

PACEMAKER REGULARITY: INTER-SPECIES COMPARISON OF ELECTRIC ORGAN DISCHARGE FREQUENCY. K.T. Moortgat^{1*}, T.H. Bullock², and T.J. Sejnowski³. ¹Physics and ²Neuroscience Depts., University of California, San Diego, 92093; ³Computational Neurobiology Lab, Salk Institute, La Jolla, CA 92037.

Certain species of weakly electric fish produce pulses, commanded by a central pacemaker, orders of magnitude more regular than other known biological oscillations. Here we investigate the inter-species differences in electric organ discharge (EOD) timing regularity among some South American wave-type fish, *Sternopygus macrurus*, *Eigenmannia virescens*, and three species of *Apteronotus*, as well as *Microsternarchus* sp. Measurements were made during day and in physical isolation. The natural EOD of these species ranges from 20 to 1300 Hz.

We show that EODs of all three *Apteronotus* species (*leptorhynchus*, 650 Hz; *albifrons*, 980 Hz; sp., 1300 Hz) are regular to sub-microsecond resolution (standard deviation (sd) as low as 0.2 μ sec; coefficient of variation (sd/mean), cv \approx 0.00014) over thousands of EOD cycles. In contrast, the low frequency (20 Hz) *Microsternarchus* is much less regular (ca. 0.2 msec; cv \approx 0.00403). A 500 Hz *Eigenmannia* EOD was very stable (0.4 μ sec; cv \approx 0.00019) while *Sternopygus* (100 Hz) had less timing regularity (2.1 μ sec; cv \approx 0.0002). The regularity appears to be species-specific but independent of mean frequency.

The cv will remain constant over thousands of cycles but can vary by a factor of ten on longer time scales (hours). One hypothesis under study is that regularity is adjusted by the individual, depending on its behavioral state. The ability of a species to maintain regular EODs largely depends on the medullary pacemaker nucleus, which varies in cell number, degree and type of coupling, and ratio of cell types among species. We are studying which of these features is most important in attaining the observed EOD regularity. Support: NIMH fellowship to KTM; NINDS, NIH to W. Heiligenberg (deceased), and HHMI to TJS.