Claims:

1. A method of culturing human multipotent stem cells in suspension culture *in vitro*, the method comprising:

(i) attaching human multipotent stem cells to a plurality of microcarriers to form microcarrier-stem cell complexes;
(ii) culturing the microcarrier-stem cell complexes in suspension culture;
(iii) passaging the cultured cells from (ii); and
(iv) repeating steps (i)-(iii) through at least ~~2~~3 passages, wherein human multipotent stem cells are expanded between each passage, and

wherein stem cells in the culture after step (iv) are multipotent~~.~~;

and wherein the microcarriers comprise or consist of cellulose, dextran, collagen, gelatin or polystyrene, hydroxylated methacrylate, or are macroporous or microporous carboseed microcarriers, the microcarriers being optionaly coupled with protamine or polylysine,

2. The method of claim 1 wherein in (i) the surface of the microcarriers is coated in a matrix~~.~~, wherein the matrix comprises one or more of Matrigel™ (BD Biosciences), hyaluronic acid, laminin, fibronectin, vitronectin, collagen, heparan sulphate, dextran, dextran sulphate or chondroitin sulphate.

3. The method of claim 1 or 2 further comprising the step of inducing differentiation of the stem cells obtained after step (iv).

4. The method of claim 3 wherein the method comprises placing the microcarrier-stem cell complexes under conditions which induce the differentiation of the stem cells.

5. The method of any one of claims 1 to 4 wherein after step (iv) the method comprises the step of separating stem cells from the microcarriers and culturing the separated stem cells in non-microcarrier culture under conditions which induce differentiation of the stem cells.

6. The method of claim 1 further comprising the differentiation of multipotent stem cells, comprising:

(v) attaching multipotent stem cells obtained after step (iv) to a plurality of second microcarriers to form microcarrier-stem cell complexes, wherein

the surface of the second microcarriers is coated in a second matrix or is uncoated; and

(vi) culturing the microcarrier-stem cell complexes from (v) in suspension culture under conditions that induce the differentiation of the stem cells.

7. The~~A~~ method of claim 6 wherein in (i) the surface of the microcarriers is coated in a first matrix, wherein the matrix comprises an extracellular matrix component. ~~culturing and differentiating human multipotent stem cells *in vitro*, the method comprising:~~

(i) attaching human multipotent stem cells to a plurality of first microcarriers to form microcarrier-stem cell complexes;

(ii) culturing the microcarrier-stem cell complexes in suspension culture;

(iii) passaging the cultured cells from (ii); and

(iv) repeating steps (i)-(iii) through at least 2 passages,

wherein stem cells in the culture after step (iv) are multipotent, the method further comprising:

(v) attaching multipotent stem cells obtained after step (iv) to a plurality of second microcarriers to form microcarrier-stem cell complexes, wherein the surface of the second microcarriers is coated in a second matrix or is uncoated; and

(vi) culturing the microcarrier-stem cell complexes from (v) in suspension culture under conditions that induce the differentiation of the stem cells.

8. The method of any one of claims 1 to 7 wherein the stem cells are adult stem cells, or multipotent stem cells derived from pluripotent stem cells. wherein in (i) the surface of the microcarriers is coated in a first matrix.

9. The method of any one of claims 1 to 8 wherein the microcarriers are rod-shaped. A method of differentiating stem cells *in vitro*, comprising attaching human multipotent stem cells to a plurality of microcarriers to form microcarrier-stem cell complexes, wherein the surface of the microcarriers is coated in a matrix or is uncoated, and culturing the microcarrier-stem cell complexes in suspension culture under conditions that induce the differentiation of the stem cells.

10. The method of any one of claims 71 to 9 wherein the matrix comprises one or more of Matrigel™ (BD Biosciences), hyaluronic acid, laminin, fibronectin, vitronectin, collagen, heparan sulphate, dextran sulphate, chondroitin sulphate. the stem cells are adult stem cells, or multipotent stem cells derived from pluripotent stem cells.

11. The method of any one of claims 1 to 910 wherein the matrix comprises a mixture of laminin, collagen I, heparan sulfate proteoglycans, and entactin 1. microcarriers are rod-shaped.

12. The method of any one of claims 1 to 11 wherein the microcarrier is a macroporous or microporous carboseed microcarrier. matrix comprises an extracellular matrix component.

13. The method of any one of claims 1 to ~~11~~12 wherein the microcarrier is positively charged or has a positive surface charge. ~~wherein the matrix comprises one or more of Matrigel™ (BD Biosciences), hyaluronic acid, laminin, fibronectin, vitronectin, collagen, elastin, heparan sulphate, dextran, dextran sulphate, chondroitin sulphate.~~

14. The method of any one of claims 1 to ~~11~~ 13 wherein in step (ii) the stem cells are cultured for a period of time sufficient to expand the number of stem cells in the culture. ~~wherein the matrix comprises a mixture of laminin, collagen I, heparan sulfate proteoglycans, and entactin 1.~~

~~15. The method of any one of claims 1 to 14 wherein the microcarrier comprises or consists of one or more of cellulose, dextran, hydroxylated methacrylate, collagen, gelatin, polystyrene, plastic, glass, ceramic, silicone.~~

~~16. The method of any one of claims 1 to 14 wherein the microcarrier is a macroporous or microporous carboseed microcarrier.~~

~~17. The method of any one of claims 1 to16 wherein the microcarrier is positively charged.~~

~~18. The method of any one of claims 1 to 17 wherein the microcarrier has a positive surface charge.~~

~~19. The method of any one of claims 1 to 18 wherein in step (ii) the stem cells are cultured for a period of time sufficient to expand the number of stem cells in the culture.~~

~~20~~15. The method of any one of claims 1 to ~~19~~14 wherein in each repeat cycle the stem cells of step (i) are obtained from the passaged cells of step (iii) of the preceding repeat cycle.

~~21~~16. The method of any one of claims 1 to 15~~20~~ wherein in step (iv), steps (i)-(iii) are repeated through one of: ~~at least 3 passages,~~ at least 4 passages, at least 5 passages, at least 6 passages, at least 7 passages, at least 8 passages, at least 9 passages, at least 10 passages, at least 11 passages, at least 12 passages, at least 13 passages, at least 14 passages, at least 15 passages, at least 16 passages, at least 17 passages, at least 18 passages, at least 19 passages, at least 20 passages, at least 21 passages, at least 22 passages, at least 23 passages, at least 24 passages, at least 25 passages, at least 30 passages, at least 40 passages, at least 50 passages, at least 60 passages, at least 70 passages, at least 80 passages, at least 90 passages, at least 100 passages.

~~22. An aggregate comprising two or more microcarriers having human multipotent cells attached thereto, wherein each microcarrier comprises one or more of cellulose, dextran, hydroxylated methacrylate, or collagen, and wherein the microcarrier has an~~

elongate shape and has a longest dimension of less than about 2000μm and a shortest dimension of more than about 10μm, and wherein the surface of the microcarrier is coated in a matrix comprising an extracellular matrix component, and wherein one or a plurality of human multipotent cells are attached to the matrix coating.

23. Use of a microcarrier in the culture of human multipotent cells *in vitro* to generate new cells having multipotent status, wherein the microcarrier comprises one or more of cellulose, dextran, hydroxylated methacrylate, or collagen, and wherein the microcarrier has an elongate shape and has a longest dimension of less than about 2000μm and a shortest dimension of more than about 10μm, and wherein the surface of the microcarrier is coated in a matrix comprising an extracellular matrix component, and wherein one or a plurality of human multipotent cells are attached to the matrix coating.

24. Use of a microcarrier in the *in vitro* differentiation of human multipotent cells, wherein the microcarrier comprises one or more of cellulose, dextran, hydroxylated methacrylate, or collagen, and wherein the microcarrier has an elongate shape and has a longest dimension of less than about 2000μm and a shortest dimension of more than about 10μm, and wherein the surface of the microcarrier is coated in a matrix comprising an extracellular matrix component, and wherein one or a plurality of human multipotent cells are attached to the matrix coating.

25. A method of culturing human multipotent cells *in vitro* to generate new cells having multipotent status, the method comprising culturing a microcarrier under conditions suitable for the generation of new cells having multipotent status, wherein the microcarrier comprises one or more of cellulose, dextran, hydroxylated methacrylate, or collagen, and wherein the microcarrier has an elongate shape and has a longest dimension of less than about 2000μm and a shortest dimension of more than about 10μm, and wherein the surface of the microcarrier is coated in a matrix comprising an extracellular matrix component, and wherein one or a plurality of human multipotent cells are attached to the matrix coating.

26. A method of differentiating human multipotent cells *in vitro*, the method comprising culturing a microcarrier under conditions that induce the differentiation of the multipotent cells, wherein the microcarrier comprises one or more of cellulose, dextran, hydroxylated methacrylate, or collagen, and wherein the microcarrier has an

elongate shape and has a longest dimension of less than about 2000μm and a shortest dimension of more than about 10μm, and wherein the surface of the microcarrier is coated in a matrix comprising an extracellular matrix component, and wherein one or a plurality of human multipotent cells are attached to the matrix coating.

Claims:

1. A method of culturing human multipotent stem cells in suspension culture *in vitro*, the method comprising:

(i) attaching human multipotent stem cells to a plurality of microcarriers to form microcarrier-stem cell complexes;
(ii) culturing the microcarrier-stem cell complexes in suspension culture;
(iii) passaging the cultured cells from (ii); and
(iv) repeating steps (i)-(iii) through at least 3 passages, wherein human multipotent stem cells are expanded between each passage, and

wherein stem cells in the culture after step (iv) are multipotent;

and wherein the microcarriers comprise or consist of cellulose, dextran, collagen, gelatin or polystyrene, hydroxylated methacrylate, or are macroporous or microporous carboseed microcarriers, the microcarriers being optionaly coupled with protamine or polylysine,

2. The method of claim 1 wherein in (i) the surface of the microcarriers is coated in a matrix, wherein the matrix comprises one or more of Matrigel™ (BD Biosciences), hyaluronic acid, laminin, fibronectin, vitronectin, collagen, heparan sulphate, dextran, dextran sulphate or chondroitin sulphate.

3. The method of claim 1 or 2 further comprising the step of inducing differentiation of the stem cells obtained after step (iv).

4. The method of claim 3 wherein the method comprises placing the microcarrier-stem cell complexes under conditions which induce the differentiation of the stem cells.

5. The method of any one of claims 1 to 4 wherein after step (iv) the method comprises the step of separating stem cells from the microcarriers and culturing the separated stem cells in non-microcarrier culture under conditions which induce differentiation of the stem cells.

6. The method of claim 1 further comprising the differentiation of multipotent stem cells, comprising:

(v) attaching multipotent stem cells obtained after step (iv) to a plurality of second microcarriers to form microcarrier-stem cell complexes, wherein

the surface of the second microcarriers is coated in a second matrix or is uncoated; and

(vi) culturing the microcarrier-stem cell complexes from (v) in suspension culture under conditions that induce the differentiation of the stem cells.

7. A method of claim 6 wherein in (i) the surface of the microcarriers is coated in a first matrix, wherein the matrix comprises an extracellular matrix component.

8. The method of any one of claims 1 to 7 wherein the stem cells are adult stem cells, or multipotent stem cells derived from pluripotent stem cells. .

9. The method of any one of claims 1 to 8 wherein the microcarriers are rod-shaped.

10. The method of any one of claims 7 to 9 wherein the matrix comprises one or more of Matrigel™ (BD Biosciences), hyaluronic acid, laminin, fibronectin, vitronectin, collagen, heparin sulphate, dextran sulphate, chondroitin sulphate.

11. The method of any one of claims 1 to 9 wherein the matrix comprises a mixture of laminin, collagen I, heparan sulfate proteoglycans, and entactin 1.

12. The method of any one of claims 1 to 11 wherein the microcarrier is a macroporous or microporous carboseed microcarrier.

13. The method of any one of claims 1 to 12 wherein the microcarrier is positively charged or has a positive surface charge.

14. The method of any one of claims 1 to 13 wherein in step (ii) the stem cells are cultured for a period of time sufficient to expand the number of stem cells in the culture.

15. The method of any one of claims 1 to 14 wherein in each repeat cycle the stem cells of step (i) are obtained from the passaged cells of step (iii) of the preceding repeat cycle.

16. The method of any one of claims 1 to 15 wherein in step (iv), steps (i)-(iii) are repeated through one of: at least 4 passages, at least 5 passages, at least 6 passages, at least 7 passages, at least 8 passages, at least 9 passages, at least 10 passages, at least 11 passages, at least 12 passages, at least 13 passages, at least 14 passages, at least 15 passages, at least 16 passages, at least 17 passages, at least 18 passages, at least 19 passages, at least 20 passages, at least 21 passages, at least 22 passages, at least 23 passages, at least 24 passages, at least 25 passages, at least 30 passages, at least 40

passages, at least 50 passages, at least 60 passages, at least 70 passages, at least 80 passages, at least 90 passages, at least 100 passages.