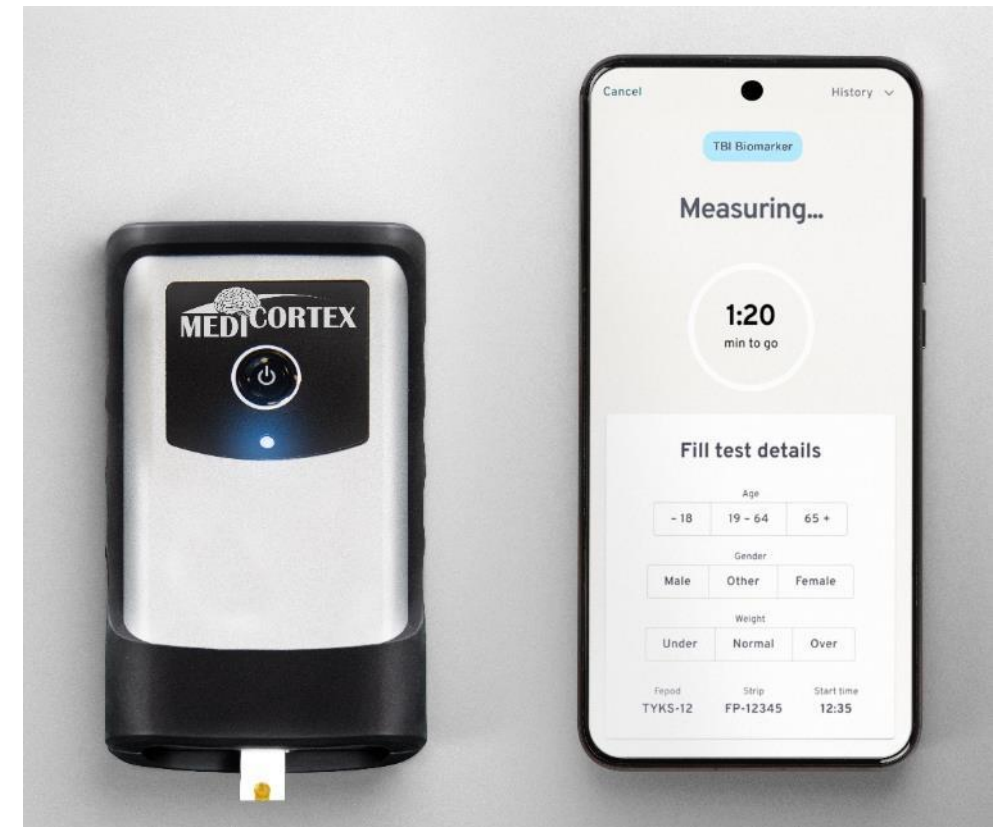
Illustration of MRI findings in TBI
(not from the case study)
Left – normal Right - TBI

2nd Generation Quantitative Test



Electrochemical sensor and device for quantitative measurement (TesTBI)

- Recognition of the biomarker in sample by highly specific synthetic binding molecules (aptamers)
- Biomarker in sample triggers an electric signal on sensor which is translated to quantitative value through unique software
- Collaboration with Fepod Oy Ltd (www.fepod.fi)
- Funding is searched for expanding the project



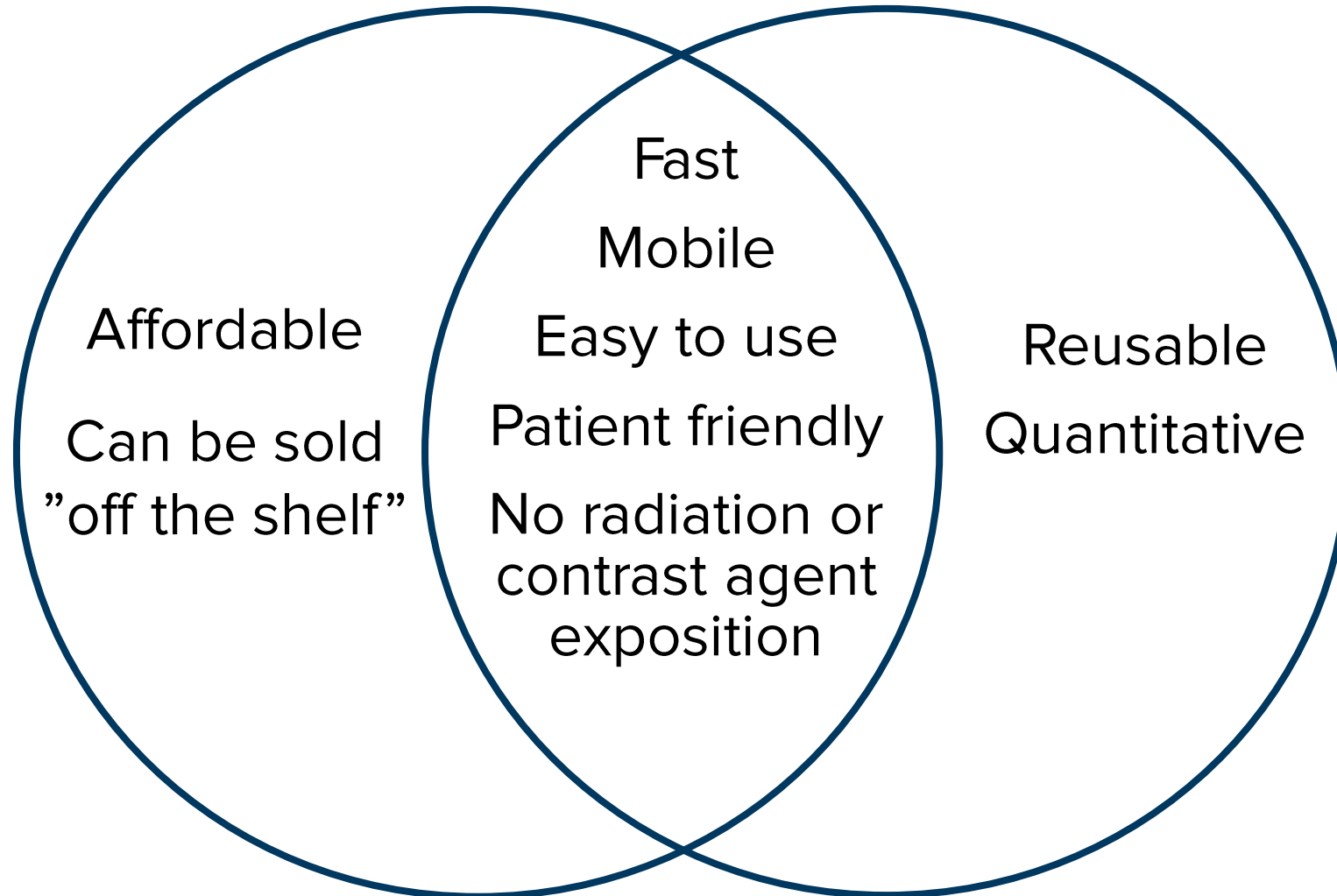
Illustration

Medicortex Test Advantages



ProbTBI™ Kit

TesTBI Reader Device



Our Potential Clients



**Army
paramedics**



**Hospitals and
emergency rooms**



Paramedics



**First
responders**



**Sport
teams**



Schools



**Nursing
homes**



**Private
people**



**Insurance
companies**

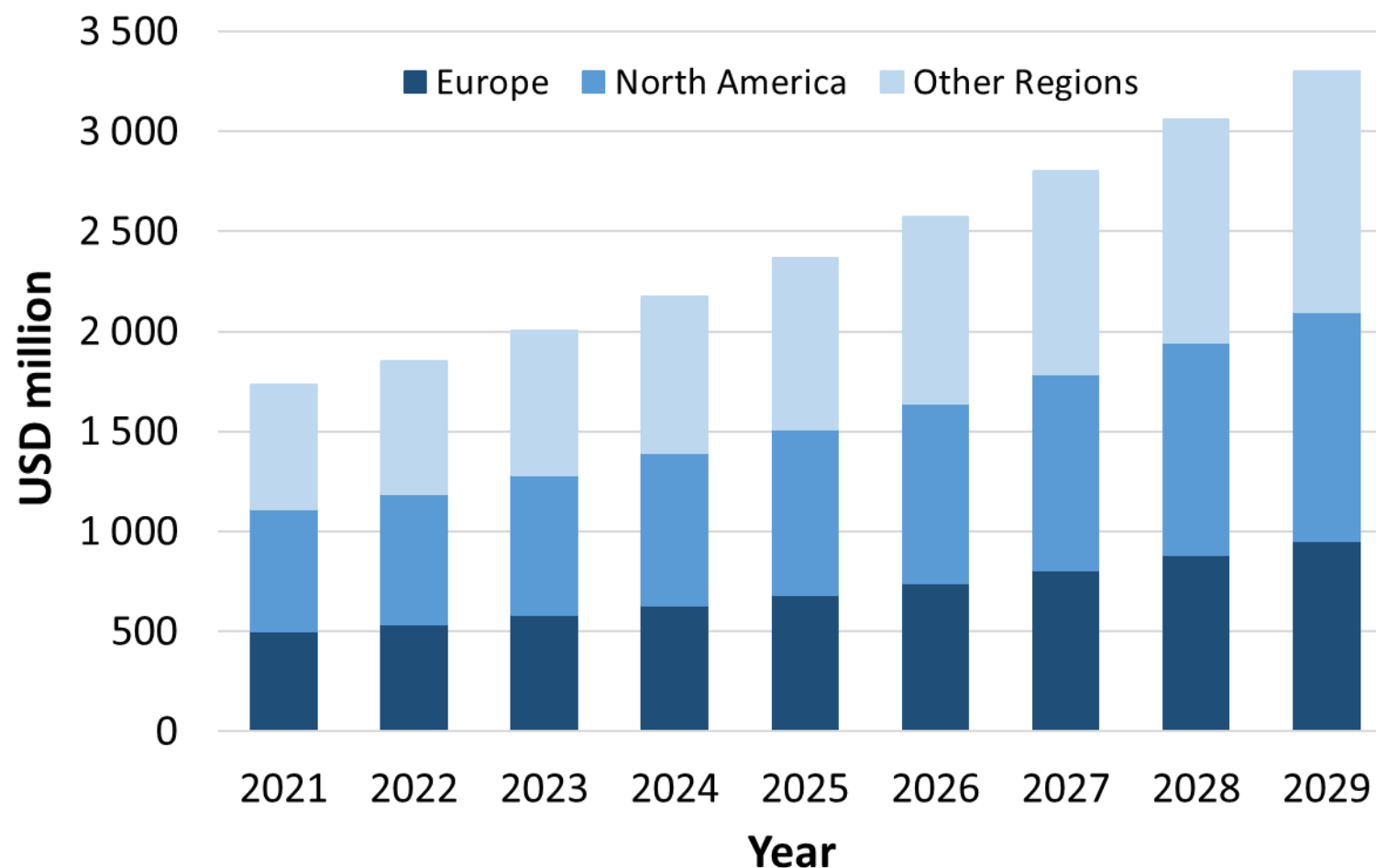


**Pharma
companies**

Market Potential



Traumatic Brain Injury diagnostic global market expected to reach **\$3.3 billion** by 2029



Source:
Cognitive Market
Research (2021)

Market growth can be related to increase in population, aging population, increased number of vehicles on the road, and extra leisure time to get engaged with risky activities, as well as enhanced clinical classification and diagnostics.

The background is a solid blue color with a faint, out-of-focus image of a glass vial and several blue and white capsules scattered around it. The text is centered in the upper half of the image.

Drug Development: Future Prospects

Neuro-protective Medication for Brain Injury

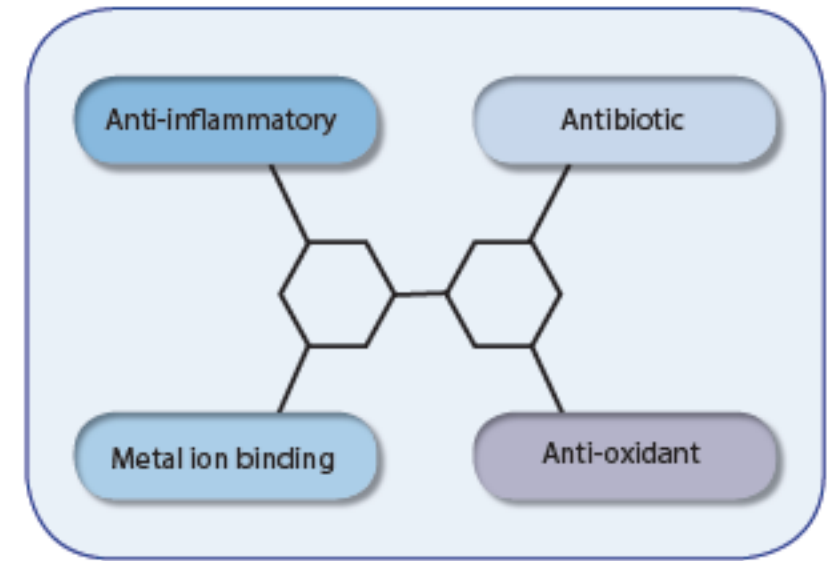
- Medicortex has designed and patented several compounds (New Chemical Entities, NCE) with multiple neuroprotective functionalities
 - Potential **drug candidates** for halting the exacerbation of the brain injury (secondary injury)
- Secondary injury involves multiple biochemical reaction cascades occurring in the brain
- A multifunctional drug is believed to have higher therapeutic potential than previously studied drug candidates which targeted single reaction pathways



Neuro-protective Medication for Brain Injury



- Two compounds (**TBI-466** and **MCF-013**) have been chemically synthesized
 - Found to be safe in preclinical escalating dose studies
- The compounds
 - Have the ability to cross the blood-brain barrier (BBB)
 - Contain a newly designed chemical spacer on which at least two functional groups are attached
 - Have several neuroprotective properties:
 - ✓ Binding of free metal ions
 - ✓ Anti-oxidation
 - ✓ Anti-inflammation
 - ✓ Free radicals scavenging



The background is a solid blue color with several faint, semi-transparent financial charts overlaid. In the top left, there is a bar chart with approximately 10 bars of varying heights. In the top right, there is a line chart with a grid background, showing a fluctuating line with data points. In the bottom right, there is another bar chart with about 10 bars, some of which are quite tall. The overall aesthetic is professional and data-oriented.

Intellectual Property Position

Patents for the Biomarker and Diagnostics



1. Prognostic and Diagnostic Glycan-based Biomarkers of Brain Damage

- European patent No. 3283880
- US patent No. 10,739,335
- Canadian patent No. 2,982,503
- Israeli patent No. 254 980

2. Non-invasive Brain Injury Diagnostic Device

- PCT-application WO/2018/154,401, has entered national phases
- South African patent (number pending)
- Utility model granted in China and Australia

3. Device and Method for Detecting of Brain Injury in a Subject

- PCT-application WO 2021/099677
- Australian innovation patent No. 2020104474
- Finnish Utility model No. 13179

Patents for the Biomarker and Diagnostics

(continues)



4. A Method for Determining a Lectin-binding Glycan Indicative to Traumatic Brain Injury

- European patent No. 4133279
- PCT-application WO 2021/205059

5. A Method for Diagnosis of Traumatic Brain Injury

- Finnish patent No. 130340
- PCT-application WO 2023/161557

6. Method of Detecting Tissue Damage

- Finnish patent No. 130428
- PCT-application WO 2023/161553

7. A Hand-held Liquid Sample Collection and Testing Device

- Finnish utility model No. 13331
- German utility model No. 20 2023 100 246



Patents for the Drug Development



1. Multivalent Compounds for Use in the Treatment and Prevention of Brain Damage

- US patent No. 9,975,846
- Finnish patent No. 127024
- Israeli patent No. 251407
- European patent No. 3201173

2. Conjugates and Conjugates for Use in Preventing or Treating of Brain Damage and Neurodegenerative Diseases

- PCT-application WO 2021/038125
- Finnish patent No. 130262

Patent for COVID-19 Diagnostics

1. Method for Determining Coronavirus and Kit for the Same

- PCT-application WO 2021/205058
- European patent No. 3911956

The background is a solid blue color with various financial-themed elements. On the left, there is a stack of silver coins. In the center and right, there are faint, semi-transparent images of a bar chart and a pie chart. At the top, there is a large, faint number '12.73.0M' and a percentage '+3.32%'. At the bottom left, there is a faint number '13.12.0M' and a percentage '+16.28%'. The overall theme is finance and investment.

Public and Private Financing

Equity up to Now

- About 3.3 M€ from the founder and 280 private investors
- Total number of shares issued about 22 million
- Current price per share 1.00 € and total valuation 22 M€

Subsidies in the Past

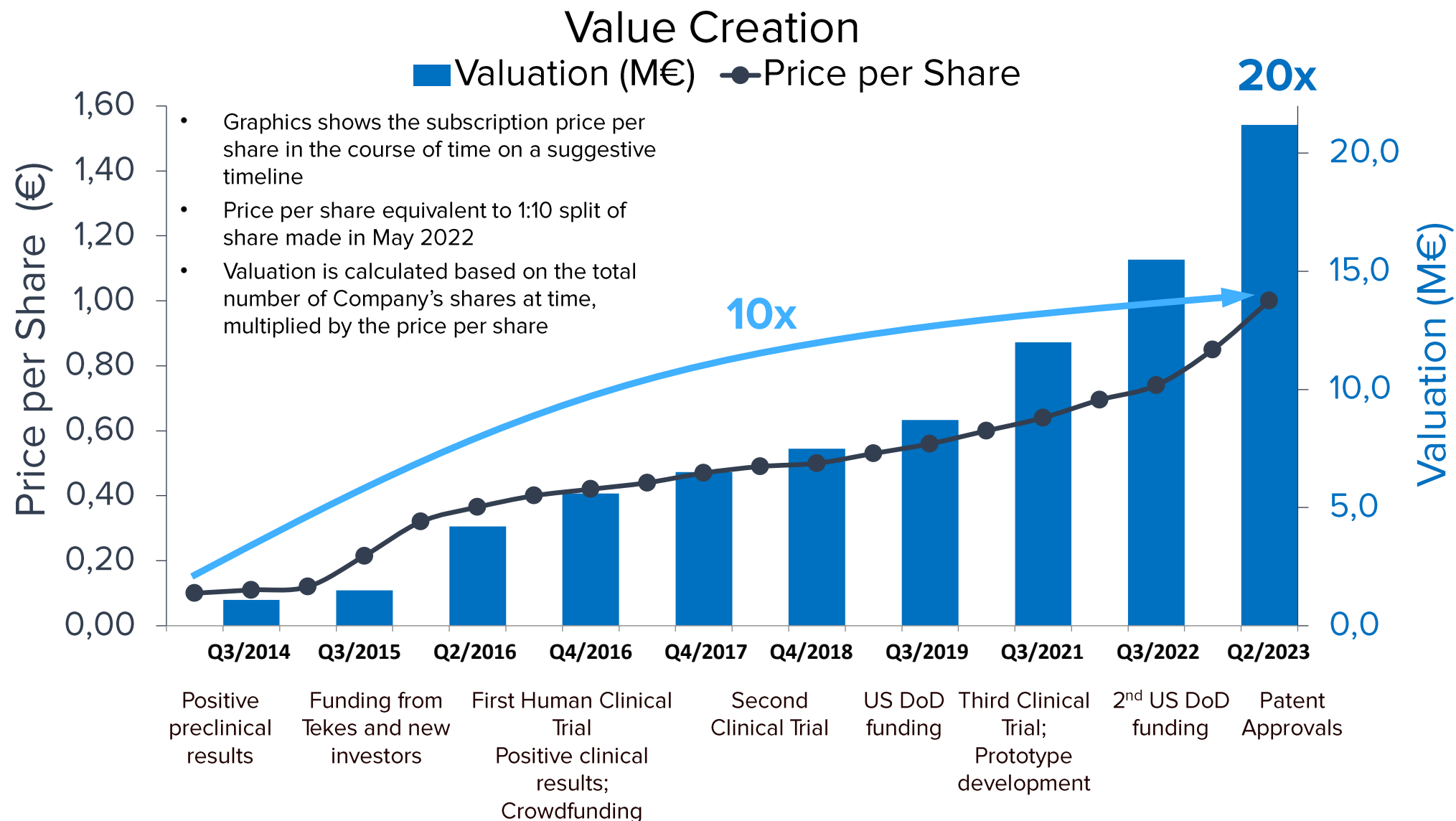
- Total of 1.8 M€ in grants
 - Including 1.1 M dollars from the US Department of Defense
- 70 k€ in awards

Present

- A research grant of 2.1 million dollars received from the US Department of Defense (see [press release](#))
- **Medicortex is looking for investors:**
 - <https://www.medicortex.fi/eng/investors/>



From 2014–2023 Increase in Value



Use of Funds 2024-2025



www.medicortex.fi

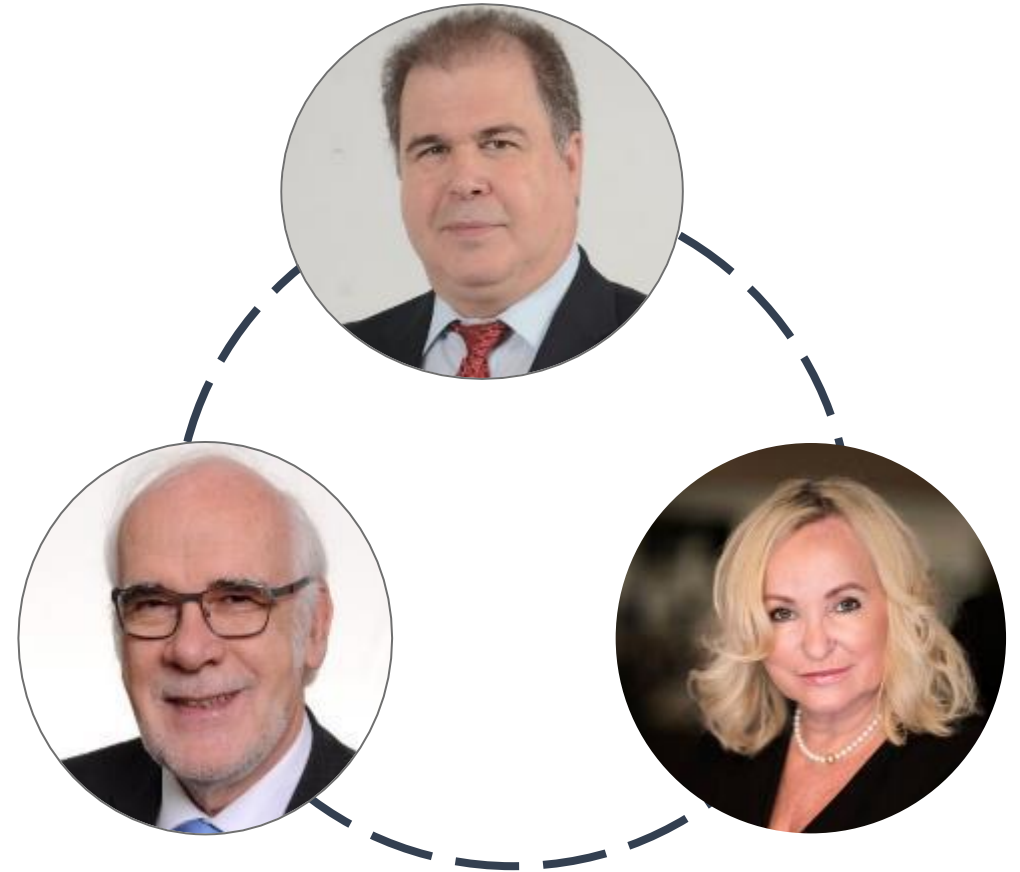
New investments will be used for the diagnostic kit development:

- Strip test prototype assembly and manufacturing
- Test validation in clinical experiments
- Initiation of the regulatory process
- Performing the TesTBI electrochemical sensor feasibility studies

Board of Directors



- Chairman of the Board - [Adrian Harel](#), PhD, MBA
- Member - [Mårten Kvist](#), MD, PhD, Associate Professor, Chairman of the Scientific and Clinical Advisory Board
- Independent Member - [Anna Tenstam](#), MSc, MBA, Served as a manager and board member in several companies



Scientific and Clinical Advisory Board



Mårten Kvist, MD, PhD, Associate Professor, Chairman of the Scientific and Clinical Advisory Board, Finland.

Lauri Kangas, PhD, Associate Professor, Pharma Scientific Adviser, Chief Scientific Officer, Finland.

Risto O. Roine, Professor in Neurology and Chief Physician, Division of Clinical Neurosciences, University of Turku and Turku University Hospital, Finland.

Mika Hannula, Professor, DSc (Tech), Vice Rector, University of Turku, Finland.

Antti Kaipia, MD, PhD, Associate Professor, Chief, Department of Urology, Tampere University Hospital, Finland.

Markku Tuominen, MD, PhD, Chief Physician and CEO, Medisport Oy, Finland.

Timo Kurki, MD, PhD, Associate Professor, Neuroradiologist, Chief of Medical Imaging, Terveystalo Oy, Finland.

The Team



CEO, Founder
Adrian Harel
PhD, MBA



CSO
Lasse Välimaa
PhD



COO
Pihla Miettinen
MSc



Senior Scientist
Ivette Bañuelos
PhD



Scientific Writer
Leonardo Lara-
Valderrábano
PhD



Product Manager
Begum Utz
PhD



Research Assistant
Julia Virtanen
MSc



Development Engineer
Kaisa Leppä
BSc

Medicortex in the Press



1

Medicortex was granted a European patent for detection of biomarker indicative to brain injury

2

Business Finland supporting Medicortex

3

Medicortex was granted a Finnish patent related to the detection of tissue damage

4

Medicortex Finland was granted a European patent related to the diagnostics of COVID-19 in saliva

5

Medicortex Finland Plc appointing a new advisor

6

Medicortex Finland Plc signed a 2 million dollars research grant contract with the US Department of Defense

YouTube videos

- [How repeated concussions affect your brain](#)
- [Concussion in sports and Medicortex test](#)
- [Concussion in army personnel and Medicortex test](#)

LinkedInTM group

- [The Science Behind TBI](#)
 - Posts and discussion about science and research on TBI
 - >2,600 members

www.medicortex.fi

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