



## ThreadRite IV ID: 04169

Featured Innovators: Cameron Dezfulian, MD and William Clark, PhD

Peripheral intravenous catheters (or IV's) are the mainstay for providing therapies in modern medicine. Yet approximately 90 million people each year require multiple attempts to establish IV access. These extra attempts result in increased hospital cost associated with employee time, additional patient discomfort, and delays in delivering important therapies. Currently IV catheters rely upon blood return and they do not assist with advancing the catheter into the vein. ThreadRite is a modified standard catheter that immediately alerts clinicians to vein entry. It also employs a guidewire to help clinicians thread the IV right into the vein. ThreadRite will reduce patient pain as well as provider costs associated with this common problem.

### Technology Description

ThreadRite consists of a modified standard IV catheter, which connects to a lightweight re-usable detection unit. The disposable unit has a guidewire in line with the needle and catheter. The guidewire-needle connects to the detector, which measures electrical resistance. Subcutaneous tissue has far higher resistance than blood, so the detection unit registers this resistance change and signals vessel entry instantly with a light, tone, and vibration. Once in the vessel, the guidewire facilitates catheter advancement.

### Advantages

- Reduction in cost to healthcare systems that are not reimbursed for failed attempts. By eliminating multiple attempts, we save 1-2 hours wasted per 8 hour shift. This time savings translates into cost savings by reduced staffing on the IV team (e.g. from 4 to 3 nurses per shift) or redirection of effort for other important tasks (e.g. phlebotomy, maintenance of vascular access sites, placement nasogastric tubes, etc.).
- Reduced patient pain and bruising from failed attempts, and hence improved satisfaction.
- Reduced adverse events including infiltrations, phlebitis, infections, and bruising – all of which are associated with multiple IV attempts.
- More rapid delivery of potentially life-saving therapies such as blood, fluid or antibiotics.

### Applications

- Insertion of arterial catheters
- Insertion of pericardiocentesis catheters
- Insertion of a peritoneal catheter
- Placement of thoracostomy catheters into pleural effusions or pneumothoraces
- Insertion of catheters into the cerebrospinal fluid
- Insertion of percutaneous tracheostomy tubes

### Stage of Development

We have built a working prototype that is capable of distinguishing between subcutaneous tissue and blood. The design is being finalized in preparation for animal testing and human feasibility studies.

### IP Status

A US provisional patent application was filed on July 7, 2017.

### Notable Mentions

- Coulter Translational Research Partners II Program: \$50,000
- Pitt Center for Medical Innovation: \$20,000
- Pitt Ventures First Gear: \$3,000

## Innovators



### **Cameron Dezfulian, MD**

Assistant Professor  
Adult and Pediatric Critical Care  
Medicine  
School of Medicine  
University of Pittsburgh

Dr. Dezfulian is a clinician-scientist at the University of Pittsburgh School of Medicine. He was born in Iran in 1974 and immigrated to US in 1978 prior to the Islamic Revolution. Dr. Dezfulian has been on faculty in Critical Care Medicine since 2011. Clinically, he cares for both adult and pediatric patients in the ICUs at UPMC Mercy, Presbyterian and Children's Hospital of Pittsburgh. His translational research centers on the use of nitrite/nitric oxide to mitigate post-cardiac arrest resuscitation injury. He has been funded during his career by NIH, AHA, the Laerdal foundation, and Mallinckrodt Pharmaceuticals, Inc. At present he is involved in two randomized clinical trials of nitrite and inhaled nitric oxide after out-of-hospital cardiac arrest both of which were funded in part on the basis of his earlier lab based research.

#### **Education**

MD Duke University  
BS University of Florida

#### **Publications**

- Coppler PJ, Wallace DJ, Dezfulian C, Rittenberger JC, Callaway CW, Elmer J, 2016. Influence of Cardiac Catheterization and Automated Implantable Cardioverter Defibrillator Placement on Long-Term Cause of Death in Cardiac Arrest Patients Discharged From the Hospital.
- Munoz-Price LS, Dezfulian C, Wyckoff M, Lenchus JD, Rosalsky M, Birnbach DJ, Arheart KL, 2012. Effectiveness of stepwise interventions targeted to decrease central catheter-associated bloodstream infections. *Critical care medicine*;40(5):1464-9.
- Dezfulian C, Lavelle J, Nallamotheu BK, Kaufman SR, Saint S, 2003. Rates of infection for single-lumen versus multilumen central venous catheters: a meta-analysis. *Critical care medicine*;31(9):2385-90.



### **William Clark, PhD**

Professor  
Mechanical Engineering and Materials  
Science  
  
Director of Innovation, Product  
Development, and Entrepreneurship  
  
Swanson School of Engineering  
University of Pittsburgh

Dr. Clark is the founder of Diamond Kinetics, Inc., based in Pittsburgh, where he is helping to create a better baseball experience through technology. Dr. Clark's research interests are in the area of dynamic systems, control, and mechatronics, and in addition to the ThreadRite IV technology includes the development of novel sensing methods including sensor fusion and the use of inertial measurements for a variety of human and industrial motion applications.

#### **Education**

PhD Virginia Polytechnic Institute and State University  
MS Virginia Polytechnic Institute and State University  
BS Virginia Polytechnic Institute and State University

#### **Publications**

- Kimber, M.A., Clark, W.W., and Schaefer, L.A., 2014, "Conceptual Analysis and Design of a Partitioned Multifunctional Smart Insulation," *Journal of Applied Energy*, vol.114, pp. 310-319
- Mo, C., Davidson, J., and Clark, W.W., 2014, "Energy Harvesting with Piezoelectric Circular Membrane under Pressure Loading," *Smart Materials and Structures*, vol.23.
- Bond, D., Kimber, M.L., and Clark, W.W., 2013, "Configuring Wall Layers for Improved Insulation Performance," *Journal of Applied Energy*, pp. 235-245.

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