CLAIMS

1. An imaging agent comprising 2-deoxy-2-[^{18}F]fluoroglucaric acid (^{18}F-FGA), or a pharmaceutically-acceptable salt thereof, in which the imaging agent preferentially accumulates in a necrosis.

2. An imaging agent according to Claim 1, in which the imaging agent delivers a dosage of radiation in a range of from 1 mCi to 50 mCi.

3. A composition comprising an imaging agent according to Claim 1 or 2, the imaging agent disposed in a pharmaceutically-acceptable carrier, diluent, vehicle, or excipient.

4. A method of preparing a radiopharmaceutical for use in PET imaging, comprising:

combining a reaction initiator with a mixture comprising 2-deoxy-2-[^{18}F]fluoro-D-glucose (^{18}F-FDG), an oxidizing agent, an alkaline buffering agent, and a reaction accelerator to form a reaction mixture, in which the reaction initiator is selected from the group consisting of sodium hypochlorite (NaOCl) and calcium hypochlorite ($Ca(ClO)_2$ and the reaction accelerator is selected from the group consisting of sodium bromide (NaBr) and potassium bromide (KBr); and

reacting the reaction mixture for a duration of less than about 10 min causing conversion of substantially all of the ^{18}F-FDG into 2-deoxy-2-[^{18}F]fluoroglucaric acid (^{18}F-FGA).

5. A method according to Claim 4, in which the oxidizing agent is selected from the group consisting of 2,2,6,6-tetramethylpiperidine 1-oxyl (TEMPO), 4-hydroxy-TEMPO, TEMPO methacrylate, 4-Oxo-TEMPO, 4-amino-TEMPO, 4-acetamido-TEMPO, 4-carboxy-TEMPO, 4-hydroxy-TEMPO benzoate, 4-(2-Iodoacetamido)-TEMPO, 4-Maleimido-TEMPO, 4-Isothiocyanato-TEMPO, 4-(2-Bromoacetamido)-TEMPO, 4-methoxy-TEMPO, 4-Cyano-TEMPO, 4-amino-4-carboxy-TEMPO, 4-Phosphonooxy-TEMPO hydrate, 2,2,6,6-tetramethyl-4-(methylsulfonyloxy)-1-piperidinooxy, hydrogen peroxide, sodium hypochlorite, calcium hypochlorite, ozone, nitric acid, permanganate compounds, halogens, metal-catalyzed oxidation agents, gold nanoparticles, nanoparticles which mimic peroxidase activity-mimicking nanoparticles, glucose oxidase, and glucose-oxidizing enzymes or compounds.

6. A method according to Claim 4 or 5, in which the alkaline buffering agent has a buffering capacity in a pH range of 9 to 12.

7. A method according to Claim 4, 5 or 6, in which the reacting step occurs at a reaction temperature in a range of 0 °C to 25 °C.

8. A method according to any of Claims 4 to 7, comprising adding an acid to the reaction mixture after conversion of the ^{18}F-FDG into ^{18}F-FGA to change the pH of the reaction mixture to a pH in a range of 6.5 to 7.5.

9. A method according to any of Claims 4 to 8, in which the oxidizing agent is a free compound, or is linked to a bead, resin, or polymer.

10. A method according to any of Claims 4 to 9, in which the ^{18}F-FGA produced comprises an amount of radiation in a range of from 1 mCi to 50 mCi.

11. A kit for producing an imaging agent according to Claim 1 or 2, comprising: (1) an oxidizing agent, (2) a reaction initiator, (3) a reaction accelerator, and (4) an alkaline buffering agent, in which the reaction initiator is selected from the group consisting of sodium hypochlorite (NaOCl) and calcium hypochlorite ($Ca(ClO)_2$ and the reaction accelerator is selected from the group consisting of sodium bromide (NaBr) and potassium bromide (KBr); and instructions for combining a quantity of 2-deoxy-2-[^{18}F]fluoro-D-glucose (^{18}F-FDG) with the oxidizing agent, the reaction initiator, the reaction accelerator, and the buffering agent to produce the imaging agent, in which the imaging agent comprises ^{18}F-FGA.

12. A kit according to Claim 11, further comprising an acid able to neutralize the reaction mixture to a pH in a range of 6.5 to 7.5.

13. A kit according to Claim 11 or 12, in which the oxidizing agent is selected from the group consisting of 2,2,6,6-tetramethylpiperidine 1-oxyl (TEMPO), 4-hydroxy-TEMPO, TEMPO methacrylate, 4-Oxo-TEMPO, 4-amino-TEMPO, 4-acetamido-TEMPO, 4-carboxy-TEMPO, 4-hydroxy-TEMPO benzoate, 4-(2-Iodoacetamido)-TEMPO, 4-Maleimido-TEMPO, 4-Isothiocyanato-TEMPO, 4-(2-Bromoacetamido)-TEMPO, 4-methoxy-TEMPO, 4-Cyano-TEMPO, 4-amino-4-carboxy-TEMPO, 4-Phosphonooxy-TEMPO hydrate, 2,2,6,6-tetramethyl-4-(methylsulfonyloxy)-1-piperidinooxy, hydrogen peroxide, sodium hypochlorite, calcium hypochlorite, ozone, nitric acid, permanganate compounds, halogens, metal-catalyzed oxidation agents, gold nanoparticles, nanoparticles which mimic peroxidase activity-mimicking nanoparticles, glucose oxidase, and glucose-oxidizing enzymes or compounds.

14. A kit according to Claim 11, 12 or 13, in which the ^{18}F-FGA produced comprises an amount of radiation in a range of from 1 mCi to 50 mCi.

15. An imaging agent for use in a positron emission tomography (PET) imaging method, the imaging agent comprising the imaging agent according to Claim 1 or 2, the method comprising:

administering the imaging agent to a subject;

allowing the imaging agent to penetrate into a tissue of the subject, the tissue suspected to contain a necrosis; and

collecting a PET image of the tissue suspected to contain the necrosis.