CLAIMS:

1. Isolated recombinant laminin-521, comprising:

an alpha chain comprising a polypeptide with at least 80% identity to a polypeptide sequence of SEQ ID NO: 1;

a beta chain comprising a polypeptide with at least 70% identity to a polypeptide sequence of SEQ ID NO: 2; and

a gamma chain comprising a polypeptide with at least 70% identity to a polypeptide sequence of SEQ ID NO: 3;

wherein the alpha, beta, and gamma chains are assembled into recombinant laminin-521.

2. The isolated recombinant laminin-521 of claim 1, wherein the alpha chain polypeptide has at least 90% identity to the polypeptide sequence of SEQ ID NO: 1.

3. The isolated recombinant laminin-521 of claim 2, wherein the beta chain polypeptide has at least 90% identity to the polypeptide sequence of SEQ ID NO: 2.

4. The isolated recombinant laminin-521 of claim 3, wherein the gamma chain polypeptide has at least 90% identity to the polypeptide sequence of SEQ ID NO: 3.

5. A pharmaceutical composition, comprising: a) isolated recombinant laminin-521; and b) a pharmaceutically acceptable carrier.

6. A composition that enables self-renewal of pluripotent stem cells grown *in vitro*, comprising a growth medium and a coating thereover, the coating comprising recombinant laminin 521 (laminin-11).

7. The composition of claim 6, wherein the composition further comprises a growth factor.

8. The composition of claim 6, wherein the composition is devoid of any differentiation inhibitors, feeder cells, or differentiation inductors.

9. A method for maintaining the pluripotency of pluripotent stem cells *in vitro*, comprising:

providing a substrate comprising a growth medium and a coating thereover, the coating comprising a matrix of either recombinant laminin 521 (laminin-11) or recombinant laminin 511;

dissociating pluripotent stem cells into a single cell suspension; and

placing the pluripotent stem cells in the single cell suspension on the coating.

10. The method of claim 9, wherein the composition is devoid of any differentiation inhibitors, feeder cells, or differentiation inductors.

11. The method of claim 9, wherein the pluripotent stem cells are placed on the coating as a monolayer.

12. The method of claim 9, wherein the pluripotent stem cells are placed on the coating at a density of 200 cells / mm^2 or less.

13. The method of claim 9, wherein the pluripotent stem cells are placed on the coating at a density of 200 cells / mm^2 or more.

14. The method of claim 9, wherein the pluripotent stem cells are placed on the coating such that no two stem cells contact each other.

15. A method of maintaining the pluripotency of pluripotent stem cells *in vitro*, comprising:

receiving a substrate having a coating thereon, the coating containing an intact laminin;

placing pluripotent stem cells and a cell culture medium on the substrate; and

activating the PI3-kinase/Akt pathway.

16. The method of claim 15, wherein the intact laminin is laminin-521 or laminin-511.

17. The method of claim 15, wherein the cell culture medium does not contain any growth factors.

18. The method of claim 15, wherein the cell culture medium does not contain beta fibroblast growth factor (bFGF).

19. The method of claim 15, wherein the coating also contains a cadherin.

20. The method of claim 15, wherein the pluripotent stem cells are placed on the coating at a density of 200 cells / mm^2 or less.

21. A method of isolating recombinant laminin-521, comprising:

providing host cells that express recombinant laminin-521, wherein the recombinant laminin-521 comprises:

a first chain comprising a polypeptide with at least 80% identity to a polypeptide sequence of SEQ ID NO: 1,

a second chain comprising a polypeptide with at least 70% identity to a polypeptide sequence of SEQ ID NO: 2, and

a third chain comprising a polypeptide with at least 70% identity to a polypeptide sequence of SEQ ID NO: 3,

wherein the first, second, and third chains are assembled into recombinant laminin-521;

growing the host cells in a cell culture medium under conditions to stimulate expression of the recombinant laminin-521 chains;

passing the host cell culture medium through a column, wherein the column contains a compound that binds to the recombinant laminin-521;

washing the column to remove unbound materials; and

eluting the bound recombinant laminin-521 from the column.

22. The method of claim 21, wherein the column is an antibody affinity column, a gel-filtration chromatography column, or an ion-exchange column.

23. A recombinant expression vector comprising a nucleic acid of SEQ ID NO: 4 operatively linked to a promoter sequence.

24. The vector of claim 23, further comprising a polylinker sequence, a polyadenylation signal sequence, a termination sequence, a selectable marker, or an epitope tag.

25. A medical device or a graft having an exterior surface, the exterior surface being coated with isolated recombinant laminin-521.

26. A kit, comprising:

isolated recombinant laminin-521; and

a container.

27. An automated robotic system, comprising:

an input area for receiving an initial culture of pluripotent stem cells;

a means for removing the stem cells from the initial culture;

a means for placing the stem cells into single cell suspension; and

a means for replating the stem cells in the single cell suspension onto a matrix containing laminin-521.

CLAIMS:

1. A composition that enables self-renewal of pluripotent stem cells grown *in vitro*, comprising a growth medium and a coating, the coating comprising recombinant laminin 521 (laminin-11).

2. The composition of claim 1, wherein the composition further comprises a growth factor.

3. A method for maintaining the pluripotency of pluripotent stem cells *in vitro*, comprising:

providing a substrate comprising a growth medium and a coating thereover, the coating comprising a matrix of recombinant laminin 521 (laminin-11);

dissociating pluripotent stem cells into a single cell suspension; and

placing the pluripotent stem cells in the single cell suspension on the coating.

4. The method of claim 3, wherein the pluripotent stem cells are placed on the coating as a monolayer.

5. The method of claim 3, wherein the pluripotent stem cells are placed on the coating such that no two stem cells contact each other.

6. A method of maintaining the pluripotency of pluripotent stem cells *in vitro*, comprising:

receiving a substrate having a coating thereon, the coating containing an intact laminin-521;

placing pluripotent stem cells and a cell culture medium on the substrate; and

activating the PI3-kinase/Akt pathway.

7. The method of claim 6, wherein the cell culture medium does not contain any growth factors.

8. The method of claim 6, wherein the cell culture medium does not contain beta fibroblast growth factor (bFGF).

9. The method of claim 6, wherein the coating also contains a cadherin.

10. A medical device or a graft having an exterior surface, the exterior surface being coated with isolated recombinant laminin-521.