WHAT IS CLAIMED IS:

1. An ex vivo method to prepare a graft comprising a recellularized extracellular matrix of a mammalian liver, liver lobe or portion thereof, comprising:

selecting a perfusion decellularized extracellular matrix of a mammalian liver, a liver lobe or a portion thereof and two populations of cells including a first population of mammalian cells including endothelial cells or stem or progenitor cells capable of differentiation into endothelial cells, and a second population of mammalian cells including islet cells, beta cells, insulin like cells, or stem cells or progenitor cells capable of differentiation into islet cells or beta cells; and

contacting the perfusion decellularized extracellular matrix and the two population of cells under conditions and for a period of time that provide for re-endothelialization of the vasculature of the perfusion decellularized extracellular matrix with the endothelial cells or differentiation and functional maturation in the vasculature of the perfusion decellularized extracellular matrix of the first population comprising stem or progenitor cells, and recellularization of the perfusion decellularized extracellular matrix with the islet cells, beta cells or insulin like cells, or recellularization and differentiation and functional maturation in the perfusion decellularized extracellular matrix of the second population comprising stem or progenitor cells into islet cells, beta cells or insulin like cells.

2. The method of claim 1 wherein the selected perfusion decellularized extracellular matrix is a perfusion decellularized extracellular matrix of a liver.

3. The method of claim 1 wherein the selected perfusion decellularized extracellular matrix is a perfusion decellularized extracellular matrix of a liver lobe.

4. The method of claim 1 wherein the selected perfusion decellularized extracellular matrix is a portion >8 cm^3 of a perfusion decellularized extracellular matrix of a liver lobe.

5. The method of any one of claims 1 to 4 wherein the cells in the first and the second populations are xenogeneic to the decellularized extracellular matrix.

6. The method of any one of claims 1 to 4 wherein the cells in the first and the second populations are allogeneic to the decellularized extracellular matrix.

7. The method of any one of claims 1 to 6 wherein the cells in the first population, the second population, or both, include iPS cells.

8. The method of any one of claims 1 to 7 wherein the perfusion decellularized extracellular matrix contains an intact vascular network.

9. The method of any one of claims 1 to 8 wherein the conditions include perfusing the matrix with media.

10. The method of claim 9 wherein the media contain activators or inhibitors of differentiation pathways selected to provide for cell-specific differentiation including Activin A, Retinoic Acid, bFGF, clozapine-N-oxide, phosphoinositide-3-kinase inhibitor, Nicotinamide, or a combination thereof..

11. The method of any one of claims 1 to 10 wherein the first population of cells is contacted with the extracellular matrix either by injection or perfusion, or a combination thereof.

12. The method of any one of claims 1 to 10 wherein the second population of cells is contacted with the extracellular matrix either by injection or perfusion, or a combination thereof.

13. The method of any one of claims 1 to12 wherein the first population, the second population, or both, comprise primary cells.

14. The method of any one of claims 1 to 13 wherein the second population comprises a plurality of different cell types.

15. The method of any one of claims 1 to 14 wherein the first population, the second population, comprise human embryonic stem cells.

16. The method of any one of claims 1 to 14 wherein the insulin producing cells are encapsulated.

17. The method of any one of claims 1 to 5 or 7 to16 wherein the extracellular matrix is from a nonhuman mammal and is populated with human cells.

18. The method of any one of claims 1 to 17 wherein the extracellular matrix is to be implanted in a mammal.

19. The method of claim 18 wherein the extracellular matrix is to be implanted in the mammal prior to contact with the first population, the second population, or both.

20. The method of claim 19 wherein the cells in the first population, the second population, or both, are injected into the mammal.

21. The method of claim 18 wherein the extracellular matrix is to be implanted in a mammal after contact with the first population, but before the second population.

22. The method of claim 17 wherein extracellular matrix is implanted in a mammal after contact with the second population but before contact with the first population.

23. The method of claim 22 wherein the extracellular matrix is implanted in a mammal after contact with the first population and the second population.

WHAT IS CLAIMED IS:

1. An ex vivo method to prepare a graft comprising a recellularized extracellular matrix of a mammalian liver, liver lobe or portion thereof, comprising:

selecting a perfusion decellularized extracellular matrix of a mammalian liver, a liver lobe or a portion thereof and two populations of cells including a first population of mammalian cells including endothelial cells or stem or progenitor cells capable of differentiation into endothelial cells, and a second population of mammalian cells including islet cells, beta cells, insulin like cells, or stem cells or progenitor cells capable of differentiation into islet cells or beta cells; and

contacting the perfusion decellularized extracellular matrix and the two population of cells under conditions and for a period of time that provide for re-endothelialization of the vasculature of the perfusion decellularized extracellular matrix and recellularization of the perfusion decellularized extracellular matrix with the islet cells, beta cells or insulin like cells, or recellularization and differentiation and functional maturation of the stem or progenitor cells into islet cells, beta cells or insulin like cells in the perfusion decellularized extracellular matrix.

2. The method of claim 1 wherein the selected perfusion decellularized extracellular matrix is a perfusion decellularized extracellular matrix of a liver.

3. The method of claim 1 wherein the selected perfusion decellularized extracellular matrix is a perfusion decellularized extracellular matrix of a liver lobe.

4. The method of claim 1 wherein the selected perfusion decellularized extracellular matrix is a portion >8 cm^3 of a perfusion decellularized extracellular matrix of a liver lobe.

5. The method of any one of claims 1 to 4 wherein the cells in the first and the second populations are xenogeneic to the decellularized extracellular matrix.

6. The method of any one of claims 1 to 4 wherein the cells in the first and the second populations are allogeneic to the decellularized extracellular matrix.

7. The method of any one of claims 1 to 6 wherein the cells in the first population, the second population, or both, include iPS cells.

8. The method of any one of claims 1 to 7 wherein the perfusion decellularized extracellular matrix contains an intact vascular network.

9. The method of any one of claims 1 to 8 wherein the conditions include perfusing the matrix with media.

10. The method of claim 9 wherein the media contain activators or inhibitors of differentiation pathways selected to provide for cell-specific differentiation including Activin A, Retinoic Acid, bFGF, clozapine-N-oxide, phosphoinositide-3-kinase inhibitor, Nicotinamide, or a combination thereof..

11. The method of any one of claims 1 to 10 wherein the first population of cells is contacted with the extracellular matrix either by injection or perfusion, or a combination thereof.

12. The method of any one of claims 1 to 10 wherein the second population of cells is contacted with the extracellular matrix either by injection or perfusion, or a combination thereof.

13. The method of any one of claims 1 to12 wherein the first population, the second population, or both, comprise primary cells.

14. The method of any one of claims 1 to 13 wherein the second population comprises a plurality of different cell types.

15. The method of any one of claims 1 to 14 wherein the first population, the second population, or both, comprise human embryonic stem cells.

16. The method of any one of claims 1 to 14 wherein the insulin producing cells are encapsulated.

17. The method of any one of claims 1 to 5 or 7 to16 wherein the extracellular matrix is from a nonhuman mammal and is populated with human cells.

18. The method of any one of claims 1 to 17 further comprising implanting the extracellular matrix in a mammal.

19. The method of claim 18 wherein the extracellular matrix is implanted in the mammal prior to contact with the first population, the second population, or both.

20. The method of claim 19 wherein the cells in the first population, the second population, or both, are injected into the mammal.

21. The method of claim 18 wherein the extracellular matrix is implanted in a mammal after contact with the first population, but before the second population.

22. The method of claim 17 wherein extracellular matrix is implanted in a mammal after contact with the second population but before contact with the first population.

23. The method of claim 22 wherein the extracellular matrix is implanted in a mammal after contact with the first population and the second population.

24. A recellularized matrix prepared by the method of any one of claims 1 to 23.