MENTAL ILLNESS AND VIOLENCE: A NEURODEVELOPMENTAL PERSPECTIVE

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Congressional Neuroscience Caucus
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COMMOM GOALS IN MEDICINE

- Prevention
- Early identification
- Early intervention

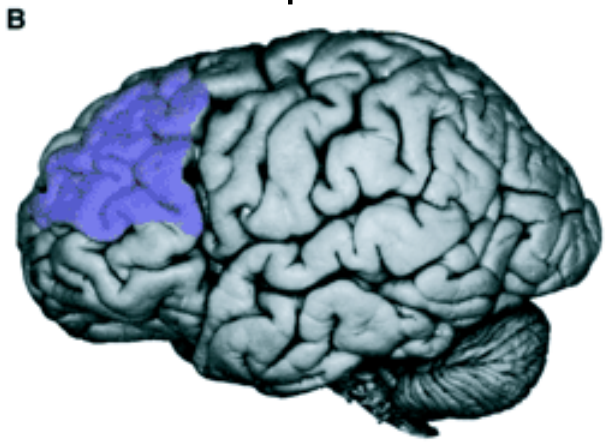
CHALLENGES

- Brain and its disorders are complex
- Big science - team work is needed
- Integrative multifaceted approach to identification and care: family, school, community, health professionals

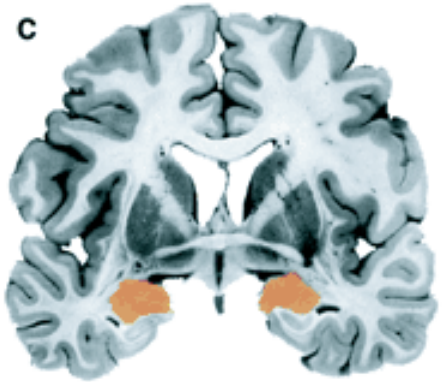
Key Structures Underlying Emotional Regulation

Orbital (green) ventromedial (red) prefrontal cortex

Dorsolateral prefrontal cortex

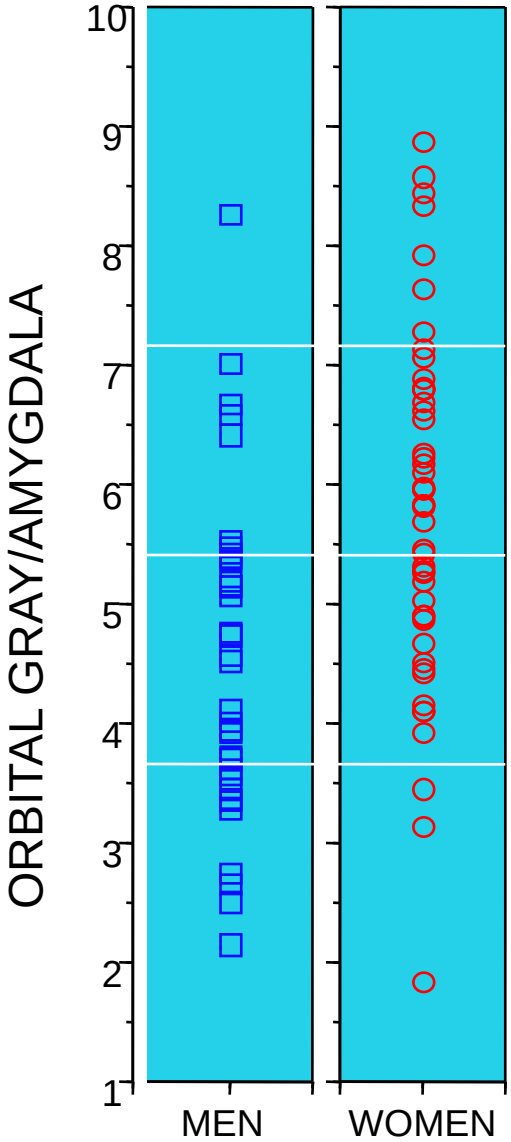


Amygdala



Anterior cingulate cortex

SEX DIFFERENCES



From Davidson et al., *Science*, July 28, 2000.

From Gur et al., *Cerebral Cortex* 2002

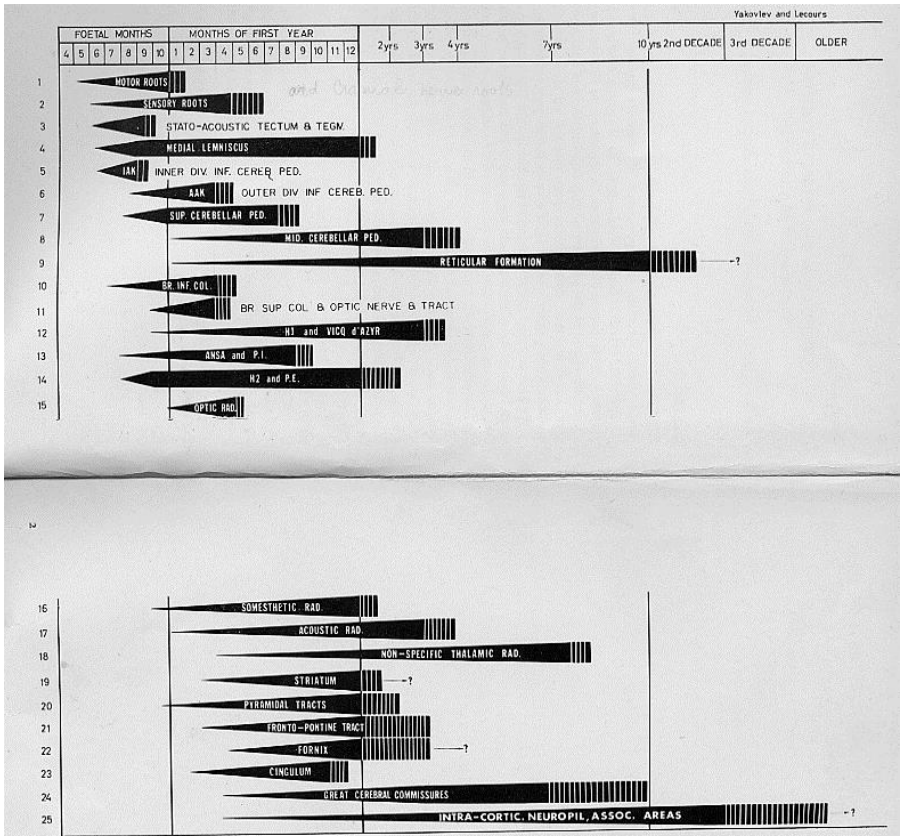
Brain Maturation

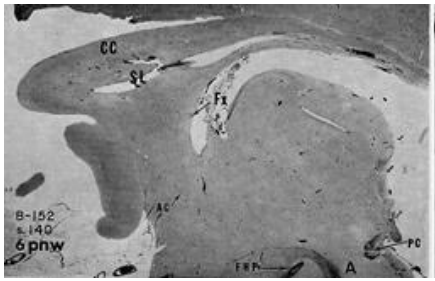
Spinal cord at lumbar level

25 Wks gestation

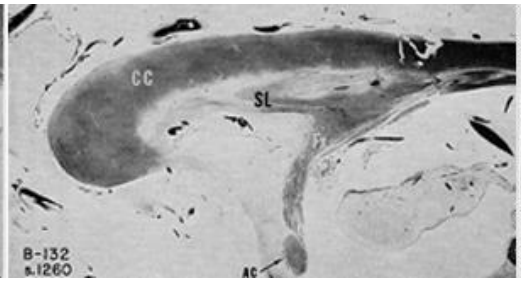
term

Developmental trajectories

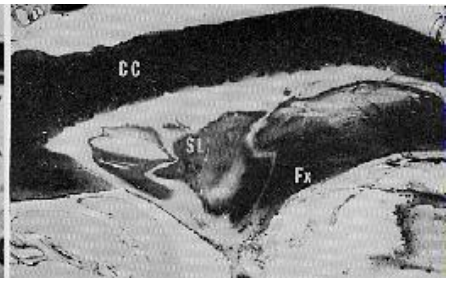




6 postnatal wks



1 year



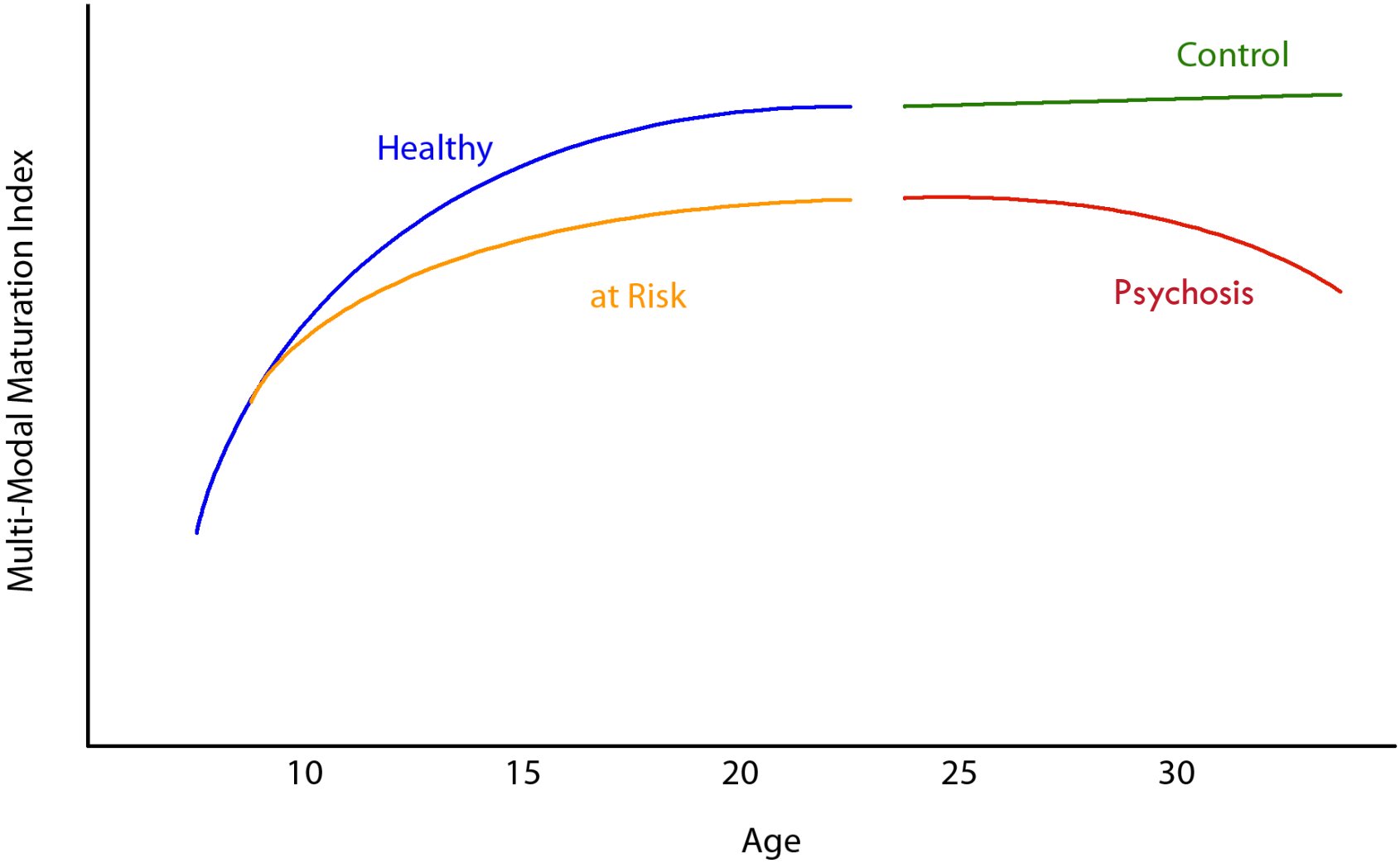
28 years

Corpus callosum

Yakovlev PL, Lecours AR (1967)

EARLY COURSE OF PSYCHOSIS

- Period of transition
- Brain maturation
- Vulnerability


Control
Healthy
at Risk
Psychosis
Multi-Modal Maturation Index
10
15
20
25
30
Age

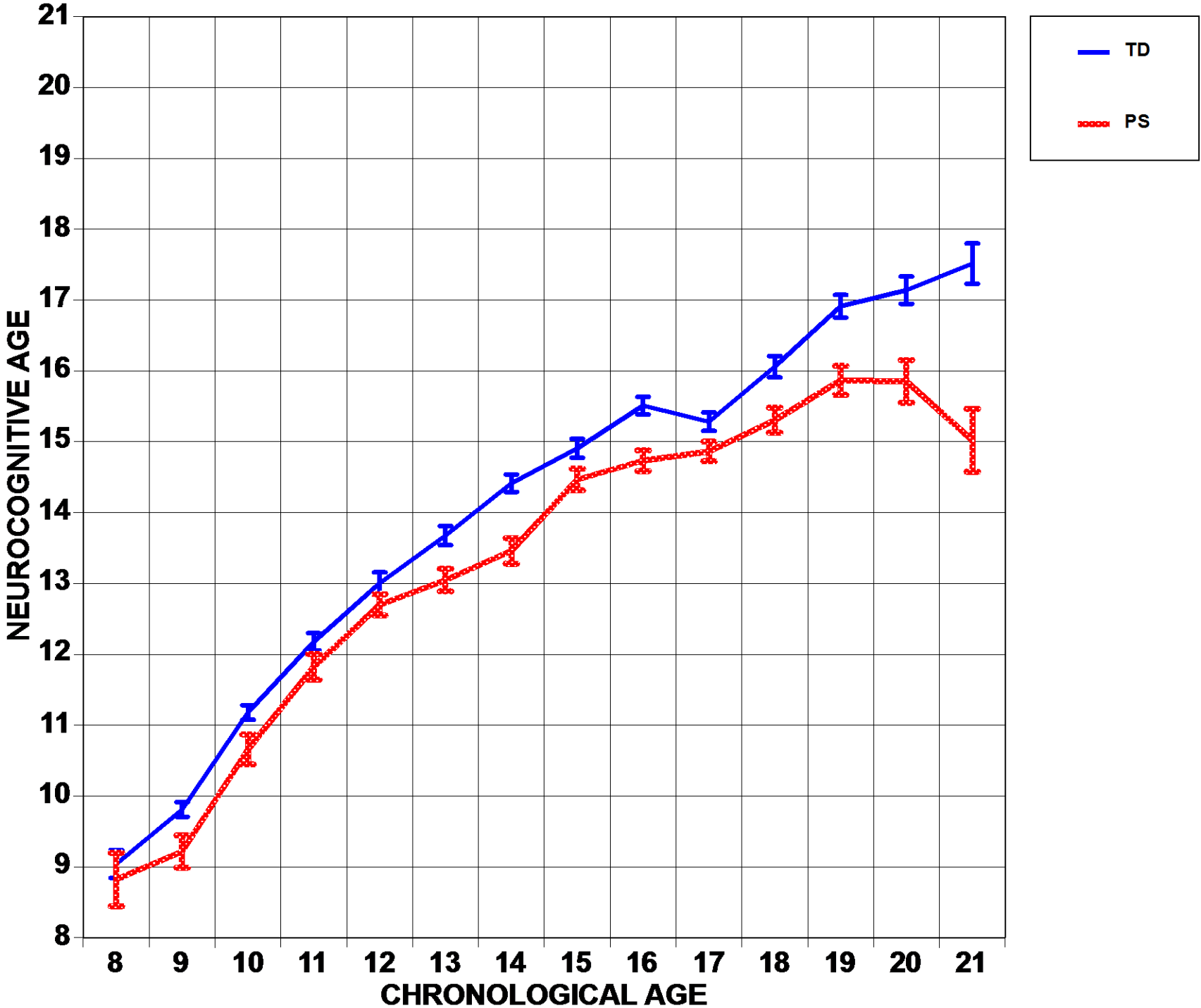
WHAT DO WE KNOW ABOUT PSYCHOSIS?

- A process
- Associated with brain changes that relate to behavior
- Interventions can work

HOW DO WE KNOW IT?

- Study of youth at risk and first presentation
- Longitudinal studies
- Early intervention programs

DATA


TD
PS
NEUROCOGNITIVE AGE
CHRONOLOGICAL AGE
21
20
19
18
17
16
15
14
13
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11
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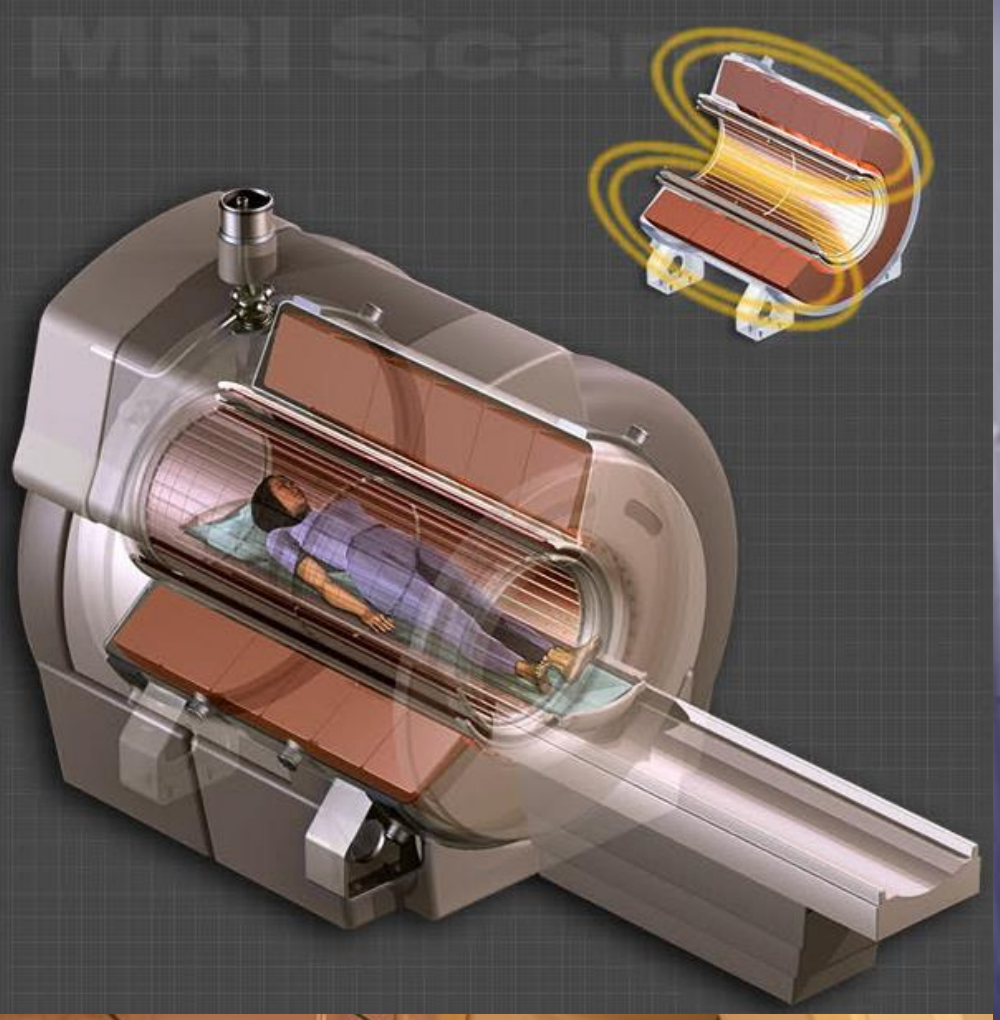
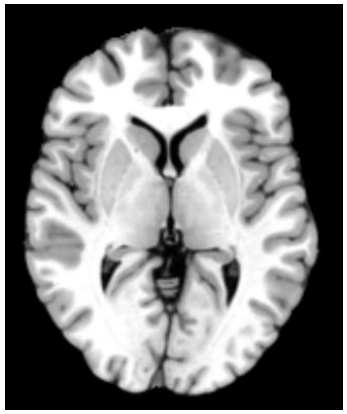
21

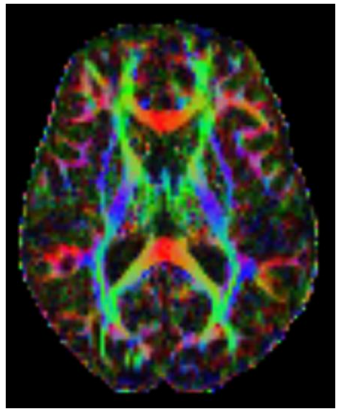


Clockwise from bottom left, images from: lcni.uoregon.edu/images/gallery/Machine1500x375.png, www.griffwason.com/mri_scanner1.htm, and biologybiozine.com/images/tech_09.jpg (accessed 12/4/09).

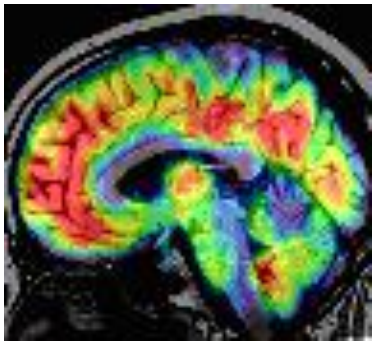
Neuroimaging: MRI



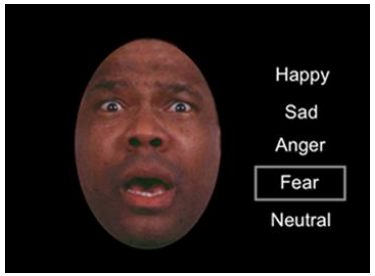
T1-weighted structural (3:28)



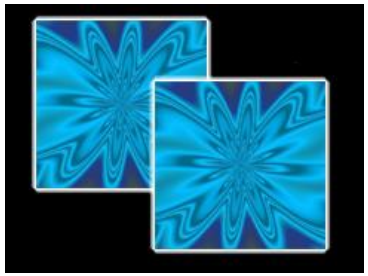
Diffusion Tensor imaging (10:56)



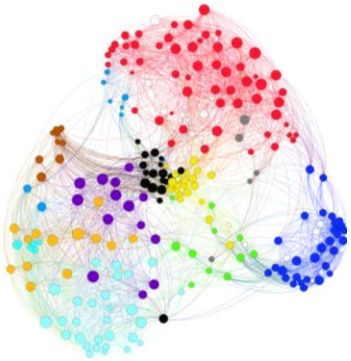
ASL Perfusion (5:32)



fMRI: Emotion Identification (10:36)



fMRI: Fractal *n*-Back (11:39)

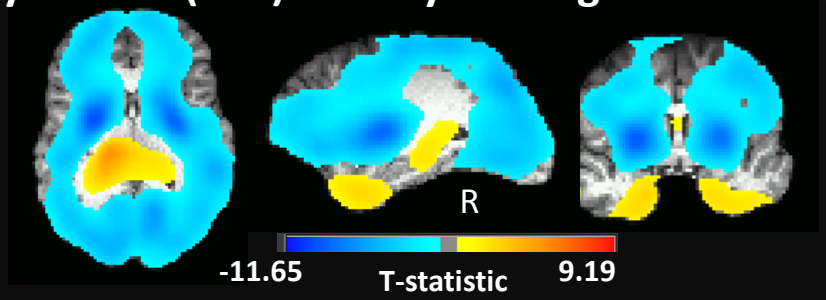


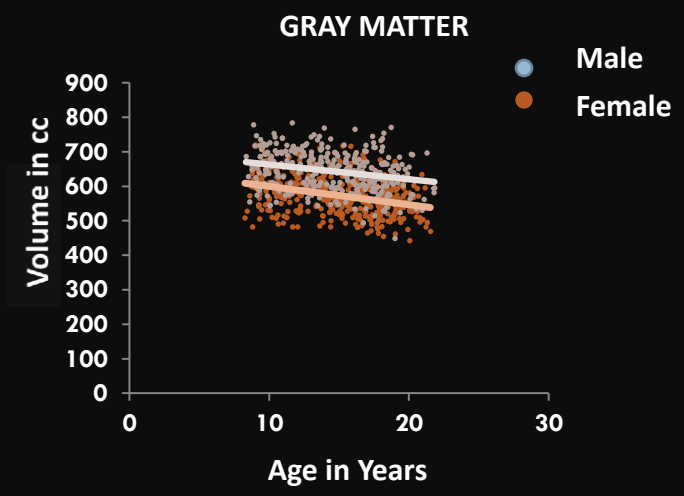
fMRI: Resting State (6:18)

Total scan time : 50 minutes

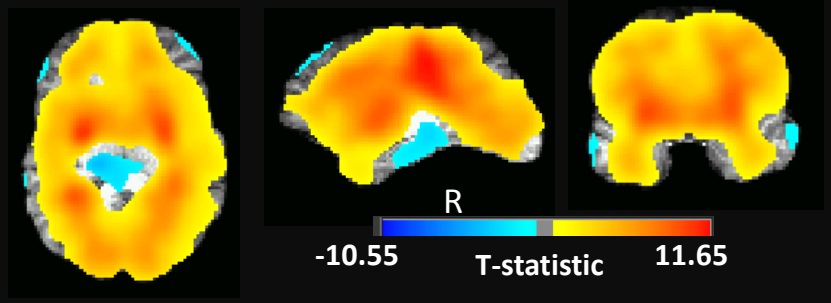
RELATIVE GROWTH OF BRAIN REGIONS WITH AGE (8-21 yrs, 731 subjects)

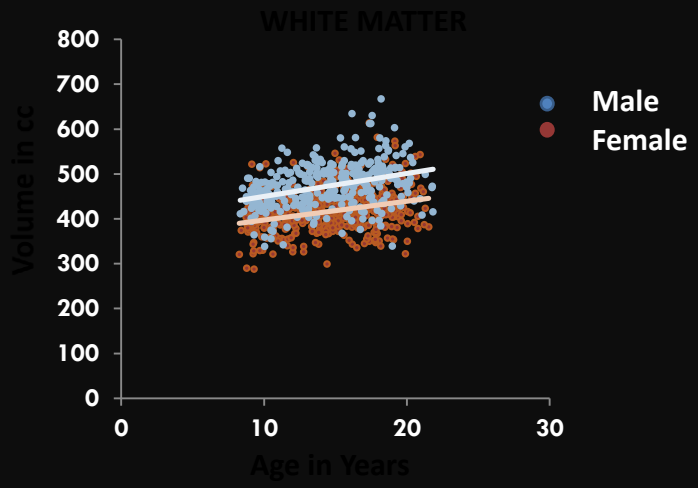
Gray Matter (GM) density with age: correcting for sex



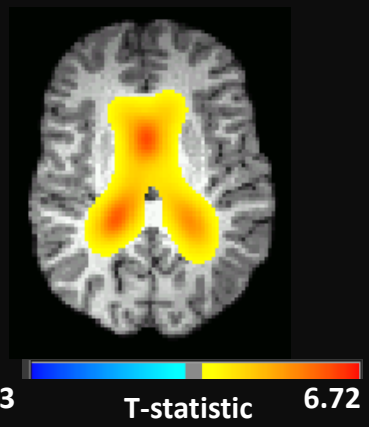


White Matter (WM) density with age: correcting for sex





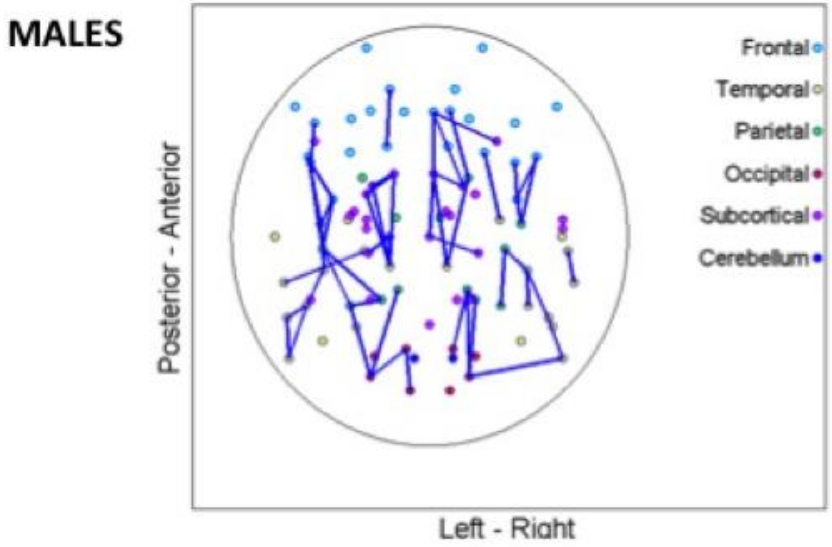
Ventricles (CSF) density with age: correcting for sex

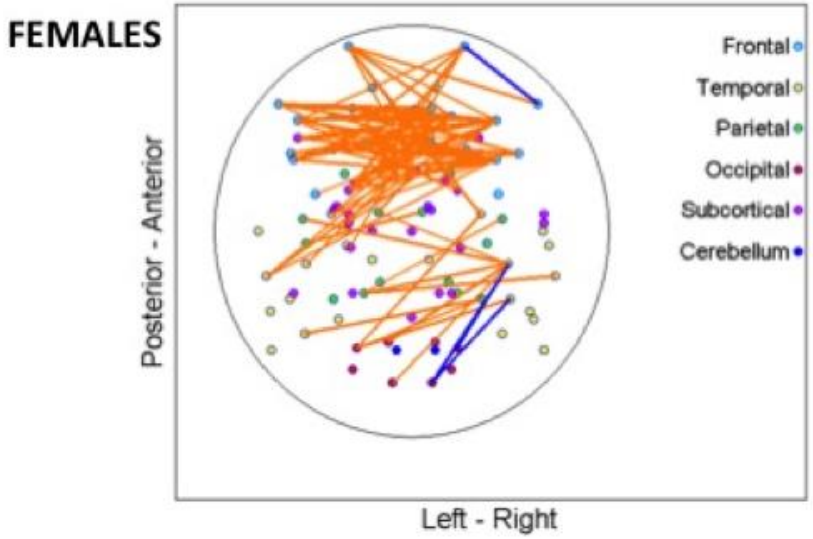


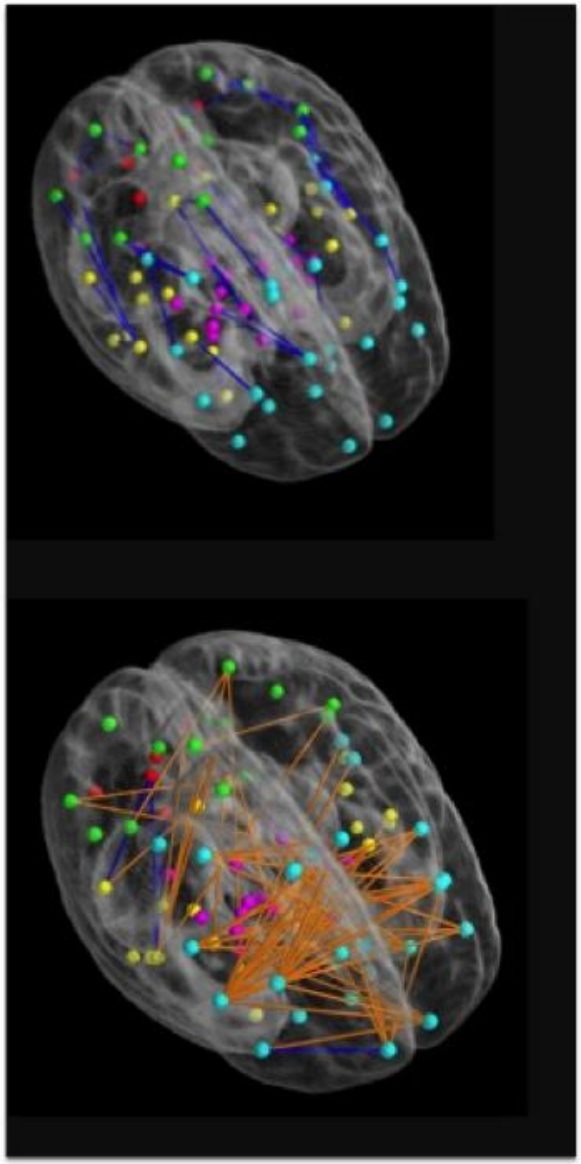
The proportion of GM relative to the total brain volume decreases with age and that of WM increases with age. This reflects both the effects of volume change and maturation of WM, which increases myelin that appears bright

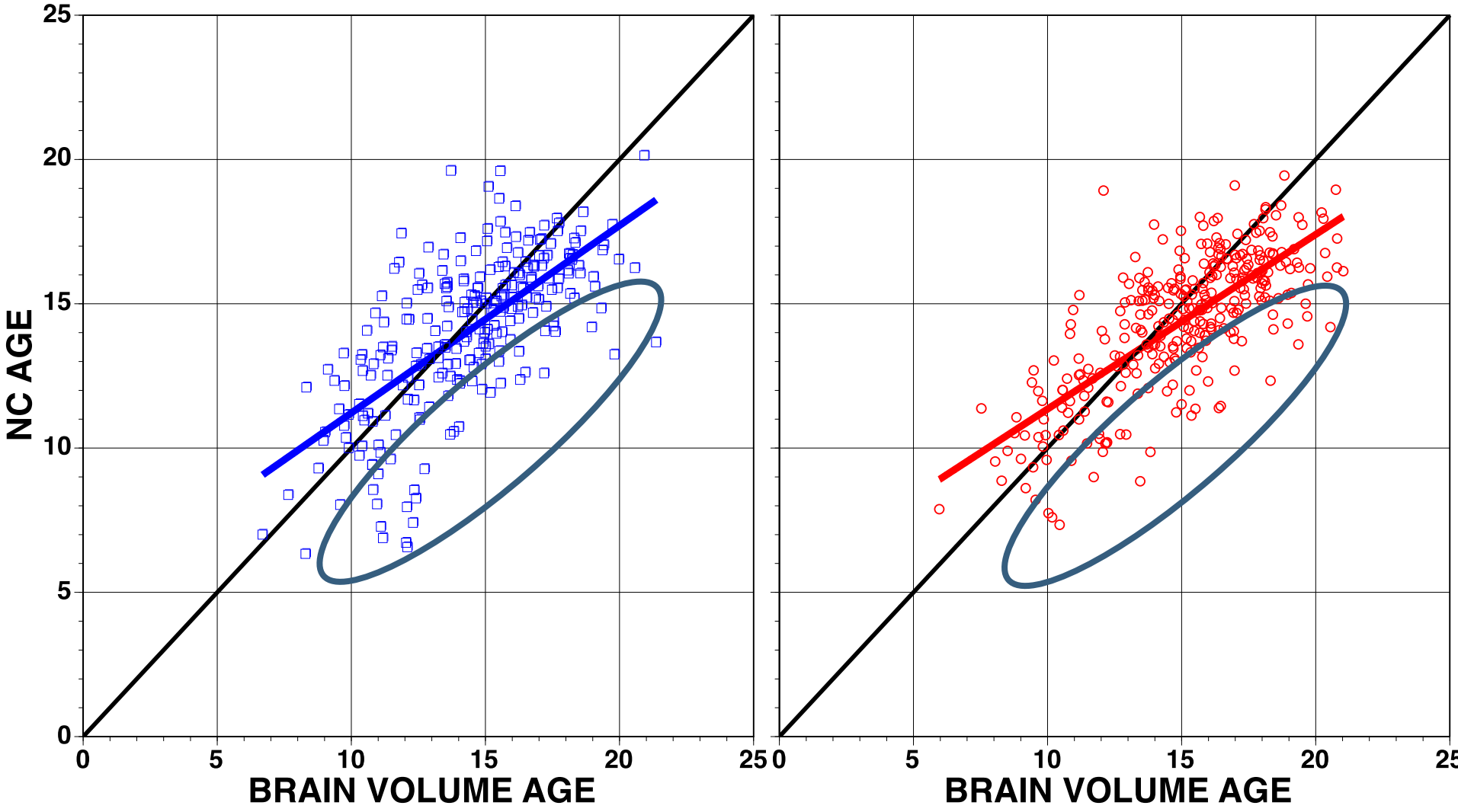
(FDR corrected q<0.05, p<0.01) Radiological convention

DTI Tractography








NC AGE
BRAIN VOLUME AGE
BRAIN VOLUME AGE
0
5
10
15
20
25

WHAT DO WE NEED TO DO?

- Investigate precursors that will allow early detection
- Focused research on informative populations with advanced neuroscience methodology
- Education – families, schools, communities
- Integrated science-based interventions