[0012] In the fourth subpopulation (D), at least one of genes *PAX6*, *SIX3*, and *SLC2A1* is expressed in the Day 26-34 gene profile. Desirably, more or most of these genes are expressed.

[0013] In the fifth subpopulation (E), at least one of genes *VSX2*, *PTH2*, *FZD5*, *RARRES2*, *DIO3*, *SOX2*, and *CYP1B1* is expressed in the Day 26-34 gene profile. Desirably, more or most of these genes are expressed.

[0013a] In one aspect, the present disclosure refers to a photoreceptor progenitor cell, wherein a Day 26-34 gene profile indicates that:

(A) (i) *CRX* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, or (ii) *C11orf96* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, or (iii) *NEUROD4* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million; or

(B) (i) *STMN2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million, or (ii) *ONECUT2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million, or (iii) *ELAVL4* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million; or

(C) (i) *CNTN2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, or (ii) *POU4F2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million; or

(E) (i) *VSX2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million.

[0013b] In one aspect, the present disclosure refers to a method for producing a population of photoreceptor progenitors, comprising:

plating pluripotent human stem cells on a cell culture surface having a laminin matrix thereon, wherein the laminin matrix comprises (i) a first laminin which is laminin-521, wherein the laminin-521 is an intact protein; and (ii) a second laminin selected from the group consisting of laminin-323 and laminin-523, wherein the second laminin is an intact protein;

culturing the pluripotent human stem cells in a neural induction medium comprising a TGFβ inhibitor and a Wnt inhibitor for a first time period of about 120 hours to about 168 hours;

culturing the pluripotent human stem cells in a photoreceptor differentiation medium comprising a brain derived neurotrophic factor (BDNF), a ciliary neurotrophic factor (CNTF), retinoic acid, and a gamma secretase inhibitor for a second time period of about 288 hours to about 816 hours; and

identifying the population of photoreceptor progenitors by (i) preparing a Day 16-24 gene profile and selecting photoreceptor progenitors in which at least one of genes DAPL1, SIX6 SFRP2, LHX2, *PAX6*, CDH2, CLDN1, TRPM3, RELN, DCT and PMEL is expressed; and (ii) preparing a Day 26-34 gene profile and selecting photoreceptor progenitors in which:

CLAIMS:

1. A photoreceptor progenitor cell, wherein a Day 26-34 gene profile indicates that:

(A) (i) *CRX* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, or (ii) *C11orf96* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, or (iii) *NEUROD4* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million; or

(B) (i) *STMN2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million, or (ii) *ONECUT2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million, or (iii) *ELAVL4* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million; or

(C) (i) *CNTN2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, or (ii) *POU4F2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million; or

(E) (i) *VSX2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million.

2. The photoreceptor progenitor cell of claim 1, wherein the Day 26-34 gene profile indicates that (i) *CRX* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, and (ii) *C11orf96* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million.

3. The photoreceptor progenitor cell of claim 2, wherein the Day 26-34 profile also indicates that *NEUROD4* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million.

4. The photoreceptor progenitor cell of claim 2, wherein the Day 26-34 profile also indicates that *RCVRN, FAM57B, or SYT4* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million.

5. The photoreceptor progenitor cell of claim 1, wherein the Day 26-34 gene profile indicates that (i) *STMN2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million, and (ii) *ONECUT2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million.

6. The photoreceptor progenitor cell of claim 5, wherein the Day 26-34 profile also indicates that *ATOH7* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million.

7. The photoreceptor progenitor cell of claim 1, wherein the Day 26-34 gene profile indicates that (i) *CNTN2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, and (ii) *POU4F2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million.

8. The photoreceptor progenitor cell of claim 7, wherein the Day 26-34 profile also indicates that *CXCR4* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million.

9. The photoreceptor progenitor cell of claim 1, wherein the Day 26-34 profile indicates that (i) *VSX2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million, and (ii) *PTH2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million.

10. The photoreceptor progenitor cell of claim 1, wherein a Day 16-24 gene profile indicates that at least one of genes *DAPL1*, *SIX6*, *SFRP2*, *LHX2*, *PAX6*, *CDH2*, *CLDN1*, *TRPM3*, *RELN*, *DCT*, and *PMEL* is expressed.

11. The photoreceptor progenitor cell of claim 10, wherein the Day 16-24 gene profile indicates that *PAX6* is expressed.

12. A method for producing a population of photoreceptor progenitors, comprising:

plating pluripotent human stem cells on a cell culture surface having a laminin matrix thereon, wherein the laminin matrix comprises (i) a first laminin which is laminin-521, wherein the laminin-521 is an intact protein; and (ii) a second laminin selected from the group consisting of laminin-323 and laminin-523, wherein the second laminin is an intact protein;

culturing the pluripotent human stem cells in a neural induction medium comprising a TGFβ inhibitor and a Wnt inhibitor for a first time period of about 120 hours to about 168 hours;

culturing the pluripotent human stem cells in a photoreceptor differentiation medium comprising a brain derived neurotrophic factor (BDNF), a ciliary neurotrophic factor (CNTF), retinoic acid, and a gamma secretase inhibitor for a second time period of about 288 hours to about 816 hours; and

identifying the population of photoreceptor progenitors by (i) preparing a Day 16-24 gene profile and selecting photoreceptor progenitors in which at least one of genes DAPL1, SIX6 SFRP2, LHX2, *PAX6*, CDH2, CLDN1, TRPM3, RELN, DCT and PMEL is expressed; and (ii) preparing a Day 26-34 gene profile and selecting photoreceptor progenitors in which:

(A) (i) *CRX* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, or (ii) *C11orf96* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, or (iii) *NEUROD4* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million; or

(B) i) *STMN2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million, or (ii) *ONECUT2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 10 gene count-per-million, or (iii) *ELAVL4* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 1 gene count-per-million; or

(C) (i) *CNTN2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million, or (ii) *POU4F2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million; or

(E) *VSX2* is expressed with a Log2 normalized and cell cycle adjusted gene count of at least 5 gene count-per-million.

13. The method of claim 12, wherein the neural induction medium comprises:
from about 5 μM to about 15 μM of the TGFβ inhibitor; and
from about 5 μM to about 15 μM of the Wnt inhibitor.

14. The method of claim 12, wherein:
the TGFβ inhibitor is SB431542; or
the Wnt inhibitor is CKI-7.

15. The method of claim 12, wherein the photoreceptor differentiation medium comprises:
from about 1 ng/mL to about 20 ng/mL of the brain derived neurotrophic factor (BDNF);
from about 1 ng/mL to about 30 ng/mL of the ciliary neutrotrophic factor (CNTF);
from about 0.1 μM to about 5 μM of the retinoic acid; and
from about 5 μM to about 15 μM of the gamma secretase inhibitor.

16. The method of claim 12, wherein the gamma secretase inhibitor is DAPT.

17. The method of claim 12, wherein the weight ratio of the second laminin to the first laminin is from about 1:1 to about 4:1.