My research focuses on understanding the impact of obesity induced inflammation on metabolic and cardiovascular complications. With the epidemic of obesity facing children and adolescents, understanding the long-term complications of obesity on the immune system is clinically relevant. The 5 key papers chosen as the basis for promotion are selected based on her impact on the field.


Understanding the impact of obesity on the hematopoietic niche, myelopoiesis, macrophage development, and inflammatory profiles of tissue macrophages has become the prime focus of the Singer Lab. This paper demonstrates that bone marrow derived macrophages from obese animals are primed from inflammation after in vitro culture, bone marrow transplantation, and serial bone marrow transplantation. This work has been well recognized as enhancing our understanding of the long-term impact of diet on the immune system. I designed experiments, performed them, and wrote this manuscript. This work has led to further mechanistic studies in my lab as well as translational investigations investigating the clinical importance of obesity induced hematopoietic changes (Papers 9, 21, 22, and 28).


The work focuses on the influence of sex and gender on myeloid inflammatory responses to high fat diet and the metabolic consequences of these differences. Work on sex differences in mouse models is critical to increasing our mechanistic understanding of what happens in obese men and women, given several sexually dimorphic diseases and complications exist clinically. I designed, completed, analyzed, and prepared this manuscript and am the corresponding author on this publication. The findings specifically demonstrate that female bone marrow is less inflammatory in response to diet compared to males even when transplanted to males or in culture. I have been fortunate to be nationally recognized as an expert in this area of sex-differences in metabolic inflammation due to work done in this publication leading to national presentations and requested articles describing sex differences in adiposity, lipolysis, and the role of androgen sex hormones in driving sex differences in obesity induced hematopoiesis.


My lab has focused its investigations on understanding the mechanisms that lead to sexual dimorphism in metabolic disease. While we are currently evaluating the impact of estrogen and androgen sex hormones there are several other sexually dimorphic mechanisms that may lead to the dampened inflammatory responses in females fed a high fat diet. One of those mechanisms is the difference in storage of fatty acids and the breakdown of stored lipids. In
this manuscript we detail the sexually dimorphic lipid species in male and female gonadal adipose tissue, the response to induced lipolysis, and the profiles of inflammatory leukocytes that expand/respond to lipolysis. As the senior author for these studies, I worked with the first author in design, analysis, interpretation, and manuscript preparation. This is a further area of research in our laboratory with upcoming manuscripts in this area.


Along with understanding the local bone marrow niche effects, we realized there were programmed changes in hematopoietic cells given persistent myelopoiesis activation with serial transplantation of marrow from high fat diet fed mice (#11). Using bone marrow culture/microarray of bone marrow derived macrophages we identified that the TLR4 pathway on leukocytes is activated with high fat diet exposure. This work has identified that both the canonical and non-canonical pathways are important in the bone marrow response and the macrophage polarization seen in obesity. I am the senior author on this publication and designed, performed, and supervised studies, analyzed data, and worked with the first author to prepare this manuscript.


Women enroll in obesity weight management programs and undergo bariatric surgery at higher rates compared to men, but many pre-clinical studies are conducted in male animal models. Given the gaps in our understanding of how weight loss models impact female responses in adiposity and metabolic inflammation, we conducted studies in this manuscript to evaluate the effects of weight loss on adipose and bone marrow inflammatory profiles using both dietary and bariatric surgery. We identified that while males had persistent tissue inflammation even after weight loss, females were protected. Vertical sleeve gastrectomy (VSG), however, induced reduced inflammation in both sexes in adipose but enhanced inflammation in the liver. As the senior author on this manuscript, I designed the studies, assisted in the completion of experiments, data analysis, interpretation, and manuscript preparation. This manuscript also led to a collaborative follow-up study looking into the impact of VSG on the bone marrow niche (40) recently accepted in the Journal of Clinical Investigation.