



## RESEARCH PROGRESS REPORT SUMMARY

**Grant 02507:** Characterizing Developmental Lung Disease as a Cause of Sudden Death in the Norwich Terrier

**Principal Investigator:** Kurt Williams, DVM, PhD  
**Research Institution:** Michigan State University  
**Grant Amount:** \$116,076  
**Start Date:** 3/1/2018      **End Date:** 2/28/2021  
**Progress Report:** End-Year 2  
**Report Due:** 2/29/2020      **Report Received:** 5/25/2020

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### Original Project Description:

Neonatal respiratory distress syndrome has been attributed to more than 60% of deaths early in life in puppies. The underlying cause(s) of this apparently common problem is poorly understood. Despite the high frequency of respiratory-related mortality in neonatal puppies, there are no reports describing the underlying lung pathology in affected individuals. In human medicine the classification, management and evaluation of diffuse interstitial lung diseases in infants are well described. The most severe neonatal lung diseases in humans develop as a result of abnormal development of the lung, and often result in death soon after delivery. The investigators recently documented microscopic evidence of striking abnormal lung development in puppies of various breeds who died suddenly, suggesting that developmental lung disease (DLD) is an important and unrecognized cause of early death in young puppies. Breeders of Norwich Terriers (NT) report that sudden death of puppies early in life is common. Through preliminary studies, a high incidence of DLD in NT puppies associated with sudden death has been identified. The identification of a breed-association with DLD in the NT presents an opportunity to correlate the pathology and genetics to sudden death in NT puppies. Findings could lead to the development of preventive measures to reduce the incidence of DLD in the NT as well as other dog breeds, and may also be applicable to similar developmental lung diseases in children.

**Publications:** None at this time.



### **Presentations:**

Brandon Franz was a DVM summer research student working on the 3D vascular reconstruction of DLD in the Norwich Terrier. Brandon presented his data at the National Veterinary Scholars Symposium. The title of his poster presentation was 'Evidence of Intrapulmonary Vascular Anastomoses in Developmental Lung Disease in the Norwich Terrier'.

### **Report to Grant Sponsor from Investigator:**

We have made considerable early progress in advancing our understanding of developmental lung disease in the Norwich Terrier. Developmental lung disease (DLD) appears to be an important contributing factor in early life death in puppies of this breed of dog. We are using a 2-pronged approach to investigate this poorly understood disease: investigating intricacies of the structural abnormalities in lungs from affected puppies, and pursuing a genetic basis for this disease in the Norwich Terrier (NT). We used specialized computer software to take 2D images and structures in the lung and convert them into 3D images to investigate abnormalities in the lungs of affected puppies, especially abnormalities in blood vessels. Using this technique we have data that strongly suggests that there are abnormal pathways that allows a percentage of blood flow to bypass the normal pathway through the lungs.

The second major goal of our research is to look for a genetic basis for this disease in the NT. Our initial efforts to identify a genetic basis for this disease utilized genome wide sequence analysis (GWAS). These efforts did not identify an obvious genetic defect. This is not entirely unexpected. GWAS may miss complex genetic diseases. Because of this we are now going forward with sequencing the entire genome of related normal and affected Norwich Terriers.

Thanks to the efforts of NT breeders, we have identified a litter which lost a puppy to DLD, but which also has normal siblings. This family of Norwich Terriers allows us a source of DNA for sequencing. At this time we have the samples from this family of NT dogs prepared and sent off to China for sequencing. Unfortunately the COVID-19 pandemic has profoundly affected the progress on this important work. The shutdown of China's economy delayed the sequencing being completed. Now the sequencing has been completed, but the shutdown of the US economy and the campus of Michigan State University put a halt to research activities. We are hopeful that regular research activity will begin soon and the sequencing data will be analyzed.