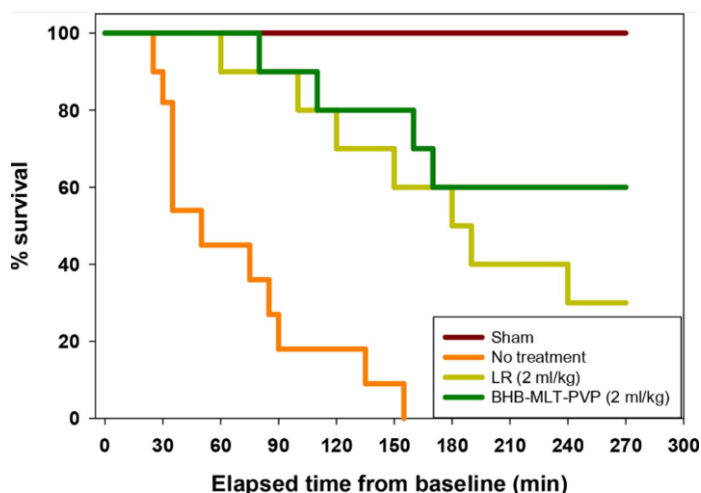




## Treating trauma-induced acute blood loss

Novel formulations of D- $\beta$ -hydroxybutyrate and melatonin improve survival from hemorrhagic shock.



IP Status: US Patents 10,307,398 | 9,149,450 | 9,186,340

### Applications

- Emergency medicine to treat acute hemorrhagic shock

### Key Benefits & Differentiators

- Improved efficacy compared to the clinical standard, LR solution, in vivo (60-80% survival, compared to 30% for LR)
- Replacement of DMSO improves in vivo efficacy and reduces in vitro hemolysis.
- Simplified, user-friendly preparation of lyophilized powder reconstituted in water.

### Technology Overview

Hemorrhagic shock (HS) is the second-leading cause of injury-related death. HS is caused by rapid blood loss, resulting in decreased blood pressure, reduced oxygen delivery to cells, and hypothermia. To supplement lost blood volume, first responders employ specially formulated solutions called resuscitation fluids (RFs). Despite widespread clinical use, uncertainty remains regarding optimal use of these fluids, and adverse effects have been described for both normal saline and Lactated Ringer's (LR) solution, the two most used treatments. Therefore, there is need to develop readily usable and efficacious RFs.

Initial studies showed treatment with a combination of D- $\beta$ -hydroxybutyrate (BHB) and melatonin (M) improves survival in HS animal models. However, the DMSO solvent necessary to solubilizing melatonin has therapeutic liability limiting its use in RF. Researchers at the UMN identified novel formulations with alternative cosolvents (PVP alone or in combination with PEG and CD), which circumvent the limitations of using DMSO. These new RFs demonstrate

### Technology ID

2017-0028, Z04048

### Category

Engineering & Physical  
Sciences/Sustainable Technology  
Life Sciences/Therapeutics  
Agriculture &  
Veterinary/Veterinary Medicine

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improved efficacy in rat HS models compared to both the clinical standard (normal saline and LR) and the original DMSO-based formulation.

### **Phase of Development**

#### **TRL: 5-6**

Pre-clinical proof of concept in rat and pig models of hemorrhagic shock or trauma

### **Desired Partnerships**

This technology is now available for:

- License
- Sponsored research
- Co-development

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### **Researchers**

- [Gregory Bielman, MD](#) Professor, Department of Surgery
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- [Seema Thakral, PhD](#) Communications Director, Scientist, Characterization Facility

### **References**

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