Claims

1. A method for producing retinal cells or a retinal tissue, comprising the following steps (1) - (3):
(1) a first step of culturing human pluripotent stem cells in the absence of feeder cells and in a medium comprising a factor for maintaining undifferentiated state,
(2) a second step of culturing the pluripotent stem cells obtained in the first step in suspension in the presence of a Sonic hedgehog signal transduction pathway activating substance to form a cell aggregate, wherein the Sonic hedgehog signal transduction pathway activating substance is selected from a protein belonging to the Hedgehog family, Shh receptor agonist, Purmorphamine(9-cyclohexyl-N-[4-(4-morpholinyl)phenyl]-2-(1-naphthalenyloxy)-9H-purin-6-amine) and SAG(N-methyl-N'-(3-pyridinylbenzyl)-N'-(3-chlorobenzo[b]thiophene-2-carbonyl)-1,4-diaminocyclohexane); and
(3) a third step of culturing the aggregate obtained in the second step in suspension in the presence of a BMP signal transduction pathway activating substance to obtain an aggregate containing retinal cells or a retinal tissue, wherein the BMP signal transduction pathway activating substance is added to the medium between day 2 and day 9 after the start of the second step and wherein the BMP signal transduction pathway activating substance is selected from BMP2, BMP4, BMP7, GDF7 and anti-BMP receptor antibody.

2. The production method according to claim 1, wherein, in the second step, the cells obtained in the first step are dispersed, and the dispersed cells are cultured in suspension.

3. The production method according to claim 1 or 2,

wherein the factor for maintaining undifferentiated state is one or more proteins selected from the group consisting of bFGF, FGF4, FGF8, EGF, Nodal, Activin A, Activin B, TGFβ1 and TGFβ2.

4. The production method according to claim 3, wherein the factor for maintaining undifferentiated state is bFGF.

5. The production method according to any of claims 1 to 4, wherein, in the second step, the concentration of the Sonic hedgehog signal transduction pathway activating substance in the medium is a concentration corresponding to Sonic hedgehog signal transduction activity of SAG at 10 nM to 700 nM.

6. The production method according to claim 1 to 5, wherein the BMP signal transduction pathway activating substance is BMP4.

7. The production method according to any of claims 1 to 6, wherein, in the third step, the BMP signal transduction pathway activating substance is added to the medium between day 3 and day 6 after the start of the second step.

8. The production method according to any of claims 1 to 7, wherein, in the third step, the aggregate is cultured in a medium containing a Sonic hedgehog signal transduction pathway activating substance at a concentration not more than a concentration corresponding to Sonic hedgehog signal transduction activity of SAG at 700 nM.

9. The production method according to any of claims 1 to 8, wherein the first step is performed by an adhesion

culturing method.

10. The production method according to any of claims 1 to 9, wherein the pluripotent stem cells are induced pluripotent stem cells.

11. The production method according to any of claims 1 to 10, wherein uniformed aggregates are formed in the second step.

12. The production method according to any of claims 1 to 11, wherein the aggregate obtained in the third step comprises one or more cells selected from the group consisting of retinal progenitor cell, neural retinal progenitor cell, photoreceptor precursor cell, photoreceptor cell, rod photoreceptor cell, cone photoreceptor cell, horizontal cell, amacrine cell, interneuron, ganglion cell, retinal pigment epithelial cell, and ciliary marginal zone cell.

13. The production method according to any of claims 1 to 12, wherein the suspension culturing is performed in the absence of a basement membrane preparation.

14. A method for producing a neural retina comprising:

producing a cell aggregate comprising a retinal tissue by the production method according to any one of claims 1 to 13, and,

cutting out the retinal tissue from the cell aggregate.