CLAIMS

What is claimed is:

1. [3-^{13}C]acetoacetate, wherein at least 0.1%, more preferably at least 1%, and most preferably at least 10% of said [3-^{13}C]acetoacetate is hyperpolarized.

2. Composition comprising the [3-^{13}C]acetoacetate of claim 1.

3. Method of preparing the [3-^{13}C]acetoacetate of claim 1 or the composition of claim 2, wherein the method comprises the steps of :
(a) chemically synthesizing [3-^{13}C]acetoacetate or a composition comprising [3-^{13}C]acetoacetate; and
(b) hyperpolarizing said [3-^{13}C]acetoacetate or said composition.

4. The method of claim 3, wherein [3-^{13}C]acetoacetate is prepared from [3-^{13}C]ethyl acetoacetate.

5. The method of claim 4, wherein the chemical synthesis of [3-^{13}C]acetoacetate involves the saponification of [3-^{13}C]ethyl acetoacetate.

6. The method of any one of claims 3-5, wherein the chemical synthesis of [3-^{13}C]acetoacetate comprises reacting [3-^{13}C]ethyl acetoacetate and a base, preferably an alkali hydroxide, more preferably lithium hydroxide, under conditions allowing said reaction.

7. The method of any one of claims 3-6, wherein the synthesized [3-^{13}C]acetoacetate is hyperpolarized using Dynamic Nuclear Polarization (DNP).

8. Method of determining the spatial and temporal distribution and metabolism of [3-^{13}C]acetoacetate and/or its metabolites in a cell or a subject, wherein the method comprises the steps of:
(a) administering the [3-^{13}C]acetoacetate of claim 1 or the composition of claim 2 to the cell or subject; and
(b) determining the distribution and metabolism of hyperpolarized [3-^{13}C]acetoacetate and/or its metabolites in the cell or subject by magnetic resonance imaging (MRI), magnetic resonance spectroscopy (MRS), and/or magnetic resonance spectroscopic imaging (MRSI).

9. The method of claim 8, wherein the cell or subject is a cell culture, an ex vivo tissue, a human, or an animal.

10. The method of claim 8 or 9, wherein the metabolites of [3-^{13}C]acetoacetate are selected from the group consisting of [5-^{13}C]glutamate, [1-^{13}C]citrate, [1-^{13}C]acetylcarnitine, and [3-^{13}C]beta-hydroxybutyrate.

11. The method of any one of claims 8-10, wherein the magnetic resonance signals from hyperpolarized [3-^{13}C]acetoacetate and its metabolites are used to study the in vivo metabolism of acetoacetate and/or other ketone bodies.

12. The method of any one of claims 8-11, wherein the magnetic resonance signals from hyperpolarized [3-^{13}C]acetoacetate and its metabolites are used to quantify specific physiological functions of the cell or subject in healthy (e.g. starvation) and/or diseased conditions.

13. Use of the [3-^{13}C]acetoacetate of claim 1 or the composition of claim 2 in MRI, MRS, and/or MRSI.

14. Use of the [3-^{13}C]acetoacetate of claim 1 or the composition of claim 2 in the preparation of an imaging agent for diagnosis of a condition, disease, or disorder associated with the metabolism of acetoacetate and/or other ketone bodies.