

OPERATION BENCH TO BATTLEFIELD

The Combat Casualty Care Program
at the Michigan Center for Integrative Research in Critical Care



BATTLEFIELD REALITIES

Despite major advances in modern civilian medicine, few have been made that have specific impact in combat casualty care to improve long-term survival and recovery of the severely wounded warrior. The complexity and severity of wounds incurred on the battlefield are beyond what we experience at home. Additionally, the 'Golden Hour' concept developed and practiced by the civilian trauma community — that trauma victims have the best chance of survival if they begin receiving care at a definitive trauma center within one hour of their injury — is significantly complicated on the battlefield due to issues with transport availability, terrain, weather, and active combat conditions.

These unique conditions make it imperative that researchers work to improve field treatment capability, and make sophisticated life-saving care readily available to the injured, despite their location. The added challenge in this endeavor is the inability to predict, with certainty, the landscape of future conflicts, which could range from desert and mountainous environments to the tropics, or even to small tactical operations in large cities.

This unprecedented unpredictability and the need for a new generation of adaptive tools and devices that can be deployed in the battlefield, are the cornerstone around which the **Michigan Center for Integrative Research In Critical Care** developed its **Combat Casualty Care Program**.

COMBAT CASUALTIES BY THE NUMBERS*



30 min

Approximately 86% of all battlefield deaths occur within the first 30 minutes after wounding

#1

Traumatic hemorrhage is the number one cause of combat deaths for U.S. service members



379,500+

service members have sustained a traumatic brain injury (TBI)

Nearly 25% of combat deaths in Iraq and Afghanistan between 2001 and 2011 were 'potentially survivable'



90% of those deaths occurred before the injured reached a medical facility

*Data provided by the U.S. Department of Defense and Centers for Disease and Prevention (CDC)

THE MCIRCC SOLUTION

MCIRCC's Combat Casualty Care Program brings together world-class researchers, clinicians, engineers, and data scientists from the University of Michigan to develop cutting-edge solutions that elevate the care, outcomes, and quality of life of critically injured service members. The impact of this pioneering approach is made even more substantial through our partnerships with entrepreneurs and industry.

1

Resuscitation and Tissue Salvage

MCIRCC has been instrumental in testing new resuscitation strategies, such as freeze-dried plasma, and are currently developing low volume (weight) resuscitation and other modalities, which enhance tissue survival and healing, reduce bleeding, prevent infection, and lessen pain in trauma and burns.

2

Hemorrhage Control

Our researchers are developing and testing new hemostatic strategies including new tourniquets and external and internal compression devices, hemostatic materials and bandages, and endovascular hemorrhage control devices. Some of these technologies have already been deployed in the battlefield.

3

Acute Life Support

Innovative technologies that support vital organs such as the respiratory, cardiovascular, and renal systems are currently being developed by MCIRCC researchers. Several of these technologies incorporate advanced control approaches, which attempt to develop closed-loop systems which use multiple physiologic inputs to provide precision life support.

OUR IMPACT

Our research and product portfolio is guided by the complexity of battlefield injuries, the challenges faced by first responders, and the echelons of care the wounded travel through before they reach a definitive trauma center. This integrative research plays a significant role in developing strategies that will not only be effectively deployed on the battlefield to save lives, but also those that will become next generation products and services here at home.

4

Traumatic Brain Injury

MCIRCC researchers are re-examining how severe TBI is diagnosed, monitored, and treated by leveraging new models, therapeutics, devices, and diagnostics in parallel, rather than using the prevalent 'silver-bullet' approach. Much of this work is done as a result of MCIRCC's partnership with the Massey Foundation.

5

Physiologic Monitoring & Clinical Decision Support Systems

MCIRCC clinicians, physiologists, engineers, and data scientists are creating the next generation of deep physiological vital signs and monitors, as well as big data clinical decision support algorithms that will allow for precision diagnoses and care for the severely wounded.

6

Acute Rehabilitation Engineering

Our researchers are developing new approaches to automated and precision rehabilitation and other countermeasures that will leave patients stronger and reduce complications from prolonged immobilization.

WHY MCIRCC?

WE HAVE THE RECIPE FOR SUCCESS.

The University of Michigan Center for Integrative Research in Critical Care (MCIRCC) is the innovation hub for more than 170 critical care researchers across the University of Michigan. As one of the first comprehensive enterprises devoted to transforming critical care medicine, we foster multidisciplinary collaborations between our members – unifying scientists, clinicians, engineers and industry partners – to accelerate science and deploy cutting-edge solutions that elevate the care, outcomes, and quality of life of the critically ill and injured. In addition, MCIRCC has developed close collaborative partnerships with the U.S. Department of Defense including:

- U.S. Army Medical Research and Materiel Command
- U.S. Army Institute of Surgical Research
- United States Special Operations Command
- Joint Special Operation Medical Training Center
- F. Edward Hebert School of Medicine Uniformed Services University (America's Medical School)
- Office of Naval Research

MCIRCC leaders have also developed civilian trauma center-based training programs responsible for providing clinical training for more than 1,200 special operations combat medics.

WE ARE LEADERS AND BEST.

MCIRCC is focused on leveraging our multidisciplinary model of research with our ability to integrate University of Michigan's prestigious reputation, campus-wide talent, and supporting resources to bring university-led critical care innovations to market. Our members span many disciplines across the university, yet have the common goal of improving the lives of critically ill and injured patients and their families.

WE TAKE RESEARCH TO THE NEXT LEVEL.

Our members are at the cutting-edge of science and innovation. For example, in June 2016, MCIRCC multidisciplinary teams received more Prolonged Field Care Research Awards from the Department of Defense's Combat Casualty Care Research Program than any university in the country.

- Ocular Bioimpedance Device and Optic Nerve Ultrasound for the Care of Traumatic Brain Injury
- Valproic Acid to Improve Survival Prolonged Damage Control Resuscitation
- Noninvasive Monitoring Tools for Prolonged Field Care Goal Directed Therapy
- Gastroesophageal Resuscitative Occlusion of the Aorta (GROA) for Rapid Intraabdominal Hemorrhage Control

BE A VICTOR FOR OUR WARRIORS

YOU CAN SAVE LIVES ON THE BATTLEFIELD AND AT HOME.

Technologies and approaches that enhance survival of our military personnel will also greatly benefit thousands civilian trauma victims each year. Over the last decade, several important medical and surgical innovations created for military conflicts have found their way into everyday emergency and critical care practice here at home. These range from the creation of new bandages, devices, and transfusion protocols to control life-threatening hemorrhage, to new operative and surgical care models which improve a trauma victim's chance of survival. The University of Michigan not only uses these innovations today, but research like that done at MCIRCC continues to play a significant role in developing these and other technologies that will be used to save lives both on the battlefield and at home.

YOU CAN INFLUENCE SCIENCE AND DISCOVERY.

With current scattered and insufficient funding sources discouraging high-risk research, enhancing long-term survival following battlefield injury requires solutions that seem almost like science fiction. So we are embarking on a unique partnership model that depends upon private support from donors, investors, and entrepreneurs. And while the investment is great, the return on the investment is even greater. These funds will enable the MCIRCC Combat Casualty Care Program to perform high risk research, maintain research facilities, engage our members, and enable scientists, engineers, and physicians to investigate problems and invent the solutions necessary to save lives.



A GIFT THAT GETS RESULTS

With MCIRCC at the helm, many promising TBI research projects have been funded and developed into products through the **Massey TBI Grand Challenge**. Created by a gift from the Joyce and Don Massey Family Foundation, this intensive program includes education sessions, proposal submissions, and project reviews by experts from across U-M, industry, and the Department of Defense (DoD).

Since 2015, 19 teams have received funding, going on to publish their work in peer-reviewed journals, present at national conferences, and/or obtain follow-on funding through other sources. In addition, the Grand Challenge helped to establish a partnership between MCIRCC and the DoD's Combat Casualty Care Research Program, which has provided our TBI research community with invaluable resources and opportunities.

A photograph of a soldier lying on the ground, being treated by medical personnel. The soldier is wearing camouflage gear and a helmet. Medical personnel are visible around the soldier, with one person's hands and a medical device (possibly a ventilator or pump) in the foreground. The scene is outdoors, possibly in a field or training area. The image is overlaid with a semi-transparent blue filter.

**“WE MUST ATTACK THESE PROBLEMS FROM EVERY
ANGLE AND WITH EVERY CONCEIVABLE RESOURCE
IN THE SAME WAY MEDICINE HAS ATTACKED OTHER
PROBLEMS SUCH AS CANCER AND HEART DISEASE.
OUR SERVICE MEN AND WOMEN AND THEIR FAMILIES
DESERVE NOTHING LESS.”**

- Dr. Kevin Ward, MCIRCC Executive Director

For more information, contact:

Phil Jacokes, Managing Director
pjacokes@med.umich.edu
(734) 647-1461

MCIRCC
CENTER FOR INTEGRATIVE
RESEARCH IN CRITICAL CARE

North Campus Research Complex
Building 10-103A
2800 Plymouth Road
Ann Arbor, MI 48109