The following is claimed:

1. A biocompatible tissue graft comprising:

a first layer of a bioremodelable collageneous material;

a second layer of biocompatible synthetic or natural remodelable or substantially remodelable material attached to the first layer; and

at least one fiber stitched in a reinforcing pattern in the first layer and/or second layer to mitigate tearing of the graft, improve fixation retention of the graft, and/or limit cyclic stretching of the graft, and substantially maintain these properties following partial enzymatic degradation of the graft while one or more of its layers remodels, the at least one fiber having at least one free end extending beyond a peripheral surface of the tissue graft for securing the tissue graft to a host tissue.

2. The tissue graft of claim 1, wherein the at least one fiber extends at a non-perpendicular angle to the peripheral surface of the graft.

3. The tissue graft of claim 1, wherein the at least one fiber extends beyond opposing peripheral surfaces of the graft.

4. The tissue graft of claim 1, wherein the at least one fiber comprises a first fiber that extends beyond a first pair of opposing peripheral surfaces and a second fiber that extends beyond a second pair of opposing peripheral surfaces different from the first pair.

5. The tissue graft of claim 1, wherein the fiber comprises a biocompatible material that is bioresorbable, biodegradable, or non-resorbable.

6. The tissue graft of claim 1 wherein at least one of the first layer, the second layer, and the fiber is modified to improve adhesion between the layers and the fiber.

7. The tissue graft of claim 1, wherein the at least one fiber is stitched into at least one of the first layer or the second layer in a cross-hatched configuration, a concentric pattern, multiple concentric patterns, or a linear pattern.

8. The tissue graft of claim 1, wherein at least one of the first layer and the second layer is decellularized.

9. The tissue graft of claim 1, wherein at least one the first layer and the second layer further comprises at least one differentiated or progenitor cell.

10. The tissue graft of claim 1, wherein at least one of the first layer and the second layer further comprises at least one biologically active molecule selected from the group consisting of drugs, sclerosing agents, enzymes, hormones, cytokines, colony-stimulating factors, vaccine antigens, antibodies, clotting factors, angiogenesis factors, regulatory proteins, transcription factors, receptors, structural proteins, nucleic acid therapeutic agents, and combinations thereof.

11. The tissue graft of claim 1, the first layer comprising an extracellular matrix and the at least one fiber reinforcing the extracellular matrix.

12. The tissue graft of claim 11, the second layer comprising extracellular matrix.

13. The tissue graft of claim 11, wherein the extracellular matrix is decellularized.

14. The tissue graft of claim 1, wherein the second layer comprising a biocompatible substantially remodelable synthetic material.

15. The tissue graft of claim 14, wherein the second layer comprises a mesh of synthetic material.

16. The tissue graft of claim 1, wherein the fiber comprises a natural or synthetic material.

17. The tissue graft of claim 1, wherein the first layer comprises a mammalian-derived or plant-based collagen material.

18. The tissue graft of claim 1, wherein the at least one fiber is radio-opaque to allow the location, integrity, and/or deformation of the tissue graft to be assessed in a living system.

19. A method of constructing a biocompatible tissue graft comprising:

providing a tissue graft that includes a first layer of a bioremodelable collageneous material and a second layer of biocompatible synthetic or natural remodelable or substantially remodelable material; and

stitching at least one fiber into at least one of the layers in a reinforcement pattern to mitigate tearing of the graft, improve fixation retention of the graft, and/or limit cyclic stretching of the graft and substantially maintain these properties following partial enzymatic degradation of the graft while one or more of its layers remodels, the at least one fiber having a free end that extends beyond a peripheral surface of the graft and being effective for securing the graft to a host tissue.

20. A biocompatible tissue graft comprising:

a first layer including a first material;

a second layer including a second material;

a third layer including a third material, at least one of the second material or third material being different from the first material; and

at least one fiber stitched in a reinforcing pattern in the first layer, the second layer, and/or third to mitigate tearing of the graft, improve fixation retention of the graft, and/or limit cyclic stretching of the graft and substantially maintain these properties following partial enzymatic degradation of the graft while one or more of its layers remodels, the at least one fiber having at least one free end extending

beyond a peripheral surface of the tissue graft for securing the tissue graft to a host tissue.

Claims:

1. A biocompatible tissue graft comprising:

a first layer of a bioremodelable collagenous material;

a second layer of biocompatible synthetic or natural remodelable or substantially remodelable material attached to the first layer; and

first and second fibers that are stitched in a cross-hatched reinforcing pattern in the first layer and/or second layer to mitigate tearing and/or improve fixation retention of the layers;

wherein the ends of the first fiber are stitched together to form a continuous stitch construction and the ends of the second fiber are stitched together to form a continuous stitch construction, or the ends of the first and second fibers are stitched together to form a continuous stitch construction.

2. The tissue graft of claim 1, wherein the second fiber is disposed in an overlying fashion relative to the first fiber such that the first fiber is disposed between a top surface of the graft and the second fiber.

3. The tissue graft of claim 1, wherein the second fiber is disposed between a top surface of the graft and the first fiber.

4. The tissue graft of claim 1, wherein the cross-hatched reinforcing pattern comprises a first shape, formed from the first fiber, and a second shape that is formed from the second fiber and extends perpendicular to the first shape.

5. The tissue graft of claim 1, wherein the cross-hatched reinforcing pattern comprises a first shape, formed from the first fiber, and a second shape that is formed from the second fiber and extends at a non-perpendicular angle to the first shape.

6. The tissue graft of claim 1, wherein the first fiber extends from a first side to a second side of the graft, and the second fiber extends from a front surface to a rear surface of the graft.

7. The tissue graft of claim 1, the first layer comprising extracellular matrix and at least one of the first and second fibers reinforcing the extracellular matrix.

8. The tissue graft of claim 7, the second layer comprising extracellular matrix.

9. The tissue graft of claim 1, wherein the second layer comprises a biocompatible substantially remodelable synthetic material.

10. The tissue graft of claim 9, wherein the second layer comprises a mesh of synthetic material.

11. The tissue graft of claim 1, wherein at least one of the first and second fibers comprises a natural or synthetic material.

12. The tissue graft of claim 11, wherein the first layer comprises a mammalian-derived or plant-based collagen material.

13. The tissue graft of claim 11, wherein at least one of the first and second fibers is selected from the group consisting of collagen, silk, sericin free silk, modified silk fibroins, polyesters like PGA, PLA, polylactic-co-glycolic acid (PLGA), polyethyleneglycol (PEG), polyhydroxyalkanoates (PHA), polyethylene terephthalate (PET), polyethylene (PE), ultra-high molecular weight polyethylene (UHMWPE), blends thereof, and copolymers thereof.

14. The tissue graft of claim 1, wherein at least one of the first layer, the second layer, the first fiber, and the second fiber is modified to improve adhesion between the layers and the first and/or second fiber(s).

15. The tissue graft of claim 7, wherein the extracellular matrix is decellularized.

16. The tissue graft of claim 1, wherein at least one the first layer or the second layer further comprises at least one differentiated or progenitor cell.

17. The tissue graft of claim 1, wherein at least one of the first layer or the second layer further comprises at least one biologically active molecule selected from the group consisting of drugs, sclerosing agents, enzymes, hormones, cytokines, colony-stimulating factors, vaccine antigens, antibodies, clotting factors, angiogenesis factors, regulatory proteins, transcription factors, receptors, structural proteins, nucleic acid therapeutic agents, and combinations thereof.

18. The tissue graft of claim 1, wherein one or more of the mechanical properties of the graft is substantially maintained following partial enzymatic degradation of the graft while it remodels.

19. The tissue graft of claim 1, further comprising a third fiber that is stitched in the first and/or second layer and traverses at least one of the first and second fibers, the third fiber having at least one free end extending beyond a peripheral surface of the tissue graft for securing the tissue graft to a host tissue.

20. A biocompatible tissue graft comprising:

a first layer of a bioremodelable collagenous material;

a second layer of biocompatible synthetic or natural remodelable or substantially remodelable material attached to the first layer; and

first and second fibers stitched in a reinforcing pattern in the first layer and/or second layer to mitigate tearing of the graft and/or improve fixation retention of the graft, the second fiber having at least one free end extending beyond a peripheral surface of the tissue graft for securing the tissue graft to a host tissue;

wherein the ends of the first fiber are stitched together to form a continuous stitch construction.

21. The tissue graft of claim 20, wherein the second fiber traverses the first fiber.

22. The tissue graft of claim 20, further including a plurality of first fibers that form a concentric pattern.

23. The tissue graft of claim 20, further including a plurality of first fibers that form a cross-hatched pattern.

24. The tissue graft of claim 20, wherein the second fiber extends at a non-perpendicular angle to the peripheral surface of the graft.

25. The tissue graft of claim 20, wherein the second fiber extends at a perpendicular angle to the peripheral surface of the graft.

26. The tissue graft of claim 20, wherein the second fiber extends beyond opposing peripheral surfaces of the graft.

27. The tissue graft of claim 20, wherein at least one of the first and second fibers is stitched in the reinforcing pattern to limit cyclic stretching of the graft.

28. The tissue graft of claim 20, wherein one or more of the mechanical properties of the graft is substantially maintained following partial enzymatic degradation of the graft while it remodels.