Leukodystrophies are inherited disorders of the nervous system. Until magnetic resonance imaging emerged as a clinical tool, the diagnosis of leukodystrophies was difficult and imprecise; MRI has allowed new understandings and classifications of leukodystrophies that have greatly enhanced both our diagnostic ability and our understanding of these complex disorders. However, optimal use of MRI in this setting requires a fundamental understanding of pathologies of the axon and glia and the changes seen on MRI with various forms of white matter destruction. The purpose of this talk is to present the diagnostic MRI lesion patterns of leukodystrophies as well as the advanced MR techniques that are of use in assessing disease progression.

1) Pathologies of Axon and Glia in the LD
   - Inflammatory Demyelination
   - Axonal Degeneration
   - Microglial Activation
   - Spongiform Pathology
   
   *Objective: Identify Cellular Components of White Matter Degeneration*

2) Conventional brain MRI lesion patterns in LD
   - Brain MRI in Inflammatory Demyelination
   - Brain MRI in Axonal Degeneration
   - Brain MRI in Microglial Activation
   - Brain MRI in Spongiform Disorders

   *Objective: Identify T1, T2 and FLAIR Lesion Patterns in the LD*

3) Proton MR Spectroscopy in LD
   - Choline Distribution in Progressive Demyelination
   - N-acetylaspartate during Axonal Degeneration
   - Myoinositol and Microglial Activation

   *Objective: Characterize Abnormalities of Brain Metabolism in the LD*

4) Diffusion Tensor Imaging in LD
   - Apparent Diffusion Coefficient (ADC) in White Matter Pathology
   - Fractional Anisotropy (FA) in White Matter Pathology

   *Objective: Identify Contributions of White Matter Pathology to ADC and FA*

5) Recent Applications of Advanced MR Technology in LD
   - High Field MR Spectroscopy
   - Contrast Enhanced Ex Vivo MRI
   - Diffusion Spectroscopic Imaging

   *Objective: Identify Opportunities for New Applications of Advanced MRI Technology*

*Overall Objective: Integrate a Multimodal Advanced Neuroimaging Approach to the Pathology of LD*