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## BIOGRAPHICAL SKETCH

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NAME: Patwardhan, Abhijit R

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POSITION TITLE: Professor

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### EDUCATION/TRAINING

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INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
College of Engineering Pune, India	BE	05/1984	Mechanical Engineering
University of Kentucky, Lexington, KY	MS	08/1988	Mechanical Engineering
University of Kentucky, Lexington, KY	PhD	08/1992	Biomedical Engineering

### Positions

07/2008 - present      Professor. Department of Biomedical Engineering, University of Kentucky.  
07/2004 - 06/2019      Director of Graduate Studies, Dept of Biomedical Engineering, University of Kentucky.  
07/2015 - 07/2017      Interim chair. Department of Biomedical Engineering, University of Kentucky.  
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.  
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).

### Contributions to Science

1. 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.
  - a. Jing L, Agarwal A, Patwardhan A. Supernormal Conduction and Suppression of Spatial Discord in Alternans of Cardiac Action Potentials. *Front. Physiol.* 6:407. 2015.
  - b. Alaei S, Wang S, Anaya P, Patwardhan A. Co-occurrence and phase relationship between alternans of the R wave amplitude (RWAA) and of the T wave (TWA) in ECGs. *Comput Biol Med.* 121:103785. 2020.
2. I have been involved in collaborative work investigating growth dynamics of the cyst form of the parasite *Toxoplasma gondii*. Analysis of the pattern of growth of the parasites within cysts suggested that, contrary to the long held belief, the parasites within the cysts may not be dormant after all. The behavior of these, in terms of replication and growth presents an intriguing mathematical problem that has direct implications on understanding this enigmatic form of the parasite. The opportunistic nature underlying the initiation of replication in the life cycle stage of the parasite suggests that a mathematical model may be ideal to predict their growth dynamics within tissue cysts.

- a. 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): pii: e01155-15. Doi: 10.1128/mBio.01155-15. 2015.
  - b. 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. Recently, studies in my laboratory have explored how some of the effects of listening to music on autonomic function in cardiovascular regulation come about. These studies showed that the degree of synchronicity, a measure of entrainment, between autonomic and cerebral electrical rhythms shows an overall increase while listening to music.
- a. Mollakazemi MJ, Biswal D, Elayi SC, Thyagarajan S, Evans J, Patwardhan A. Synchronization of autonomic and cerebral rhythms during listening to music: effects of tempo and cognition of songs. *Physiol Res*. 68: 1005-1019, 2019.
  - b. Dibyajyoti Biswal, Mohammad Javad Mollakazemi, and Abhijit Patwardhan. Changes in Coherent Activity Between EEG and Various Frequency Components of Music While Listening to Familiar and Unfamiliar Songs. 6<sup>th</sup> International Symposium on Smart Electronics Systems (IEEE-iSES) 2020.
  - c. MJ Mollakazemi, D Biswal, J Evans, A Patwardhan. Eigen Decomposition of Cardiac Synchronous EEGs for Investigation of Neural Effects of Tempo and Cognition of Songs. 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 2018.
4. For many years, alternans and electrical restitution have been the focus of several investigations. 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. Not surprisingly, many studies were devoted to developing a variety of pacing protocols to empirically characterize the restitution relationship. All of the protocols that were being developed 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.
- a. 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.
  - b. The above paper was the focus of an editorial; RD Berger. Electrical Restitution Hysteresis: Good Memory or Delayed Response? *Circ Res*, 94:567-69, 2004.

My bibliography:

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