WHAT IS CLAIMED IS:

1. A vector for conditionally expressing proteins having the functions of immunomodulators comprising a polynucleotide encoding a gene switch, wherein said polynucleotide comprises (1) at least one transcription factor sequence which is operably linked to a promoter, wherein said at least one transcription factor sequence encodes a ligand-dependent transcription factor, and (2) a polynucleotide encoding a protein having the function of IL-12 and one or more proteins having the function of an immunomodulator operably linked to a promoter which is activated by said ligand-dependent transcription factor, wherein the one or more immunomodulators are selected from IL-1, IL-2, IL-3, IL-4, IL-5, IL-7, IL-8, IL-9, IL-10R DN or a subunit thereof, IL-15, IL-18, IL-21, IL-23, IL-24, IL-27, GM-CSF, IFN-gamma, IL-15-R-alpha, CCL3 (MIP-1a), CCL5 (RANTES), CCL7 (MCP3), XCL1(lymphotactin), CXCL1 (MGSA-alpha), CCR7, CCL19 (MIP-3b), CXCL9 (MIG), CXCL10 (IP-10), CXCL12 (SDF-1), CCL21 (6Ckine), OX40L, 4-1BBL, CD40, CD70, GITRL, LIGHT, b-Defensin, HMGB1, Flt3L, IFN-beta, TNF-alpha, dnFADD, BCG, TGF-alpha, TGFbRII DN, ICOS-L and S100.

2. The vector of claim 1, which is an adenoviral vector.

3. The vector of claim 1, wherein said polynucleotide encoding said one or more proteins having the functions of the immunomodulator and said polynucleotide encoding said protein(s) having the function of IL-12 are under control of a regulated promoter of said gene switch.

4. The vector of claim 1, wherein said gene switch is an ecdysone receptor (EcR)-based gene switch.

5. The vector of claim 1, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence under the control of a first promoter and a second transcription factor sequence under the control of a second promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription

factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

6. The vector of claim 1, wherein said polynucleotide encoding the one or more proteins having the functions of the immunomodulator encodes the human immunomodulator(s).

7. The vector of claim 1, wherein said polynucleotide encoding the protein having the function of IL-12 encodes human IL-12.

8. An *in vitro* method of producing a population of immune cells or therapy support cells (TSC) expressing protein(s) having the function of one or more immunomodulators, comprising modifying the immune cells with the vector of claim 1.

9. The method of claim 8, wherein said vector is an adenoviral vector.

10. The method of claim 8, wherein said polynucleotide encoding said protein having the function of the immunomodulator and the polynucleotide encoding said protein having the function of IL-12 are under control of said gene switch.

11. The method of claim 8, wherein said gene switch is an EcR-based gene switch.

12. The method of claim 8, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence under the control of a first promoter and a second transcription factor sequence under the control of a second promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

13. The method of claim 8, wherein said polynucleotide encoding the protein having the function of the immunomodulator encodes the human immunomodulator.

14. The method of claim 8, wherein said polynucleotide encoding a protein having the function of IL-12 encodes human IL-12.

15. The method of claim 8, wherein said cells are human dendritic cells.

16. The method of claim 15, wherein said dendritic cells are bone marrow dendritic cells.

17. A population of immune cells or TSC expressing protein(s) having the function of one or more immunomodulators, which have been modified with the vector of claim 1.

18. The population of claim 17, wherein said vector is an adenoviral vector.

19. The population of claim 17, wherein said polynucleotide encoding said protein having the function of the immunomodulator and the polynucleotide encoding said protein having the function of IL-12 are under control of said gene switch.

20. The population of claim 17, wherein said gene switch is an EcR-based gene switch.

21. The population of claim 17, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence under the control of a first promoter and a second transcription factor sequence under the control of a second promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

22. The population of claim 17, wherein said polynucleotide encoding the protein having the function of the immunomodulator encodes the human immunomodulator.

23. The population of claim 17, wherein said polynucleotide encoding a protein having the function of IL-12 encodes human IL-12.

24. The population of claim 17, wherein said cells are human dendritic cells.

25. The population of claim 24, wherein said dendritic cells are bone marrow dendritic cells.

26. An *in vitro* engineered immune cell or a TSC comprising the vector of claim 1.

27. The *in vitro* engineered immune cell of claim 26, wherein said vector is an adenoviral vector.

28. The *in vitro* engineered immune cell of claim 26, wherein said polynucleotide encoding said protein having the function of the immunomodulator and the polynucleotide encoding said protein having the function of IL-12 are under control of said gene switch.

29. The *in vitro* engineered immune cell of claim 26, wherein said gene switch is an EcR-based gene switch.

30. The *in vitro* engineered immune cell of claim 26, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence under the control of a first promoter and a second transcription factor sequence under the control of a second promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

31. The *in vitro* engineered immune cell of claim 26, wherein said polynucleotide encoding the protein having the function of the immunomodulator encodes the human immunomodulator.

32. The *in vitro* engineered immune cell of claim 26, wherein said polynucleotide encoding a protein having the function of IL-12 encodes human IL-12.

33. The *in vitro* engineered immune cell of claim 26, wherein said immune cell is a human dendritic cell.

34. The *in vitro* engineered immune cell of claim 33, wherein said dendritic cell is a bone marrow dendritic cell.

35. A pharmaceutical composition comprising the population of *in vitro* engineered immune cells or TSC according to claim 17.

36. A pharmaceutical composition comprising the *in vitro* engineered immune cell or the TSC of claim 26.

37. The pharmaceutical composition of claim 35 or 36, wherein the pharmaceutical composition is suitable for intratumoral, intraperitoneal or subcutaneous administration.

38. The pharmaceutical composition of claim 35, wherein said population of cells comprises at least 10^4 cells.

39. The pharmaceutical composition of claim 35, wherein said population of cells comprises at least 10^7 cells.

40. Use of the combination of the immune cell or TSC of claim 17 and a therapeutically effective amount of an activating ligand in the preparation of medicaments for treating a tumor in a mammal, whereinsaid one or more immunomodulators selected from IL-1, IL-2, IL-3, IL-4, IL-5, IL-7, IL-8, IL-9, IL-10R DN or a subunit thereof, IL-15, IL-18, IL-21, IL-23, IL-24, IL-27, GM-CSF, IFN-gamma, IL-15R alpha, CCL3 (MIP-1a), CCL5 (RANTES), CCL7 (MCP3), XCL1(lymphotactin), CXCL1 (MGSA-alpha), CCR7, CCL19 (MIP-3b), CXCL9 (MIG), CXCL10 (IP-10), CXCL12 (SDF-1), CCL21 (6Ckine), OX40L, 4-1BBL, CD40, CD70, GITRL, LIGHT, b-Defensin, HMGB1, Flt3L, IFN-beta, TNF-alpha, dnFADD, TGF-alpha, TGFbRII DN, ICOS-L and S100 is expressed.

41. The use of claim 40, wherein said tumor is a benign tumor.

42. The use of claim 40, wherein said tumor is a malignant tumor.

43. The use of claim 40, wherein said tumor is a melanoma.

44. The use of claim 40, wherein said tumor is a malignant melanoma skin cancer.

45. The use of claim 40, wherein said *in vitro* engineered immune cells comprise a vector comprising a polynucleotide encoding a gene switch, wherein said polynucleotide comprises (1) at least one transcription factor sequence operably linked to a promoter, wherein said at least one transcription factor sequence encodes a ligand-dependent transcription factor, and (2) a polynucleotide encoding a protein having the function of the immunomodulator linked to a promoter which is activated by said ligand-dependent transcription factor.

46. The use of claim 40, wherein said vector is an adenoviral vector.

47. The use of claim 40, wherein said polynucleotide encoding said protein having the function of the immunomodulator and the polynucleotide encoding said protein having the function of IL-12 are under control of said gene switch.

48. The use of claim 47, wherein said gene switch is an EcR-based gene switch.

49. The use of claim 48, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence under the control of a first promoter and a second transcription factor sequence under the control of a second promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

50. The use of claim 40, wherein said polynucleotide encoding the protein having the function of the immunomodulator encodes the human immunomodulator.

51. The use of claim 40, wherein said polynucleotide encoding a protein having the function of IL-12 encodes human IL-12.

52. The use of claim 40, wherein said immune cells are human dendritic cells.

53. The use of claim 52, wherein said dendritic cells are bone marrow dendritic cells.

54. The use of claim 40, wherein said ligand is a diacylhydrazine.

55. The use of claim 40, wherein said ligand is selected from RG-115819, RG-115932, and RG-115830.

56. The use of claim 40, wherein said ligand is an amidoketone or oxadiazoline.

57. The use of claim 40, wherein said ligand is administered less than one hour before or after said *in vitro* engineered immune cells.

58. The use of claim 40, wherein said ligand is administered less than 24 hours after said *in vitro* engineered immune cells.

59. The use of claim 40, wherein said ligand is administered less than 48 hours after said *in vitro* engineered immune cells.

60. A method for determining the efficacy of an *in vitro* engineered immune cell based therapeutic regime in a patient comprising:

(a) measuring the level of expression or the level of activity or both of interferon-gamma (IFN-γ) in a first biological sample obtained from said patient in need thereof before administration of *in vitro* engineered immune cells, thereby generating a control level;

(b) administering to a patient in need thereof, *in vitro* engineered immune cells engineered to conditionally express one or more proteins having the functions of an immunomodulator and a protein having the function of IL-12;

(c) administering to said patient in need thereof an effective amount of an activating ligand;

(d) measuring the level of expression or the level of activity or both of IFN- γ in a second biological sample obtained from said patient in need thereof following administration of *in vitro* engineered immune cells and activating ligand, thereby generating a test level; and

(e) comparing the control level to the test level of IFN- γ, wherein an increase in the test level of expression, activity or both of IFN- γ relative to the control level indicates that the therapeutic regime is effective in said patient in need thereof,

wherein the immunomodulator is selected from IL-1, IL-2, IL-3, IL-4, IL-5, IL-7, IL-8, IL-9, IL-10R DN or a subunit thereof, IL-15, IL-18, IL-21, IL-23, IL-24, IL-27, GM-CSF, IFN-gamma, IL-15R alpha, CCL3 (MIP-1a), CCL5 (RANTES), CCL7 (MCP3), XCL1(lymphotactin), CXCL1 (MGSA-alpha), CCR7, CCL19 (MIP-3b), CXCL9 (MIG), CXCL10 (IP-10), CXCL12 (SDF-1), CCL21 (6Ckine), OX40L, 4-1BBL, CD40, CD70, GITRL, LIGHT, b-Defensin, HMGB1, Flt3L, IFN-beta, TNF-alpha, dnFADD, TGF-alpha, TGFbRII DN, ICOS-L and S100.

61. The method of claim 60, wherein said patient in need thereof is a human patient.

62. The method of claim 60, wherein said patient is a cancer patient.

63. The method of claim 62, wherein said cancer patient is a melanoma patient.

64. The method of claim 60, wherein the level of IFN-γ is measured by ELISA.

65. The method of claim 60, wherein said immune cells are engineered *in vitro* to conditionally express one or more proteins having the functions of an immunomodulators and the protein having the function of IL-12 and comprise a vector comprising a polynucleotide encoding a gene switch, wherein said polynucleotide comprises (1) at least one transcription factor sequence operably linked to a promoter, wherein said at least one transcription factor sequence encodes a ligand-dependent transcription factor, and (2) a polynucleotide encoding one or more proteins having the function of the immunomodulator and, the IL-12 linked to a promoter which is activated by said ligand-dependent transcription factor.

66. The method of claim 65, wherein said vector is an adenoviral vector.

67. The method of claim 65, wherein said gene switch is an EcR-based gene switch.

68. The method of claim 67, wherein said ligand binds to the EcR ligand binding domain.

69. The method of claim 67, wherein said ligand is a diacylhydrazine.

70. The method of claim 69, wherein said ligand is selected from RG-115819, RG-115932, and RG-115830.

71. The method of claim 67, wherein said ligand is an amidoketone or oxadiazoline.

72. The method of claim 67, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence under the control of a first promoter and a second transcription factor sequence under the control of a second promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

73. The method of claim 65, wherein said polynucleotide encoding a protein having the function of IL-12 encodes human IL-12.

74. The method of claim 61, wherein said immune cells are human dendritic cells.

75. The method of claim 74, wherein said dendritic cells are bone marrow dendritic cells.

76. The method of claim 60, wherein said activating ligand is administered intratumorally, orally, intraperitoneally, or subcutaneously.

77. The method of claim 60, wherein said activating ligand is administered less than one hour before or after said *in vitro* engineered dendritic cells.

78. The method of claim 60, wherein said activating ligand is administered less than 24 hours after said *in vitro* engineered dendritic cells.

79. The method of claim 60, wherein said activating ligand is administered less than 48 hours after said *in vitro* engineered dendritic cells.

80. A kit comprising (a) immune cells engineered to contain a vector comprising a polynucleotide encoding a gene switch controlling expression of one or more proteins having the function of an immunomodulator and, a protein having the function of IL-12, and (b) a ligand that activates the gene switch.

81. The kit of claim 80, wherein the ligand is RG-115819, RG-115830 or RG-115932.

82. The vector of claim 1, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence and a second transcription factor sequence under the control of a promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

83. The vector of claim 82, wherein said first transcription factor sequence and said second transcription factor sequence are connected by an EMCV internal ribosomal entry site (IRES).

84. The *in vitro* engineered immune cell of claim 26, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence and a second transcription factor sequence under the control of a promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

85. The *in vitro* engineered immune cell of claim 84, wherein said first transcription factor sequence and said second transcription factor sequence are connected by an EMCV internal ribosomal entry site (IRES).

86. The use of claim 48, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence and a second transcription factor sequence under the control of a promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

87. The *in vitro* engineered immune cell of claim 86, wherein said first transcription factor sequence and said second transcription factor sequence are connected by an EMCV internal ribosomal entry site (IRES).

88. The method of claim 67, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence and a second transcription factor sequence under the control of a promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

89. The method of claim 88, wherein said first transcription factor sequence and said second transcription factor sequence are connected by an EMCV internal ribosomal entry site (IRES).

90. A composition comprising a composition comprising two or more populations of *in vitro* engineered immune cells or therapy support cells, wherein each of the populations of *in vitro* engineered cells in the composition comprises a vector comprising a polynucleotide encoding a gene switch, wherein said polynucleotide comprises (1) at least one

transcription factor sequence operably linked to a promoter, wherein said at least one transcription factor sequence encodes a ligand-dependent transcription factor, and (2) a polynucleotide encoding a protein having the function of an immunomodulator linked to a promoter which is activated by said ligand-dependent transcription factor, and wherein each population of *in vitro* engineered cells in the composition expresses one or more immunomodulators that are different from the one or more immunomodulators expressed in the other population(s) of *in vitro* engineered cell in the composition.

91. Use of two or more populations of immune cells or TSCs of claim 17 and a therapeutically effective amount of an activating ligand in the preparation of medicaments for treating a tumor in a mammal,
wherein each population of immune cells or TSCs expresses a different set of one or more immunomodulators; and
wherein the expression of proteins having the function of the immunomodulators is induced.

92. Use of two or more populations of an immune cells or TSCs of claim 17 and a therapeutically effective amount of an activating ligand in the preparation of medicaments for treating a tumor in a mammal,
wherein each population of immune cells or TSCs expresses a different set of one or more proteins having the function of an immunomodulator,
wherein at least one of the proteins having the function of the immunomodulator or IL-12 is under control of a conditional promoter that is activated by a ligand; and
wherein the expression of a protein having the function of the immunomodulators and/or the protein having the function of IL-12 is induced.

93. The vector of claim 1, wherein the one or more immunomodulators are selected from IL-1, IL-2, IL-3, IL-4, IL-5, IL-7, IL-8, IL-9, IL-10R DN or a subunit thereof, IL-15, IL-21, IL-23, IL-24, IL-27, GM-CSF, IFN-gamma, IL-15-R-alpha, CCL3 (MIP-1a), CCL5 (RANTES), CCL7 (MCP3), XCL1(lymphotactin), CXCL1 (MGSA-alpha), CCR7, CCL19 (MIP-3b), CXCL9 (MIG), CXCL10 (IP-10), CXCL12 (SDF-1), CCL21

(6Ckine), OX40L, 4-1BBL, CD40, CD70, GITRL, LIGHT, b-Defensin, HMGB1, Flt3L, IFN-beta, TNF-alpha, dnFADD, BCG, TGF-alpha, TGFbRII DN, ICOS-L and S100.

WHAT IS CLAIMED IS:

1. A vector for conditionally expressing one or more immunomodulators comprising a polynucleotide encoding a gene switch, wherein said polynucleotide comprises (1) at least one transcription factor sequence which is operably linked to a promoter, wherein said at least one transcription factor sequence encodes a ligand-dependent transcription factor, and (2) a polynucleotide encoding one or more immunomodulator operably linked to a promoter which is activated by said ligand-dependent transcription factor, wherein the one or more immunomodulators are selected from IL-1, IL-2, IL-3, IL-4, IL-5, IL-7, IL-8, IL-9, IL-10R DN or a subunit thereof, IL- 15, IL- 18, IL-21, IL-23, IL-24, IL-27, GM-CSF, IFN-alpha, IFN-gamma, CCL3 (MIP-1a), CCL5 (RANTES), CCL7 (MCP3), XCLl(lymphotactin), CXCLl (MGSA-alpha), CCR7, CCL 19 (MIP-3b), CXCL9 (MIG), CXCL10 (IP-10), CXCL 12 (SDF-1), CCL21 (6Ckine), OX40L, 4- 1BBL, CD40, CD70, GITRL, LIGHT, b-Defensin, HMGBl, Flt3L, IFN-beta, TNF-alpha, dnFADD, BCG, TGF-alpha, PD-LlRNAi, a PD-Ll antisense oligonucleotide, TGFbRII DN, ICOS-L and S100.

2. The vector of claim 1, further comprising a polynucleotide encoding IL- 12.

3. The vector of claim 2, wherein said polynucleotide encoding said one or more immunomodulator and said polynucleotide encoding IL- 12 are under control of a regulated promoter of said gene switch.

4. The vector of claim 1, wherein said gene switch comprises an ecdysone receptor ligand binding domain.

5. The vector of claim 1, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence under the control of a first promoter and a second transcription factor sequence under the control of a second promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

6. A method of producing a population of immune cells or therapy support cells (TSC)

expressing one or more immunomodulators, comprising modifying the immune cells with a recombinant vector according to claim 1, wherein immune cells are selected from the group consisting of dendritic cells, macrophages, neurophils, mast cells, eosinophils, basophils, natural killer cells and lymphocytes and the therapy support cells are selected from the group consisting of stem cells, fibroblasts, endothelial cells and keratinocytes.

7. The method of claim 6, wherein said vector further comprises a polynucleotide encoding IL- 12.

8. A population of immune cells or TSC expressing one or more immunomodulators, which have been modified with the recombinant vector according to claim 1, wherein immune cells are selected from the group consisting of dendritic cells, macrophages, neurophils, mast cells, eosinophils, basophils, natural killer cells and lymphocytes and the therapy support cells are selected from the group consisting of stem cells, fibroblasts, endothelial cells and keratinocytes.

9. The population of claim 8, wherein said vector further comprises a polynucleotide encoding IL- 12.

10. An in vitro engineered immune cell or a TSC comprising the vector according to claim 1, wherein immune cells are selected from the group consisting of dendritic cells, macrophages, neurophils, mast cells, eosinophils, basophils, natural killer cells and lymphocytes and the therapy support cells are selected from the group consisting of stem cells, fibroblasts, endothelial cells and keratinocytes.

11. The in vitro engineered immune cell of claim 10, wherein said vector further comprises a polynucleotide encoding IL-12.

12. A kit comprising (a) immune cells engineered to contain a vector comprising a polynucleotide encoding a gene switch controlling expression of one or more immunomodulator and, optionally, IL- 12, and (b) a ligand that activates the gene switch, wherein said immunomodulator is selected from IL-1, IL-2, IL-3, IL-4, IL-5, IL-7, IL-8, IL-9, IL-10R DN or a subunit thereof, IL- 15, IL- 18, IL-21, IL-23, IL-24, IL-27, GM-CSF, IFN-

alpha, IFN-gamma, CCL3 (MIP-1a), CCL5 (RANTES), CCL7 (MCP3), XCLl(lymphotactin), CXCLl (MGSA-alpha), CCR7, CCL 19 (MIP-3b), CXCL9 (MIG), CXCL10 (IP-10), CXCL 12 (SDF-1), CCL21 (6Ckine), OX40L, 4- 1BBL, CD40, CD70, GITRL, LIGHT, b-Defensin, HMGBl, Flt3L, IFN-beta, TNF-alpha, dnFADD, BCG, TGF-alpha, PD-LlRNAi, a PD-Ll antisense oligonucleotide, TGFbRII DN, ICOS-L and S100, and wherein immune cells are selected from the group consisting of dendritic cells, macrophages, neurophils, mast cells, eosinophils, basophils, natural killer cells and lymphocytes.

13. The vector of claim 1, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence and a second transcription factor sequence under the control of a promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.

14. A pharmaceutical composition comprising a population of immune cells or TSC of claim 8, or the in vitro engineered immune cell or TSC of claim 10 for treating a tumor in a mammal.

15. The composition of claim 14, wherein said said immune cells or TSC, or said in vitro engineered immune cell or TSC are further engineered to conditionally express a polynucleotide encoding IL-12.

16. The composition of claim 15, wherein said polynucleotide encoding said immunomodulator and the polynucleotide encoding IL- 12 are under control of said gene switch.

17. The composition of claim 16, wherein said gene switch comprises an ecdysone receptor ligand binding domain.

18. The composition of claim 17, wherein said polynucleotide encoding a gene switch comprises a first transcription factor sequence under the control of a first promoter and a second transcription factor sequence under the control of a second promoter, wherein the proteins encoded by said first transcription factor sequence and said second transcription

factor sequence interact to form a protein complex which functions as a ligand-dependent transcription factor.