

# EVALUATING ADC VALUES IN THE FETAL BRAIN IN PREGNANCIES COMPLICATED WITH TTTS OR CMV

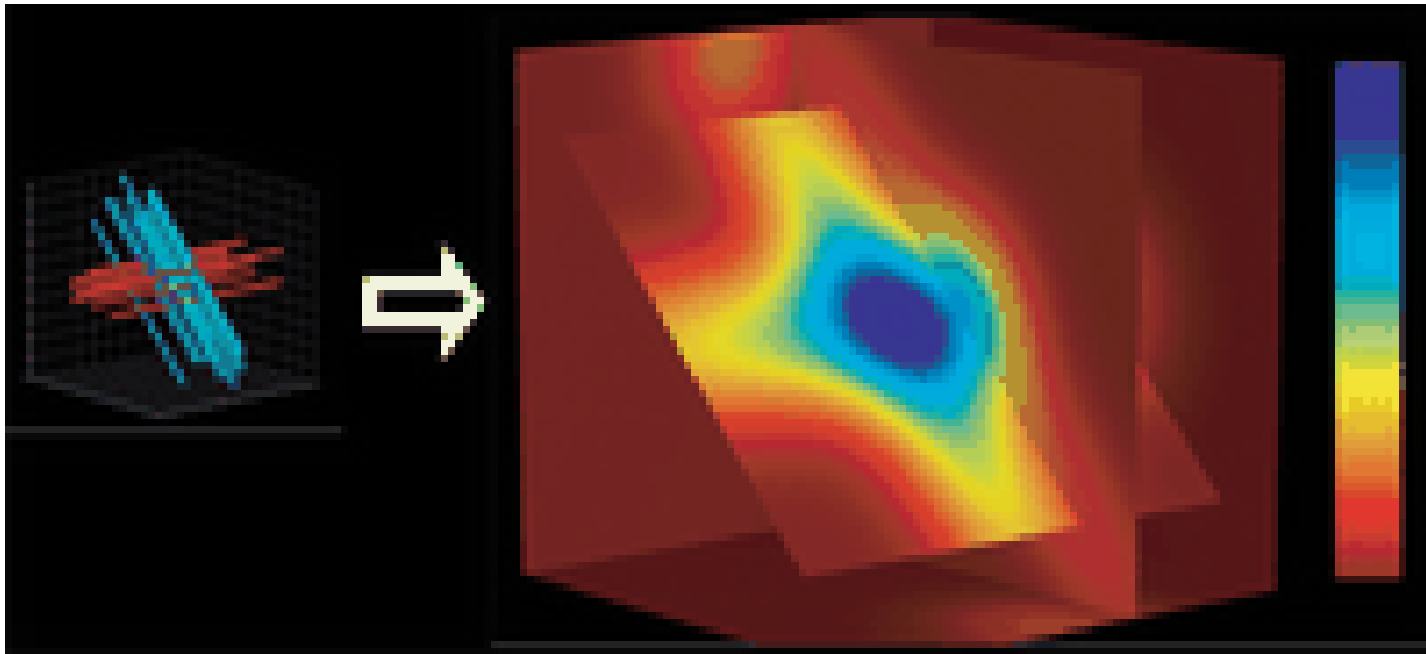
Dafi Bergman, 3<sup>rd</sup> year Medical student in the 4-year program  
B.Sc Life and Medical Sciences, Tel Aviv University  
Supervised by: Dr. Chen Hoffman  
Department of Neuroradiology, Sheba Medical center

# DIFFUSION IMAGING

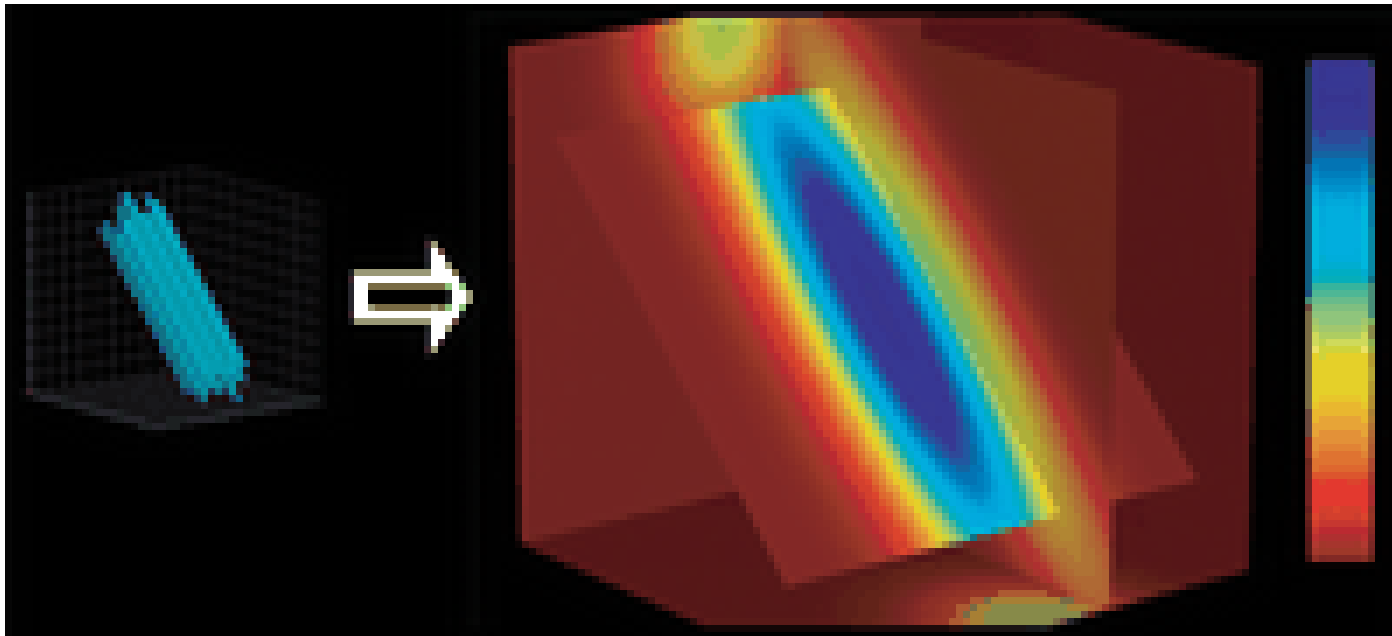
In every voxel (a 3D pixel), water is moving.

- ◉ In a voxel that contains spherical cells or randomly oriented tubular structures that intersect, the motion of the water molecules is random and is not constricted to one direction = **Isotropic**.
- ◉ In a voxel that contains longitudinal cells or tubular structures without intersections, such as axons, the motion of the water molecules is confined by the adjacent elements, and becomes directional = **Anisotropic**.

# ISOTROPIC

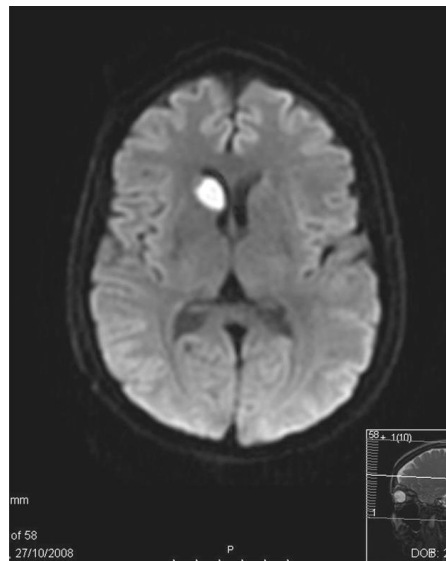


# ANISOTROPIC



# WHAT IS DWI?

- In DWI constructed images, each image voxel has an image intensity that reflects a single best measurement of the rate of water diffusion at that location.



# WHAT IS ADC?

Apparent Diffusion Coefficient (ADC) is the diffusion index, in which DWI results are displayed - it's units are  $\text{mm}^2/\text{s}$ , as it represents spatial motion.

- ⦿ Low ADC value  $\longrightarrow$  high level of organization
- ⦿ High ADC value  $\longrightarrow$  low level of organization

# STUDY OBJECTIVES

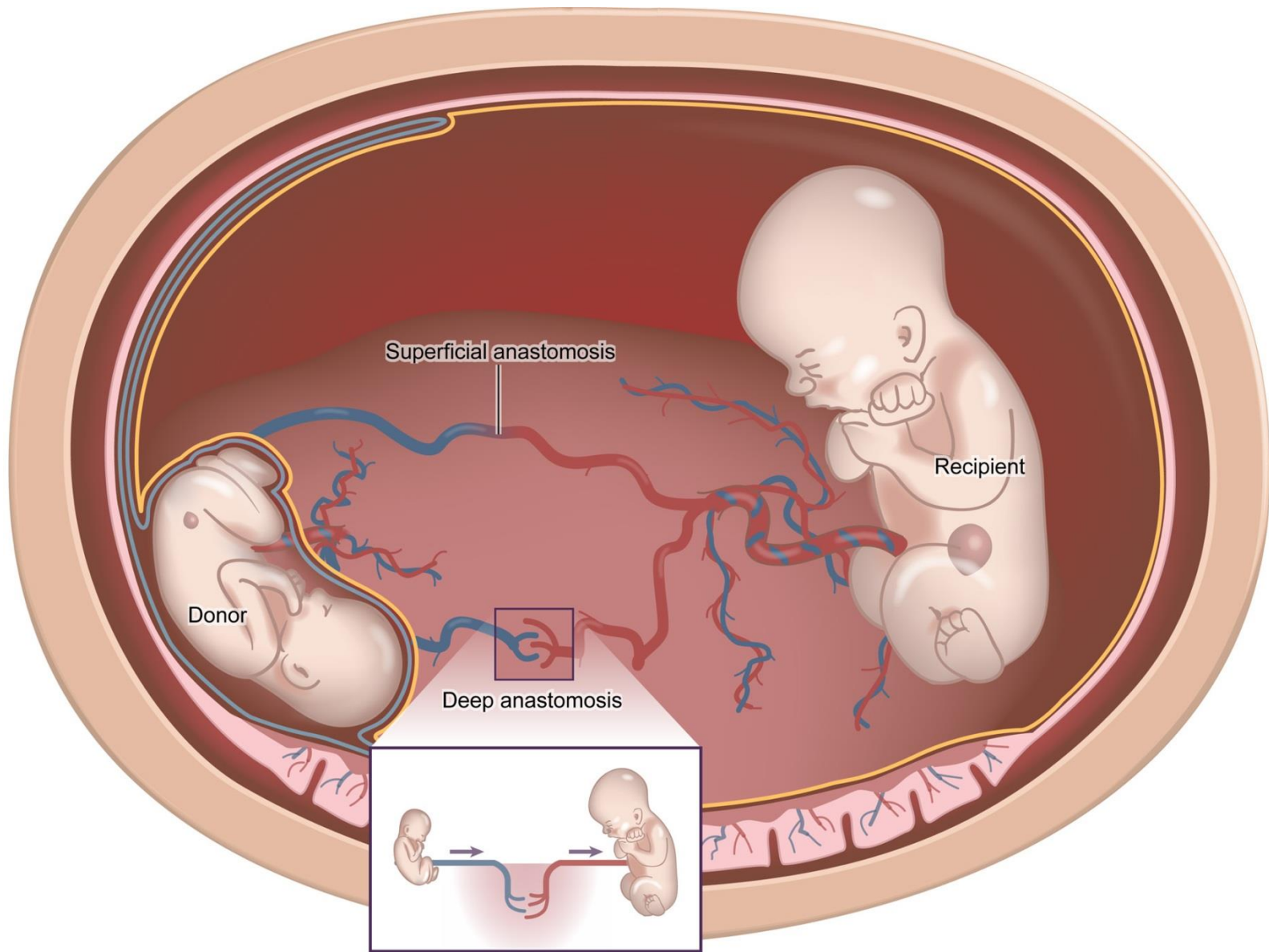
We aim to evaluate the magnitude, significance, and prevalence of immediate ischemic insult and ADC values of the fetal brain in:

- ⦿ Iatrogenic intervention or fetal death in twin pregnancies complicated with Twin-to-Twin Transfusion Syndrome (TTTS)
- ⦿ Maternal CMV infection during pregnancy.

# WHAT IS TTTS?

- ◉ Twin-to-Twin Transfusion Syndrome is a condition in which the blood flow through the vascular anastomoses between two identical twins is unequal.
- ◉ This creates a situation where the 'Donor twin' is large and hyperperfused and the 'Recipient twin' is small and hypoperfused.



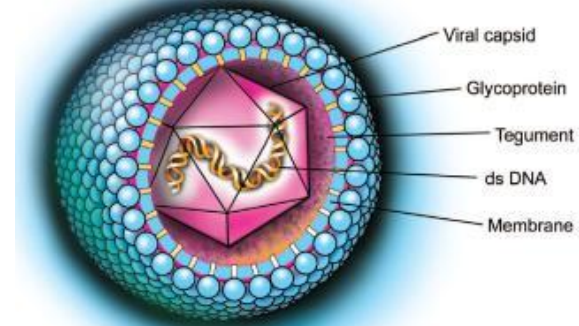


# BRAIN INJURY IN TTTS

- ◉ The exact pathogenesis of cerebral injury in TTTS is not fully understood but it appears that donors and recipients are at equal risk for cerebral injury
- ◉ If untreated, this condition ends in pregnancy loss by 26 weeks in over 90% of cases.
- ◉ Fetoscopic laser surgery caused marked decrease in neonatal morbidity, but neurocognitive morbidity is still a major problem.

# WHAT IS CMV?

- Cytomegalovirus (CMV) is a viral genus of the viral family known as herpesviruses



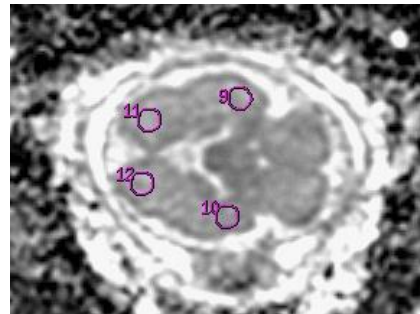
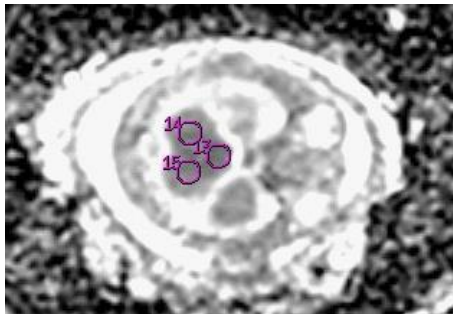
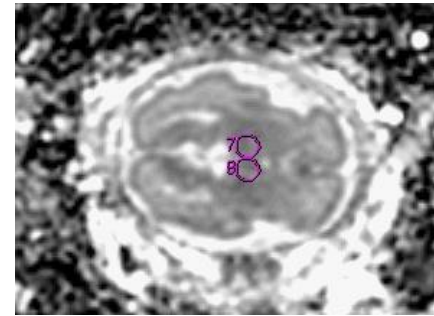
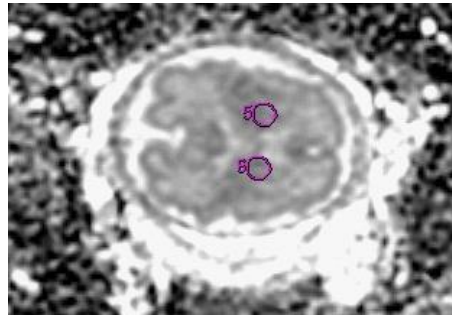
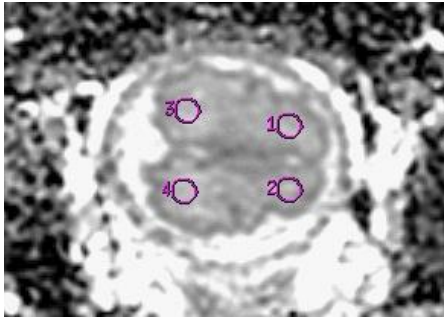
HCMV Human Cytomegalovirus

- CMV is the most common cause of intrauterine infection, affecting 0.3-2% of live-born infants.
- Congenital CMV infection is specifically worrisome when maternal infection occurs during the 1<sup>st</sup> or 2<sup>nd</sup> trimester of pregnancy.

# RISKS OF MATERNAL CMV INFECTION

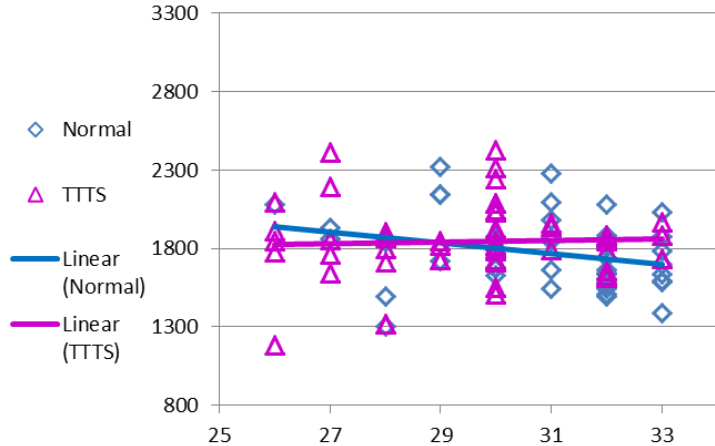
- ◉ 10% of congenitally infected infants are symptomatic at birth:  
About a third of them will die and up to 90% of the survivors will develop long term sequelae, such as hearing impairment or neurological abnormalities
- ◉ CMV infection is also considered as a significant risk factor for developing schizophrenia and cognitive deficits later in life.

# ROIs

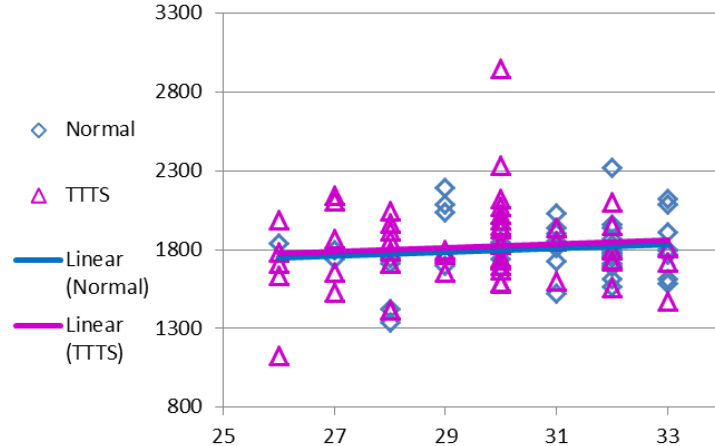


# PRELIMINARY RESULTS - TTTS

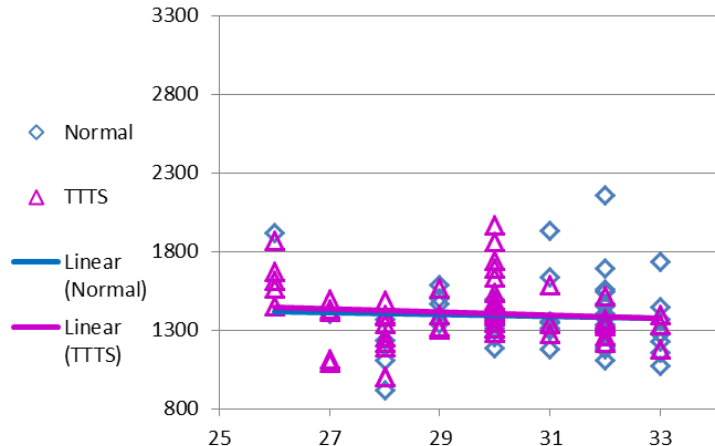
**ADC values for Parietal ROI**



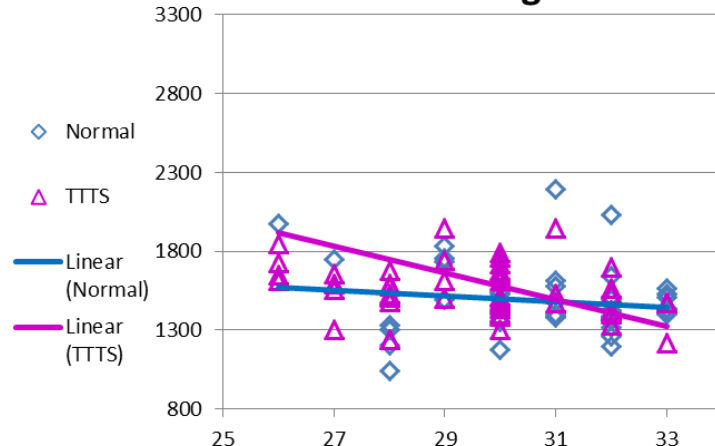
**ADC values for Frontal ROI**



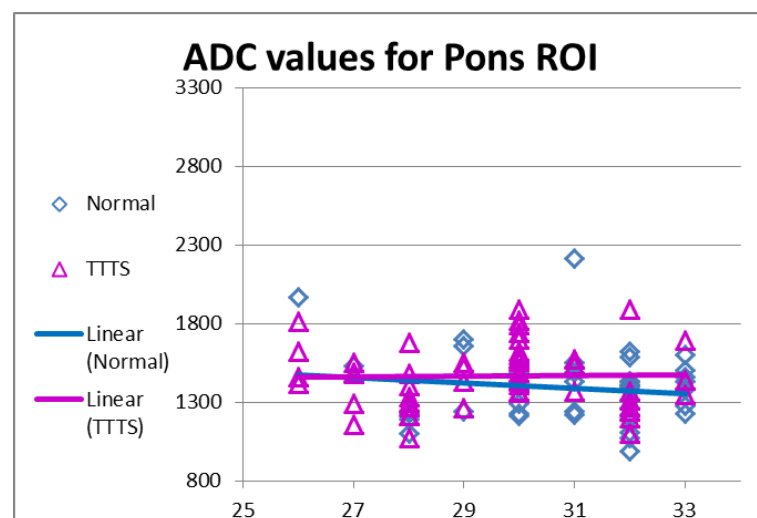
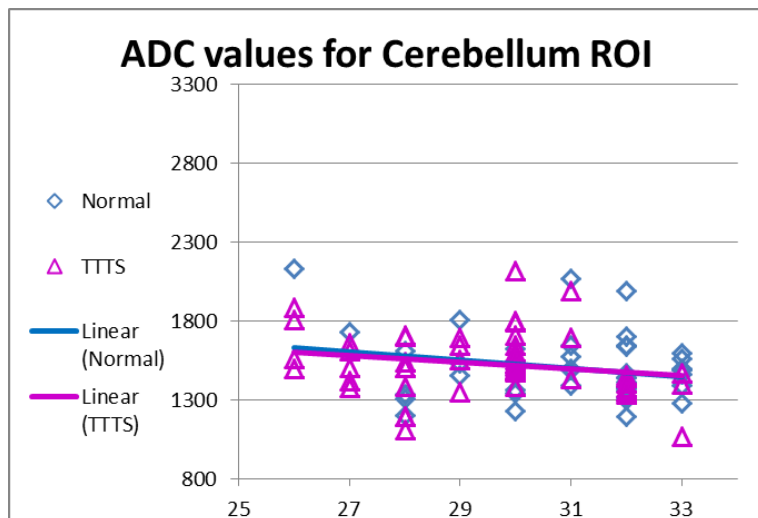
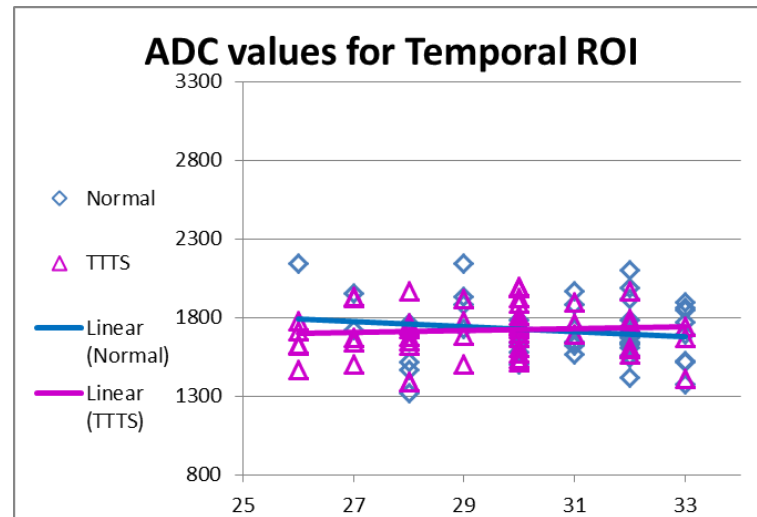
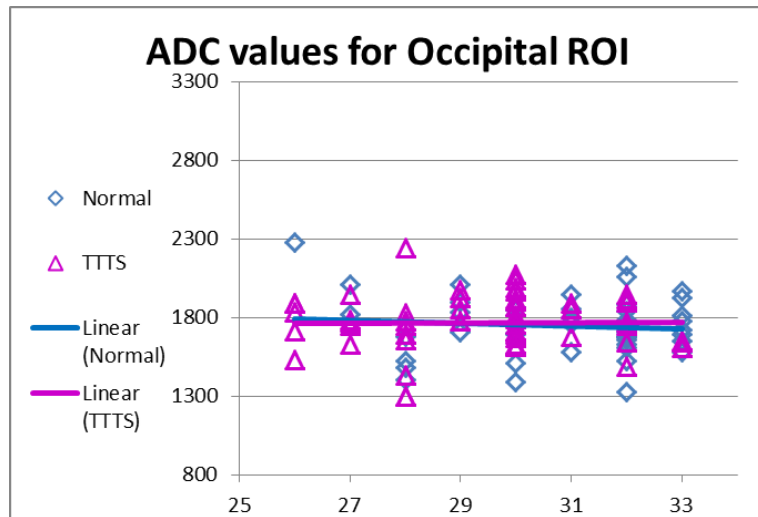
**ADC values for Thalamus ROI**



**ADC values for Basal Ganglia ROI**



# PRELIMINARY RESULTS - TTTS



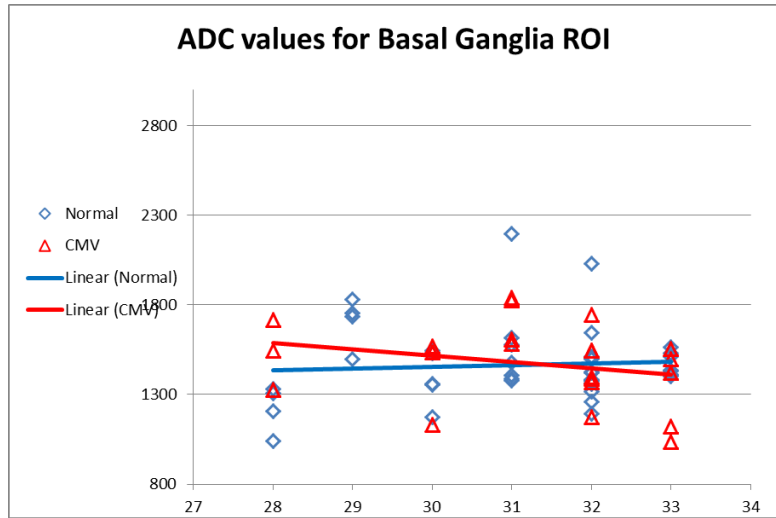
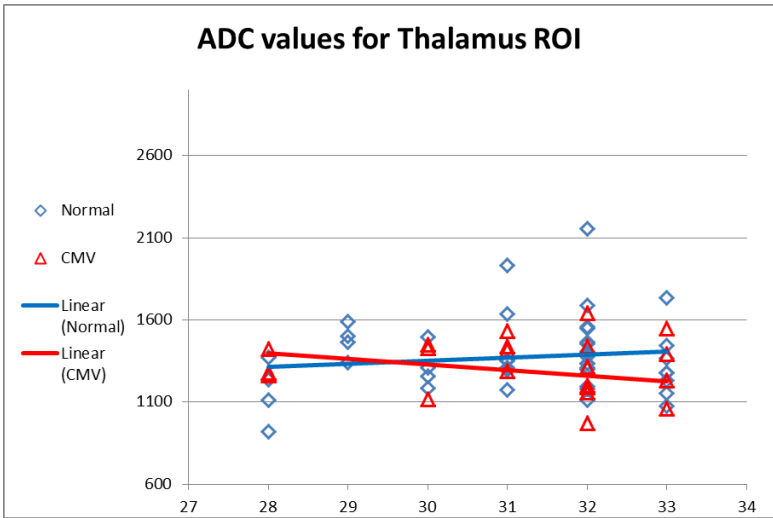
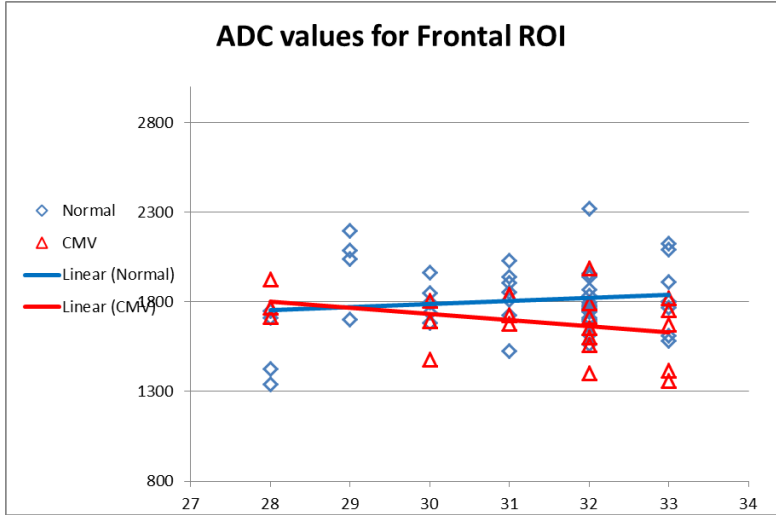
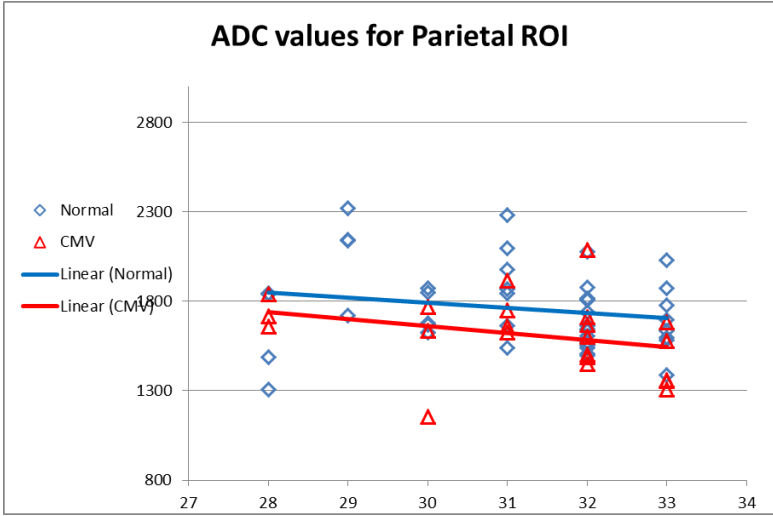


# DISCUSSION - TTTS

- ◉ There are several ROIs in which there is a difference between the TTTS twins and the normal fetuses:
  - Inverse trends in the parietal lobes
  - High ADC value in the BG which decreases over time - perhaps resolution of edema in follow up scans.
  - No change in ADC value in the temporal lobes and the pons.
  - There appears to be no difference in the other regions.

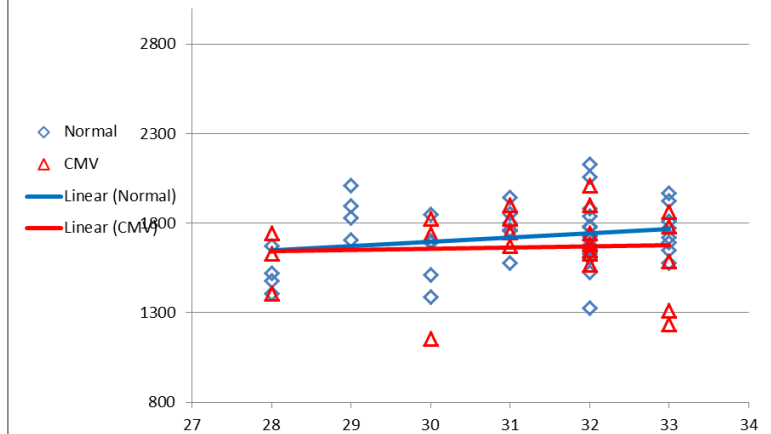


# PRELIMINARY RESULTS - CMV

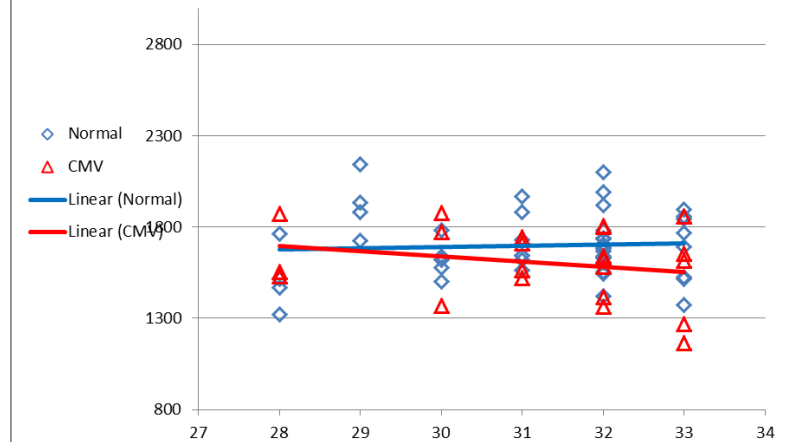


# PRELIMINARY RESULTS - CMV

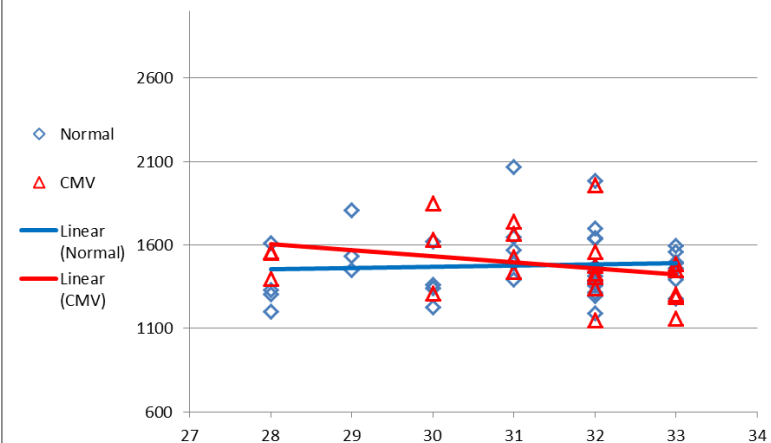
ADC values for Occipital ROI



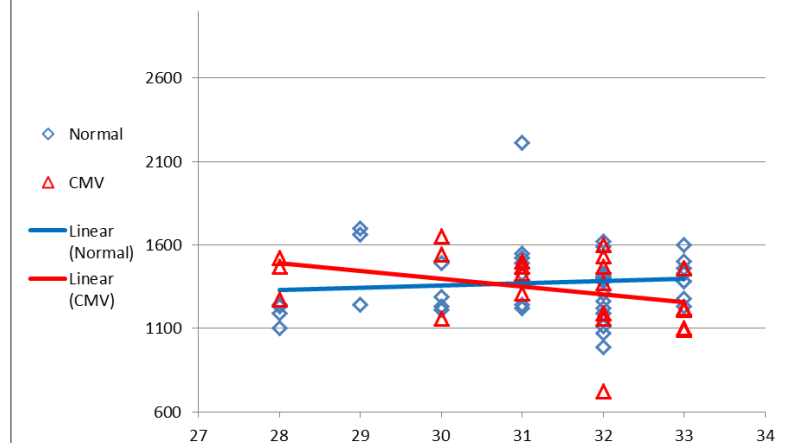
ADC values for Temporal ROI



ADC values for Cerebellum ROI



ADC values for Pons ROI



## DISCUSSION - CMV

- ◉ In all regions the mean ADC values are lower in the CMV group.
- ◉ In early stages of the pregnancy, the ADC values in some regions of the CMV group are higher than in the normal group, but by the 33<sup>rd</sup> week they all fall below the normal mean values.
- ◉ This may be due to inflammatory process and corrective microglial reaction in the CMV group

# WHAT'S NEXT?

- ◉ We plan to expand this study to a broader, large scale inquiry into the clinical and psychological outcome for the children, and see if it correlates with the DWI findings.
- ◉ This will be done using the Vinland adaptive behavior scale, which is a valid and reliable test to measure a person's adaptive level of functioning.  
The questionnaire will filled according to phone interviews with the parents.

THANK YOU FOR LISTENING!

Any questions?

