# Mitochondrial Network Dynamics: Benefits of a High Metabolic Demand (Lactation) Condition in Rats

*Ryleigh Randall, Hailey A. Parry, Hayden W. Hyatt, Wendy R. Hood, and Andreas N. Kavazis*

Pregnancy and lactation are physically and metabolically challenging events in a female's lifetime. In this regard, the female body undergoes significant metabolic changes over the course of pregnancy that support the growing fetus and prepare for lactation. During pregnancy, the female body facilitates energy storage that can lead to increased risk of metabolic diseases such as type 2 diabetes. Lactation initiates a beneficial metabolic shift that reverses the gestation-induced energy storage to that of milk production.

Breastfeeding reduces postpartum adiposity by facilitating lipid transport to mammary glands for milk production. Importantly, the liver has a high metabolic rate and plays a key role in various pathways including milk production. The metabolic alterations that occur during pregnancy and lactation require cellular remodeling to facilitate these changes. Therefore, the purpose of this study was to investigate the effects of lactation on mitochondrial fission and fusion and autophagy in the liver.

Female rats (ten weeks old) were assigned to: (1) nonreproductive, (2) reproductive without lactation (did not suckle their pups), and (3) reproductive with lactation (suckled their pups) groups. Half of the animals from each group were sacrificed at peak lactation (14 days postpartum). The other half were sacrificed twelve weeks post weaning (weaning was done at 21 days postpartum). This resulted in six groups with eight animals per group. Several markers of mitochondrial fusion and fission and autophagy were measured in the liver via Western blots.

Autophagy is a process in which cells recycle old or damaged components and can play a role in liver remodeling during reproduction. In this regard, during peak lactation, the lactating animals had larger liver mass compared to those that did not lactate. However, the liver mass in the lactating animals at the post weaning time were smaller compared to the animals that did not lactate. Our results suggest that an increase in autophagy may, in part, explain this size difference, as autophagy and cell growth are known to be conversely regulated.

Mitochondria are the powerhouse of the cell; they transform chemical energy from the food we eat into adenosine triphosphate (ATP), the energy currency of the cell. Therefore, it is not surprising that mitochondria are constantly undergoing remodeling based on the energy needs of the body. Two of the main process of mitochondria remodeling are fusion (the process of two smaller organelles combining to form one larger organelle) and fission (the process of cleaving one larger organelle into two smaller ones). Our results indicate that the liver mitochondrial network is regulated via the fusion pathways, but further research is warranted.

In conclusion, lactation has rapid and persistent beneficial effects and provide additional support of the Stuebe and Rich-Edwards "reset hypothesis" which posits that lactation helps to reset maternal metabolism postpartum.

## Statement of Research Advisor

Ryleigh is a hard worker, an extremely fast learner, and a dependable student researcher who has helped to collect these data to better understand female reproductive health.

– *Andreas Kavazis, Kinesiology*