

Dr. Garcia-Villar R.

**NINTH
CORNELL UNIVERSITY
FIELD OF PHYSIOLOGY
GRADUATE/UNDERGRADUATE STUDENT SYMPOSIUM**

**Cornell University
Hagen Room, Schurman Hall
Tuesday, April 13, 1993, 3:00 p.m.**

**NOTE: The Annual Physiology Dinner will be at the
Boxcar/Loading Dock Restaurant, Dryden Road,
cocktails at 7:30 p.m., dinner at 8:00.**

ORAL COMMUNICATIONS

Application of Nonlinear Dynamical Systems Theory to Cardiac Purkinje Fibers MARI WATANABE, ROBERT F. GILMOUR, JR.

6.

Some aspects of cardiac electrical activity can be attributed to nonlinear behavior. The merit of nonlinear dynamical systems theory, popularly referred to as chaos theory, lies in its ability to find determinism in irregular, apparently random behavior. Previous studies have shown that the cellular electrical activity of canine and sheep cardiac Purkinje fibers stimulated at constant intervals (SI) conforms to predictions based on this theory. For a given SI, there exist reciprocal interactions between the active and rest states of the cell as defined by the Time to Full Repolarization (TFR) (active) and Diastolic Interval (DI) (rest), where $DI_n = SI - TFR_{n-1}$. TFR is also dependent upon the preceding DI, where $TFR_n = f(DI_n)$. These two relations determine all subsequent DI and TFR once an initial value is given for either. The nonlinear function f had a steep positive slope for small DI, a negative slope for large DI, and a maximum at the transition. Because this transition was abrupt (not smooth) we used piecewise fitting to model this function. Simulations of behavior of Purkinje fibers at various stimulus intervals demonstrated a chaotic regime over a narrow (10 ms) range of stimulus intervals, and confirmed experimental results. To gain further insight into the features of piecewise linear functions, we also studied the tent function: $y = a * x$ for $x \leq b$, $y = -a * (x - 2b)$ for $x > b$ as a prototype. The results of our study may suggest one mechanism for the irregular activity observed during cardiac arrhythmias.

7.

BACTERIAL ENDOTOXIN DOES NOT INCREASE THE CONTRACTILITY OF OVARECTOMIZED RAT MYOMETRIUM. David J. DiaPiazza, Rafael Garcia-Villar and Peter W. Nathanielsz

Previous studies have established a link between bacterial infections and premature labor. However, the mechanism by which bacterial infection induces premature parturition in the setting of infection is not clearly understood. Several investigators have demonstrated that the host's immune response to endotoxin, the lipopolysaccharides (LPS) of gram-negative bacteria, is responsible for the increased myometrial contractility. In order to determine the role of prostaglandins and oxytocin in the increased myometrial contractility, the present study investigates the effect of an intraperitoneal injection of LPS (0.5 mg) from *Escherichia coli* upon ovariectomized rat myometrium. No effect upon spontaneous contractility or sensitivity to prostaglandin $F_{2\alpha}$ or oxytocin was seen when isolated myometrium from LPS-treated rats was compared with controls when tested in vitro superfusion system. Leukopenia confirmed that the endotoxin injection did indeed cause an immune response in ovariectomized rats.