UNIVERSITY OF PITTSBURGH
innovation
INSTITUTE

CardioSense ID: 03620

Featured Innovators: Prashant Kumta, PhD, Robert Kormos, MD, and Mitali Patil, MS

There is an increasing need to move diagnostic testing to point-of-care (POC) facilities and applications, especially for rapid-onset cardiac conditions such as congestive heart failure (CHF) and myocardial infarction (MI). The Centers for Disease Control and American Heart Association reported that annually, over 5.7 million adults suffer from CHF or MI, incurring costs over $50 billion. Symptoms of these conditions such as breathlessness or chest pain are misdiagnosed is about 40 percent of cases, allowing the disease to remain silent until serious complications arise. Although biomarkers could improve accuracy, they are investigated only about 50 percent of the time. To remove the barriers for testing, Cardiosense was designed as a portable device for rapidly and accurately screening patients for CHF and MI biomarkers. Accurate POC testing ensures that the patients receive the most appropriate medical care in a timely and expedient fashion.

Technology Description

CardioSense is a POC handheld biosensor that serves as a preliminary diagnostic and prognostic tool for CHF and MI. Using electrochemical impedance spectroscopy (EIS) and aptamers, CardioSense can detect biomarkers specific to CHF and MI in a cost-effective manner. Use of EIS makes the device highly sensitive, thus allowing the detection of biomarkers within minutes from just a finger prick's worth of blood, eliminating the need for long turnover and blood processing times required by current biomarker diagnostic techniques. In addition, aptamers improve the sensitivity of the device and allow the device to be reusable, thus reducing the amount of times the electrode disks need to be changed.

Advantages

- Eliminates the need for processing blood prior to testing
- Detects concentrations of biomarkers within minutes for rapid diagnosis/prognosis
- Highly sensitive, allowing for the detection of even trace concentrations of biomarkers
- Scaled down into a handheld model for ease of use and portability
- Aptamers and disks can be reused numerous times
- Cost-effective and inexpensive to make
- Universal platform for additional applications beyond CHF and MI

Applications

- Detection of brain natriuretic peptide and troponin T for the diagnosis and screening of CHF and MI
- Can be branched out to other cardiac markers to detect other cardiovascular diseases (i.e. creatinine kinase, myoglobin) or other disease states (e.g., traumatic brain Injury)
- Can also be used with antibodies, enzymes, and other biological detection elements, thus reducing the cost of developing new aptamers

Stage of Development

Optimization in the laboratory

IP Status

PCT patent filed on Oct. 4, 2016

Notable Mentions

- 2017 Coulter Translation Research Partners II Program Award (Funding: $50,000, November 2017)
- 2016 Clinical and Translational Science Institute T1/T2 Pilot Award (Funding: $25,000, March 2017)
- 2016 McGowan Institute of Regenerative Medicine First Place Poster Award, Category: Medical Devices (No Funding)
- 2015 Michael G. Wells Healthcare Competition Third Place Award (Funding: $3,000 Effective October 2015)

UNIVERSITY OF PITTSBURGH
innovation
INSTITUTE

Innovators

Prashant Kumta, PhD

Edward R. Weidlein Chair Professor
Bioengineering
Chemical and Petroleum Engineering
Mechanical Engineering and Materials Science
Oral Biology, School of Dental Medicine
McGowan Institute of Regenerative Medicine
University of Pittsburgh

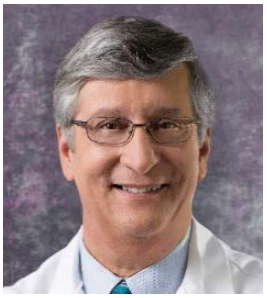
Dr. Kumta has over 27 years of experience in the field of materials science and engineering with particular expertise in the innovative synthesis, design and engineering of novel materials (ceramics, metals and polymers) and systems for a variety of electrochemical applications such as energy storage, conversion as well as bioengineering and biotechnology related applications including bioresorbable materials for bone tissue engineering, non-viral gene delivery, stem cell plasticity and delivery platforms. He is an American Ceramic Society (ACerS) and American Institute of Medical and Biological Engineering (AIMBE) Fellow, and is Editor in Chief of International Journal Materials Science and Engineering B, Advanced Functional Solid-State Materials. He has published over 290 peer reviewed publications, over 485 abstracts and presentations with over 140 invited talks on subjects related to electrochemical and biotechnology systems.

Education

PhD University of Arizona
MS University of Arizona
BTech. Indian Institute of Technology, India

Publications

- Ramanathan M, Patil M, Epur R, Yun Y, Shanov V, Schulz M, Heinemen WR, Datta MK, Kumta PN. “Gold-coated carbon nanotube electrode arrays: Immunosensors for impedimetric detection of bone biomarkers.” Biosensors and Bioelectronics, 2016; 77:580-8.
- Ramanathan M, Patil MS, Epur R, Kumta PN. “Tartrate Resistant Acid Phosphatase assisted degradation of single-wall carbon nanotubes.” ACS Biomaterials Science & Engineering 2016; 2(5): 712-21.



Robert Kormos, MD, FRCS(C), FACS, FAHA

Professor of Cardiothoracic Surgery and Bioengineering
Brack G. Hattler Chair
Cardiothoracic Transplantation
University of Pittsburgh Medical Center

Dr. Kormos has over 30 years of experience in the field of congestive heart failure (CHF) therapies, including mechanical circulatory support, both from the translational side as well as clinical trial execution. He has national and international consulting positions with CMS, FDA AAMI, and is a past president of the International Society for Heart and Lung Transplantation. He has published over 300 peer reviewed articles, over 300 Abstracts and proceedings and 40 book chapters and a textbook on subjects related to CHF.

Education

MD University of Western Ontario, Canada
BA University of Western Ontario, Canada

Mitali Patil, MS

PhD Student
University of Pittsburgh

Education

MS University of Alaska
BS University of Alaska

Mitali Patil is researching the development of aptamer-based impedimetric biosensors for the detection of cardiac biomarkers. Previous research has included an electrochemical assessment of magnesium-based electrodes, carbon nanotube enzymatic degradation via 3D modeling, and carbon nanotube biosensors for bone biomarker sensing. She has participated in various competitions, placing third in the 2015 Michael G. Wells Healthcare Competition, first in the Medical Devices Category at the 2016 McGowan Regenerative Medicine Retreat, and received a Translational Medicine Grant from the Clinical Science and Translational Institute.

University of Pittsburgh
Innovation Institute

130 Thackeray Ave
Pittsburgh, PA 15260

innovation.pitt.edu

Contact

Janice Panza, PhD
Technology Licensing Manager
412-648-2225
jpanza@innovation.pitt.edu