**SUPPLEMENTAL INFORMATION**

**Supplemental Tables**

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| HP signal intensity [a.u.] *vs.* Tissue volume [mm3] | Fractional HP metabolite signal ([13C]metabolite/tC) *vs.* Fractional tissue volume |
|  | Pyruvate | Lactate | HCO3– |  | Pyruvate/tC | Lactate/tC | HCO3–/tC |
| WM | 0.49 | 0.48 | 0.42 | WM/tV | 0.45 | -0.32 | -0.36 |
| GM | 0.58 | 0.54 | 0.60 | GM/tV | 0.57 | -0.54 | 0.08 |
| CSF | -0.41 | -0.44 | -0.41 | CSF/tV | -0.64 | 0.54 | 0.15 |

Table S1. Pearson product-moment correlation coefficients (*r*) between brain tissue volumes and hyperpolarized signals. WM: white matter, GM: grey matter, CSF: cerebrospinal fluid, HP: hyperpolarized, tC: total HP 13C signal within the slice, tV: total tissue volume within the slice.

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| HP signal intensity [a.u.] *vs.* Tissue volume [mm3] | Fractional metabolite signal ([13C]metabolite/tC) *vs.* Fractional tissue volume |
|  | Pyruvate | Lactate | HCO3– |  | Pyruvate/tC | Lactate/tC | HCO3–/tC |
| WM | 0.24 | 0.23 | 0.18 | WM/tV | 0.20 | 0.10 | 0.13 |
| GM | 0.34 | 0.30 | 0.36 | GM/tV | 0.32 | 0.30 | 0.01 |
| CSF | 0.17 | 0.19 | 0.17 | CSF/tV | 0.41 | 0.30 | 0.02 |

Table S2. Coefficients of determination (*R2*) for linear regression between tissue type and hyperpolarized signals. WM: white matter, GM: grey matter, CSF: cerebrospinal fluid, HP: hyperpolarized, tC: total HP 13C signal within the slice, tV: total tissue volume within the slice.

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| HP signal intensity [a.u.] *vs.* Tissue volume [mm3] | Fractional metabolite signal ([13C]metabolite/tC) *vs.* Fractional tissue volume |
|  | Pyruvate | Lactate | HCO3– |  | Pyruvate/tC | Lactate/tC | HCO3–/tC |
| WM | 0.05 | 0.06 | 0.10 | WM/tV | 0.08 | 0.23 | 0.17 |
| GM | 0.02 | 0.03 | 0.01 | GM/tV | 0.02 | 0.03 | 0.76 |
| CSF | 0.11 | 0.09 | 0.12 | CSF/tV | 0.008 | 0.03 | 0.59 |

Table S3. P-values for linear regression between tissue type and hyperpolarized signals. WM: white matter, GM: grey matter, CSF: cerebrospinal fluid, HP: hyperpolarized, tC: total HP 13C signal within the slice, tV: total tissue volume within the slice.

**Supplemental Figures**

Figure S1. Performance of RF Coils. (A) Excitation profile (B1+) of 13C transmit (Tx) was measured for flip angle of 22.5o using a dual flip angle method. Performance of the 13C quadrature Tx coil was evaluated using a spherical phantom that contains 0.4-M [13C]HCO3–, and the measured spatial B1+ profile was consistent over the entire phantom. (B) Receive (Rx) profiles (90o) of the individual 8-channel 13C arrays. Rx performance was tested using a cylindrical phantom (non-labeled pure ethylene glycol, thus 1.1% natural abundance 13C). Enhanced 13C signals were detected from the margin of the phantom near the coil elements, as shown in the channel-combined 13C image (square of sum of square).