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FUNCTIONAL GENOMICS IN ANIMAL IMPROVEMENT, FOOD SAFETY AND HUMAN HEALTH

NON-TECHNICAL SUMMARY: Understanding gene functions in regulation of animal growth, development and reproduction is essential to solving many key animal production problems including improvements in fertility, increased lean/fat ratios, enhanced production efficiency, and overall quality. In addition, discerning basic mechanisms about stem cell biology and tissue development are critically important to understand the diet-related human diseases of obesity and cancer development. As a newly formed Animal Biology and Biomedicine collaborative research team, we will synergize our individual research projects to add more value through shared tools, information and knowledge. Specifically, genomic resources, genetic innovations, and epigenetic technologies are expected to significantly change the way we solve problems related to animal and human health as it relates to food now and in the future.

OBJECTIVES: Understanding functional mechanisms regulating animal growth, development and reproduction is central to solving many key animal production problems including improvements in fertility, increased lean/fat ratios, enhanced production efficiency, and overall quality. In addition, understanding basic mechanisms about stem cell biology and tissue development are critically important to understand the food-related human diseases of obesity and cancer development. Therefore, our proposed collaborative research will create novel functional genomics models, reagents and tools that are designed to be used to address challenges in animal productivity and food safety to benefit human health in Washington and to lead the way in the nation, and the world. Additionally, the proposed collaborative project aims to minimize production costs, optimize product quality and thus enhance the local and global competitiveness of Washington's livestock and food manufacturing industries. To accomplish these overall goals, we will pursue four objectives: Objective #1: To investigate potential links between transcriptome complexity and complex phenotypes for animal breeding. Objective #2: To explore genetic and cellular mechanisms governing animal growth and development. Objective #3: To identify critical molecular events necessary for establishing and maintaining successful pregnancies and to determine how disruption of these pathways lead to women's reproductive diseases to understand animal reproduction. Objective #4: To elucidate mechanisms responsible for the beneficial effects of dietary polyphenolic compounds on gut microbiota, epithelial differentiation and intestinal barrier function to understand animal health.

APPROACH: This team research involves a wide range of laboratory techniques, including conventional molecular, cellular and immunological research techniques; genomic, transcriptomic, proteomic and metabolomic analyses; next-generation sequencing strategies and bioinformatics analysis; RNA interference and epigenetic analyses, as well as CRISPR/Cas 9 gene editing strategies. These techniques have been successfully implemented by the research participants in this project for functional genomic and developmental studies.

KEYWORDS: Animal growth, development and reproduction; Genome editing, transcriptome diversity and epigenome modification; Animal and human health
