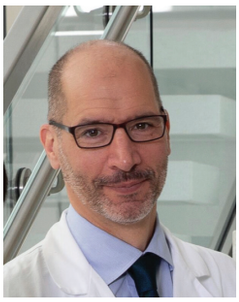
Dr. Miguel Valderrábano Leads New Issue on Cardiac Electrophysiology

The editors of the *Methodist DeBakey Cardiovascular Journal* thank Miguel Valderrábano, MD, for his leadership as guest editor of this issue on cardiac electrophysiology, an update to the electrophysiology issue he spearheaded for this publication in 2015.



Miguel Valderrábano, MD

Dr. Valderrábano is the Lois and Carl Davis Centennial Chair and chief of cardiac electrophysiology at the Houston Methodist DeBakey Heart & Vascular Center and professor of cardiology at the Houston Methodist Academic Institute. He also leads a basic research laboratory focused on finding new and more effective treatments for atrial fibrillation, including epicardial mapping and ablation. His research team uses optical mapping techniques in cell cultures and other models to explore mechanisms of ventricular fibrillation and sudden cardiac death.

The Valderrábano Lab has received grant funding from the American Heart Association and the National Institutes of Health (NIH), including an NIH-funded study evaluating the efficacy and safety of an alcohol infusion treatment for patients with persistent atrial fibrillation.

Dr. Valderrábano earned his medical degree from the Universidad Autónoma De Madrid in Madrid, Spain, then went on to complete his internal medicine training at the UCLA-West Los Angeles VA Medical Center in California. From there, he completed fellowships in cardiology and clinical cardiac electrophysiology at Cedars-Sinai Medical Center in Los Angeles, where he was named chief cardiology fellow in 2002. His first faculty position was at the David Geffen School of Medicine at UCLA, where he was named director of the Implanted Devices Clinic at UCLA's Cardiac Arrhythmia Center and assistant professor of medicine at UCLA Medical Center. Dr. Valderrábano holds memberships in the American Heart Association, American College of Cardiology, and the Heart Rhythm Society.

Exploring New Frontiers in Cardiac Electrophysiology

Miguel Valderrábano, MD

Since the birth of cardiac electrophysiology at the dawn of the 20th century, when Einthoven devised the first electrocardiographic machine, technology has been a fundamental pillar of clinical electrophysiology. Without the ability to sample, process, and display electrical signals from the heart, the field would simply not exist. From the surface electrogram, constructed by sampling voltage differences between electrodes in the skin of the chest and limbs, a whole scientific discipline evolved as a diagnostic tool to interpret cardiac electrical signals in health and disease by combining technology with anatomy and physiology.

With the advent of cardiac catheterization, electrical signals sampled from different portions of the heart introduced a new level of sophistication in the mechanistic understanding of arrhythmia. Even with the added mechanistic insights, electrophysiology remained a purely diagnostic discipline. It was only after another technology was incorporated—radiofrequency ablation—that operators were able to complete the process from diagnosis to cure. From the clinical presentations, including palpitations, syncope, and other symptoms, the abnormal rhythm would be detected by the surface electrocardiogram, its mechanisms and precise anatomical origin would be confirmed by intracardiac electrograms, and the responsible substrate could be eliminated by ablation in the same procedure. With this approach, most supraventricular tachycardias could be cured at once, as could many ventricular tachycardias.

However, there were limitations. The technologies to guide this procedure—fluoroscopy and signal recording—were limited in demonstrating the precise catheter location relative to vital structures. Technology made a qualitative leap in the 1990s with the development of 3-dimensional (3D) mapping systems, which allowed the operator to visualize intracardiac catheters in 3D shells of the heart chambers along with their electrical signals.

Despite this added level of sophistication, cardiac electrophysiology hit another wall when trying to deal with two challenges: (1) lack of mechanistic understanding of complex arrhythmias such as atrial fibrillation, and (2) limitations in the reach of therapeutic tools, particularly when targeting arrhythmia substrates deep in the cardiac muscle. For these challenges, the solution may come not from the technology pillar but rather from the other two pillars of cardiac electrophysiology: anatomy and physiology.

In this issue of the *Methodist DeBakey Cardiovascular Journal*, we focus on complex arrhythmias and review several therapeutic approaches built on new and old anatomical and physiological concepts. Drs. Pasquale Santangeli, Naga Venkata Pothineni, and Fermin Garcia launch this issue with an update on the use of radiofrequency to reach intramural ventricular arrhythmias, a complex anatomical challenge. Capitalizing on the anatomy, Drs. Frank Bogun and Jackson Liang demonstrate how mapping coronary veins can add to the precise localization of ventricular arrhythmias in challenging cases. This concept is also explored by me and Drs. Adi Lador, Akanibo Da-Wariboko, and Liliana Tavares, who explain how coronary vein mapping guides the therapeutic use of ethanol to treat radiofrequency-refractory ventricular tachycardia. This once again completes the journey from diagnosis to treatment, but this time using more anatomy than technology as an inspiration.

We then explore novel physiological concepts. In a radical departure from the decades-old approach of destroying heart muscle to treat cardiac arrythmias, Drs. Ray Chihara, Edward Chan, and colleagues describe the use of surgical cardiac sympathetic denervation for ventricular arrhythmias, targeting the nerves rather than the heart. From here, Dr. Gerald Lawrie reviews how cardiac surgery can be the final answer in cases of drug-refractory chronic ventricular tachycardia where percutaneous approaches fail.

We also explore novel physiological concepts for atrial fibrillation, starting with Drs. Peng-Sheng Chen and Takashi Kusayama, who provide an update on the neural mechanisms for atrial fibrillation and also therapeutic opportunities. We follow with an exploration of the neural mechanisms of sleep apnea-related atrial fibrillation, as reported by me and Drs. Lador and Tavares. Coupling neural mechanisms with a therapeutic approach, Dr. Lador and I then discuss the technique of vein of Marshall ethanol infusion to target profibrillatory nerves and provide a summary of our work from its development to the completion of a clinical trial. Finally, Dr. Randall Wolf describes the evolution of surgery to treat atrial fibrillation and highlights current surgical options, including the open-heart Cox-maze IV as well as several nonsternotomy and hybrid procedures.

The works presented in this issue reflect how true progress can be made if we connect the three pillars of cardiac electrophysiology: technology (procedural or engineering), anatomy, and physiology. We have enjoyed the journey of putting together a selection of novel advances in cardiac electrophysiology that derive from these iterations, and we hope readers will enjoy it too.

For further discussion and CME opportunities, I invite you to visit the journal's website at journal.houstonmethodist.org, where you can also access additional online-only content. You can also continue the conversation on social media, tagging @debakeyCVedu and #DeBakeyCVJournal.