BIOGRAPHICAL SKETCH

NAME: Patwardhan, Abhijit R

POSITION TITLE: Professor and Director of Graduate Studies

eRA COMMONS USER NAME (credential, e.g., agency login): ABHIJIT.PATWARDHAN

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
College of Engineering Pune, India	BE	1984	Mechanical Engineering
University of Kentucky, Lexington, KY	MS	1988	Mechanical Engineering
University of Kentucky, Lexington, KY	PhD	1992	Biomedical Engineering

Positions

07/2015 – present	Interim chair. Department of Biomedical Engineering, University of Kentucky.
07/2008 – present	Professor. Department of Biomedical Engineering, University of Kentucky.
07/2004 – present	Director of Graduate Studies, Department of Biomedical Engineering, University of Kentucky.
07/2002 – present	Associate Professor. Division of Cardiovascular Medicine, Department of Internal Medicine, University of Kentucky. Joint Appointment.
07/2002 - 06/2008	Associate Professor. Center for Biomedical Engineering, University of Kentucky.
08/1996 - 06/2002	Assistant Professor. Center for Biomedical Engineering, University of Kentucky.
08/1996 - 06/2002	Assistant Professor. Division of Cardiovascular Medicine, Department of Internal Medicine, University of Kentucky. Joint Appointment.
06/1992 - 08/1996	Research Assistant Professor. Center for Biomedical Engineering. University of Kentucky.
07/1984 - 08/1985	Engineer. Projects Group, Vulcan Laval Ltd. (Alpha Laval).

Contribution to Science

1. Recent studies in my laboratory have focused on determining why one of the more promising predictors of the risk of lethal arrhythmia, the T wave alternans (TWA), suffers from low specificity. With this objective, we looked closely at the mechanistic link between loss of electrical stability and alternans and observed a very interesting phenomenon; when alternans of repolarization duration occurred, which is the cellular level origin of TWA, it was almost always accompanied by alternans of the depolarization rate. But interestingly, the relationship between the alternans of depolarization rate and the repolarization duration *spontaneously changed*. Mathematical models suggest that this change in the relationship may act as a stabilizer by reducing spatial discord in alternans. I was the principal investigator for these studies, as such, I oversaw all aspects of the study. It also appears that the manifestation of this cellular level observation may underlie a peculiar phenomenon called as super normal conduction or super normal excitation that clinicians have reported when conducting EP test.

Jing L, Agarwal A, Chourasia S, Patwardhan A. Phase Relationship between Alternans of Early and Late Phases of Ventricular Action Potentials. Front Physiol.3:190. 2012.

Jing L, Agarwal A, Patwardhan A. Supernormal Conduction and Suppression of Spatial Discord in Alternans of Cardiac Action Potentials. Front. Physiol. 6:407. 2015.

2. Recently, I have been involved in collaborative work in investigating growth dynamics of the cyst form of the parasite, Toxoplasma gondii. Using experience gained in developing algorithms for analyzing images from our high speed fluorescence imaging studies, my laboratory developed an image analysis software, BradyCount 1.0, which allowed for the first time direct enumeration of parasite numbers within cysts. The behavior of these parasites, in terms of replication and growth presents an intriguing mathematical problem that has direct implications on understanding this enigmatic form of the parasite. My role in these studies was to oversee the development of algorithms for image analysis and the software, and I was instrumental in developing the mathematical modeling framework to model parasite growth.

Watts E, Zhao Y, Dhara A, Eller B, Patwardhan A, Sinai A**.** Novel approaches reveal that Toxoplasma gondii bradyzoites within tissue cysts are dynamic and replicating entities in vivo. MBio: 6(5). 2015.

Sinai AP, EA Watts, A. Dhara, RD Murphy, MS Gentry and A Patwardhan. Reexamining chronic Toxoplasma gondii infection: Surprising activity for a "dormant" parasite. Curr. Clin Micro. 3:175. 2016.

3. One of the widely accepted conditions for alternans of repolarization duration to exist is the so called restitution condition where a slope of unity of the functional relationship between a diastolic interval and succeeding action potential duration is considered to be necessary for stable alternans to exist. Since alternans is thought to be linked with arrhythmia onset, numerous studies were and continue to be devoted towards development of pacing algorithms that produce a relationship with the slope equal to unity when alternans would occur. Implicit in the theoretical construct underlying all of these studies is that there is a causal relationship between the diastolic interval and action potential duration when alternans occurs. Suspecting that the lack of finding of slopes of unity when alternans occurs was because the foundational premise was incorrect, we paced tissues such that the diastolic intervals remained unchanged irrespective of action potential durations. These studies showed that alternans of action potential duration could occur even though the preceding diastolic intervals were invariant. These results directly challenge the foundational mechanism underlying these previous studies and suggest that much of the investigation trying to device protocols that yield slopes of unity was misguided and off target.

Wu R, and Patwardhan A. Mechanism of repolarization alternans has restitution of action potential duration dependent and independent components. J Cardiovasc Electrophysiol. 17:87-93, 2006. *The above paper was the focus of accompanying editorial; E Carmeliet. Electrical Alternans: Membrane-Limited and Subcellular Components. J Cardiovasc Electrophysiol. 17:94-96, 2006.*

4. For many years, alternans and electrical restitution have been the focus of several investigations. As is widely defined, electrical restitution is the relationship between a diastolic interval and succeeding action potential duration. During late 90's and early 2000, there was considerable interest in modifying electrical restitution as a potential anti-arrhythmia treatment target. Even to date, restitution is considered to be the leading mechanism via which one predicts how an electrical disturbance will evolve in terms of whether it would be a transient event, or if it will degenerate into an unstable rhythm. Not surprisingly, many studies were devoted to exploring the restitution relationship and to developing a variety of pacing protocols to empirically characterize the restitution relationship. All of the protocols that were being developed to empirically characterize the restitution used variants of pacing where cycle lengths were the controlled variable. However, when cycle lengths are controlled, the diastolic interval and action potential durations are correlated and thus during these protocols, the diastolic intervals could not be changed sequentially and independent of action potential durations. Yet, when restitution is used to predict the fate of a disturbance, the relationship uses sequential changes in diastolic intervals as an independent variable to predict the resulting action potential durations. Realizing that there was a disconnect between how restitution was being empirically determined versus how it is mechanistically linked to evolution of a disturbance, we developed a novel pacing protocol that allowed precise control of diastolic intervals completely independent of action potential durations, unlike any other protocol that was used to characterize restitution. Using this novel protocol we characterized restitution clearly demonstrating that restitution was not uni-modal function. This protocol also provided a way for numerical quantification of a feature of restitution, memory, which was known before but for which there was no experimental way to easily quantify it. My role in these studies was that of a principal investigator.

Wu Runze, Patwardhan Abhijit. Restitution of action potential duration during sequential changes in diastolic intervals shows multi-modal behavior. Circ Res, 94:634-41, 2004. *The above paper was the focus of accompanying editorial; RD Berger. Electrical Restitution Hysteresis: Good Memory or Delayed Response? Circ Res, 94:567-69, 2004.*

Jing L, Chourasia S, Patwardhan A. Heterogeneous memory in restitution of action potential duration in pig ventricles. J Electrocardiol. 43(5):425-32. 2010.

Jing L, Brownson K, Patwardhan A. Role of slow delayed rectifying potassium current in dynamics of repolarization and electrical memory in swine ventricles. J Physiol Sci. May;64(3):185-93. 2014.

My bibliography:

http://www.ncbi.nlm.nih.gov/sites/myncbi/abhijit.patwardhan.1/bibliography/50226642/public/?sort=date&direction=ascending.