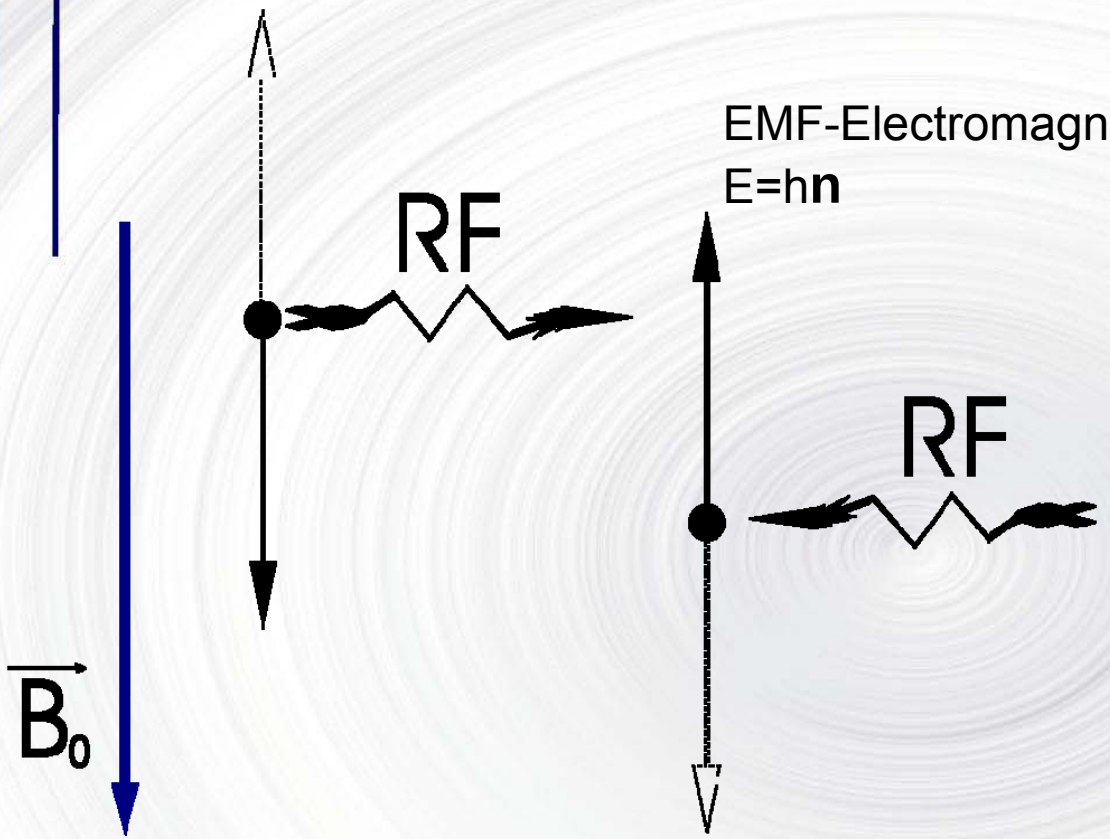
The abilities of NMR spectroscopy in researching of living tissues



EMF-Electromagnetic energy
$E=h\nu$

Conversion energy
$E=\mu/I \cdot B_0$

NMR equation:
$$\nu = (\mu/I \cdot h) \cdot B_0$$

Gyromagnetic ratio
$\gamma = \mu/I \cdot h$

For water γ =42,576 375 MHz/Tl
Local field on i-th nucleus $B_i = B_0(1-\sigma_i)$
Resonance frequency $\omega_i = \gamma B_0(1-\sigma_i)$

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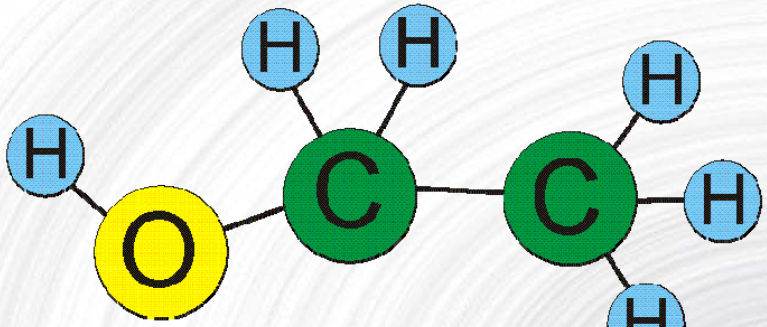
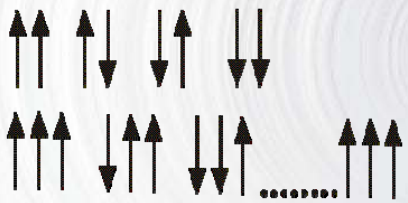
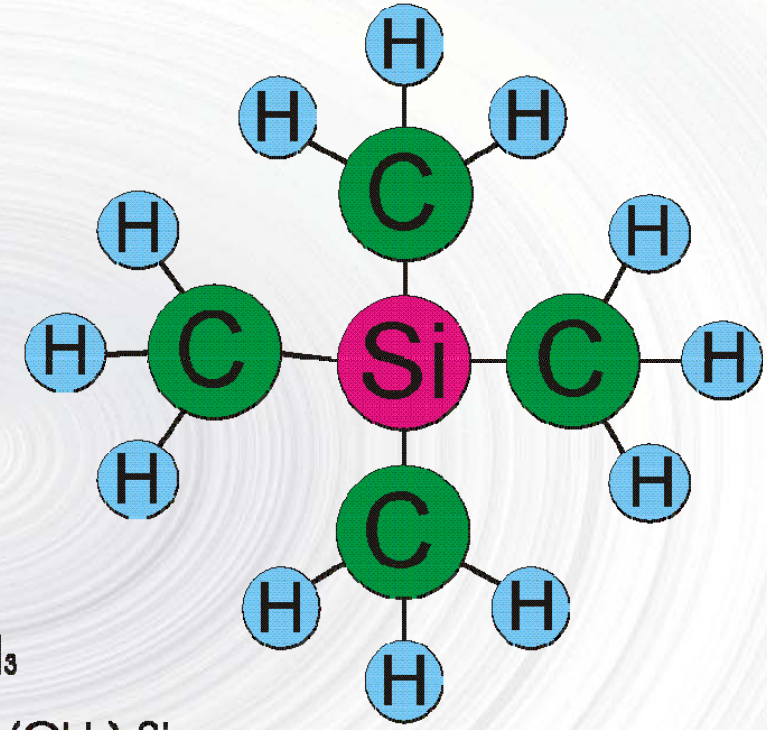
Ethyl alcohol

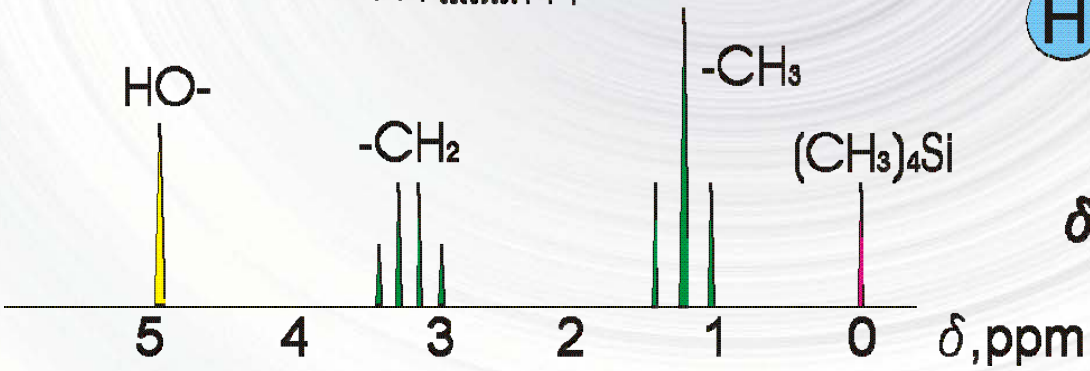


Orientation



Tetramethylsilane





$$\delta = (\omega_i - \omega_0)/\omega_0$$

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NMR spectrum is defined by:

- Chemical displacement
- Signal activity
- Spin interaction

Hydrogen's spectroscopy features:

- Small variation of proton's electronic shielding for different chemical compounds
- Proton's chemical displacement of different compounds located in range 10ppm
- Requires high-homogeneous magnetic field

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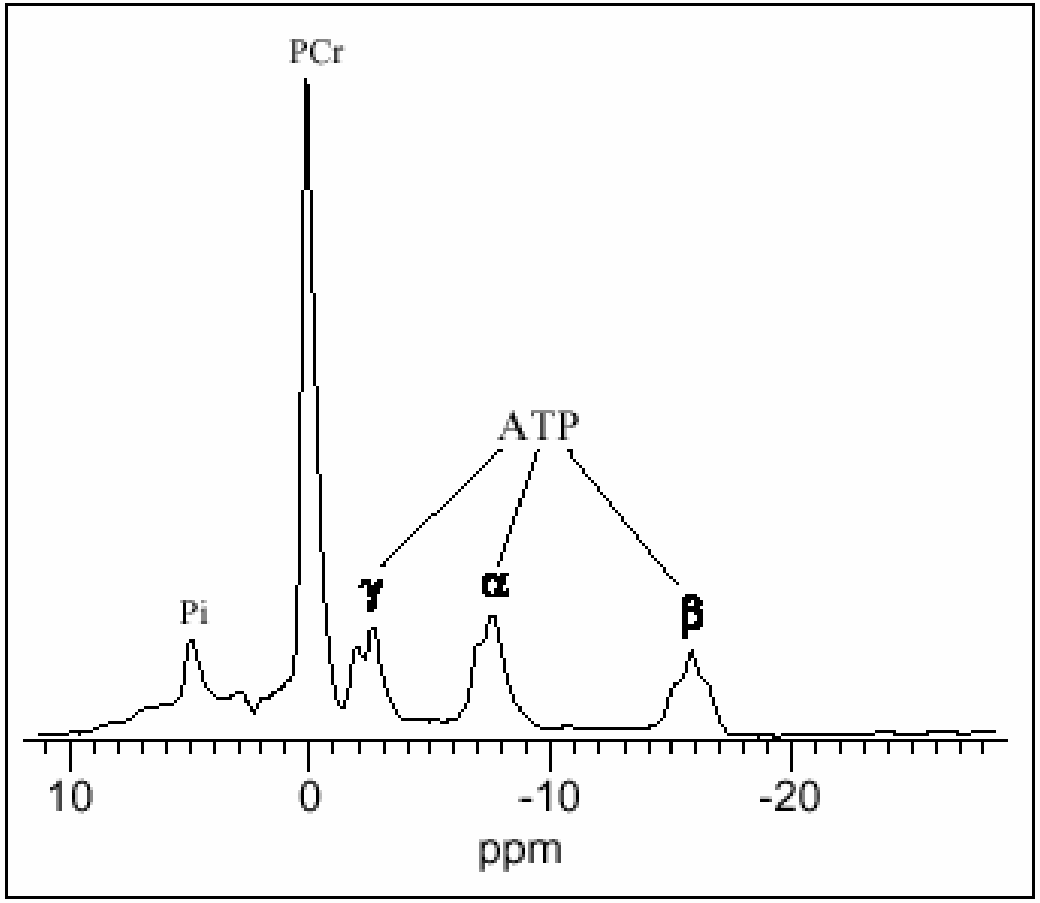
Phosphoric MR spectrum



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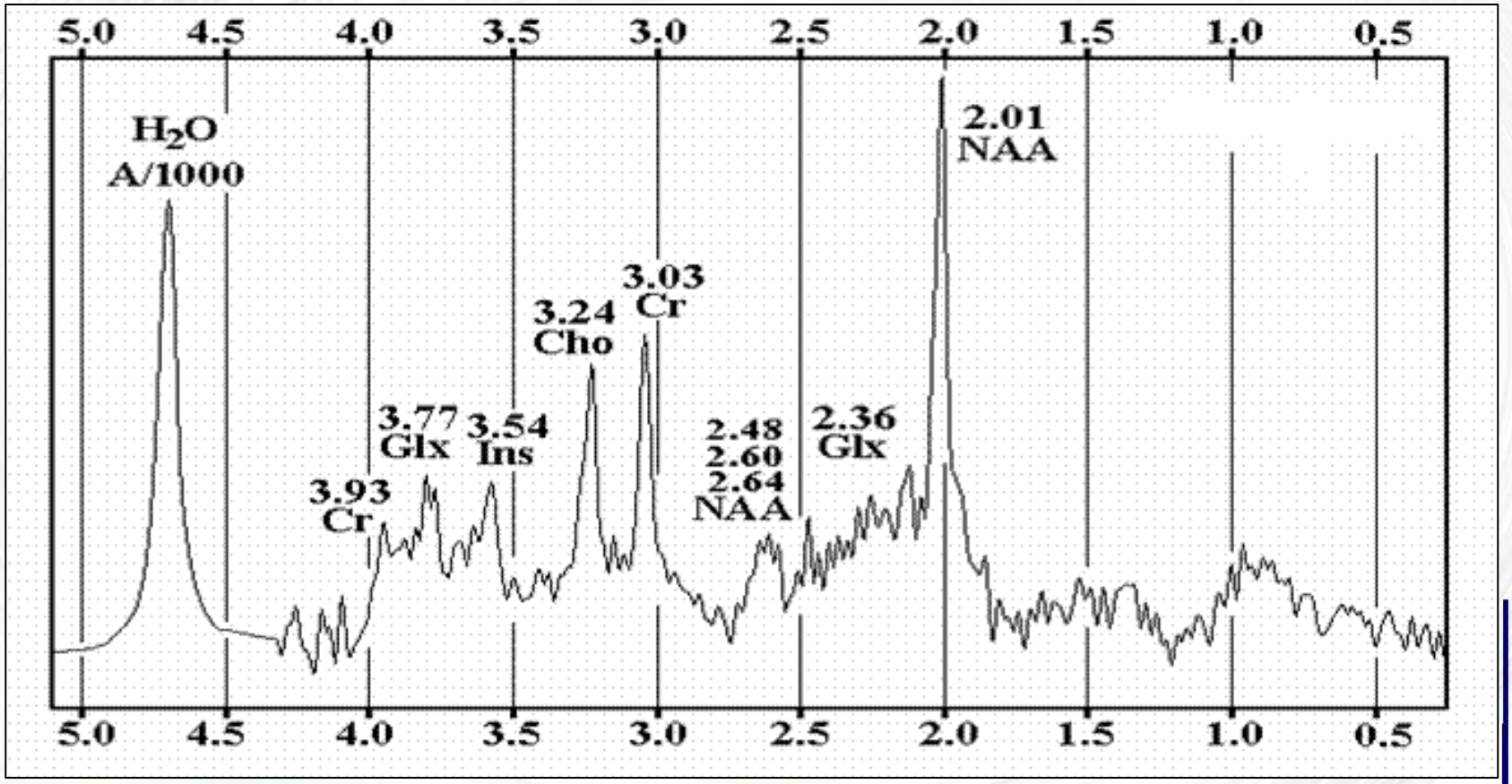
Protonic spectrum from brain substance



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What influents on chemical displacement?

- Local pH vehicle
- Temperature
- Paramagnetic & ferromagnetic inclusions

What features use in NMR-spectroscopy to increase quality of spectrum?

- Double irradiation method
- Maximum field strength
- Static iron jack
- Sample's symmetry
- Optimization of proton's length of free decreasing induction signal

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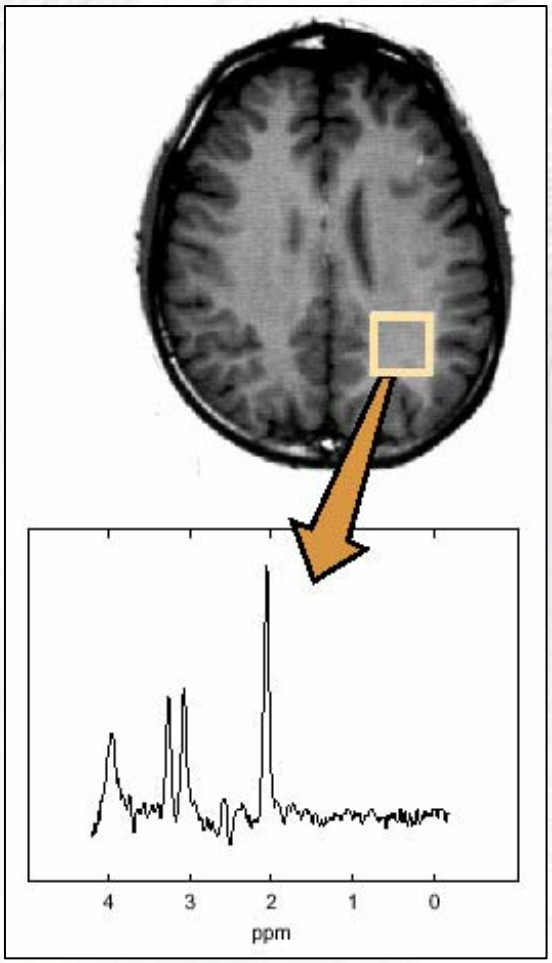
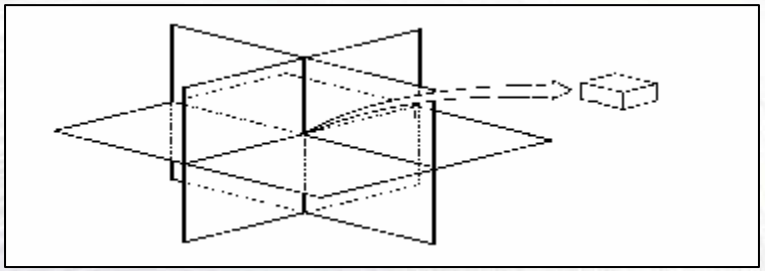
Space localization of NMR-spectral research





Localization methods:

- Surface coil.
- Spectroscopy in rotating system.
- Using differentiation and de-escalation in spectroscopy.

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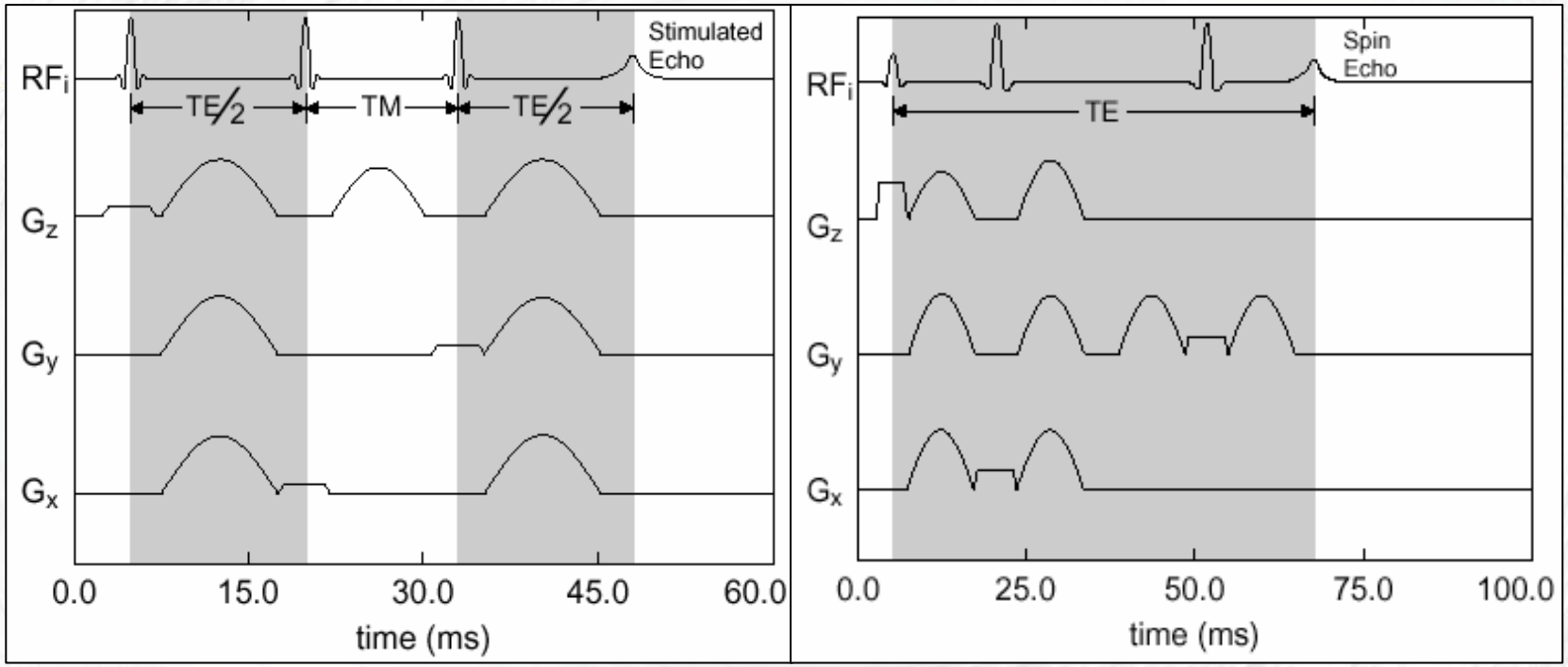
Impulse sequences STEAM and PRESS



STEAM PRESS

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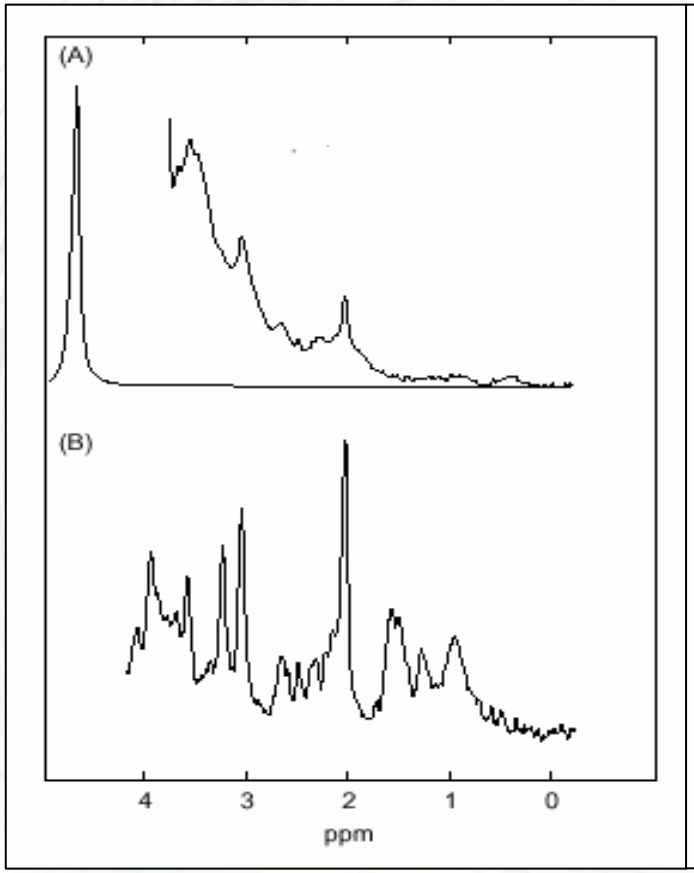
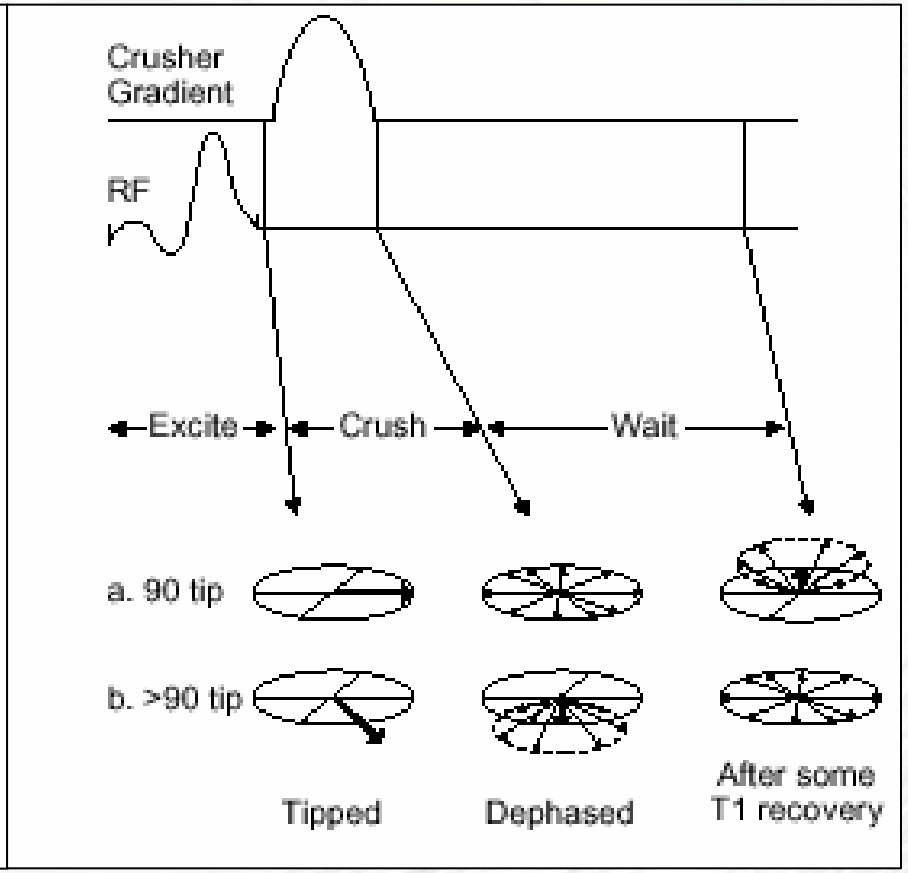
NMR signal suppression from nucleuses of water



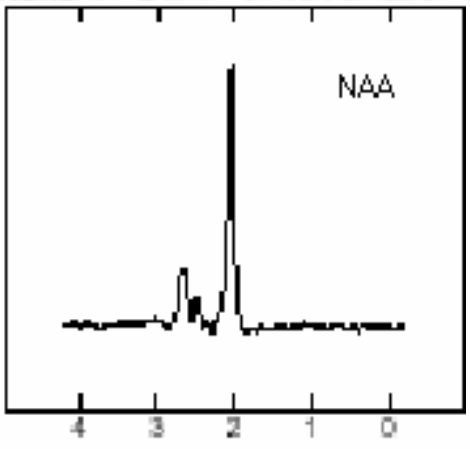
(a) – without suppression
(b) – with suppression

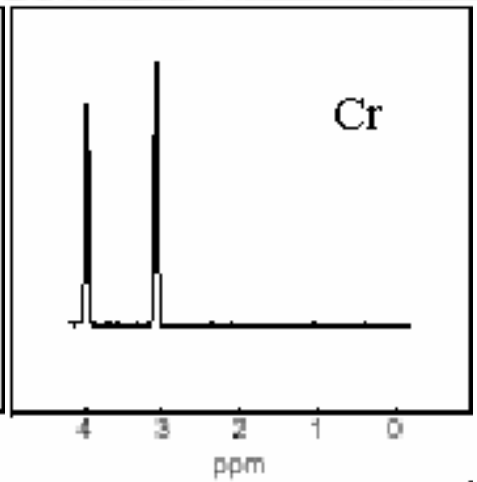


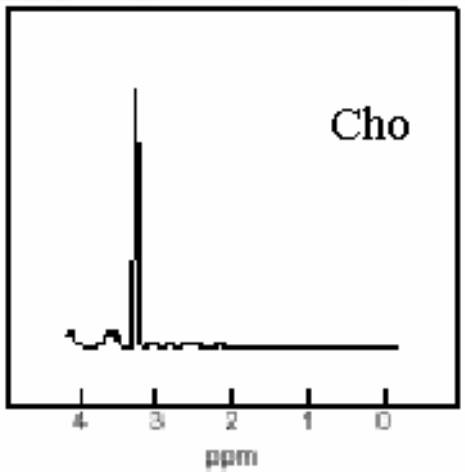
Suppression gradient

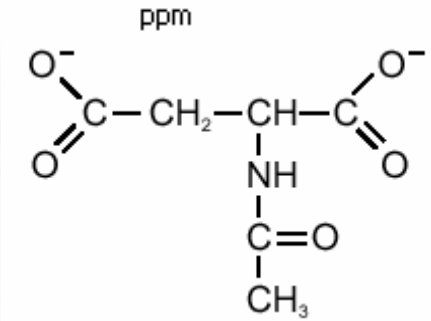
Metabolites of brain tissues, available for protonic MRS methods.

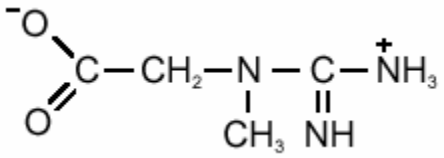
N-acetylaspartat **Kreatine.** **Choline.**

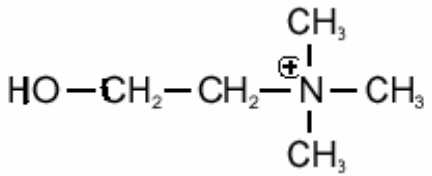






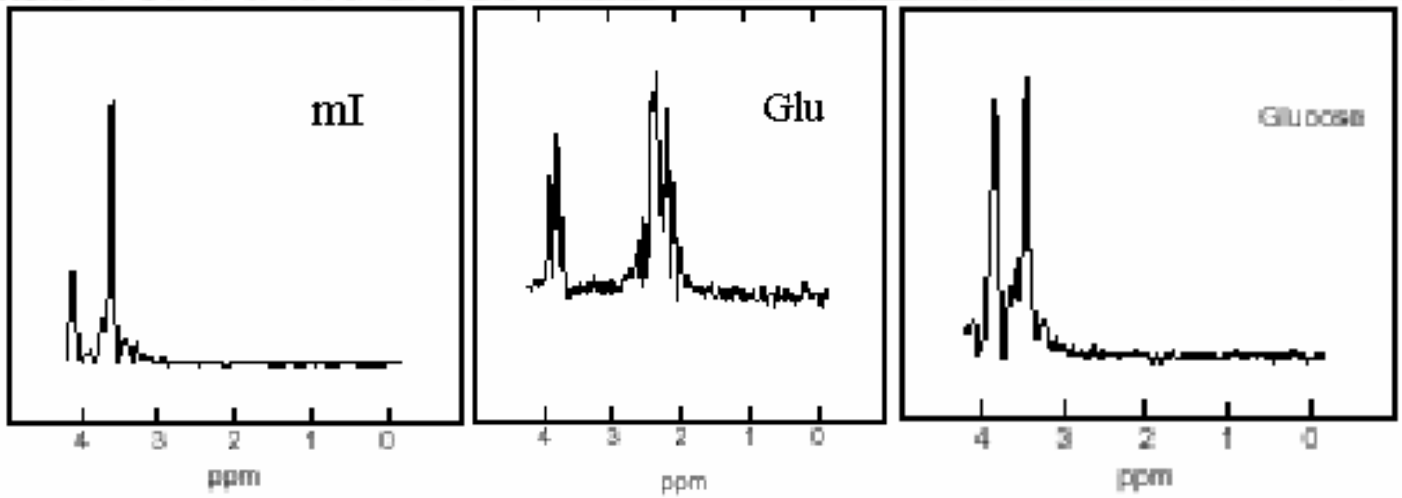


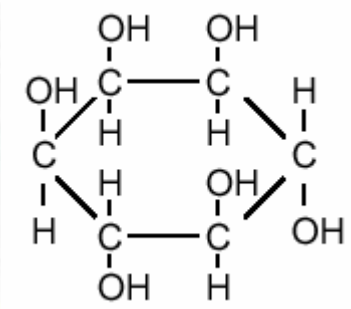


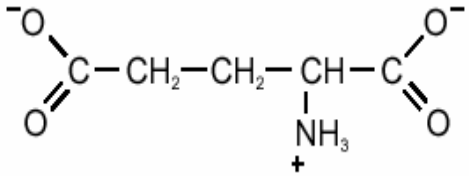


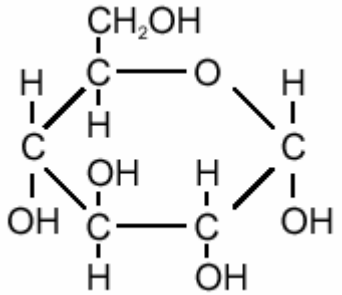
Metabolites of brain tissues, available for protonic MRS methods.

Mio-inositol **Glutamat** **Glucose**



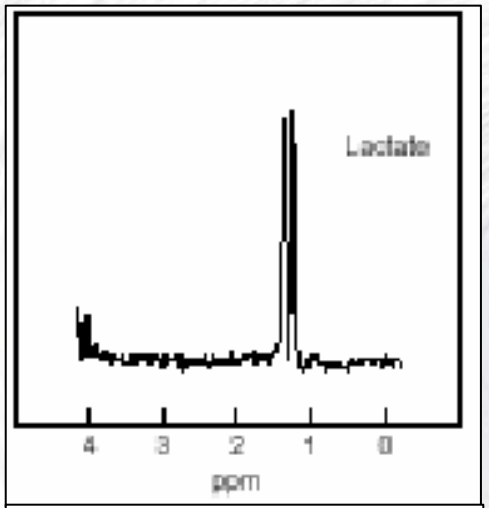


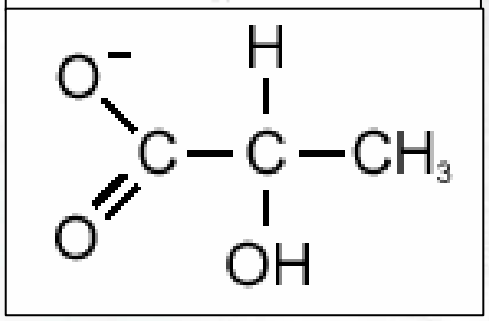




Metabolites of brain tissues, available for protonic MRS methods.

Lactate





Functions of chemical compounds, which MRS can define, are little researched.