What is claimed is:

1. An isolated limbal stem or progenitor cell (LSC) population or LSC-like population comprising a chemically synthesized, recombinant or isolated nucleic acid encoding PAX6 integrated into a chromosome, or as an extrachromosomal genetic material, wherein the isolated LSC population is substantially free of non-LSC cells or wherein the LSC-like population is substantially free of non-LSC-like cells, or wherein the isolated LSC or LSC-like population is substantially free of non-LSC and non-LSC-like cells.

2. The isolated LSC population or LSC-like population of claim 1, wherein the chemically synthesized, recombinant or isolated nucleic acid can express PAX6 or a fragment thereof, wherein PAX6 or a fragment thereof can maintain LSC or LSC-like state or can direct a stem cell or progenitor cell to a LSC or LSC-like state, and wherein LSC or LSC-like state restricts a cell population to a differentiation pathway resulting in corneal epithelial cells (CECs).

3. The isolated LSC population or LSC-like population of claim 2, wherein the chemically synthesized, recombinant or isolated nucleic acid expresses PAX6 or a fragment thereof, wherein PAX6 or a fragment thereof maintains LSC or LSC-like state or directs a stem cell or progenitor cell to a LSC or LSC-like state, and wherein LSC or LSC-like state restricts a cell population to a differentiation pathway resulting in corneal epithelial cells.

4. An isolated skin epithelial stem cell (SESC) population or SESC-like population comprising a chemically synthesized, recombinant or isolated nucleic acid encoding PAX6 integrated into a chromosome, or alternatively, not integrated remaining as an extrachromosomal genetic material, wherein the isolated SESC population is substantially free of non-SESC cells, or wherein the SESC-like population is substantially free of non-SESC-like cells, or wherein the isolated SESC or SESC-like population is substantially free of non-SESC and non-SESC-like cells, or wherein the

isolated SESC or SESC-like population is substantially free of non-SESC, non-SESC-like, non-LSC and non-LSC-like cells.

5. The isolated SESC or SESC-like population of claim 4, wherein the chemically synthesized, recombinant or isolated nucleic acid can express PAX6 or a fragment thereof, wherein PAX6 or a fragment thereof can maintain LSC or LSC-like state or can direct a stem cell or progenitor cell to a LSC or LSC-like state, and wherein LSC or LSC-like state restricts a cell population to a differentiation pathway resulting in corneal epithelial cells.

6. The isolated SESC or SESC-like population of claim 5, wherein the chemically synthesized, recombinant or isolated nucleic acid expresses PAX6 or a fragment thereof, wherein PAX6 or a fragment thereof directs SESC or SESC-like cell to a LSC or LSC-like state, wherein LSC or LSC-like state restricts a cell population to a differentiation pathway resulting in corneal epithelial cells.

7. A pharmaceutical composition comprising the LSC population or LSC-like population of claim 1 and a suitable carrier.

8. A pharmaceutical composition comprising the SESC population or SESC-like population of claim 4 and a suitable carrier.

9. The LSC population or LSC-like population of claim 1, that differentiates into a corneal epithelial cell population.

10. The SESC population or SESC-like population of claim 4, which differentiates into corneal epithelial cells.

11. The LSC population or LSC-like population of claim 1, wherein 90-95% of the LSC population or LSC-like population expresses p63, PAX6, K19 and Ki67.

12. The LSC population or LSC-like population of claim 1, wherein less than 5% of the LSC population expresses K5 and K14.

13. The LSC population of claim 1, wherein greater than 95% of the LSC population expresses WNT7A and FZD5.

14. The LSC-like population of claim 1, wherein less than 5% of the LSC-like population expresses WNT7A.

15. The SESC population or SESC-like population of claim 4, wherein 90-95% of the cell population expresses p63, K5 and Ki67 while remaining in a SESC or SESC-like cell fate.

16. The SESC population or SESC-like population of claim 4, wherein K3 or K12 expression is not detected in cells remaining in a SESC or SESC-like cell fate.

17. The SESC population of claim 4, wherein WNT7A is expressed in cells remaining in a SESC or SESC-like cell fate at about 4-5 fold lower level than the level in LSC cells.

18. The SESC population or SESC-like population of claim 4, wherein PAX6 is not expressed or expressed in cells remaining in a SESC or SESC-like cell fate at a level less than about one eighth of the level in LSC cells.

19. The SESC-like population of claim 4, wherein WNT7A is expressed in more than 70% of cells remaining in a SESC-like fate.

20. The LSC population or LSC-like population of claim 2, wherein the corneal epithelial cells express PAX6 and corneal epithelial markers, K3 and K12.

21. Tissue comprised of the cells of claim 1 or 4.

22. The cell of claim 1 or 4 for regenerating or repairing tissue in a subject, wherein said cell is to be introduced into or onto a subject in a sufficient amount to regenerate or repair tissue.

23. The cell of claim 22, wherein the tissue regenerated or repaired comprises tissues of corneal epithelial cell lineage comprising limbal stem or progenitor cell (LSC) and corneal epithelial cell.

24. A method for obtaining limbal stem cell or progenitor (LSC)-like cells from skin epithelial stem cells (SESCs) of a subject, the method comprising introduction of a PAX6 gene or up-regulating PAX6 gene expression in SESCs, in order to increase PAX6 protein in SESCs to a sufficient level so as to convert SESCs to LSC-like cells, thereby obtaining LSC-like cells from SESCs of a subject.

25. The method of claim 24, wherein introduction of a PAX6 gene or up-regulating PAX6 gene expression in SESCs for obtaining limbal stem or progenitor cell (LSC)-like cells from skin epithelial stem cells (SESCs) of a subject comprises:

(a) culturing SESCs obtained from the subject in a feeder-free cell culture in vitro or ex vivo;

(b) introducing at least one PAX6 gene or up-regulating PAX6 gene expression in the SESCS so as to increase PAX6 protein in SESCs to a sufficient level so as to convert SESCs to limbal stem cell or progenitor (LSC)-like cells, thereby obtaining mammalian limbal stem cell or progenitor (LSC)-like cells from skin epithelial stem cells (SESCs) from a subject.

26. The method of claim 24, wherein the method is an in vitro method, ex vivo method or in situ or directly applied on a subject.

27. The method of claim 24, wherein the subject is treated with an agent that introduces a nucleic acid encoding PAX6 protein, up-regulates PAX6 gene expression, or increases PAX6 activity.

28. The method of claim 24, wherein the agent comprises a gene therapy vector, viral particle, lentivirus, adenovirus, adeno-associated virus, recombinant nucleic acid, recombinant protein, PAX6 protein, small molecule regulator of PAX6 expression, inhibitor of a negative regulator of PAX6 expression, a small molecule inhibitor of a negative regulator of PAX activity, a small molecule enhancer of PAX6 activity, or a combination thereof.

29. The method of claim 24, wherein the PAX6 gene is selected from a set of PAX6a gene, PAX6b gene, engineered PAX6a gene, engineered PAXb gene, any member of the PAX6 gene family, nucleic acid encoding all or part of PAX6a protein, nucleic acid encoding all or part of PAX6b protein, and any nucleic acid encoding a protein with PAX6 or PAX6-like activity.

30. The method of claim 29, wherein a protein with PAX6 or PAX6-like activity is any protein which can cause increased expression of endogenous K19, wherein the K19 upregulated SECS may differentiate to corneal epithelial cell (CEC) or CEC-like cells with increased expression of K3 and K12 genes and decreased expression of K1 and K10 genes.

31. A method for obtaining corneal epithelial cell (CEC)-like cells from LSC-like cells of claim 25, further comprising differentiating cells of (c) in a feeder-free LSC differentiation medium so as to convert LSC-like cells to CEC-like cells.

32. The method of claim 31, wherein the feeder-free LSC differentiation medium is chemically defined, xeno-free or free of components other than components derived from the same species as the cultured cells, serum-free, and/or devoid of any animal or human product.

33. A method for obtaining and expanding in vitro mammalian limbal stem or progenitor cells (LSCs) from a subject in a feeder-free LSC culture medium, wherein the method comprises:

(a) dissociating a sample of tissue obtained from the limbus region of an eye from the subject so as to obtain single cells; and

(b) culturing single cells of (a) in a feeder-free cell culture medium so as to permit LSCs to proliferate, wherein the proliferated LSCs have a potential to differentiate into corneal epithelial cells (CECs), thereby obtaining and expanding in vitro mammalian limbal stem cells from a subject.

34. The method of claim 33, wherein in (c), single cells are cultured on a matrix or an extracellular matrix selected from a group consisting of Matrigel® or its equivalent, growth factor reduced Matrigel® or its equivalent, collagen, collagen IV, collagen IV sheet, mammalian amniotic membrane, human amniotic membrane, fibrinogen, thrombin, perlecan, laminin, fibronectin, recombinant fibronectin, proteoglycan, procollagens, hyaluronic acid, entactin, heparan sulfate, tenascin, poly-L-lysine, gelatin, poly-L-ornithine, extracellular matrix proteins, thrombin sheet, fibrinogen and thrombin sheet , and any combination thereof.

35. The method of claim 33, further comprising step (d), wherein the proliferated LSCs or LSC-like cells are passaged at 70-90% confluence before passage and 15-20% confluence after passage.

36. The method of claim 33, wherein the limbus region comprises corneal limbus of an eye, margin between cornea and conjunctiva, border of cornea and sclera, corneoscleral limbus, a region comprising interpalisade rete ridge, or a region comprising Palisades of Vogt.

37. The method of claim 33, wherein dissociating the tissue in (b) comprises treating with a dissociation agent or agents wherein the dissociation agent or agents is an

equipment or tool to mechanically dissociate tissue to smaller masses and single cells, enzyme, protease, a chemical, a metal chelator, laser or combination thereof.

38. The method of claim 33, wherein the feeder-free cell culture medium comprises a minimum essential medium, a growth factor, a hormone, and a soluble factor.

39. method of claim 38, wherein the feeder-free cell culture medium further comprises serum, preferably serum from a species from which the LSCs are being obtained and expanded or a serum substitute.

40. The method of claim 38, wherein the feeder-free cell culture medium further comprises Leukemia Inhibitory Factor (LIF) and/or a rho-associated protein kinase (ROCK) inhibitor selected from the group consisting of (R)-(+)-trans-4-(1-aminoethyl)-N-(4-Pyridyl)cyclohexanecarboxamide dihydrochloride monohydrate (Y-27632), 5-(1,4-diazepan- 1 -ylsulfonyl) isoquinoline (fasudil or HA 1077), H-1152, H-1152P, (S)-(+)-2-Methy1-1-[(4-methyl-5 isoquinolinyl)sulfonyl]homopiperazine dihydrochloride, Dimethylfasudil (diMF; H-1152P), N-(4-Pyridyl)-N'-(2,4,6-trichlorophenyl)urea, Y-39983, Wf-536, SNJ-1656, and (S)-(+)-2-methy1-1-[(4-methyl-5 -isoquinolinyl)sulfonyl]-hexahydro-1H-1,4-diazepine dihydrochloride (H-1152), imidazole-containing benzodiazepines, imidazopyridine derivative, compound comprising an indazole core, a 2-aminopyridine/pyrimidine core, a 9-deazaguanine derivative, benzamide, or aminofurazan, and derivative and analog thereof, and a combination thereof.

41. The method of claim 40, wherein the ROCK inhibitor is added to the feeder-free cell culture medium after passage four (4) of LSCs, following isolation of LSCs from the subject.

42. The method of claim 33, wherein the feeder-free cell culture medium comprises DMEM/F12 medium, DMEM, penicillin-streptomycin, serum, EGF, insulin, hydrocortisone, cholera toxin, 3,3',5-triiodo-L-thyronine, or combination thereof, wherein

serum may be fetal bovine serum but preferably serum from same species as LSC being cultured or a serum substitute.

43. The method of claim 33, wherein LSCs express a set of markers comprising WNT7A, FZD5, PAX6, p63, keratin 5 (K5), keratin 14 (K14), keratin 19 (K19) and Ki67.

44. The method of claim 33, wherein 90-95% of the LSCs express p63, PAX6, K19 and Ki67.

45. The method of claim 33, wherein less than 5% of the LSCs express K5 and K14.

46. The method of claim 33, wherein greater than 95% of the LSCs express WNT7A and FZD5.

47. The LSCs, or LSC-like cells of claim 1 for use in treating a subject with a disease associated with malfunctioning limbal stem cells or corneal epithelial cells, wherein the cells are to be transplated to an affected eye of a subject, wherein the transplanted cells populate cornea or limbus of the affected eye of the subject and restore normal cornea clarity and transparency,

thereby treating the subject with the disease associated with malfunctioning limbal stem or progenitor cells or corneal epithelial cells.

48. The LSCs, LSC-like, CECs or CEC-like cells produced by the method of claims 25, or 31 for use in treating a subject with a disease associated with malfunctioning limbal stem cells or corneal epithelial cells, wherein said cells are to be transplanted to an affected eye of a subject, wherein the transplanted cells populate cornea or limbus of the affected eye of the subject and restore normal cornea clarity and transparency,

thereby treating the subject with the disease associated with malfunctioning limbal stem or progenitor cells or corneal epithelial cells.

49. The cell of claim 47, wherein the disease or condition is a deficiency of limbal stem or progenitor cells, a deficiency of corneal epithelial cells, damage to corneal limbus, damage to cornea of an eye, damage to limbal stem cells, damage to corneal epithelial cells, congenital defect affecting corneal development or function, acquired defect affecting corneal development or function, congenital defect affecting cell fate determination switching corneal to skin lineage, acquired defect affecting cell fate determination switching corneal to skin lineage, abnormal epidermal differentiation, Stevens-Johnson syndrome, aniridia, recurrent pterygium, corneal disease, corneal epithelium squamous metaplasia, inflammatory keratopathy, trauma, chemical burns, alkaline burn, partial blindness, or complete blindness.

50. A method to determine if a patient with ocular metaplasia may benefit from treatment with PAX6 gene or gene product, wherein the method comprises assessing gene expression or protein level of WNT7A, PAX6, K3 and/or K12 in area of metaplasia, absence of WNT7A, PAX6, K3 and/or K12 in area of metaplasia indicates the patient with ocular metaplasia may benefit from treatment with PAX6 gene or gene product or cells of claim 1 or 4.

51. A kit comprising LSCs, LSC-like, CECs or CEC-like cells produced by the method of claim 25, 31, or combination of said cells thereof, culture media and supplements, a packing material and an instruction for use.

52. The kit of claim 51 further comprising a pharmaceutically acceptable carrier.

53. The kit of claim 52, wherein the pharmaceutically acceptable carrier is a contact lens or its equivalent used to support cell attachment or growth in a curvature as curvature of a human or animal eye.

54. The kit of claim 53 further comprising human amniotic membrane or animal amniotic membrane.

55. A method for assessing risk of developing an eye disease affecting cornea or cornea function in a subject, wherein said method comprises assessing activity of WNTZ7A, FZD5 and PAX6 or combination thereof, in LSCs or corneal epithelial cells, wherein lower activity or no activity of WNTZ7A, FZD5 and PAX6 or combination thereof indicates a higher risk of developing an eye disease affecting the cornea or cornea function in a subject, thereby assessing the risk of developing an eye disease affecting cornea or cornea function in a subject.

56. A method for obtaining and expanding skin epithelial stem cell (SESC) in vitro from a subject in a feeder-free cell culture medium, wherein the method comprises:

(a) dissociating a sample of tissue, which was obtained from the interfollicular epidermis or any SESC stem cell niche harboring SESCs in the subject, so as to obtain single cells; and

(b) culturing single cells of (a) in a feeder-free cell culture medium so as to permit SESCs to proliferate, wherein the proliferated SESCs have a potential to differentiate into skin epidermal cells, thereby obtaining and expanding in vitro skin epithelial stem cells in vitro from a subject.

57. The method of claim 56,further comprising differentiating isolated SESC or SESC-like cells in CnT-02 or equivalent medium which support differentiation of SESC or SESC-like cells to skin epidermal cells or skin epidermal-like cells, thereby obtaining skin epidermal cells or skin epidermal-like cells from SESC or SESC-like cells in vitro.