

# CSF Pulsatility: What does it mean?

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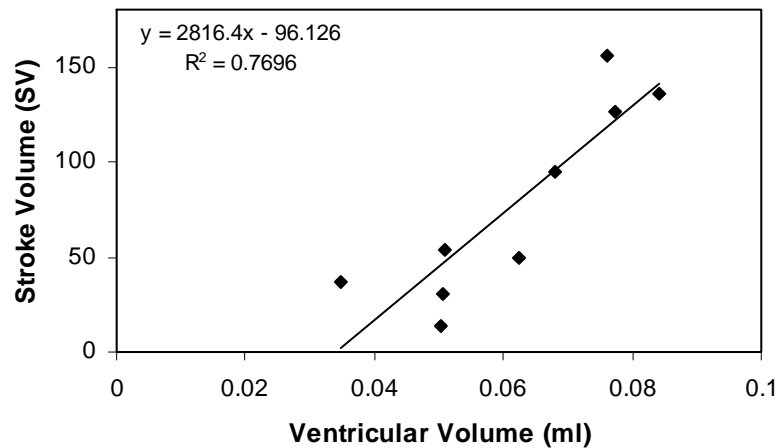
IHIWG meeting, New York, NY - April 28, 2012

## Some un-answered questions in hydrocephalus/pulsatility research:

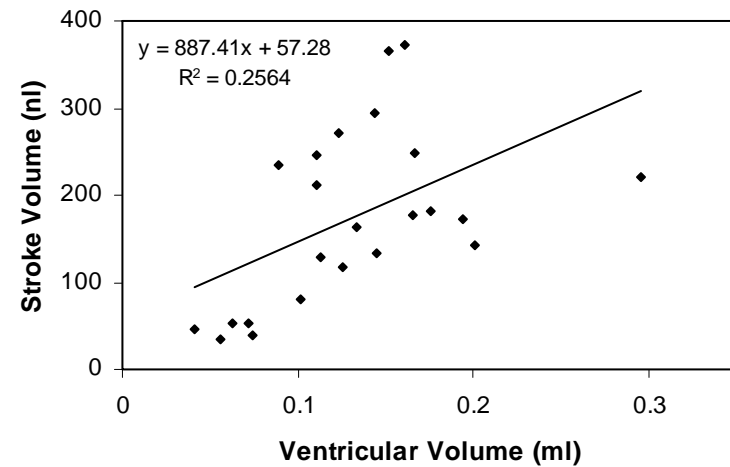
- ❑ Do intracranial pulsations play a *fundamental* role in neurological function, or are they an *extraneous artifact* of arterial pulsations?
- ❑ What causes ventricular CSF pulsations?
- ❑ Why do ventricular pulsations increase in hydrocephalus?
- ❑ What happens to these pulsations with shunting?

# Is stroke volume related to ventricular size?

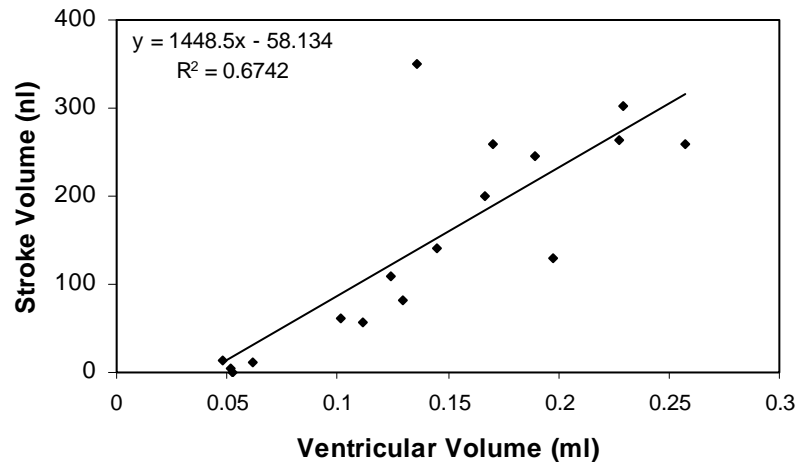
Day 2



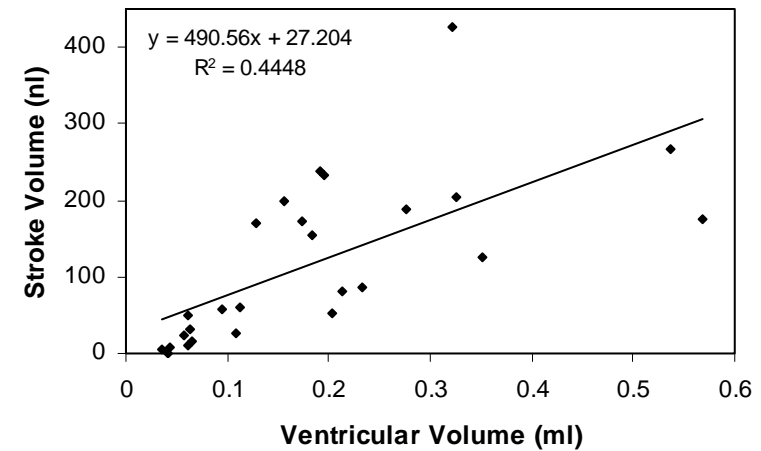
Week 1



Week 2



Week 4



Source of the variability ...

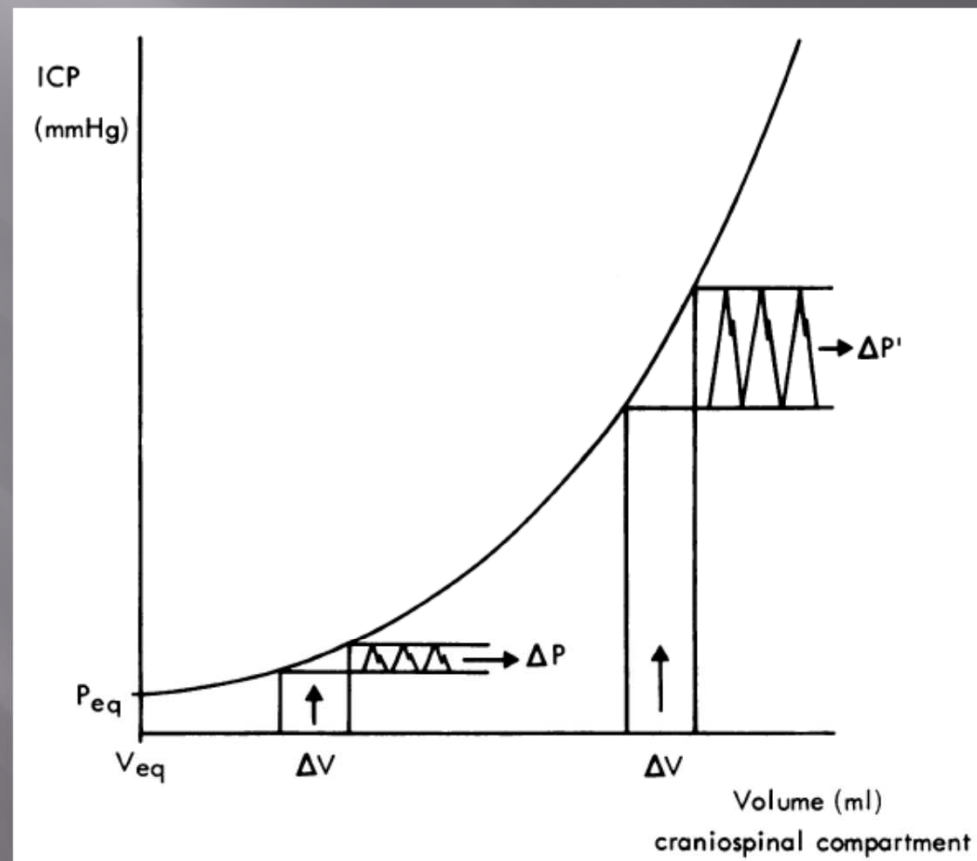
What parameters affect this relationship?

and change over the course of development  
of hydrocephalus?

Intracranial compliance

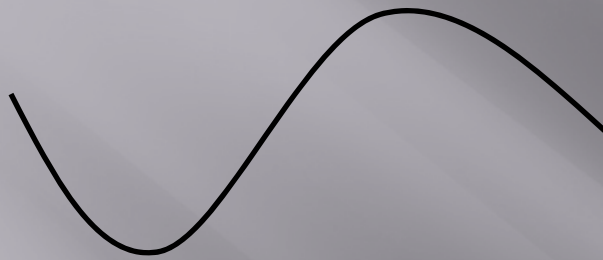


# Pulsatility and compliance are intricately related

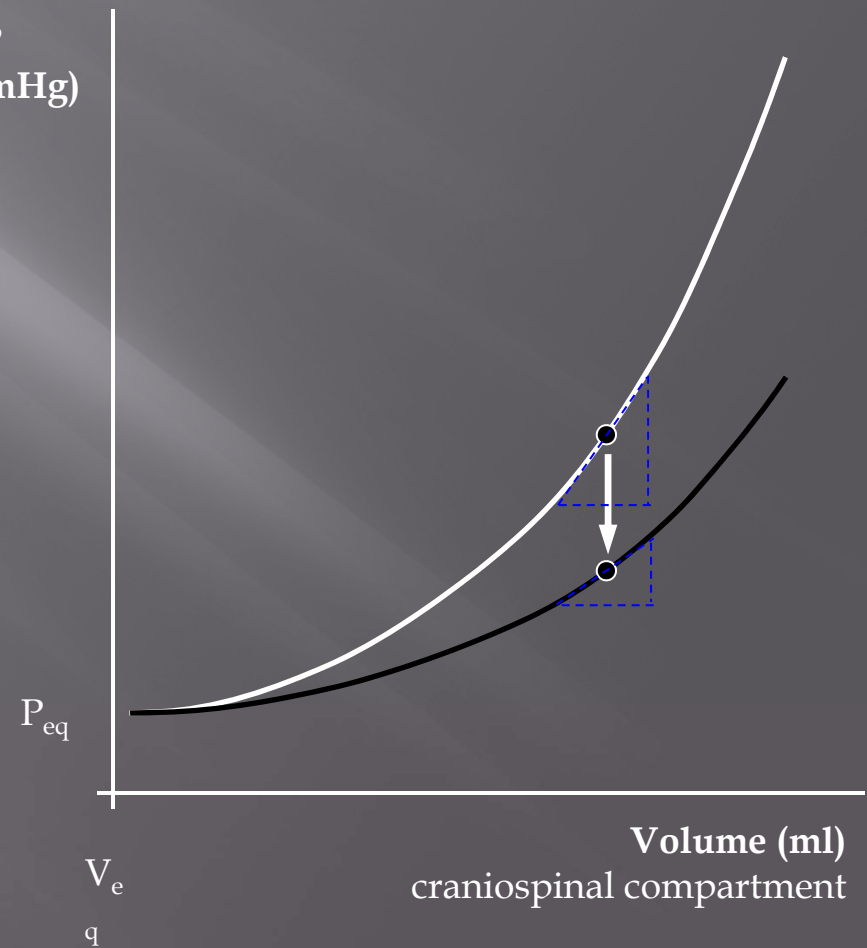


C. J. Avezaat *et al.*, *J Neurol Neurosurg Psychiatry* **42**, 687 (Aug, 1979)

# Mechanical manipulation of compliance



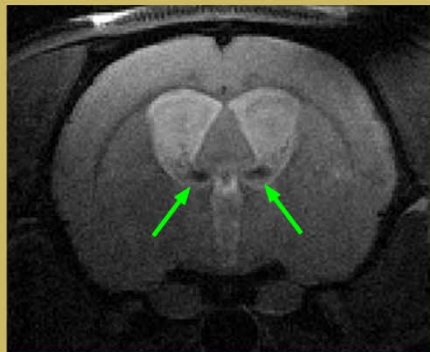
ICP  
(mmHg)



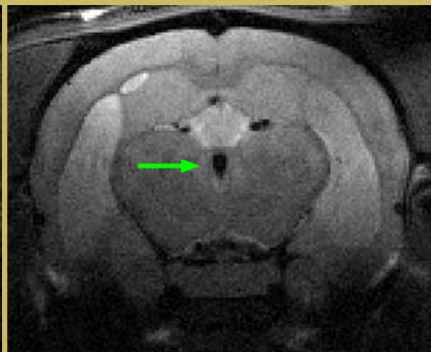
# Effect of increased compliance on CSF pulsatility

**Pre-  
craniectomy**

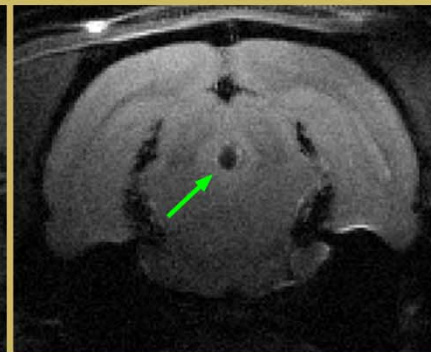
**Foramen of Monro**

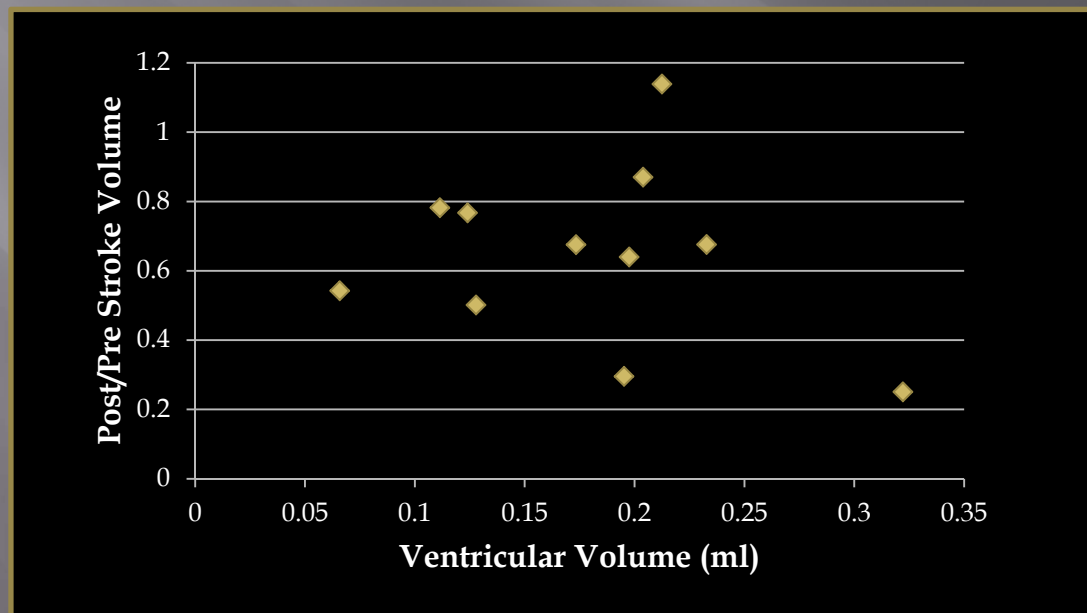
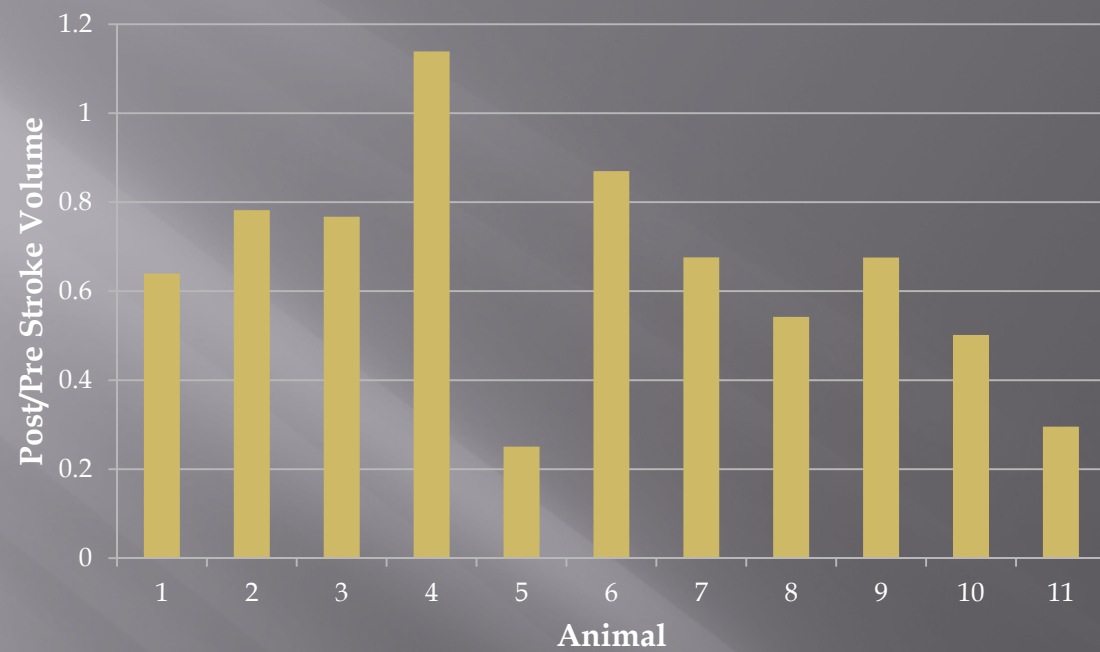


**3<sup>rd</sup> Ventricle**

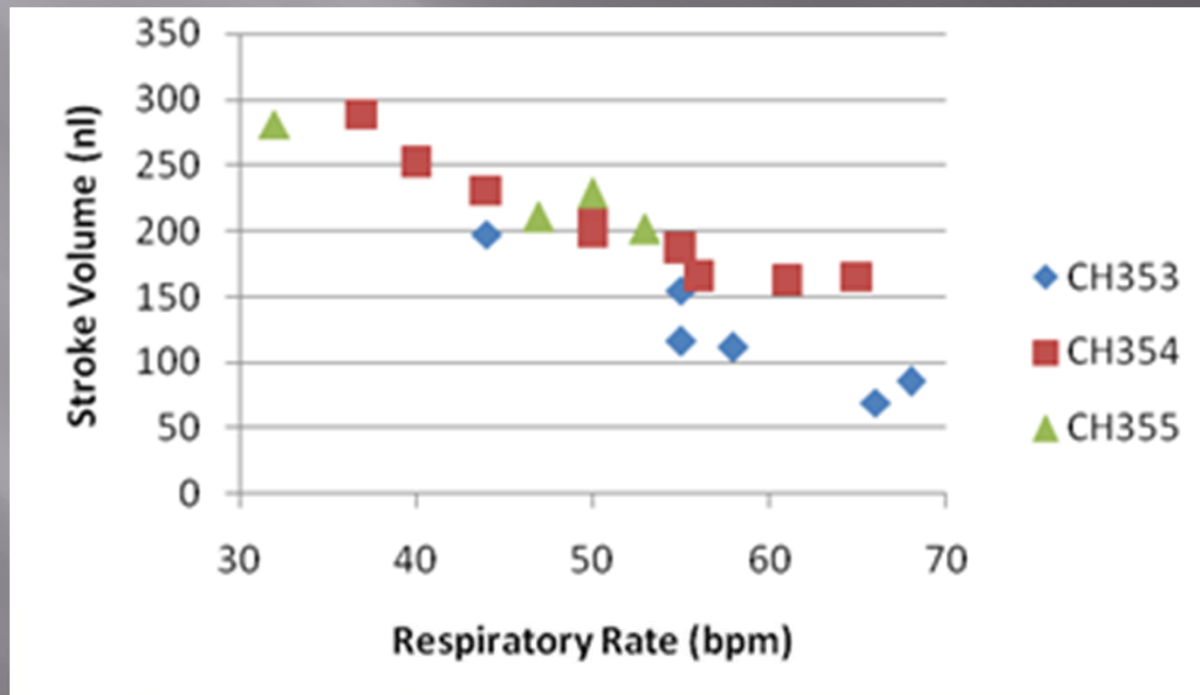


**Aqueduct**





# Physiological manipulation of compliance



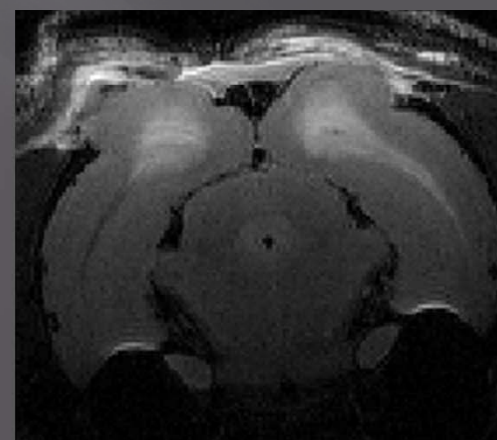
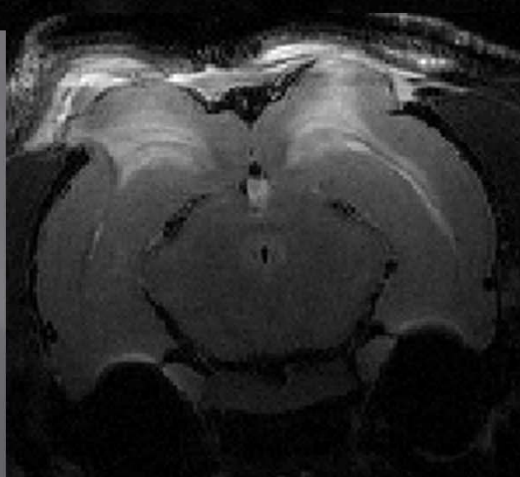
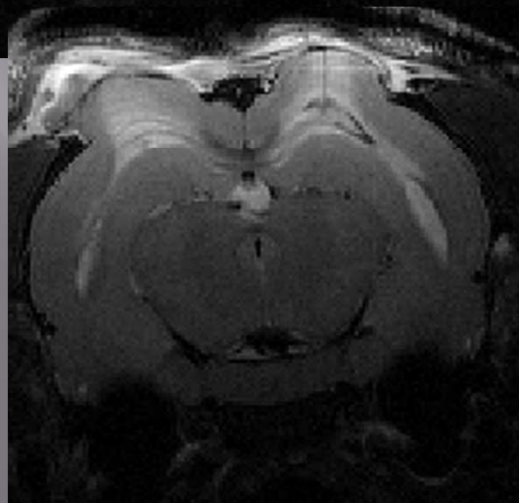
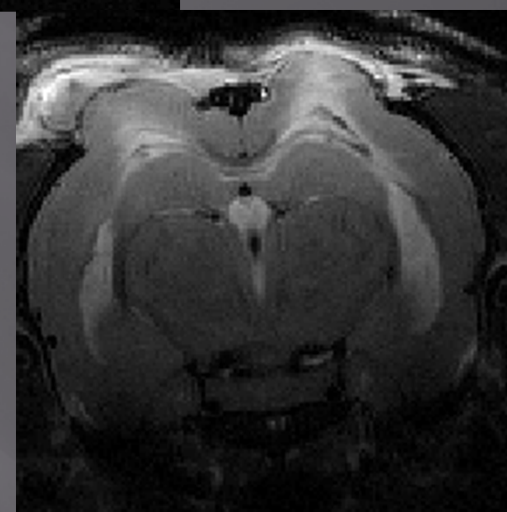
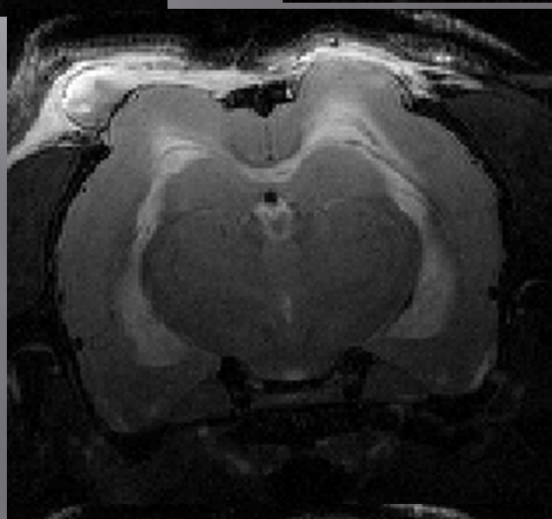
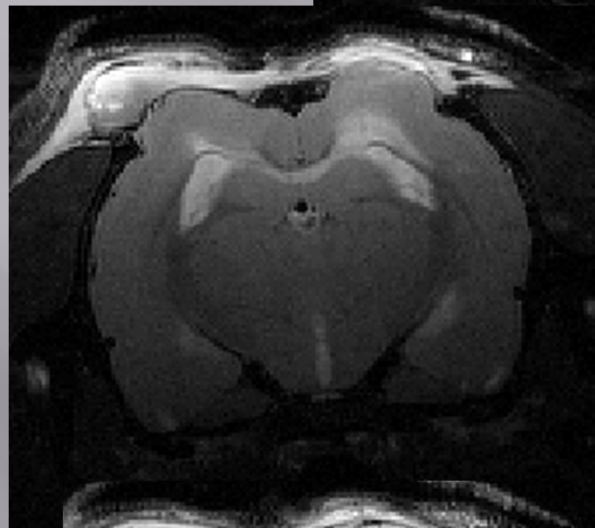
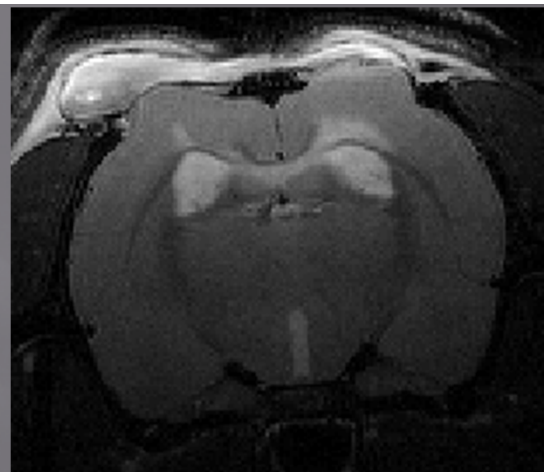
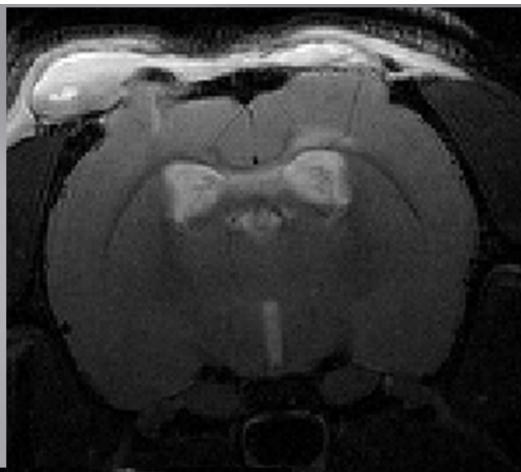


Can compliance effect the degree of ventricular dilation?

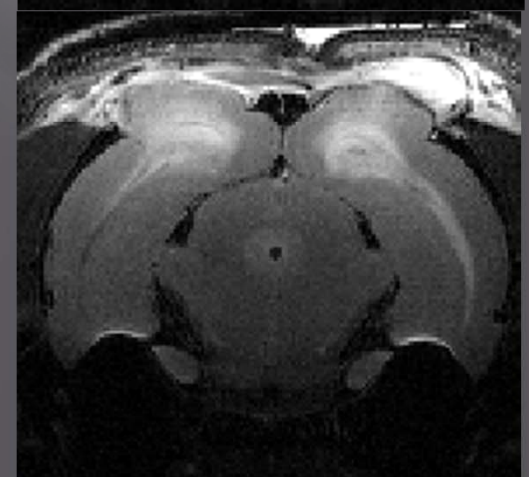
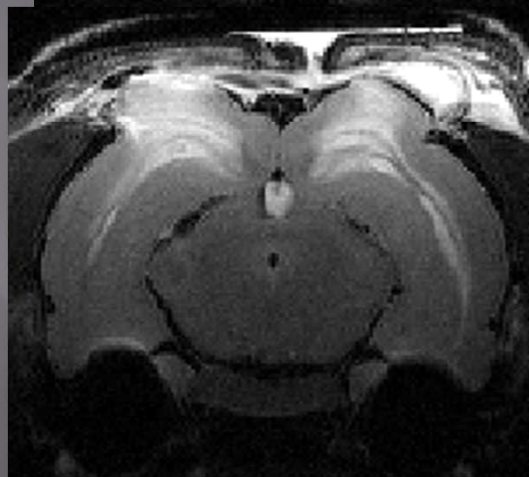
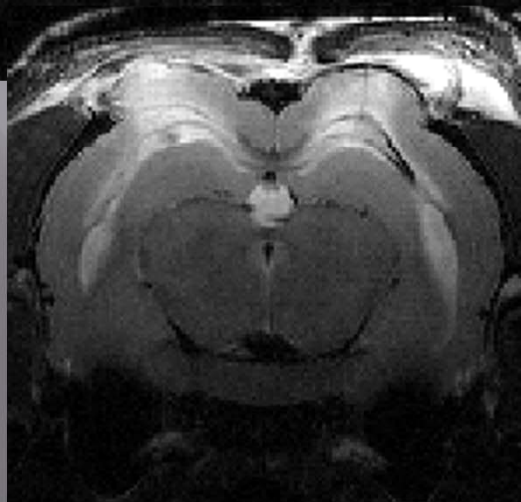
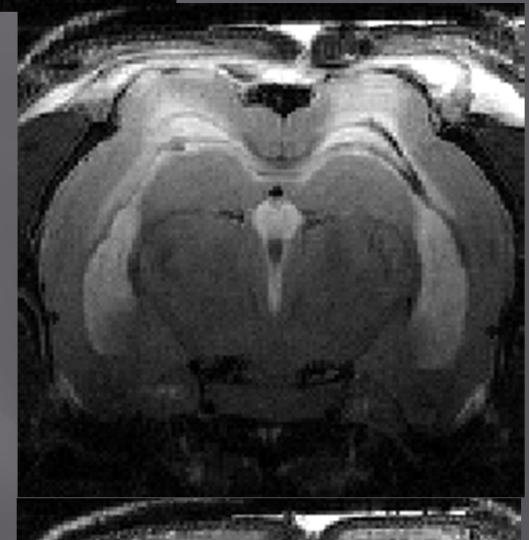
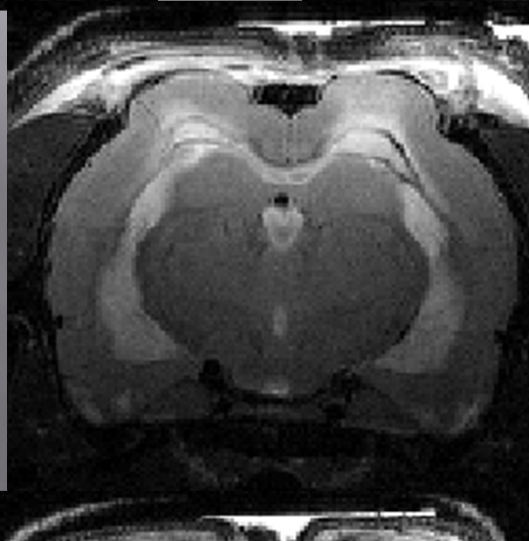
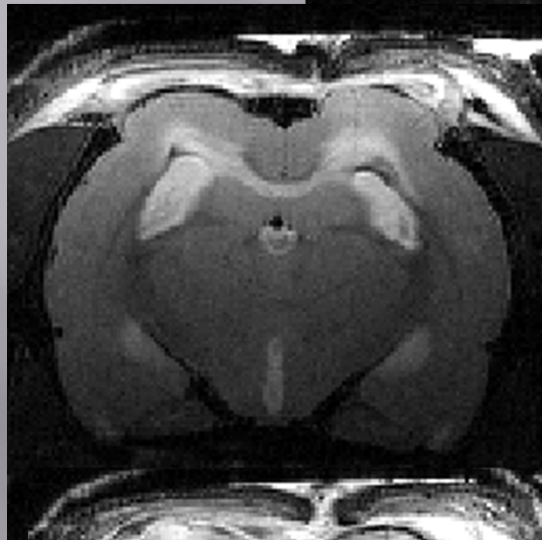
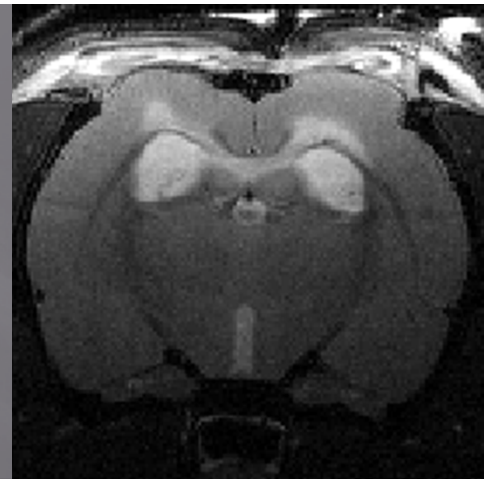
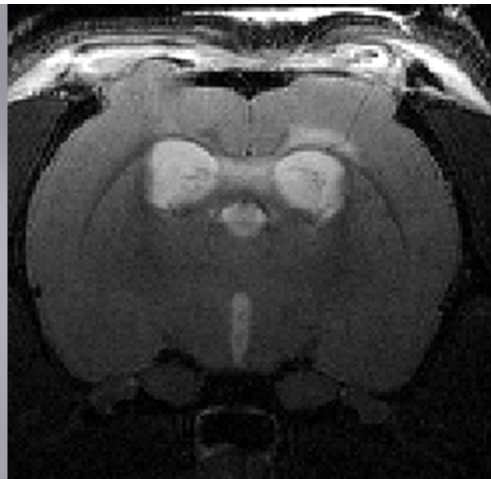




Day 4  
SV =  
90.9

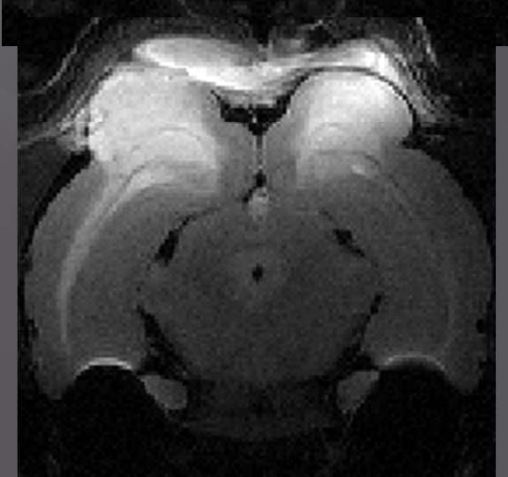
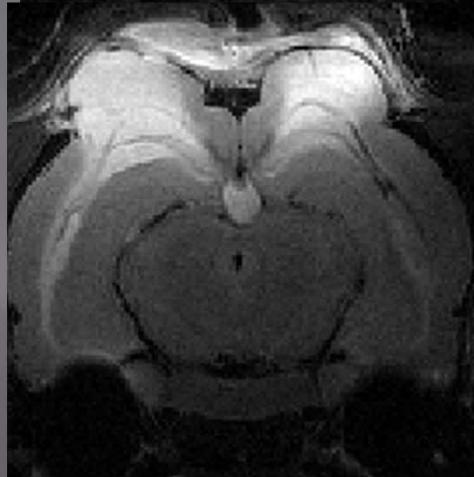
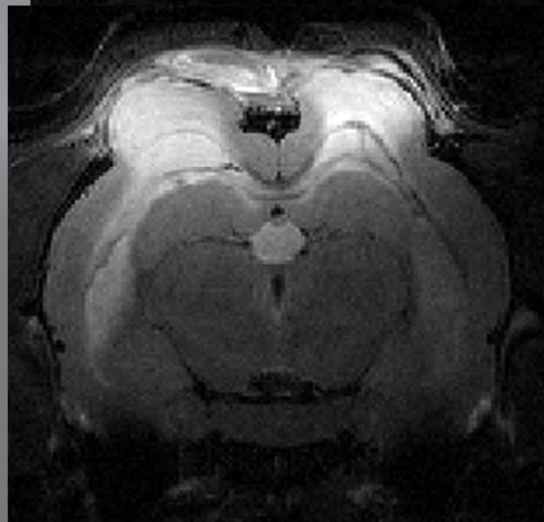
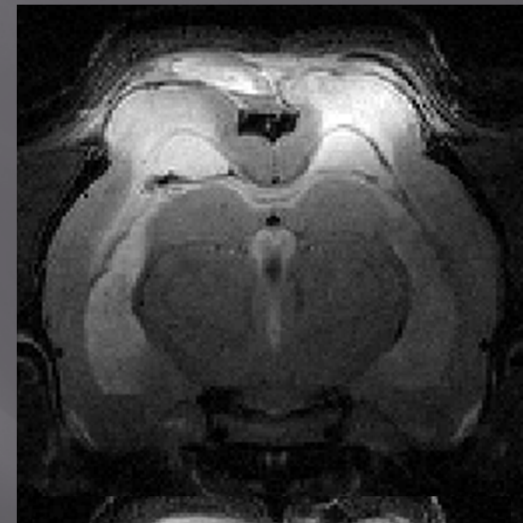
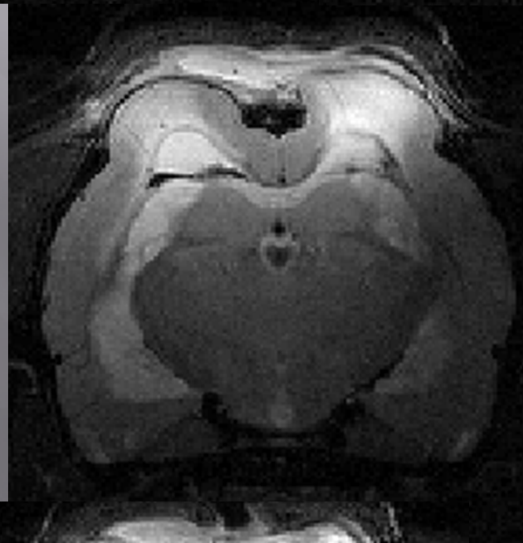
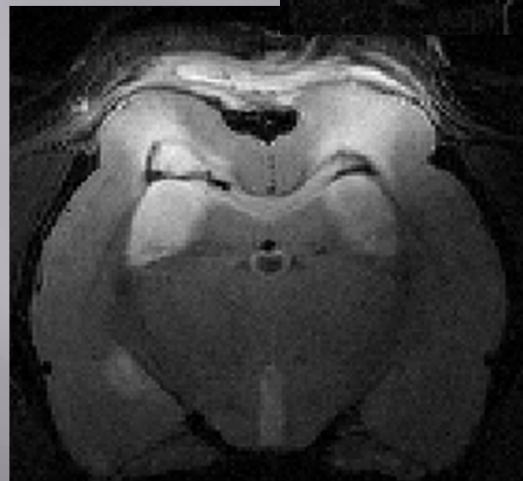
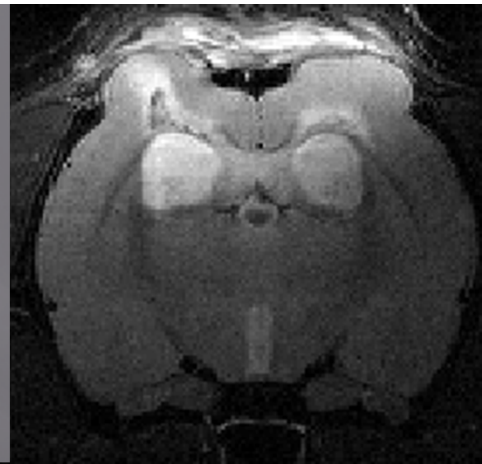
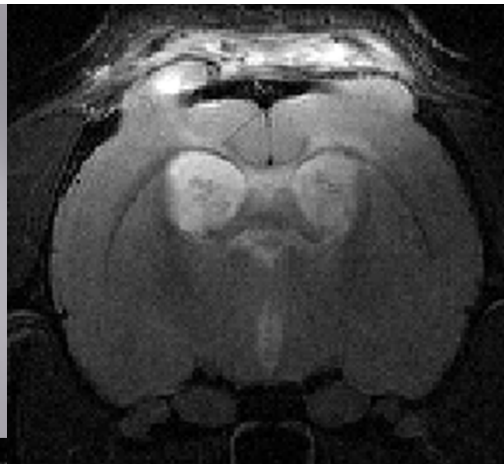


Day 7  
SV =  
69.2

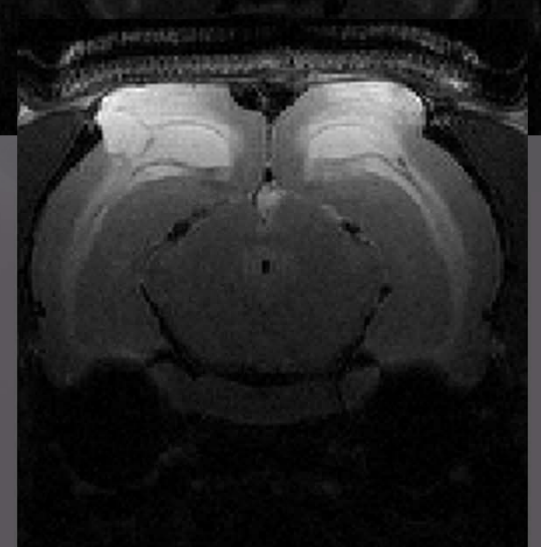
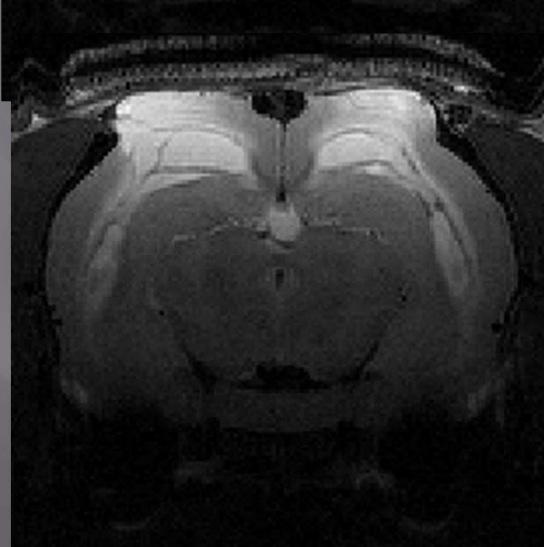
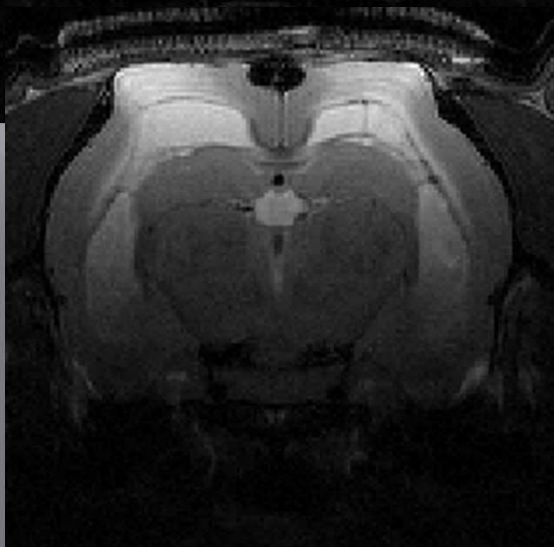
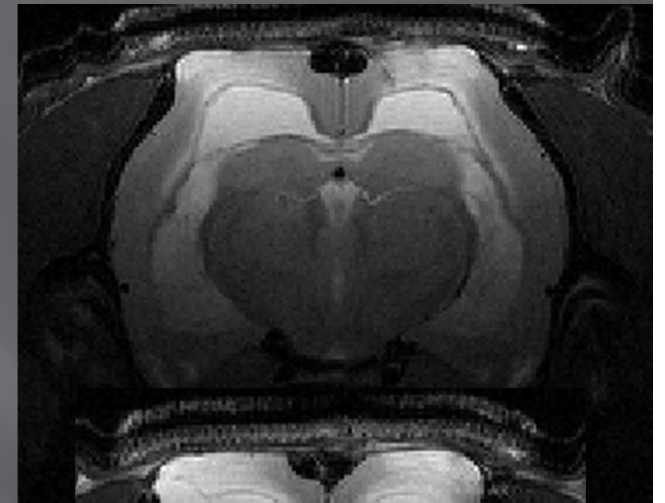
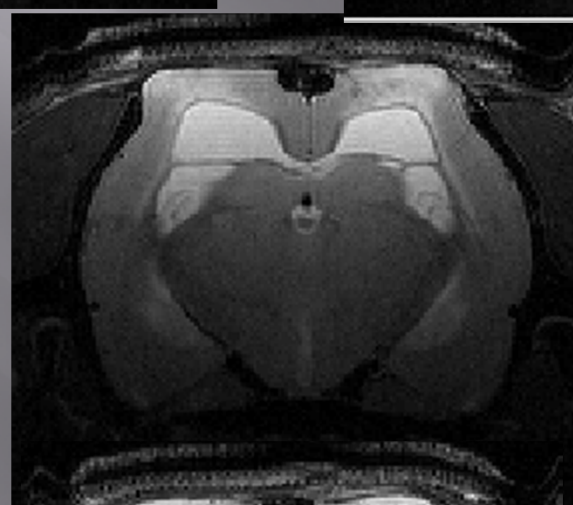
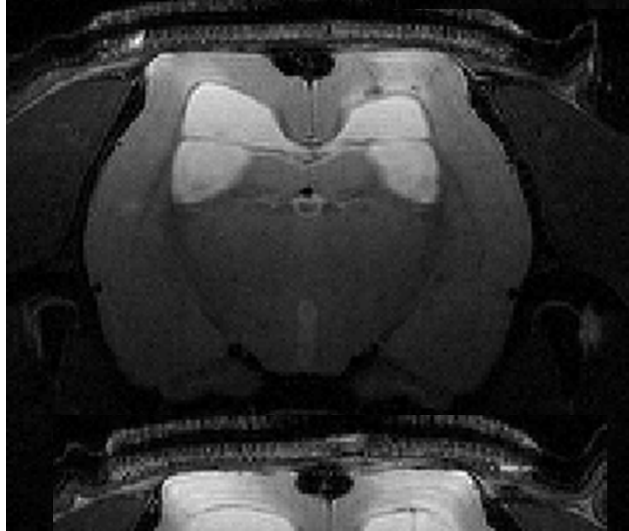
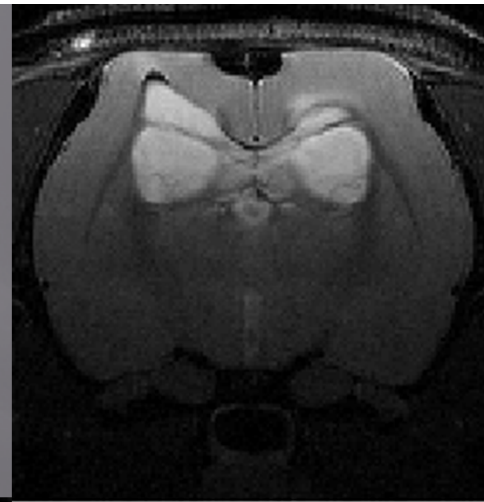
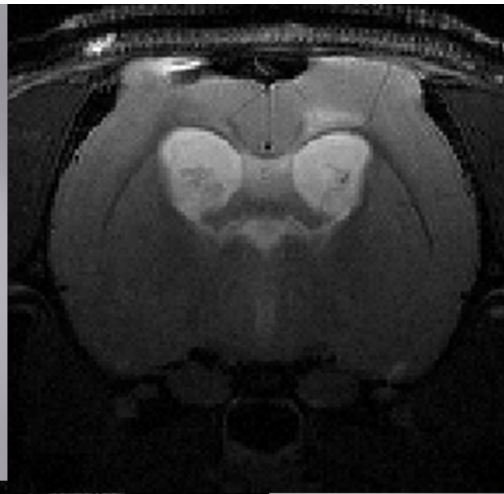




Day 11  
SV =  
94.4

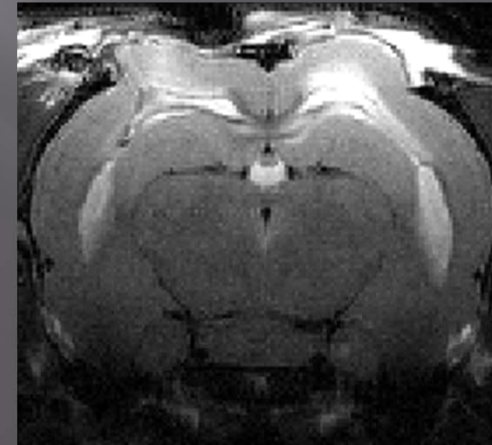
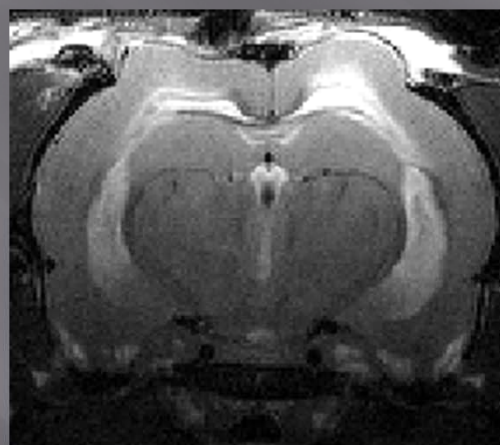
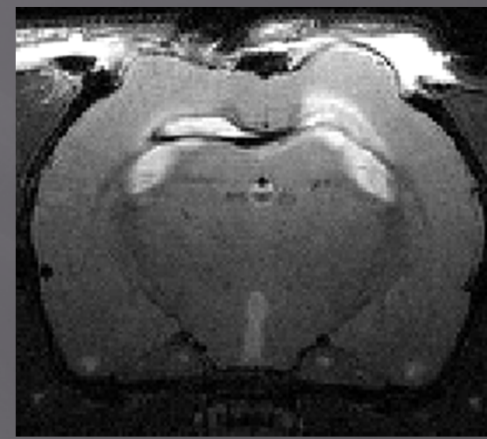
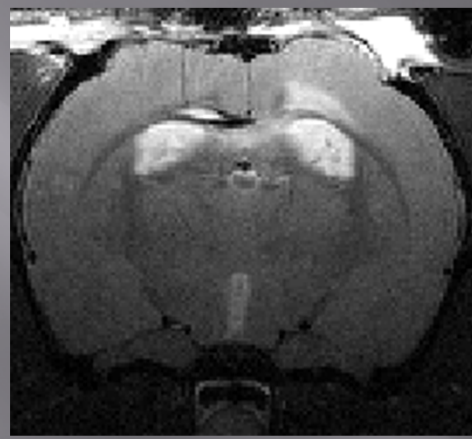
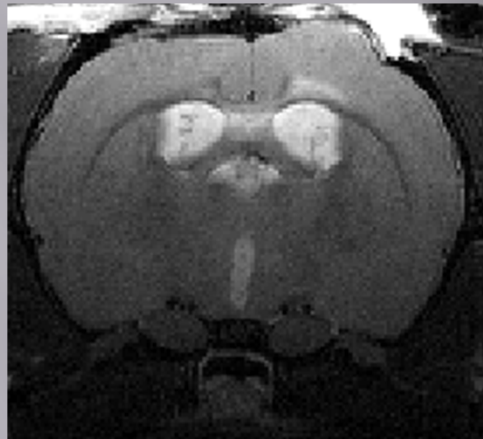


Day 21  
SV =  
75.7

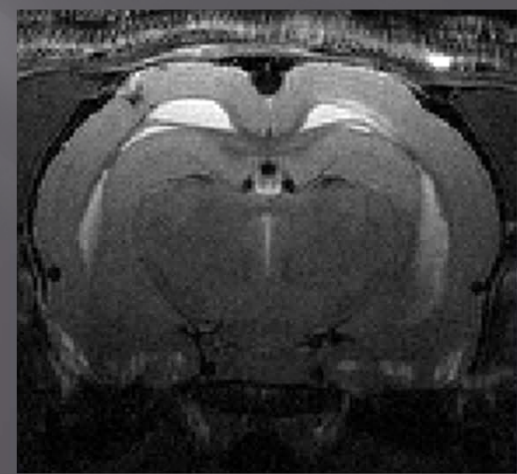
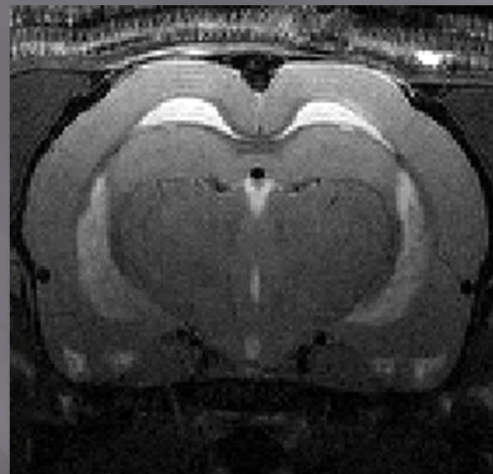
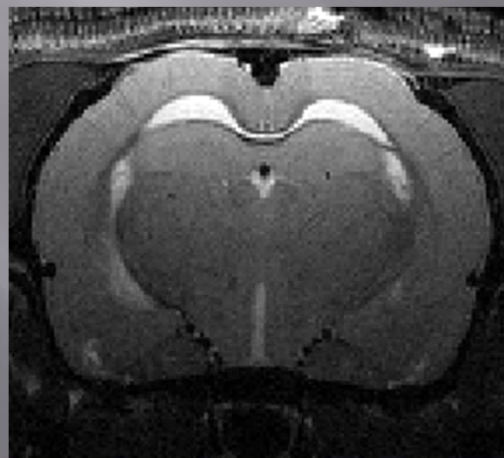
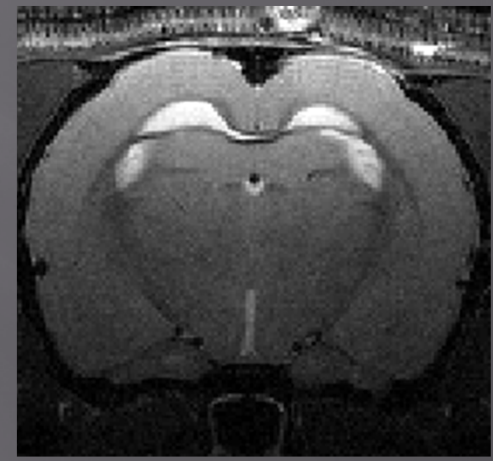
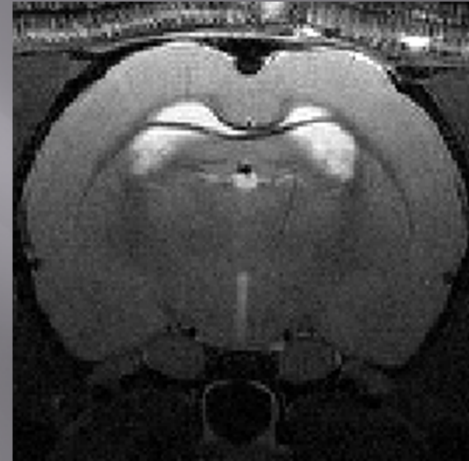
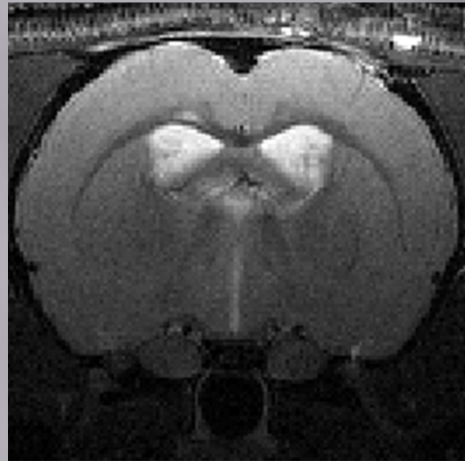




Day 5  
SV = 114.7

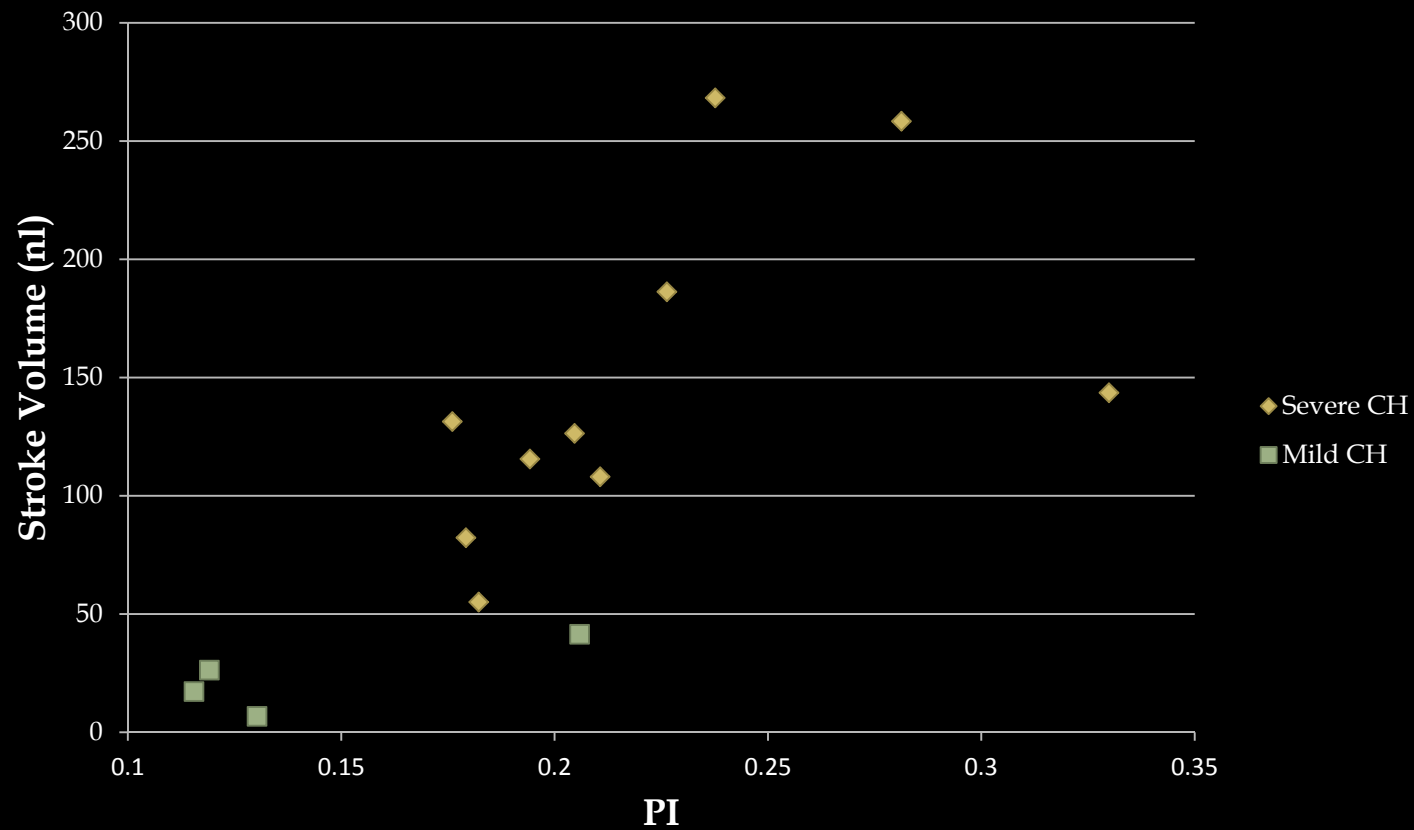


Day 19  
SV = 10.6

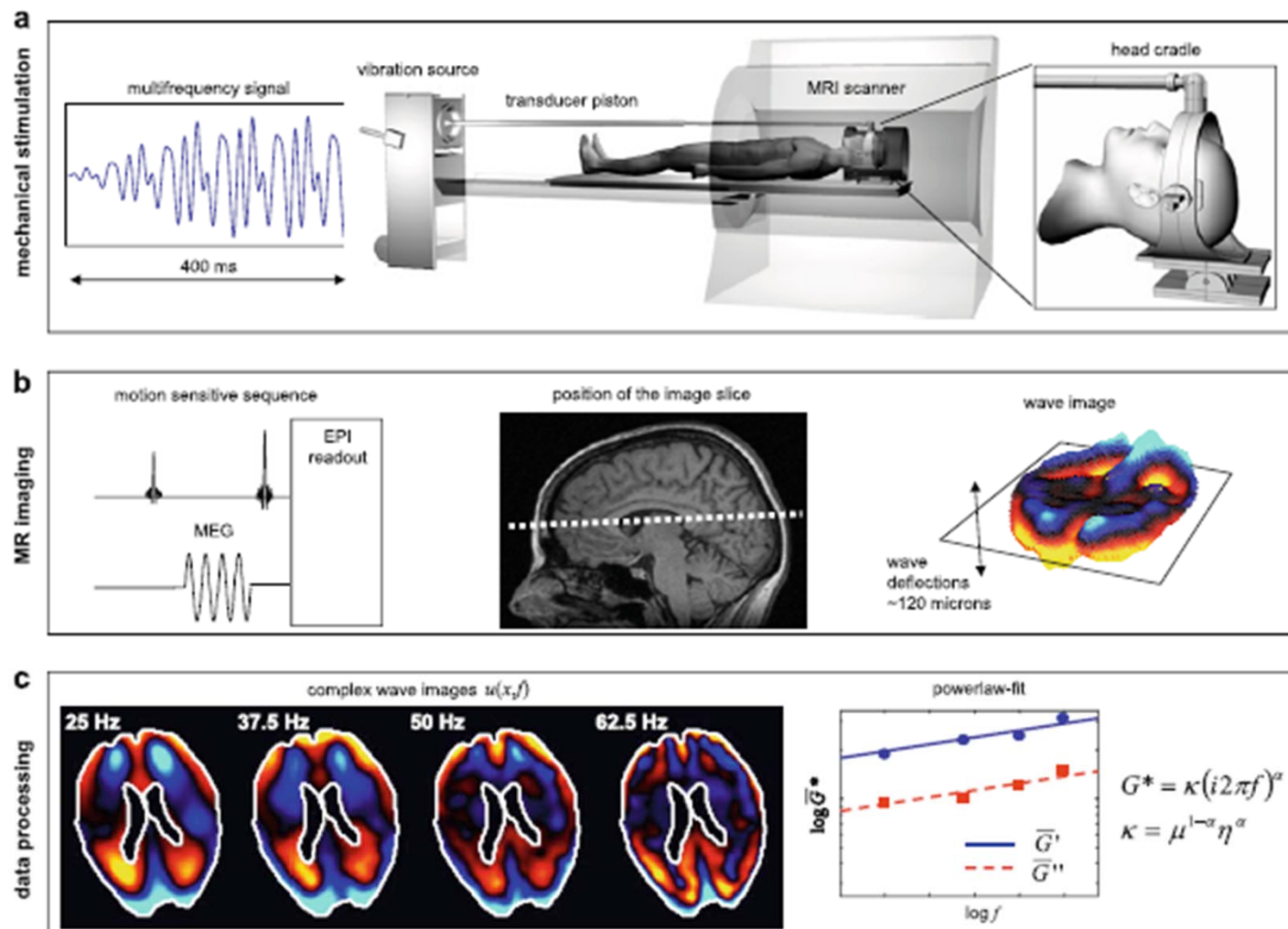




# Relationship between micro- and macro-pulsations



# So why don't we measure compliance!



From Freimann et al,  
Neuroradiology  
2011

# Acknowledgements

Pat McAllister, PhD, Utah

Shams Rashid, PhD, Stony Brook

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Batterman Family Foundation

STARS-kids Foundation

