

# Genetic effects on the microstructure of the amygdala, fusiform and hippocampus in humans

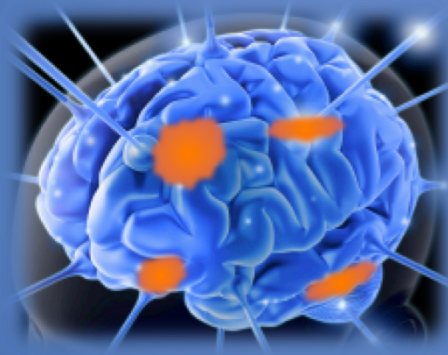
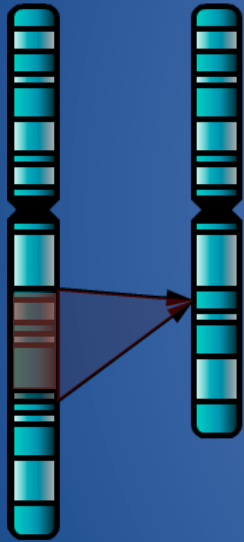
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# A model for understanding the genetic basis of social-cognition



Williams syndrome (WS): a neurodevelopmental condition caused by a deletion of ~ 26 genes on 7q11.23

# Hypersociability in Williams syndrome

- **Socially uninhibited or socially fearless** (Deutsch et al., 2007; Gosch and Pankau, 1994).
- **Greater use of emotionally provocative language** (Jones et al 2000)
- **Affinity towards attending to faces** (Riby et al 2008)

# The social-cognitive brain in Williams syndrome

## Structure

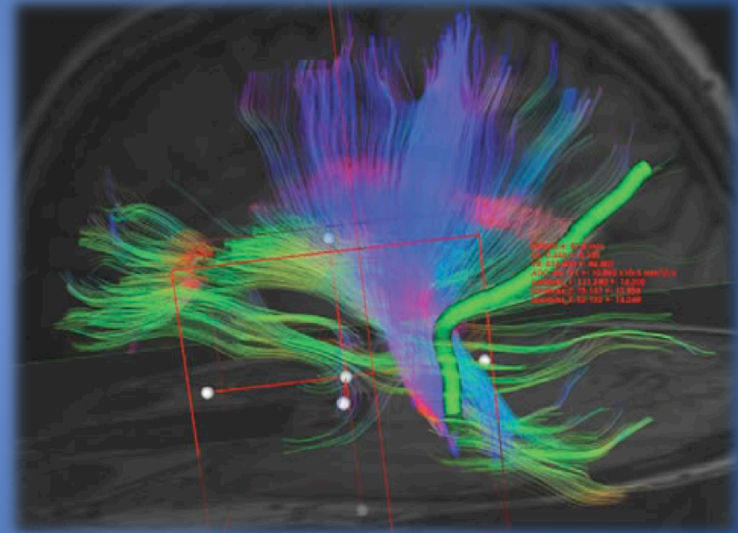
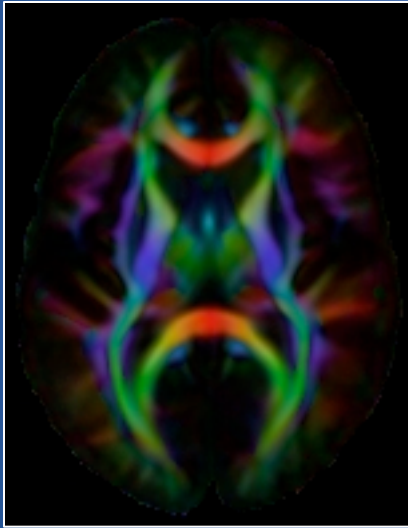
- **Enlarged amygdala volume** (Reiss et al 2004, Martens et al 2009)

## Function

- **Reduced amygdala response to fearful facial expressions** (Meyer-Landenberg et al 2005)
- **Increased amygdala response to happy facial expressions** (Haas et al 2009)
- **Enlarged functionally defined fusiform face area (FFA)** (Golarai et al 2010)

# Diffusion Tensor Imaging (DTI)

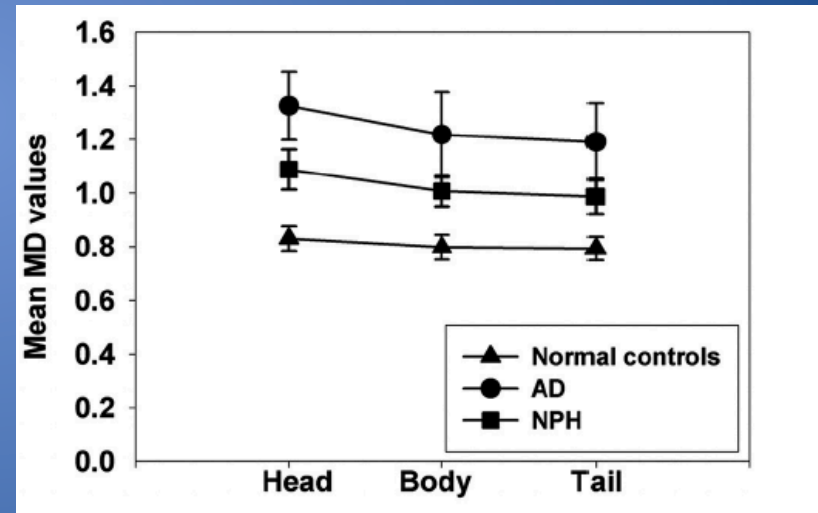
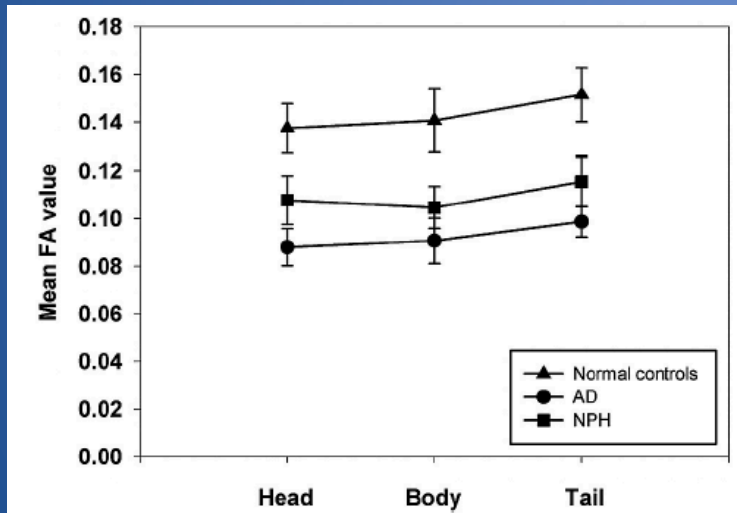
- Measures the diffusion of water molecules



- DTI of the brain regions comprised of mixed tissue types

# Abnormal diffusivity of the hippocampus in Alzheimer's

- Clerx, et al 2012, Cherubini et al 2010, Oishi et al 2011a, Oishi et al 2011b.



# Goals of current study

- Investigate the structural integrity of social-cognitive brain networks during childhood in WS
- Investigate the structural integrity of social-cognitive brain regions comprised of mixed tissue types in WS by using DTI

# Methods

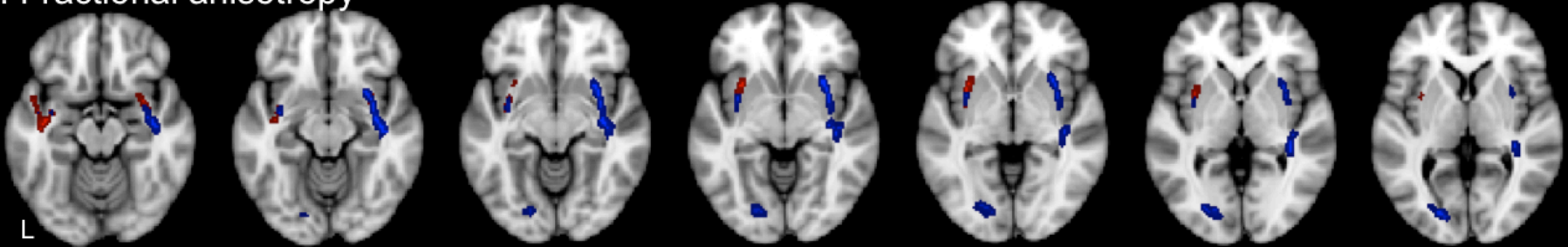
- **Sample:** 36 children  
(18 WS, 18 TD; mean age = 11.42 years)
- **DTI:** 23 noncollinear directions
- **Regions of Interest:**
  - White-matter pathways
    - Inferior fronto-occipital fasciculus (IFOF)
    - Uncinate fasciculus (UF)
  - Mixed tissue types ROIs
    - Fusiform gyrus
    - Amygdala
    - Hippocampus
    - Medial orbitofrontal gyrus
- **Analysis:** Between groups (WS vs. TD) and behavioral correlations with IQ and SRS social-cognition



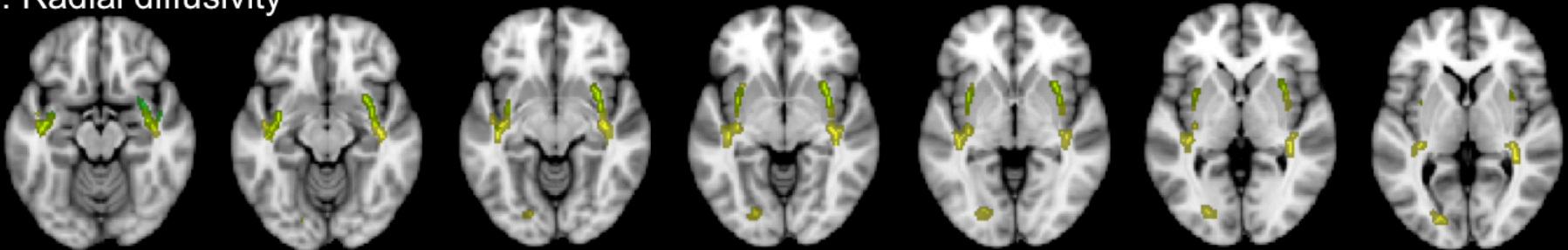


# White-matter pathways

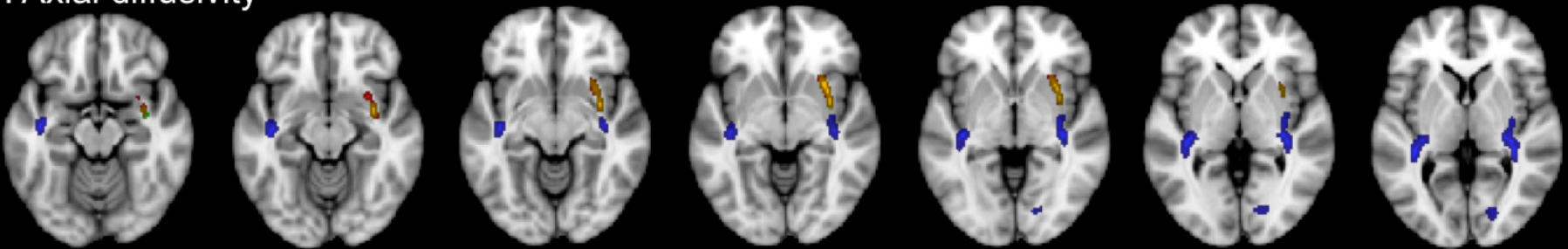
A. Fractional anisotropy



B. Radial diffusivity



C. Axial diffusivity



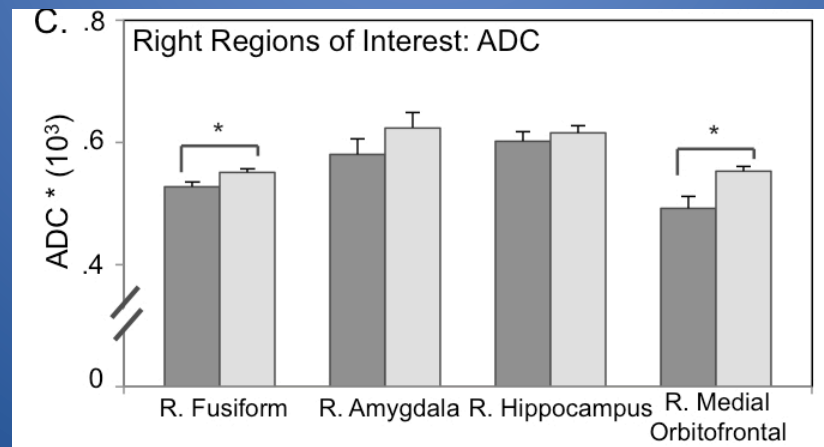
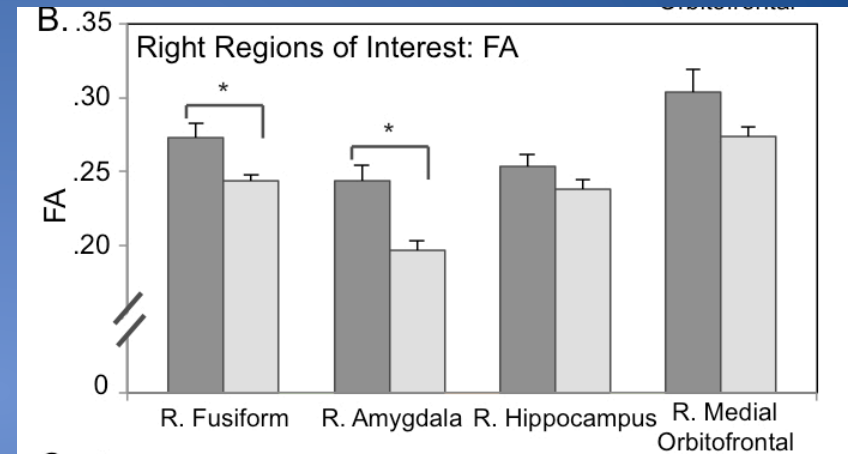
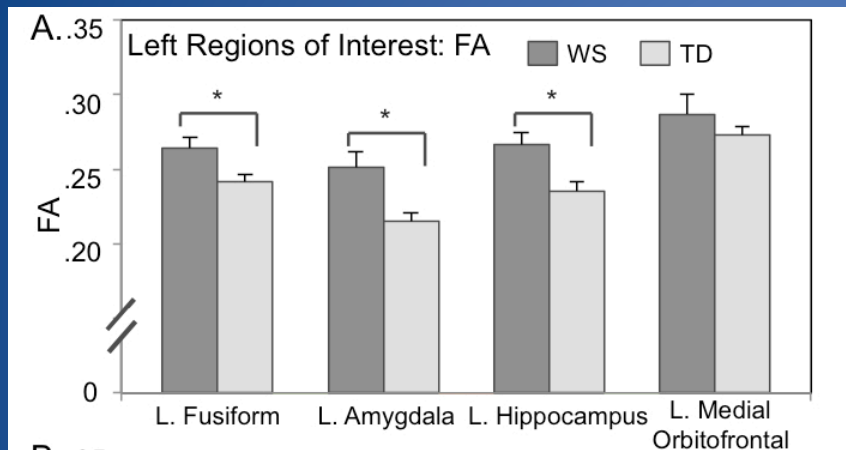
Blue IFOF: WS > TD

Yellow IFOF: TD > WS

Red UF: WS > TD

Green UF: TD > WS

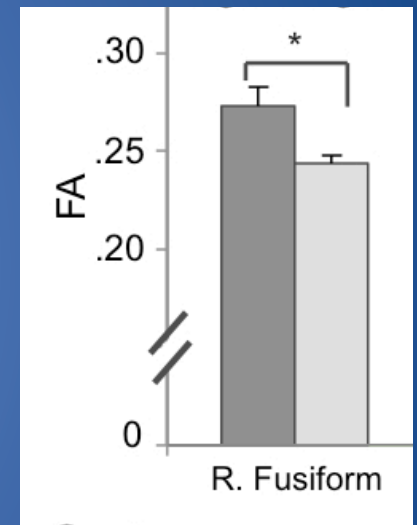
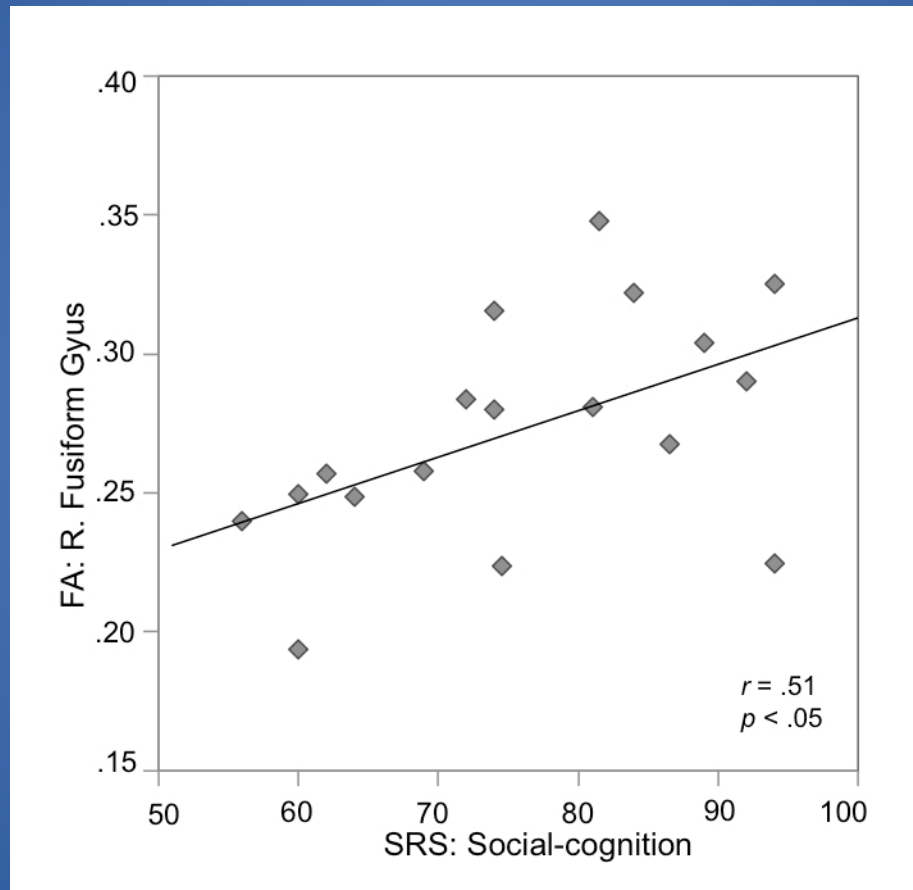
# Mixed tissue types ROIs



WS  
TD

\*  $p < .025$

# FA and social cognition in WS



# Implications

- Evidence of abnormal structure of social cognitive networks during childhood development in WS
- Evidence of microstructural alterations in several brain regions that may be associated with the WS social phenotype
- Supports the efficacy of using DTI to elucidate brain structure – behavioral associations in brain regions other than pure white-matter

# Future directions

- Combine DTI with functional connectivity analysis of fMRI data during social-cognitive processing
- Longitudinal studies to elucidate developmental trajectories of the social-cognitive brain in WS

# Thank you !!

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  - Kristen Sheau, M.S.

## Stanford University

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- New colleagues

## The University of Georgia

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- WS families



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