RESEARCH STATEMENT

The research goals of my program are focused on understanding the physiological mechanisms underlying synaptic plasticity of neurons, especially motor neurons which make synapses on muscle fibers. My research program is a multifaceted approach to the study of specific neuromodulatory molecules whose actions are relevant to the whole animal. Such research in higher animals has proven to be a daunting task and many of the breakthroughs in neuroscience have arisen due to understanding of basic principles in simpler systems and then extrapolating to more highly evolved organisms, such as humans. The invertebrate arthropods have long provided key models, especially crayfish and *Drosophila* for investigating neurophysiological principles. One advantage of invertebrates is that individual cells can be examined by a range of techniques from anatomical analysis to molecular genetics and electrophysiology, to obtain insights that are not possible, at present, in higher-animal model systems. In particular, the neuromuscular junctions of crayfish and *Drosophila* serve as models to investigate the basics principles of chemical synaptic transmission relevant to all chemical synapses in all animals. The past **NSF funded research** in my laboratory was concerned with the actions of neuromodulators (substances that can alter neuronal activity) on chemical communication of motor neurons with muscles using the crayfish as the model system. Because of the wide variety of behavioral effects which they elicit, neuromodulators are recognized as important signaling molecules in all animals. The investigation of neuromodulation in the crayfish has made me aware of the limitations in genetic manipulability of key factors when trying to address slightly different factors such as selective regulation of hormone levels. For this reason I embarked on projects making use of *Drosophila* as a tool to investigate the actions of the neuro and modulator.

Future directions on past research: I am currently addressing the interactions of various second messenger cascades inside nerve terminals and heart cells to understand their relation to cellular activity. Two of my PhD students are now focused on this line of research.

Health related future projects aimed at NIH-Nursing grant submissions:

A long term aim of this study, which will be built into a NIH-Nursing division grant proposal, is to determine if saline perfusion of damaged skeletal muscle, in a skin closed injury/DTI (deep tissue injury), would benefit, both qualitatively and quantitatively, in reducing the surround tissue damage. In addition, a person may experience a reduces pain associated with the injury and surrounding tissue damage if the heightened K+ levels could be reduced as the injured muscle degrades. The testable hypothesis is that rapid removal in intracellular constituents from injured muscle will help prevent the spread of tissue damage and promote a faster recovery from the initial DTI insult. In following through to test this hypothesis and to gather evidence based findings, I plan to work with faculty affiliated with the Univ. of Kentucky, Center of Muscle Biology (http://www.mc.uky.edu/muscle/) In particular, Dr. Esther E. Dupont-Versteegden (PhD., Associate Professor, Division of Physical Therapy, Dept. Rehabilitation Sci, College Health Sciences, Univ Ky), in development of the animal and human use protocols that would be necessary for future NIH grant submissions. This proposed research plan is directly fitting for the prevue of funding by NIH-Nursing in improving the quality of life and health of people. The **tangible results** will be presented in publications, presentations and grant submissions. This process has already begun in that I presented some aspect of the proposal in a seminar for the Center of Muscle Biology (Univ. of KY) in Sept. 2012 and have requested a sabbatical for Spring 2014 to work on the proposals.