Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Noise-induced ectopic activity in a simple cardiac cell model HAROLD HASTINGS, ALEX ZAHARAKIS, CHRISTAIN HILAIRE, ELIZABETH CHERRY, FLAVIO FENTON, SABRINA SOBEL, Hofstra University — Ectopic activity in the form of premature ventricular contractions (PVCs) is relatively common in the normal heart. Although PVCs are normally harmless, sometimes but rarely PVCs can generate spiral waves of activation through interaction with other waves of activation, potentially progressing to ventricular tachycardia, followed by ventricular fibrillation and sudden cardiac death. Clusters of PVCs have been found to be significantly more dangerous than isolated PVCs. We model PVC generation by applying triggers (noise) to the generic FitzHugh-Nagumo model as substrate, and study the effects the noise level and excitability. We find: exponential waiting time behavior at fixed parameter levels; no evidence of clustering at fixed parameter levels; and a sharp increase in PVCs as excitability approaches the auto-oscillatory threshold or noise increases beyond a similar threshold. This produces sharp increases in theoretical rates of PVC-induced fibrillation, consistent with results of A Gelzer et al. in animal models. Partially supported by the NSF and NIH.

Harold Hastings
Hofstra University

Date submitted: 01 Dec 2004 Electronic form version 1.4