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Investigating a Period-Doubling Bifurcation in Cardiac Tissue Using Alternate Pacing C.M. BERGER, H.M. DOBROVOLNY, S.S. KALB, S.F. IDRISS, D.G. SCHAEFFER, D.J. GAUTHIER, W. KRASSOWSKA[1], Duke University — The action potential duration (APD) of cardiac cells undergoes a period-doubling bifurcation when the pacing rate (PR) is increased, resulting in a period-2 behavior called alternans. Studying the susceptibility of cardiac tissue to alternans is crucial because alternans can lead to ventricular fibrillation and sudden cardiac death. One way to study this behavior is to alternate the PR from beat-to-beat, which results in beat-to-beat alternation in APD. Recent mathematical models predict that these small beat-to-beat changes in PR will result in divergent beat-to-beat variations in APD near the period-doubling bifurcation. Thus, the appearance of divergent behavior during alternate pacing can uncover the tissue's propensity to alternans. In an experiment to test this hypothesis, we observed beat-to-beat APD variations that are only a fraction of the beat-to-beat change in the PR, despite proximity to the bifurcation point. This study demonstrates the discrepancy between experiment and theory, which may be due to changes in ionic concentrations and wave propagation.

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