CENTER FOR INTEGRATIVE RESEARCH IN CRITICAL CARE
UNIVERSITY OF MICHIGAN

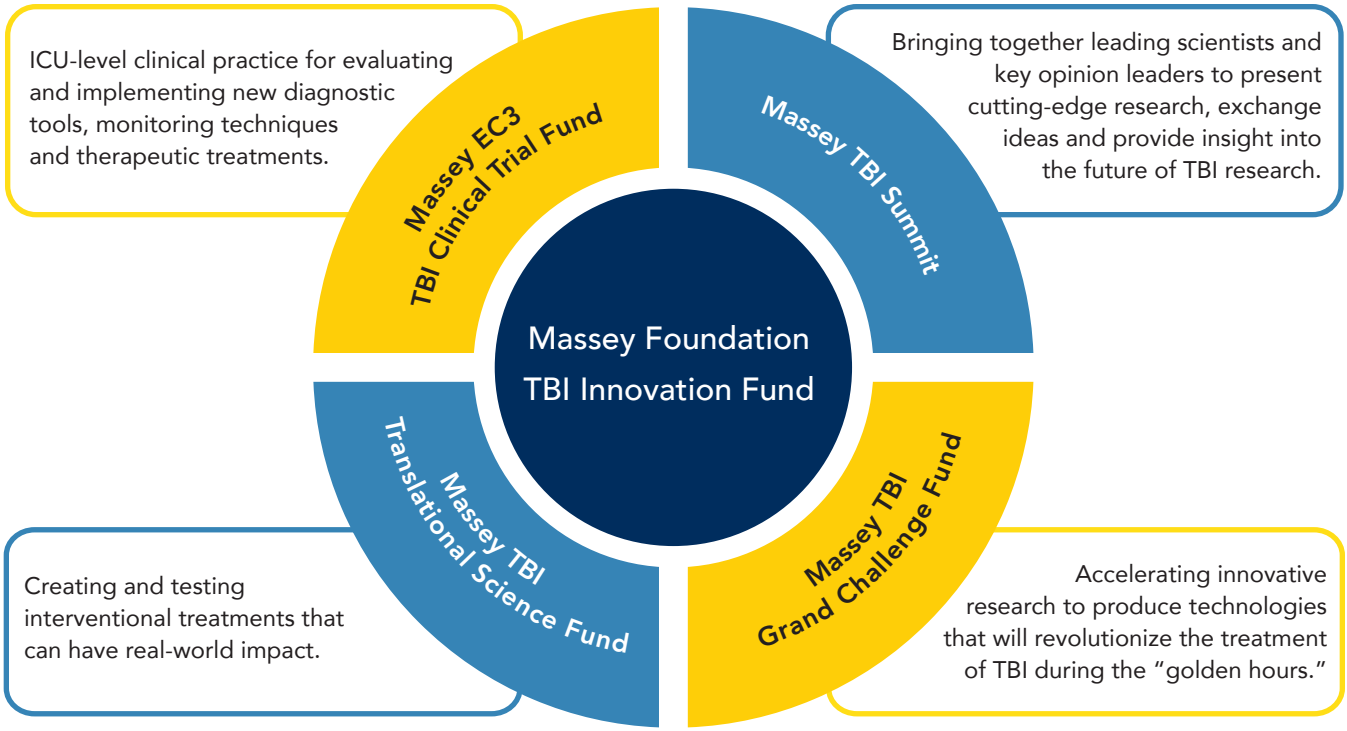
The Massey Foundation TBI Innovation Fund

The Joyce and Don Massey Family Foundation is supporting U-M efforts to save lives and improve the outcomes of those who suffer traumatic brain injuries (TBI). The fund was developed to support technology development, and translational and clinical research that will impact the diagnosis and treatment of moderate to severe TBI during the initial "golden hours" of care.

"The Golden Hours"

The significance of the golden hours is that, in general, the treatment administered during this critical time frame can determine patient survival and have a significant effect on long-term function and disability.

The Virtuous Circle: A Partnership to Drive TBI Innovation



Translational Science Projects

- Early administration of plasma and valproic acid (a brain protecting drug) to decrease the degree of brain injury and improve the speed of recovery.
- Use of a cancer medication, Imatinib, also known as Gleevec, to protect the injured brain cells.
- Treatment with an iron binding agent, deferoxamine, to reduce brain injury after traumatic brain hemorrhage.
- Administration of branch chain amino acids and memantine to attenuate the traumatic brain damage.

2015 Funded Projects

Technology Development Projects

- Real-time analytics tool that detects the early onset of hemodynamic instability to avoid secondary brain insults and injuries.
- Rapid and non-invasive assessment of intracranial pressure using ultrasound and impedance measurements of the eye.
- Automated brain imaging analysis system that:
  - detects edema and its location
  - detects hematoma and its severity
  - estimates the midline shift and its location
  - predicts intracranial pressure and its severity

For more information contact: Janene Centurione MCIRCC tel 734-647-1461 or jrcentu@umich.edu

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The TBI Research Challenge

"TBI is considered the most complex disease in our most complex organ"

What is traumatic brain injury?

Traumatic brain injury (TBI) occurs when sudden trauma causes damage to the brain. TBI can result when the head suddenly and violently hits an object, or when an object pierces the skull and enters brain tissue. Not all blows or jolts to the head result in a TBI. The severity of a TBI may range from "mild" (i.e., a brief change in mental status or consciousness) to "severe" (i.e., coma, death, or severe disability).

TBI in the United States

- 2.5 million people sustained a TBI in 2010
- 52,000 deaths each year
- Contributes to 30% of all injury related deaths
- 4th leading cause of death
- $56+ billion cost to the economy each year (direct and indirect)
- 5.3 million Americans currently live with disabilities related to TBI
- Over 60% percent of the most seriously wounded soldiers from our recent wars suffer from TBI and post-traumatic stress (PTS)

MILD

- Loss of consciousness < 30 min
- Glasgow Coma Scale of 13-15
- Often missed at time of initial injury
- 15% of people have symptoms that last a year or more

MODERATE

- Loss of consciousness 20 min to 6 hrs
- Glasgow Coma Scale of 9-12
- Usually abnormal CT or MRI findings

SEVERE

- Loss of consciousness > 6 hours
- Glasgow Coma Scale of 3-8
- Closed TBI: caused by movement of the brain within the skull
- Penetrating TBI: caused by a foreign object entering the skull

The Glasgow Coma Scale (GCS) is the most common scoring system used to describe the level of consciousness in a person following a traumatic brain injury.

Current Tests

Glasgow Coma Scale (GCS)	15-point test assesses initial severity of brain injury by checking person's ability to follow directions, speak, and move their eyes and limbs.
Computerized Tomography (CT) Scan	Quickly visualizes fractures and uncovers evidence of bleeding in the brain, blood clots, bruised brain tissue and brain tissue swelling.
Magnetic Resonance Imaging (MRI)	Used after the person's condition has been stabilized to provide information about a patient's expected outcome in the long term.
Intracranial Pressure Monitor (ICP)	Tissue swelling from a TBI can increase pressure inside the skull and cause additional damage to the brain.

Treatment Gaps

Current diagnostic tools are limited to X-rays, CT scans and MRIs

- Increase patients exposure to radiation
- Limited in their ability to detect microscopic injuries to the brain
- Limited in their ability to monitor ongoing injury mechanism
- Not portable

= Need for powerful, bedside diagnostic tools

Current monitoring techniques are invasive

- Intracranial Pressure Monitoring (ICP) is widely practiced but can increase risk of infection and cause further damage to the brain
- The efficacy of ICP monitoring and treatment is unclear

= Need for continuous, non-invasive monitoring

Lack of therapeutic treatments

Osmotic agents, anti-seizure drugs, sedatives and coma-inducing drugs are currently used to reduce swelling and limit further damage to the brain but cannot help repair damage.

= Need for personalized therapies that improve functional outcome

Current Diagnosis & Treatment

immediately following an injury

Mild injury

- Rest
- Over-the-counter pain reliever
- Close monitoring for worsening symptoms

Moderate to severe injury

- Ensure adequate oxygen and blood supply
- Monitor and treat increased intracranial pressure
- Minimize secondary damage due to inflammation, bleeding or reduced oxygen supply
- Imaging scans: CT scan or MRI

Medications

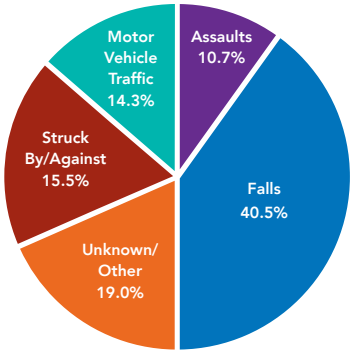
- Osmotic agents: help reduce pressure inside the brain
- Anti-seizure drugs: avoid additional brain damage caused by a seizure
- Sedatives and coma-inducing drugs: a comatose brain needs less oxygen to function

Surgery

- Remove clotted blood
- Repair skull fractures
- Open a window in the skull to relieve pressure

Leading Causes of TBI

in U.S. from 2006-2010



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