Claims

1. An amniotic fluid collection device, comprising:

a collection chamber;

a collection chamber outlet valve coupled to the collection chamber;

a collection chamber inlet valve coupled to the collection chamber;

a proximal fluid-extraction tube coupled to the collection chamber inlet valve, the proximal fluid-extraction tube comprising a medical grade material; and

a distal fluid-extraction tube coupled to the proximal fluid-extraction tube, the distal fluid extraction tube comprising a transfer portion and an inlet, wherein the inlet comprises a main inlet, a soft penetrating tip, and one or more lateral inlets,

wherein the soft penetrating tip is capable of penetrating an amniotic membrane without penetrating or damaging fetal skin.

2. The device of claim 1, wherein the distal fluid-extraction tube is supple.

~~3. A method for isolating fetal or infant cells, comprising:~~

~~(a) obtaining amniotic fluid at a gestational stage of greater than 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, or 39 weeks, using the amniotic fluid collection device of claim 1 or claim 2; and~~

~~(b) recovering fetal or infant cells from the amniotic fluid.~~

~~4. The method of claim 3, wherein the obtaining in step (a) comprises collecting amniotic fluid by caesarean section.~~

5. The method of claim 3 or 4, wherein the recovering in step (b) comprises removing particulate matter from the amniotic fluid.

6. The method of claim 5, wherein the recovering in step (b) further comprises performing gradient centrifugation.

7. The method of any of claims 3-6, further comprising culturing the recovered cells under conditions whereby the cells proliferate.

8. The method of any of claims 3-7, wherein the recovered cells in step (b) comprise at least 1 million cells per liter of amniotic fluid obtained in step (a).

9. The method of any of claims 3-8, wherein the amount of amniotic fluid obtained in step (a) is at least at or about 10 mL, 20 mL, 30 mL, 40 mL, 50 mL, 60 mL, 70 mL, 80 mL, 90 mL, 100 mL, 200 mL, 300 mL, 400 mL, 500 mL, 600 mL, 700 mL, 800 mL, 900 mL, or 1000 mL.

10. The method of any of claims 3-9, wherein the amniotic fluid is full-term amniotic fluid.

11. The method of any of claims 3-10, wherein the fetal or infant cells comprise a cell that is positive for surface expression of a marker selected from the group consisting of CD73 and CD90, wherein the cell is negative for surface expression of CD105 expression or positive for surface expression of CD34.

12. The method of claim 11, wherein the cell is positive for surface expression of CD73 and CD90.

13. The method of claim 11 or 12, wherein the cell is negative for surface expression of CD105 and is positive for surface expression of CD34.

14. The method of any of claims 11-13, wherein the cell expresses the transcription factor Oct-4.

15. The method of any of claims 11-14, wherein the cell is negative for CD45 surface expression.

16. The method of any of claims 11-15, wherein the cell is adherent.

17. The method of any of claims 11-16, wherein the cell has a fibroblastic morphology.

18. The method of any of claims 11-17, wherein the cell is pluripotent or multipotent.

19. The method of any of claims 11-18, wherein:

the cell is capable of growing in continuous culture for at least 50 days; or

the cell is capable of proliferating in culture for at least 30 population doublings; or

the cell is capable of expanding at least 1,000,000 fold in continuous culture.

20. The method of any of claims 3-19, further comprising reprogramming the recovered cells, thereby generating multipotent or pluripotent cells.

21. The method of claim 20, wherein the reprogramming comprises performing an induction of pluripotent stem cells (iPSC) procedure.

22. The method of any of claims 3-21, further comprising differentiating the cells into a desired cell or tissue type.

23. The method of claim 22, wherein the desired cell or tissue type is selected from the group consisting of hematopoietic cells, neuronal cells, endodermal cells, ectodermal cells, and mesodermal cells.

24. An isolated fetal or infant cell isolated using the method of any one of claims 3-23, comprising surface expression of a marker selected from the group consisting of CD73 and CD90, wherein:
the surface of the cell is negative for CD105 expression; or
the surface of the cell expresses CD34.

25. The isolated cell of claim 24, wherein the cell comprises surface expression of CD73 and CD90.

26. The isolated cell of claim 24 or claim 25, wherein the cell surface is negative for CD105 expression and expresses CD34.

27. The isolated cell of any of claims 24-26, wherein the cell expresses the transcription factor Oct-4.

28. The isolated cell of any of claims 24-27, wherein the cell surface is negative for CD45 surface expression.

29. The isolated cell of any of claims 24-28, wherein the cell is adherent.

30. The isolated cell of any of claims 24-29, wherein the cell has a fibroblastic morphology.

31. The isolated cell of any of claims 24-30, wherein the cell is pluripotent or multipotent.

32. The isolated cell of any of claims 24-31, wherein:

the cell is capable of growing in continuous culture for at least 50 days; or

the cell is capable of proliferating in culture for at least 30 population doublings; or

the cell is capable of expanding at least 1,000,000 fold in continuous culture.

33. A composition, comprising a fetal or infant cell of any of claims 24-32.

34. A composition, comprising a plurality of fetal or infant cells isolated using the method of any one of claims 3-23, wherein at least 10 % of the cells have surface expression of CD90, CD73, and CD34 and less than 5 % of the cells have surface expression of CD105.

35. The composition of claim 34, wherein at least 50 % of the cells express the transcription factor Oct-4.

36. The composition of claim 34 or claim 35, wherein less than 5 % of the cells have CD45 surface expression.

37. The composition of any of claims 34-36, wherein at least 50 % of the cells are adherent.

38. The composition of any of claims 34-37, wherein at least 50 % of the cells have a fibroblastic morphology.

39. The composition of any of claims 34-38, wherein at least 50 % of the cells are pluripotent or multipotent.

40. The composition of any of claims 34-39, wherein

at least 50 % of the cells are capable of growing in continuous culture for at least 50 days; or

the plurality of cells is capable of proliferating in culture for at least 30 population doublings; or

the plurality of cells is capable of expanding at least 1,000,000 fold in continuous culture.

41. The composition of any of claims 33-40, further comprising amniotic fluid.

42. The composition of claim 41, wherein the cells are present at a concentration of at least 1 million cells per liter.

43. A method for banking cells, comprising

(a) obtaining one or more samples, each containing the cell of any of claims 24-32;

(b) storing the sample under conditions to preserve viability of at least some of the cells in the sample; and

(c) storing data related to the identity of the subject from which the sample was obtained.

44. The method of claim 43, wherein the storing comprises treating the sample with one or more cryoprotective agent.

45. The method of claim 43 or claim 44, wherein step (a) comprises obtaining a plurality of samples, each obtained from a different subject.

46. A cell bank, comprising:

(a) a plurality of samples, each containing the cell of any of claims 24-32 or the composition of any of claims 33-42; and

(b) a database containing data for individual identification and retrieval of the samples.

47. The cell bank of claim 46, wherein each of the plurality of samples is derived from an individual subject.

48. The cell bank of claim 46 or 47, wherein the data includes information about the identity of the subjects from which individual samples were derived.

49. A method for collecting amniotic fluid, comprising:

(a) inserting the penetrating tip of the amniotic fluid collection device of claim 1 or claim 2 through an incision in the uterine wall of a subject;

(b) penetrating the amniotic membrane of the subject; and

(c) collecting amniotic fluid from the amniotic sac of the subject in the collection chamber of the amniotic fluid collection device,

wherein the subject is a pregnant mother at a stage of at least 30 gestational weeks.

50. The method of claim 49, wherein the subject is at a full-term stage of gestation.

51. The method of claim 49 or 50, wherein step (b) further comprises penetrating a chorionic membrane.

52. The method of any of claims 49-51, wherein the collecting in step (c) includes one or more of:

(i) initiating a siphon to transfer the amniotic fluid to a collection chamber of the amniotic fluid collection device by opening an inlet valve of the amniotic fluid collection device;

(ii) positioning a collection chamber of the amniotic fluid collection device below an inlet of the amniotic fluid collection device;

(iii) coupling a negative pressure source to an outlet of the amniotic fluid collection device to initiate transfer of the amniotic fluid; and

(iv) relocating an inlet of the amniotic fluid collection device to retrieve substantially all of the available amniotic fluid.

53. The method of any of claims 49-52, further comprising step (d) removing the amniotic fluid collection device.

54. The method of any of claims 49-53, wherein the incision is made by the amniotic fluid collection device.

55. The method of any of claims 49-54, wherein the method is performed in less than about 10 minutes, about 9 minutes, about 8 minutes, about 7 minutes, about 6 minutes, about 5 minutes, about 4 minutes, about 3 minutes, about 2 minutes, or about 1 minute.