

# Differences in White Matter Fiber Orientation in Three Clinical Groups of Children: Reading Disability, NF-1 and Reading Disability, and Controls

D. J. Peterson<sup>1</sup>, S. L. Rimrodt<sup>2,3</sup>, and L. E. Cutting<sup>4</sup>

<sup>1</sup>Developmental Cognitive Neurology, The Kennedy Krieger Institute, Baltimore, MD, United States, <sup>2</sup>Division of Developmental Medicine, Children's Hospital at Vanderbilt, Nashville, TN, United States, <sup>3</sup>Developmental Cognitive Neurology, Kennedy Krieger Institute, Baltimore, MD, United States, <sup>4</sup>Kennedy Center for Research and Development, Vanderbilt University, Nashville, TN, United States

## Introduction:

DTI was used to investigate differences in white matter fiber orientation between three groups: children with reading disability (RD), children with neurofibromatosis type 1 **and** reading disability (NF1+RD), and typically developing controls.

## Background:

Neurofibromatosis type 1 is a genetic condition that is associated with an increased likelihood of learning disabilities as well as radiologically detectable white matter abnormalities. Comparisons of DTI derived contrasts are common in the literature, but comparisons of fiber orientation are rare. This study uses the methodology of Schwartzman[1] to detect statistically significant differences in fiber orientation.

## Methods:

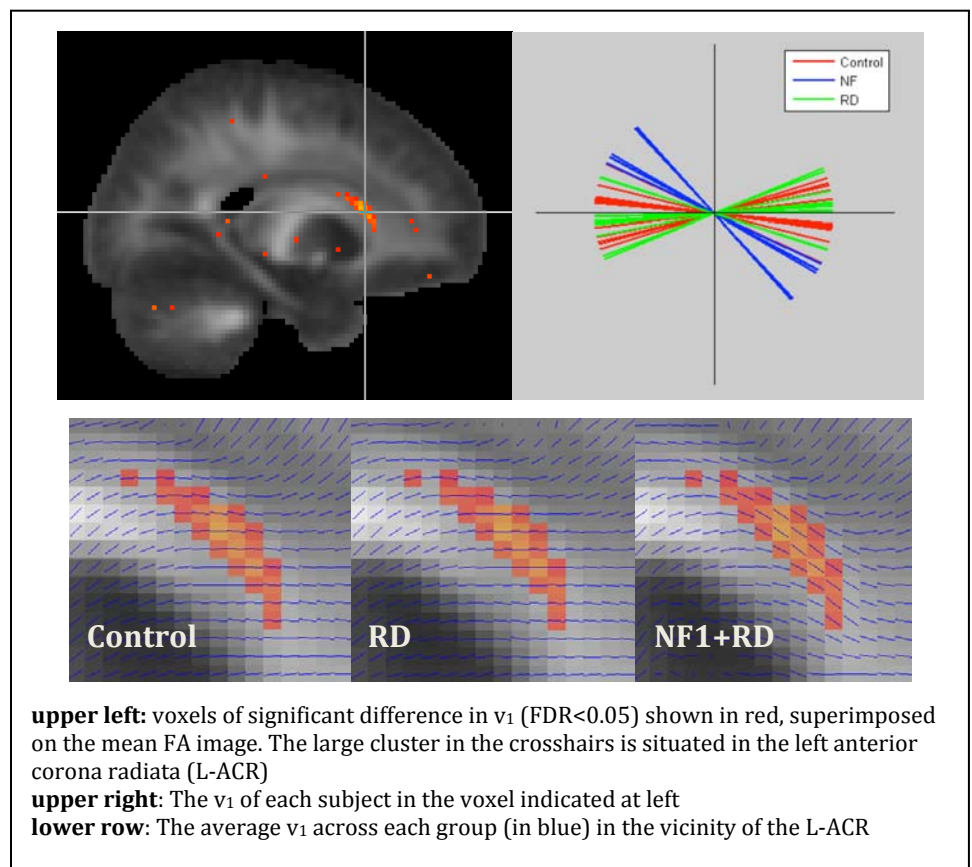
DTI data was collected on 33 children ages 7-14: 8 children with NF-1 who also had a reading disability (NF1+RD), 13 children with reading disabilities who did not have NF1 (RD), and 12 typically developing children (Controls). Motion correction and tensor estimation were performed in CATNAP[2]. Images of the principal eigenvector ( $v_1$ ) were normalized by linear transformation of the mean diffusion-weighted image to the JHU-DWI MNI-space template and reoriented according to the transformation parameters[3].

## Results:

Clusters of statistically significant voxels ( $FDR < 0.05$ ) were found most principally in the bilateral anterior corona radiata[4]. In these regions, the principal eigenvector ( $v_1$ ) was found to be oriented along the anterior-posterior axis among Control and RD subjects, while among NF-1+RD subjects,  $v_1$  was more diagonal relative to the stereotactic axes (see figure).

## Discussion:

Previous analysis of these data[5] found many widespread differences in FA and ADC across the three groups in many regions, including the bilateral anterior corona radiata. Interpretation of FA differences between clinically defined groups frequently postulates differences in fiber integrity and/or myelination. Our findings suggest that some areas of FA differences in these children with NF1+RD also may be related to differences in fiber alignment.



## References:

[1] Schwartzman et al Mag. Res. Med. 53:1423–1431 (2005) [2] Landman et al NeuroImage. 36(4):1123-1138 (2007) [3] Alexander et al, IEEE Trans. Medical Imaging 20(11):1131-1139 (2001) [4] Wakana et al NeuroImage 36:630-644 (2007). [5] Peterson et al 37<sup>th</sup> annual meeting of the Child Neurology Society, Santa Clara, CA, Nov. 2008  
This work was supported by NIH grants P50 HD052121 and R01NS049096