WHAT IS CLAIMED IS:

1. A method for culturing a pluripotent stem cell *in vitro* in an undifferentiated state, the method comprising:

   providing a substrate surface coated with a coating comprising a molecule having a catechol moiety or a polymer thereof; and

   growing a pluripotent stem cell to maintain the pluripotent stem cell in an undifferentiated state on said coated substrate surface in a growth medium.

2. The method according to claim 1, wherein the pluripotent stem cell is a human stem cell.

3. The method according to claim 1, wherein the pluripotent stem cell is a non-human animal stem cell.

4. The method according to any one of claims 1 to 3, wherein the molecule having a catechol moiety is L-3,4-dihydroxy-phenylalanine (L-DOPA).

5. The method according to claim 4, wherein the coating comprises an L-DOPA monomer.

6. The method according to claim 4 or 5, wherein the coating comprises a polymer of L-DOPA.

7. The method according to any one of claims 1 to 6, wherein the coating further comprises one or more of a protein, a peptide, a polysaccharide, a growth factor and a hormone.

8. The method according to claim 7, wherein the protein, the peptide, the polysaccharide, the growth factor or the hormone is a synthetic or recombinant molecule.

9. The method according to any one of claims 1 to 8, wherein the growth medium is free from non-human serum.

10. The method according to any one of claims 1 to 9, wherein the growth medium is free from non-human animal components.

11. The method according to any one of claims 1 to 8, wherein the growth medium comprises one or more components derived from non-human animal blood, cells or tissue.

12. The method according to claim 11, wherein the growth medium comprises non-human serum.

13. The method according to any one of claims 1 to 12, wherein the growth medium comprises one or more components derived from human blood, cells or tissue.

14. The method according to claim 13, wherein the growth medium comprises human serum.

15. The method according to any one of claims 1 to 13, wherein the growth medium is free from human serum.

16. The method according to any one of claims 1 to 12, wherein the growth medium is free from human components.

17. The method according to any one of claims 1 to 8, wherein the growth medium is synthetic and is free from animal components, including human and non-human animal components.

18. The method according to any one of claims 1 to 17, wherein the growth medium comprises one or more recombinant or synthetic proteins or peptides.

19. The method according to any one of claims 1 to 18, wherein the pluripotent stem cell is a tumor-initiating cell or a tumor stem cell.

20. The method according to any one of claims 1 to 18, wherein the pluripotent stem cell is an embryonic stem cell.

21. The method according to any one of claims 1 to 18, wherein the pluripotent stem cell is an induced pluripotent stem cell.

22. The method according to any one of claims 1 to 21, wherein the coated substrate surface comprises glass, ceramic, metal, a polymer including natural or synthetic polymers, or a material having a nano-structured surface.

23. The method according to claim 22, wherein the coated substrate surface is a polymer comprising one or more of dextran, modified dextran, cross-linked amino-modified dextran, chitosan, chitin, cellulose, cellulose acetate, polylactic acid, aminopropylmethacrylamide, polysulfone, polystyrene, polyethylene, polyethersulfone, polyester, polycarbonate, polyethylene terephtalate, nylon, polytetrafluoroethylene, polypropylene, polyurethane, polyacrylamide, poly[2-(methacryloyloxy)ethyl dimethyl-(3-sulfopropyl) ammonium hydroxide], and poly(methyl vinyl ether-alt-maleic anhydride).

24. The method according to any one of claims 1 to 23, wherein said growing comprises adding ROCK inhibitor to the growth medium.

25. The method according to any one of claims 1 to 24, wherein the substrate surface is a cell culture vessel surface, a cell culture plate surface, a membrane surface or a micro-carrier surface.

WHAT IS CLAIMED IS:

1. A method for culturing a pluripotent stem cell *in vitro* in an undifferentiated state, the method comprising:

   providing a substrate surface coated with a coating comprising a molecule having a catechol moiety or a polymer thereof; and

   growing a pluripotent stem cell to maintain the pluripotent stem cell in an undifferentiated state on said coated substrate surface in a growth medium.

2. The method according to claim 1, wherein the pluripotent stem cell is a human stem cell.

3. The method according to claim 1, wherein the pluripotent stem cell is a non-human animal stem cell.

4. The method according to any one of claims 1 to 3, wherein the molecule having a catechol moiety is L-3,4-dihydroxy-phenylalanine (L-DOPA).

5. The method according to claim 4, wherein the coating comprises ~~one or both of~~ an L-DOPA monomer ~~and a polymer thereof~~.

~~5.~~6. The method according to claim 4 or 5, wherein the coating comprises a polymer of L-DOPA.

~~6.~~7. The method according to any one of claims 1 to ~~5~~6, wherein the coating further comprises one or more of a protein, a peptide, a polysaccharide, a growth factor and a hormone.

~~7.~~8. The method according to claim ~~6~~7, wherein the protein, the peptide, the polysaccharide, the growth factor or the hormone is a synthetic or recombinant molecule.

~~8.~~9. The method according to any one of claims 1 to ~~7~~8, wherein the growth medium is free from non-human serum.

~~9.~~10. The method according to any one of claims 1 to ~~8~~9, wherein the growth medium is free from non-human animal components.

~~10.~~11. The method according to any one of claims 1 to 8, wherein the growth medium comprises one or more components derived from non-human animal blood, cells or tissue.

~~11.~~12. The method according to claim ~~10~~11, wherein the growth medium comprises non-human serum.

~~12.~~13. The method according to any one of claims 1 to ~~11~~12, wherein the growth medium comprises one or more components derived from human blood, cells or tissue.

~~13.~~14. The method according to claim ~~12~~13, wherein the growth medium comprises human serum.

~~14.~~15. The method according to any one of claims 1 to ~~12~~13, wherein the growth medium is free from human serum.

~~15.~~16. The method according to any one of claims 1 to ~~11~~12, wherein the growth medium is free from human components.

~~16.~~17. The method according to any one of claims 1 to ~~7~~8, wherein the growth medium is synthetic and is free from animal components, including human and non-human animal components.

~~17.~~18. The method according to any one of claims 1 to ~~16~~17, wherein the growth medium comprises one or more recombinant or synthetic proteins or peptides.

~~18.~~19. The method according to any one of claims 1 to ~~17~~18, wherein the pluripotent stem cell is a tumor-initiating cell or a tumor stem cell.

~~19. The method according to claim 18, wherein the stem cell is pluripotent.~~

20. The method according to any one of claims ~~19~~1 to 18, wherein the pluripotent stem cell is an embryonic stem cell ~~or an induced pluripotent stem cell~~.

20.21. The method according to any one of claims 1 to 18, wherein the pluripotent stem cell is an induced pluripotent stem cell.

~~21. The method according to claim 18, wherein the stem cell is multipotent.~~

~~22. The method according to claim 21, wherein the stem cell is an adult stem cell.~~

~~23. The method according to claim 22, wherein the stem cell is a mesenchymal stem cell.~~

24.22. The method according to any one of claims 1 to ~~23~~21, wherein the coated substrate surface comprises glass, ceramic, metal, a polymer including natural or synthetic polymers, or a material having a nano-structured surface.

25.23. The method according to claim ~~24~~22, wherein the coated substrate surface is a polymer comprising one or more of dextran, modified dextran, cross-linked amino-modified dextran, chitosan, chitin, cellulose, cellulose acetate, polylactic acid, aminopropylmethacrylamide, polysulfone, polystyrene, polyethylene, polyethersulfone, polyester, polycarbonate, polyethylene terephtalate, nylon, polytetrafluoroethylene, polypropylene, polyurethane, polyacrylamide, poly[2-(methacryloyloxy)ethyl dimethyl-(3-sulfopropyl) ammonium hydroxide], and poly(methyl vinyl ether-alt-maleic anhydride).

26.24. The method according to any one of claims 1 to ~~25~~23, wherein said growing comprises adding ROCK inhibitor to the growth medium.

27.25. The method according to any one of claims 1 to ~~26~~24, wherein the substrate surface is a cell culture vessel surface, a cell culture plate surface, a membrane surface or a micro-carrier surface.