The effect of cocaine use on brain metabolism studied using dissolution Dynamic Nuclear Polarization

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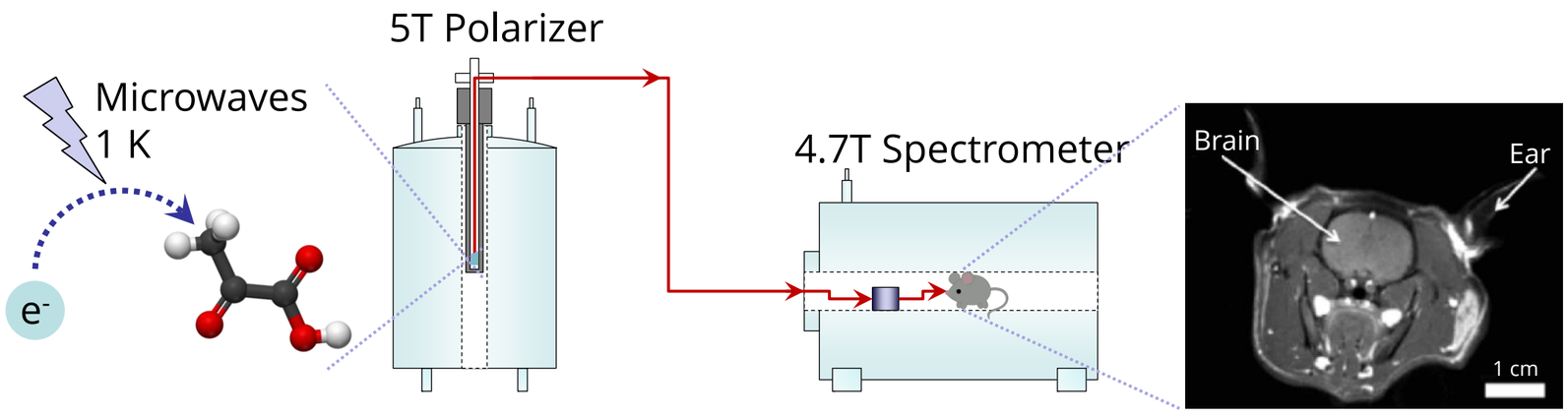
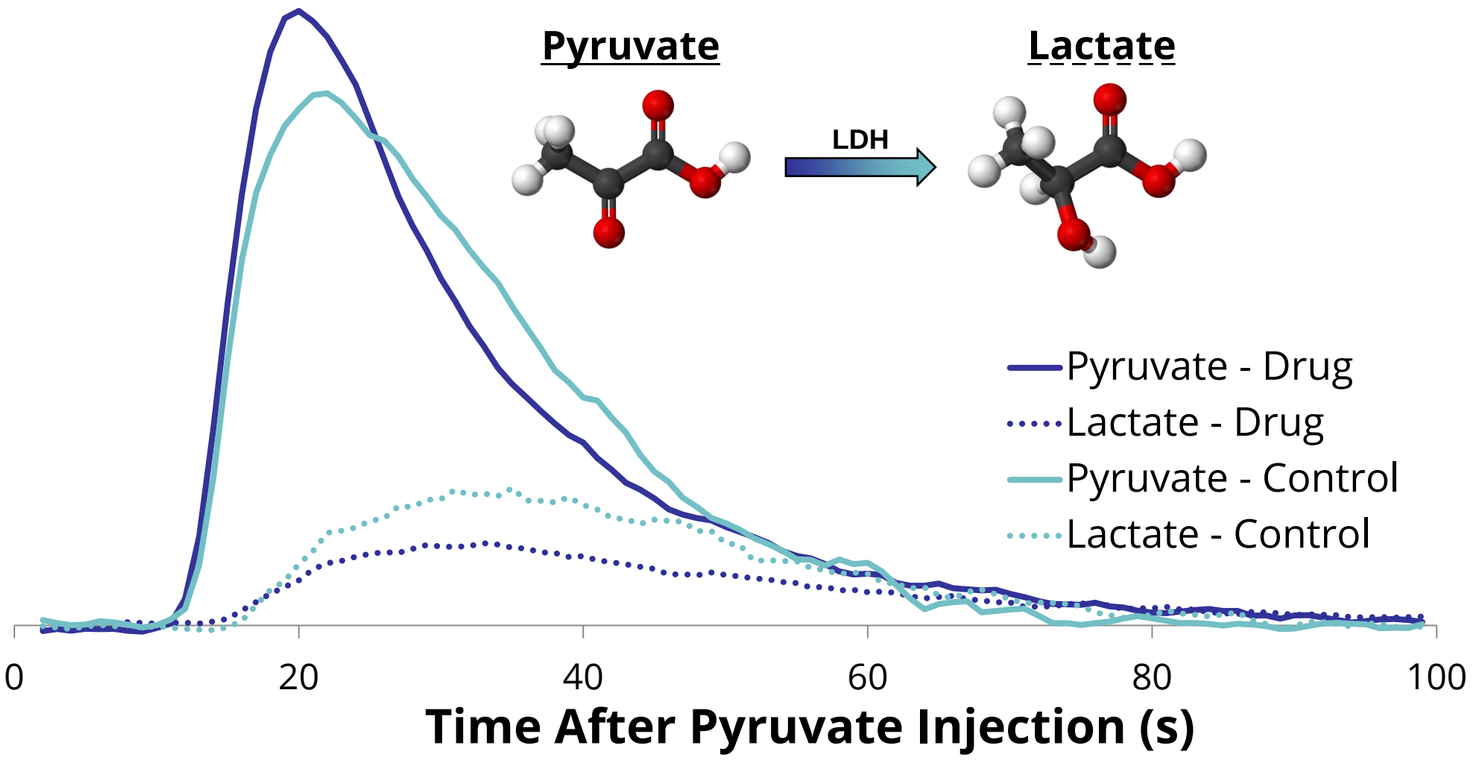
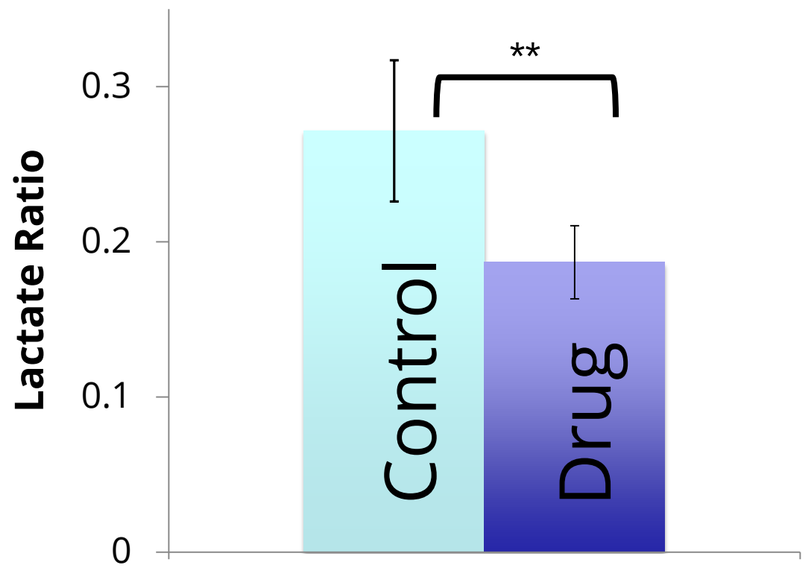
Dynamic Nuclear Polarization (DNP)







Ratio of measured lactate signal to the total measured signal from carbon metabolites

Subject	Lactate Ratio
Control	0.27
Acute injection of cocaine	0.19

Metabolism is hard to measure *in-vivo* due to the low signal we obtain from carbon with NMR. Dissolution DNP allows us to overcome this by greatly increasing (>10,000 times) the signal obtained from ^{13}C nuclei. The pyruvate metabolite is hyperpolarized, using microwave irradiation in the presence of a free radical at a temperature of 1 K. The sample is then rapidly melted and automatically injected into the rat a short time after a single dose of cocaine is administered. NMR measurements of the conversion of Pyruvate to Lactate in the brain can then be measured. These data show how cocaine is significantly altering the brain metabolism.

Conclusions

- **Dissolution DNP can be used to study metabolic processes in the brain**
- **Cocaine causes a significant change in brain metabolism**
- **There is diminished production of Lactate in the brains of rats with cocaine injections, which may indicate an overall lowering of brain metabolic activity**

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