

**FOCUS ISSUE: TECHNOLOGY AND HEART FAILURE THERAPEUTICS
2023 SHARK TANK**

INTRODUCTION

Highlights of Innovation and Technologies and Heart Failure Therapeutics

THT 2023

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The socioeconomic burden of heart failure (HF) continues to rise around the world, with ever increasing numbers of HF patients with reduced or preserved ejection fractions (HFrEF or HFpEF, respectively). Despite recent advances of medical therapies (such as combined angiotensin receptor antagonist-neprilysin inhibitor and sodium-glucose cotransporter 2 inhibitors), symptoms of HF and exercise tolerance generally worsen over time. In addition, most patients with HFrEF and about one-half of HFpEF patients ultimately succumb to complications of HF. The tremendous unmet need to improve quality of life and exercise tolerance, to reduce rates of hospitalizations, and to prolong life of HF patients continues to drive innovation outside the realm of pharmacotherapy. The Technologies and Heart Failure Therapeutics (THT) meeting sponsored by the Cardiovascular Research Foundation (<https://tht2023.crfconnect.com>) was born out of the desire to showcase such innovation and to celebrate the inventors, researchers, and financial backers behind these important efforts. This year marks the second THT meeting, which expanded from the inaugural meeting to feature approximately 200 faculty, to include over 40 scientific sessions, and was held over two and half days in Boston (March 20-22, 2023).

One of the highlights of the THT meeting is the “shark tank” competition, during which selected early-stage companies present to a small group of researchers and seasoned investors who judge and vote on the technology they deem most likely to succeed in the marketplace. In this arena, success is not necessarily based on the most sophisticated or scientifically founded ideas. Indeed, the likelihood of success, the potential market size, the ease of a path to meaningful regulatory approval, manufacturability, the likelihood of reimbursement, and the amount of time and money required to reach commercialization all factor into a somewhat subjective and complex decision-making process by investors.

This issue of *JACC: Basic to Translational Science* features 6 companies that participated in the THT shark tank competition, each addressing a different aspect of the HF conundrum.

Several devices for monitoring HF patients to guide medical management in anticipation of impending HF exacerbations are discussed. The Acorai SAVE Sensor System is a noninvasive multisensor device for estimating right atrial, pulmonary artery and pulmonary capillary wedge pressure (<https://acorai.com>). The iFPx System is a multiparameter subcutaneous sensor which includes a novel method for measuring interstitial fluid pressure (incubated by NXT Medical; <https://www.nxtbiomedical.com>), increases of interstitial fluid pressure being a harbinger of fluid overload. Future Cardia (<https://futurecardia.com>) has developed a subcutaneous monitor whose novel feature is measurement of heart and lung sounds which, when analyzed in relation to the electrocardiographic time markers, have correlated

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with changes in volume status and cardiac contractility. Can any of these approaches be as effective in guiding medical therapy to avoid HF exacerbations as invasively measured pulmonary artery pressure; the only approach so far shown to reduce HF hospitalizations?

Other devices discussed are therapeutic in nature, for either acute or chronic HF. Corstasis has developed a formulation of bumetanide that can be delivered via the intranasal route, thus increasing bioavailability over oral dosing and achieving greater urine output in patients with inadequate diuretic responsiveness (<https://corstasis.com>). Renal Innovations has developed cutaneous patches that deliver low-intensity ultrasound to the kidney and have shown that this can improve urine output in acute HF patients with inadequate response to diuretics. Syntach AB (<https://syntach.com>) is a novel ventricular assist device that is intended to mechanically restore more normal longitudinal shortening, which has been shown to improve stroke volume and overall cardiac performance in experimental heart failure.

VSling, another device discussed at the THT shark tank but not detailed in this issue, is a device that draws the displaced bases of the papillary muscles together to both improve coaptation of the mitral leaflets and to physically reverse remodel the dilated

left ventricular apical region of HFREF patients (<https://www.cardiacsuccess.com>).

This limited offering of innovative diagnostic and therapeutic approaches under development exemplifies the intense efforts being devoted to reducing morbidity and mortality in HF. It also underscores the diversity of engineering, pharmacology, medical, and business talent required to translate basic science to clinical practice. This special issue of *JACC: Basic to Translational Science* includes brief reports summarizing the presentations delivered by these companies, along with video links to their presentations and the discussions by the judges. Collectively, these reports highlight the process of translational research and serve to inspire readers to join the quest to develop new devices for the treatment of HF.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

Dr Burkhoff has received grant support from Abiomed, Ancora, Axon, and Edwards Lifesciences; and has consulted for Aquapass, Axon Therapeutics, BioMind, Corvia Medical, Impulse Dynamics, Orchestra Biomedical, TherOx, and Zoll.

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