CLAIMS

We claim:

1. An engineered vertebral disc implant comprising:

   an engineered vertebral disc, wherein the engineered vertebral disc comprises a nucleus pulposus region and an annulus fibrosus region; and

   two endplates, wherein the endplates comprise a porous polymer foam, and wherein the endplates comprise channels.

2. The engineered vertebral disc implant of claim 1 wherein the endplates further comprise hydroxyapatite.

3. The engineered vertebral disc implant of claim 1, wherein the endplates have a bone interface side and a vertebral disc interface side, wherein at least one of the two endplates comprises:

   a body; and

   a projection on the bone interface side that extends outwardly from the body.

4. The engineered vertebral disc implant of claim 1, wherein at least one of the two endplates further comprises one or more vascular-promoting agents.

5. The engineered vertebral disc implant of claim 4, wherein the one or more vascular-promoting agents are vascular endothelial growth factor, deferoxamine, nimodipine, or phthalimide neovascularization factor (PNF-1).

6. The engineered vertebral disc implant of claim 1, wherein the nucleus pulposus region comprises a top surface, bottom surface, and a side edge extending between the top and bottom surfaces and defining a perimeter of the nucleus pulposus region, wherein the perimeter of the nucleus pulposus is circumferentially surrounded by the annulus fibrosus region.

7. The engineered vertebral disc implant of claim 3, wherein the annulus fibrosus region comprises a top surface, a bottom surface, an inner side edge, and an outer side edge that defines a perimeter of the annulus fibrosus region, wherein the inner side edge and the outer side edge extend between the top surface and the bottom surface,

wherein the vertebral disc interface side of a first endplate is attached to the top surfaces of the nucleus pulposus and annulus fibrosus regions, and wherein the vertebral disc interface side of a second endplate is attached to the bottom surfaces of the nucleus pulposus and annulus fibrosus regions.

8. The engineered vertebral disc implant of claim 1, wherein the nucleus pulposus region comprises a hydrogel.

9. The engineered vertebral disc implant of claim 8, wherein the hydrogel comprises viable cells.

10. The engineered vertebral disc implant of claim 8, wherein the hydrogel is a hyaluronic acid or agarose hydrogel.

11. The engineered vertebral disc implant of claim 1, wherein the annulus fibrosus region comprises one or more sheets of nano-fibrous PCL.

12. The engineered vertebral disc implant of claim 1, wherein the annulus fibrosus region further comprises polyethylene oxide (PEO).

13. The engineered vertebral disc implant of claim 1, wherein the annulus fibrosus region comprises viable cells.

14. The engineered vertebral disc implant of claim 9, wherein the cells of the nucleus pulposus region or annulus fibrosus region have been previously cultured.

15. The engineered vertebral disc implant of claim 1, wherein the porous polymer foam is poly (ε–caprolactone) (PCL), poly(lactic-co-glycolic acid), polylactic acid, poly-DL-lactide, or polydiaxanone.

16. A method of treating disc degeneration comprising implanting one or more of the engineered vertebral disc implants of claim 1 to a subject in need thereof, wherein the endplates of the engineered vertebral disc implant are attached to the vertebra of the subject.

17. The method of claim 16, wherein the engineered vertebral disc implant is cultured prior to implanting to a patient.

18. The method of claim 16, further comprising removing the degenerated disc prior to implanting the engineered vertebral disc implant.

19. The method of claim 16, further comprising removing a portion of the vertebra prior to implanting engineered vertebral disc implants.

20. The method of claim 19, wherein removing a portion of the vertebra comprises scraping or drilling into the vertebra.

21. The method of claim 16, wherein the cells in the engineered vertebral disc implant are the cells obtained from the subject.

22. The method of claim 16, wherein the endplates are attached to the vertebra via the bone interface side.

23. The engineered vertebral disc implant of claim 2, wherein at least one of the two endplates further comprises one or more vascular-promoting agents.

24. The method of claim 16, wherein the endplates further comprise hydroxyapatite.

25. The method of claim 24, wherein at least one of the two endplates further comprises one or more vascular-promoting agents.