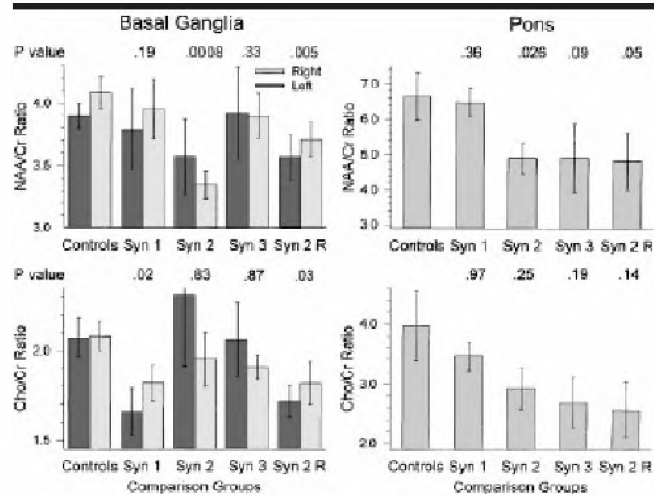


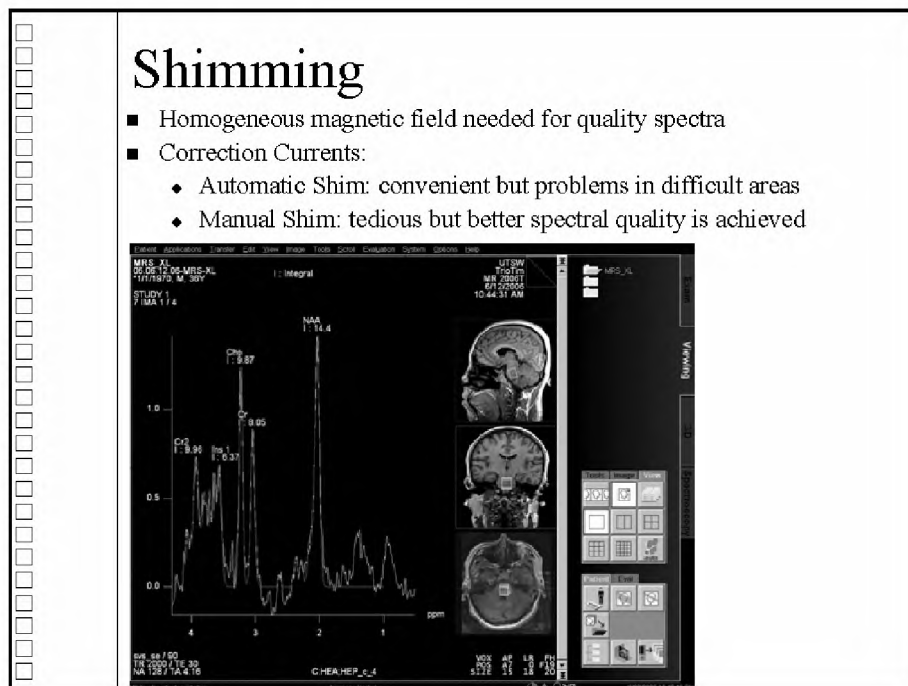
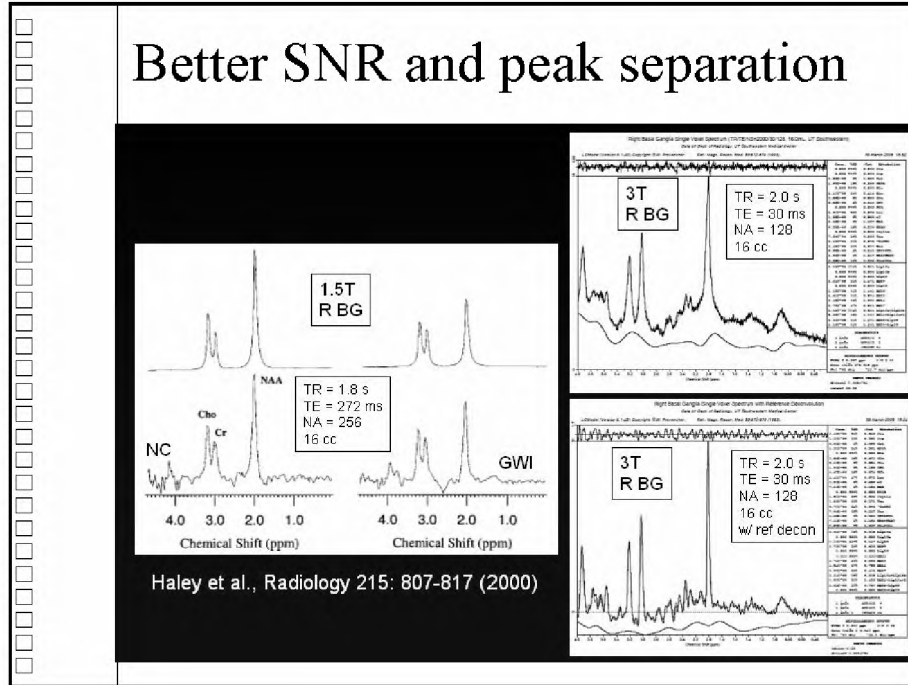
GW 1.5 T Findings (cont.)

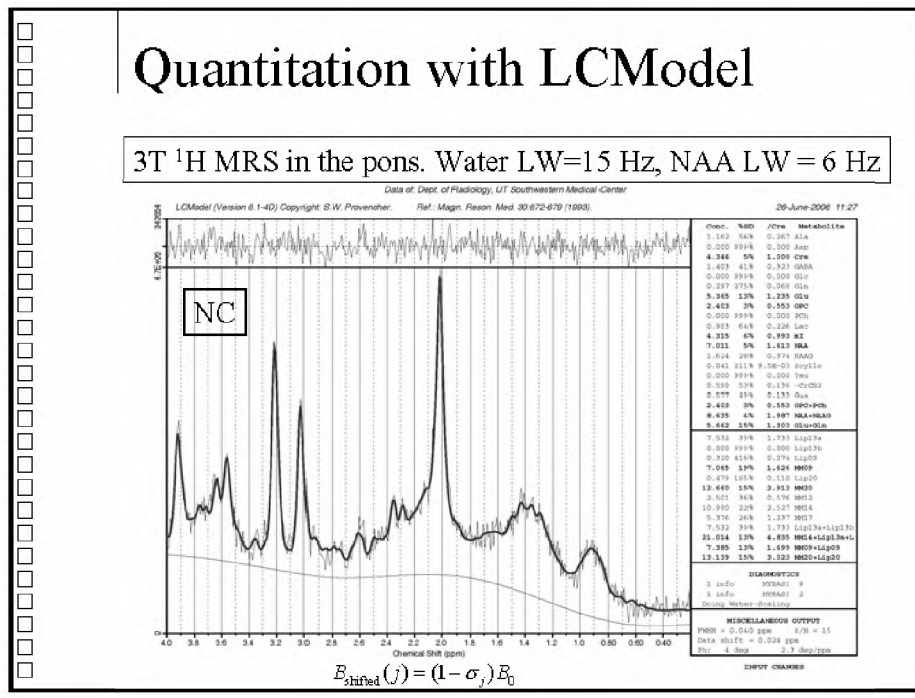


Haley et. al., Radiology, 2000; 215: 807-817

MRS of Brain Chemistry at 3 T

- Better SNR and spectral dispersion at 3T than 1.5T
- Single voxel MRS and Chemical Shift Imaging (CSI)
- Good shimming, (absolute) quantitation, and reproducibility
- Areas of interest: R&L Basal Ganglia, Pons, R&L Hippocampus
- Brain metabolites:
 - ◆ NAA, Cr, Cho (cell membrane)
 - ◆ mI (neuroglia marker), Glu (excitatory neurotransmitter)
 - ◆ Gln (metabolism)
- Metabolite relaxation times measurements





Reproducibility

- Voxel positioning
 - ◆ Manual positioning using high-res localizers
 - ◆ Siemens “AutoAlign” now available for Single Voxel MRS
- Different shims in different sessions (S. Cheshkov, A. Chang, S. Sarkar)
- Natural variability

Relaxation Times T_1 and T_2

- Affect intensity of the signal
- Corrections to calculated metabolite concentrations:
$$f_{T_2} = \exp(-TE/T_2)$$
$$f_{T_1} = 1 - \exp(-TR/T_1)$$
- Use very short TE and very long TR?
- Metabolite relaxation times are of interest themselves, could be changing in pathology
- Difficult to measure in small areas

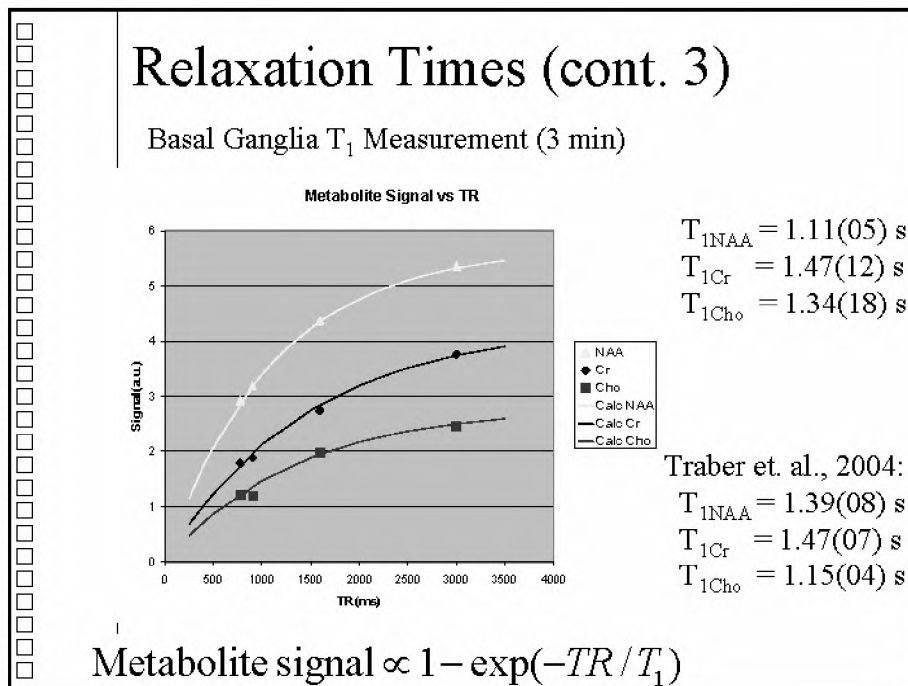
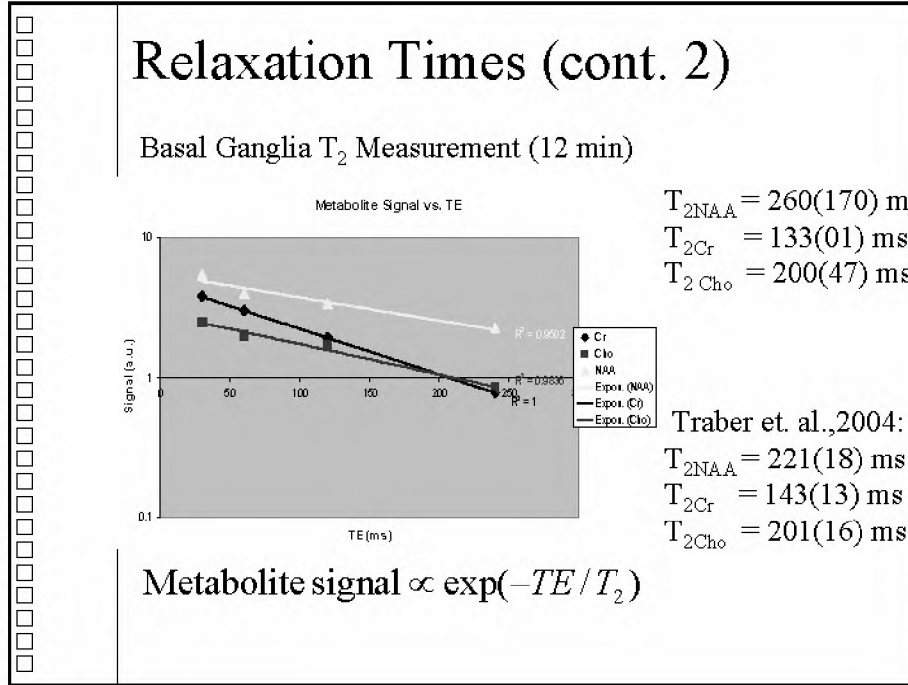
Relaxation Times (cont.)

Regional Differences in Metabolite T_2

| Metabolite | Region | N | Mean T2 (ms) | SE (ms) | p-value (vs occ. WM) |
|---------------------|-----------|----|--------------|---------|----------------------|
| NAA | occ. WM | 10 | 300 | 5 | - |
| | frontal | 7 | 280 | 5 | 0.033 |
| | cingul | 6 | 255 | 5 | 0.014 |
| | mot. cort | 10 | 245 | 5 | 0.001 |
| | basal g. | 8 | 220 | 5 | 0.001 |
| tCr-CH ₃ | occ. WM | 10 | 178 | 5 | - |
| | frontal | 7 | 170 | 5 | - |
| | cingul | 6 | 162 | 5 | - |
| | mot. cort | 8 | 162 | 5 | 0.028 |
| | basal g. | 8 | 145 | 5 | 0.028 |

Traber et. al., J. Magn. Reson. Imaging 2004;19:537-545

More at 3T in: Zaaraoui et al., MRM, 2007.



Future Work and State of the Art

- Further optimizing measurements of in vivo relaxation times T_1 and T_2 for absolute metabolite quantitation
- Brain compartments – in relation to quantitation
- Optimizing spectral deconvolution methods
- Implementing 2D and 3D CSI, e.g. EPSI for rapid CSI data collection and MIDAS for data analysis – research agreement with Siemens and University of Miami
- High-field (7T) MRS for improved SNR and spectral and spatial resolution – pilots beginning
- Multinuclear MR spectroscopy (^{31}P , ^{13}C) - to investigate pH, high-energy phosphate status, and detailed metabolic pathways