Research Interests of the Cell and Molecular Biology Program Faculty
At Missouri State University

Michael M. Craig, Ph.D. MichaelCraig@MissouriState.edu 417-836-6124 Department of Biomedical Sciences

Most of Dr. Craig's research interests concern problems in development and include the following areas: (1) Cell signaling events involving microtubules and microfilaments in the formation of polar lobes in marine gastropods; (2) the morphogenetic contributions of the vegetal bodies in polar lobes of freshwater prosobranch gastropods to organogenesis in the early embryos of these animals; (3) comparative ultrastructure of vegetal bodies in the polar lobes of several freshwater gastropod families. All of these endeavors depend upon ultrastructural approaches involving conventional scanning and transmission electron microscopy. Investigations using other model systems, such as the zebrafish, for selected developmental problems are currently being explored. Any student desiring to work with Dr. Craig will be expected to have an active interest in development and the cytoskeleton and be willing to devote significant amounts of time in learning scanning and transmission electron microscopy techniques and in contributing to the maintenance of the electron microscopy facility.

Christopher Field, Ph.D. ChrisField@MissouriState.edu 417-836-5478 Department of Biomedical Sciences

Research has centered on several areas of attachment and viral production by Infectious Pancreatic Necrosis Virus, which infects CHSE cells. Recent studies showed the virus reduced apoptosis, or programmed cell death, in viral infected cells. Studies of a cancer cell line and the effects of nitric oxide, NO, production on the mitochondria and p53, a tumor suppressor gene, are new areas of research.

Richard C. Garrad, Ph.D. RichGarrad@MissouriState.edu 417-836-5372 Department of Biomedical Sciences

Responses to extracellular nucleotides are mediated by specific cell-surface receptors. P2 receptor subtypes have been classified pharmacologically and can be subdivided into metabotropic P2 receptors that are coupled to guanine nucleotide-binding proteins (G proteins) and pathways that regulate the formation of second messengers, such as inositol trisphosphate (IP3) and the mobilization of intracellular calcium [Ca^{2+}] and ionotropic P2 receptors that are closely associated with specific plasma membrane ion channels. P2 nucleotide receptors regulate diverse physiological functions in mammalian tissues, including neurotransmission, platelet aggregation, vasodilatation and epithelial ion transport. I am studying the function of these receptors both at the molecular level and by assaying the end points of receptor function. Specifically I am trying to ascertain the important domains for ligand recognition and second messenger coupling and the events involved in receptor regulation. Additionally we are trying to understand how these receptors activate MAP kinases and couple to tyrosine kinase receptors, important intermediaries in cell growth and metabolism.

Albert R. Gordon, Ph.D. AlbertGordon@MissouriState.edu 417-836-5730 Department of Biomedical Sciences

Genes affecting the maximum life span are maintained in *Drosophila melanogaster* in a non-selective manner. We are investigating differences in several physical and behavioral characters that appear to correlate with life span with a goal of establishing non-lethal measures that reflect the physiological rates of aging. Our biochemical studies involve measurements of catalase and superoxide dismutase in individual aging adults as these relate to physiological age rather than chronological age. Our determinations permit a faster method of segregation of longer-lived and shorter-lived populations that do not depend on controlled matings among older adults. Also, we use different oxygen levels and incubation temperatures to modify the apparent rate of aging in *Drosophila*.

Joanne M. Gordon, Ph.D. JoanneGordon@MissouriState.edu 417-836-7601 Department of Biomedical Sciences

Extravasation of fluid from the intravascular space to the interstitial space usually accompanies the inflammatory process. It is thought that this movement of fluid occurs through intercellular spaces, however recent findings show that fluid and leukocytes also move through intracellular pores. The focus of my research is to explore the role of 5-hydroxytryptamine (serotonin) in inflammation and specifically the action of this inflammatory cytokine on intercellular and intracellular pores in pulmonary artery endothelial cells. The role of actin in the morphology of intracellular pores and the cell cytoskeleton are also being explored.

Michael Hendrix, Ph.D. MichaelHendrix@MissouriState.edu 417-836-4509 Department of Biomedical Sciences

The formation and loss of gap junctions has been implicated as a control mechanism for various physiological, developmental, and pathological events. Research in my laboratory has traditionally focussed on the study gap junction formation and loss in various *in vitro* and *in vivo* systems. Much of this study has been directed toward understanding processes that regulate the cascade of intracellular trafficking events, which ultimately lead to formation of the individual connexons. More recently work has focussed on control of the docking mechanism, which allow connexons from adjacent cells to connect forming a gap junction subunit. While most of the laboratory's effort has been directed to the study of one gap junction protein, connexin43, more recent work has been directed toward the study of a second protein, connexin32.

Benjamin Timson, Ph.D. BenTimson@MissouriState.edu 417-836-4145 Department of Biomedical Sciences

I am interested in the effects of the muscle regulatory factors myogenin and MyoD on the expression of fast and slow twitch myosin genes in skeletal muscle. Myosin expression can be shifted in skeletal muscle by a number of experimental perturbations including compensatory hypertrophy, immobilization atrophy, and dietary protein restriction. It also changes as a function of growth during the early postnatal period. We currently use a rat model to study the relationship between myogenin, MyoD and myosin expression under these experimental conditions.

Colette Witkowski, Ph.D. ColetteWitkowski@MissouriState.edu 417-836-6140 Department of Biomedical Sciences

Collagen type IV is a highly conserved extracellular matrix molecule required for development. This triple helical molecule is present in most basement membranes and is of the composition (□1)$_2$2□ , containing 2 1□ chains and an □2 chain. The nematode, *C. elegans*, expresses collagen IV. The *C. elegans emb-9* gene encodes the 1□ chain and the *let-2* gene encodes for the 2□ chain. Mutations in either gene affect the collagen IV molecule assembly and function with some mutations resulting in early developmental arrest during embryogenesis. In the lab, genetic, transgenic, immunofluorescence microscopy, molecular and cell biology techniques are utilized to determine the role of collagen type IV during development.

Scott D. Zimmerman, Ph.D. ScottZimmerman@MissouriState.edu 417-836-6123 Department of Biomedical Sciences

Dr. Zimmerman has completed NIH-sponsored postdoctoral training at the University of California-San Diego School of Medicine working with Cardiovascular Physiology and Biomedical Engineering groups. His scholarly interests are two-fold. He conducts basic research into the mechanisms governing the alteration of muscle structure in respons to stress (aging, injury, nutrition, etc.). His recent work has included the examination of the signaling molecules responsible for the healing of the scar and remaining cardiac muscle following a heart attack (myocardial infarction). His second line of inquiry focuses on the effects of student-centered pedagogies such as team-based learning on student learning.