Current CPR techniques don’t take into account the individual physiology of the patient – such as chest size, blood perfusion signals, and cardiac arrest cause – despite the importance of these factors for patient outcomes. Our automated mechanical chest compression device for cardiopulmonary resuscitation (“Smart” CPR) adjusts thrust depth and rate to the current needs of the patient. Although there are other automated CPR systems on the market, all of them give fixed compressions across patients and time, so ours is the only system that can provide shallower compressions for a child or more rapid compressions for a patient in decline.

**Technology Description**
Our device compresses the patient’s chest through a linear actuator controlled by a SmartMotor™. The position of the actuator is calculated with high precision by an optical encoder and a potentiometer. Our device could be linked to a cardiac monitoring system – which is already ubiquitous across ambulance fleets – that is capable of measuring electrocardiogram and perfusion signals. Then these signals could be used in real time to adjust the parameters of the Smart CPR compression arm. Animal studies have shown that Smart CPR provides greater blood perfusion and leads to more favorable survival rates from cardiac arrest.

**Advantages**
- Automated
- Personalized
- Adaptive
- Can be linked to current cardiac monitoring systems in ambulances

**Applications**
- Paramedicine
- Hospitals
- Nursing homes

**Stage of Development**
working prototype

**IP Status**
US non-provisional patent application
15/105,510

**Notable Mentions**
Center for Medical Innovation grants totaling $19,000
Dr. Menegazzi’s research interests include resuscitation from cardiac arrest, ventricular fibrillation, ventilation adjuncts, and emergency medicine.

**Publications**

- Reynolds JC, Salcido DD, Menegazzi JJ. Correlation between coronary perfusion pressure and quantitative ECG waveform measures during resuscitation of prolonged ventricular fibrillation. Resuscitation. 2012. 83(12) 1497-502
- Salcido DD, Menegazzi JJ, Rittenberger JC. Electrophysiology and hemodynamics of open chest resuscitation from cardiac arrest in a swine. Acad Emerg Med. 2009. 16(1) 89-90.

Dr. Salcido began his resuscitation research work in 2006 as a research technician under the mentorship of Dr. Menegazzi. Since then he has developed interests in cardiac arrest physiology (acute phase), resuscitation device and robotics development, signal analysis, and emergency medicine epidemiology. Currently, Dr. Salcido is a collaborator on Dr. Menegazzi's "Utilization of Quantitative ECG Measures During Cardiopulmonary Resuscitation" project, and a K12 Scholar with the NHLBI-Sponsored Career Development Program in Emergency Medicine Research.

Dr. Sundermann completed his PhD in biomedical engineering in fall 2017 and has since begun working at ZOLL Medical Corporation. For his thesis work, Dr. Sundermann was trained in the use and maintenance of eight different artificial heart support devices, managed care of adult and pediatric patients, and tracked device parameters for clinical trials. During most of this time he was also working as an emergency medical technician at Foxwall Emergency Medical Services.