~~What is claimed is:~~CLAIMS

1. A method for diagnosing~~,~~ or staging~~, or treating~~ a disorder in a subject comprising:

~~administering a first radiopharmaceutical composition to the subject; and~~

acquiring a first image of an organ or tissue of interest using positron emission tomography (PET) alone or in combination with magnetic resonance imaging (MRI);

wherein the subject has been administered a first radiopharmaceutical composition, and wherein the first radiopharmaceutical composition comprises a radiolabeled acetoacetate (AcAc) and/or a radiolabeled beta-hydroxybutyrate (BHB), or a prodrug, pharmaceutically acceptable salt, metabolite, solvate, hydrate, radioisotope, or combination thereof, and which is capable of being retained within the organ or tissue sufficient to emit positrons for detection by positron emission tomography.

2. The method of claim 1, further comprising:

~~administering a second radio pharmaceutical composition to the subject;~~

acquiring a second image of the organ or tissue of interest using PET alone or in combination with MRI, the subject having been administered a second radio pharmaceutical composition; and

comparing the first and second acquired images;

wherein the second radiopharmaceutical composition comprises a radiolabeled acetoacetate (AcAc) and/or a radiolabeled beta-hydroxybutyrate (BHB), or a prodrug, pharmaceutically acceptable salt, metabolite, solvate, hydrate, radioisotope, or combination thereof, and which is capable of being retained within the organ or tissue sufficient to emit positrons for detection by positron emission tomography and which is different from the first radiopharmaceutical composition.

3. The method of claim 2, further comprising determining CMRket, and CMRtot based on the first and second acquired images.

~~4. The method of claim 1, further comprising providing a suitable medical treatment to the subject for the disorder based on the results obtained from imaging the organ or tissue of interest using positron emission tomography.~~

~~5~~4. The method of claim ~~4~~1, further comprising providing the subject with a ~~medical treatment or~~ management program to treat, ameliorate, or prevent the progression of the disorder.

~~6~~5. The method of claim 1, further comprising monitoring cognitive impairment progression in a subject over time by assessing changes in ketone and/or glucose uptake over time as compared to a baseline.

~~7~~6. The method of claim ~~6~~5, wherein the changes in ketone and/or glucose uptake are assessed in a medically treated state.

~~8~~7. The method of claim 1, wherein the disorder is selected from diseases or conditions of altered cerebral metabolism.

~~9~~8. The method of claim ~~8~~7, wherein the diseases or conditions of altered cerebral metabolism are cognitive impairment or neurodegenerative disorders.

~~10~~9. The method of claim ~~9~~8, wherein the diseases or conditions of cognitive impairment or neurodegenerative disorders are selected from Age Associated Memory Impairment, Mild Cognitive Impairment, Alzheimer's Disease, Frontotemporal Dementia, Vascular and Mixed Dementias, or traumatic brain injury.

~~11~~10. The method of claim 1, wherein the subject is at risk for developing a disorder selected from diseases and conditions of cognitive impairment or neurodegenerative disorder.

~~12~~11. The method of claim ~~11~~10, wherein the subject's risk for developing a disease or condition of cognitive impairment or neurodegenerative disorder is determined via use of genetic markers, APOE status, or family history.

~~13~~12. The method of claim 1, wherein the first radiopharmaceutical composition comprises ^{18}F-AcAc, ^{18}F-BHB, ^{11}C-BHB, or a combination thereof.

~~14~~13. The method of claim 2, wherein the first radiopharmaceutical composition comprises ^{18}F-AcAc and/or ^{18}F-BHB, and the second radiopharmaceutical composition comprises ^{11}C-BHB and/or ^{18}F-FDG.

14. Use of a radiolabeled acetoacetate (AcAc) and/or a radiolabeled beta-hydroxybutyrate (BHB), or a prodrug, pharmaceutically acceptable salt, metabolite, solvate, hydrate, radioisotope, or combination thereof in the manufacture of a first radiopharmaceutical composition for treating a disorder selected from diseases or conditions of altered cerebral metabolism in a subject, wherein the first radiopharmaceutical composition is capable of being retained within the organ or tissue sufficient to emit positrons for detection by positron emission tomography.

15. The use of claim 14, further comprising the manufacture of a second radiopharmaceutical composition for treating the disorder selected from diseases or conditions of altered cerebral metabolism in the subject, wherein the second radiopharmaceutical composition is capable of being retained within the organ or tissue sufficient to emit positrons for detection by positron emission tomography and which is different from the first radiopharmaceutical composition.

16. The use of claim 14 or claim 15, wherein the diseases or conditions of altered cerebral metabolism are cognitive impairment or neurodegenerative disorders selected from Age Associated Memory Impairment, Mild Cognitive Impairment, Alzheimer's Disease, Frontotemporal Dementia, Vascular and Mixed Dementias, or traumatic brain injury.

17. The use of claim 14, wherein the subject is at risk for developing a disorder selected from diseases and conditions of cognitive impairment or neurodegenerative disorder.

18. The use of claim 14, wherein the first radiopharmaceutical composition comprises ^{18}F-AcAc, ^{18}F-BHB, ^{11}C-BHB, or a combination thereof.

19. The use of claim 14 or claim 15, wherein the first radiopharmaceutical composition comprises ^{18}F-AcAc and/or ^{18}F-BHB, and the second radiopharmaceutical composition comprises ^{11}C-BHB and/or ^{18}F-FDG.

20. A radiolabeled acetoacetate (AcAc) and/or a radiolabeled beta-hydroxybutyrate (BHB), or a prodrug, pharmaceutically acceptable salt, metabolite, solvate, hydrate, radioisotope, or combination for use in therapy.