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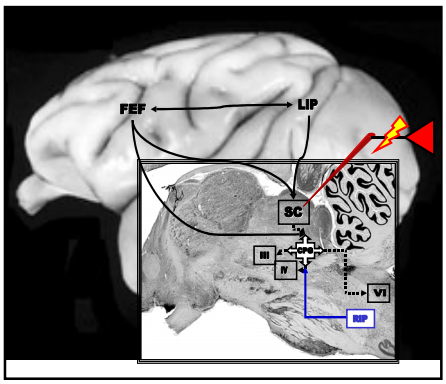
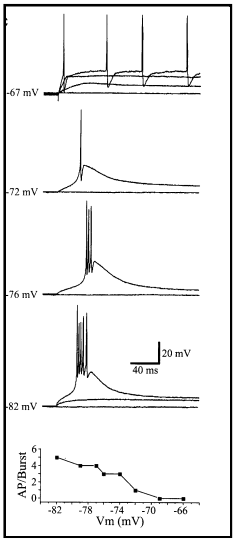
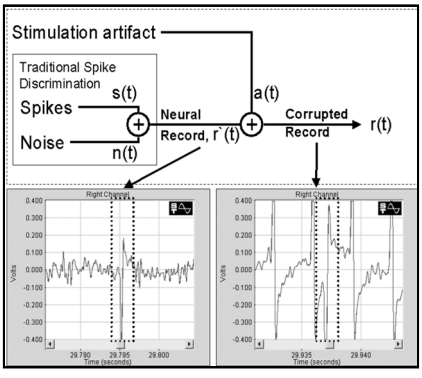
Lab Website



The research interests in my lab center around investigation of the neurophysiological basis of behavior. We use several experimental techniques, including behavioral studies, *in vivo* and *in vitro* neurophysiology, neuroanatomy and numerical modeling. In research labs at Howard University College of Medicine and Georgetown University, we investigate the visual and oculomotor behavior as"ideal" model systems for study.



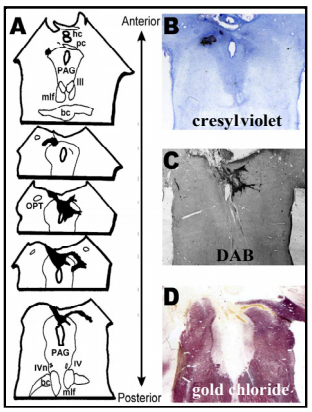
For our oculomotor studies, we essentially treat the eye movement circuits like a biologic machine. Like any machine, one can attempt to understand how it works by "reverse engineering." That is, given the machine's output, how do the internal circuits function to produce that output? One system engineering approach is to inject characteristic input signals at critical points within the circuit in the intact animal and investigate quantitative predictions based on assumptions about the biological mechanisms. Using this approach, we have addressed several fundamental issues in oculomotor physiology, which in turn reveals brain mechanisms that are general to all behavior. At a cellular level, we are working to test our prediction that certain neurons in the circuit exhibit post-inhibitory rebound. Using a trans-synaptic tracing technique involving a genetically engineered virus, we have been able to label these neurons 2 or 3 retrograde synapses back into the brain from the eye muscles. This will allow us to test our prediction using visualized patch-clamp recording of these neurons in a brain slice preparation.



For our visual system studies, we have revealed some of the cellular mechanisms for switching the thalamic relay of visual information between the faithful “tonic” mode and the non-linear “burst” mode in the primate family of species. Our current visual studies seek to shift sensitivity of this relay by experimental manipulation while revealing the perceptual consequences *in vivo*.

Working with the biomedical instrument company Riverbend Instruments, Inc., we have developed a breakthrough

technology for allowing the recording of individual neurons in the intact subject while experimentally manipulating their activity patterns with microstimulation. Using an adaptive filter technique borrowed from audio engineering, it is now possible to reliably record neurons in real-time during prolonged trains of microstimulation pulses without corrupting the recordings with electrical artifact.



Our newest research interest with the Howard University SNRP involves investigating the neural basis of an ophthalmic disorder called eye jerks. From a serendipitous case study, we discovered that a tiny stroke in the midbrain tectum could cause irrepressible eye movements. We hope to develop a "reversible stroke" model to investigate the neural mechanisms of this unusual syndrome as part of a larger future emphasis on stroke studies at the SNRP.