~~What is claimed is~~CLAIMS:

~~1. An immunogenic polypeptide comprising amino acid sequences of each of a plurality of cytotoxic T-cell (CTL) epitopes from herpesvirus antigens, wherein the polyepitope protein further comprises proteasome liberation amino acids or amino acid sequences between at least two of said plurality of CTL epitopes and wherein the polyepitope protein is capable of eliciting a CTL response upon administration to a subject as an exogenous polypeptide, wherein the polypeptide comprises at least one of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20.~~

~~2. The immunogenic polypeptide of claim 1, wherein the proteasome liberation amino acids or amino acid sequences comprise AD, K and/or R.~~

~~3. The immunogenic polypeptide of claim 1, further comprising at least one of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20, or combinations thereof.~~

~~4. The immunogenic polypeptide of claim 1, comprising each of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20.~~

~~5. The immunogenic polypeptide of any one of claims 1-4, comprising the amino acid sequence set forth in SEQ ID NO. 21.~~

~~6. The immunogenic polypeptide of any one of claims 1-5, wherein each of the epitopes are restricted by any one of the HLA class I specificities selected from HLA-A*03, HLA-A11, HLA-A*0201, HLA-A*1101, HLA-A*2301, HLA-A*3002, HLA-B27, HLA-B35.08/B35.01, HLA-B*44:0, HLA-B57*03, HLA-B*0702, HLA-B*0801, HLA-B*1501, HLA-B*3501, HLA-B*3508, HLA-B*4001, HLA-B*4402, HLA-B*4402, HLA-B*4403, HLA-B*4405, HLA-B*5301, HLA-B*5701, or HLA-B*5801.~~

~~7. The immunogenic polypeptide of claim 6, wherein the epitopes are derived from any one of the Epstein-Barr virus (EBV) antigens EBNA1, EBNA3A, EBNA3B, EBNA3C, LMP2, LMP2a, BMLF1, BZLF1, or BRLF1.~~

~~8~~1. A pharmaceutical composition comprising:

i. a polyepitope protein comprising two or more amino acid sequences of cytotoxic T-cell (CTL) epitopes from herpesvirus antigens, wherein the protein comprises proteasome liberation amino acids or amino acid sequences between at least two of said two or more CTL epitopes, wherein the protein is capable of eliciting a CTL response upon administration to a subject as an exogenous protein; or a nucleic acid encoding the polyepitope protein;

ii. ~~one or more of the immunogenic polypeptides of any one of claims 1-7, further comprising one or more~~ an immunogenic glycoprotein~~s,~~ or fragment~~s~~ thereof; or a nucleic acid encoding the immunogenic glycoprotein~~,~~ or fragment~~s~~ thereof; and

iii. an adjuvant; or a nucleic acid encoding the adjuvant.

2. The pharmaceutical composition of claim 1, wherein the composition comprises the polyepitope protein, the immunogenic glycoprotein or fragment~~s~~ thereof, and the adjuvant.

3. The pharmaceutical composition of claim 1, wherein the composition comprises one or more nucleic acid sequences encoding the polyepitope protein, the immunogenic glycoprotein or fragment~~s~~ thereof, and the adjuvant.

4. The pharmaceutical composition of claim 3, wherein the nucleic acid sequence encodes one or more of the polyepitope protein, the immunogenic glycoprotein or fragment~~s~~ thereof, and the adjuvant.

~~9. The pharmaceutical composition of claim 8, wherein the immunogenic glycoproteins are derived from herpesvirus.~~

~~10~~5. The pharmaceutical composition of any one of claim~~s~~ ~~9~~1-4, wherein the immunogenic glycoprotein~~s~~ ~~are~~ is derived from EBV, optionally ~~.~~

~~11. The pharmaceutical composition of claim 10,~~ wherein the immunogenic glycoprotein~~s~~ comprise~~s~~ at least one of glycoprotein 350 (gp350), glycoprotein B (gB), glycoprotein H (gH), glycoprotein (gL), gHgL complex, glycoprotein 42 (gp42), any fragment thereof, or any combination thereof.

~~12. The pharmaceutical composition of claim 11, wherein the immunogenic glycoprotein comprises gp350, or any fragment thereof.~~

6. The pharmaceutical composition of claim 5, wherein the immunogenic glycoprotein comprises the amino acid sequence set forth in SEQ ID NO. 43; or

wherein the nucleic acid encoding the immunogenic glycoprotein comprises the nucleic acid sequence set forth in SEQ ID NO. 44.

~~13. The pharmaceutical composition of any one of claims 1 to 11, further comprising one or more adjuvants.~~

~~14~~7. The pharmaceutical composition of ~~claim~~ any one of claims 1-6~~13~~, wherein the adjuvant comprises at least one of a toll-like receptor (TLR) agonist, a cationic anti-microbial peptide (CAMP), Adjuvant 65, α-GalCer, aluminum phosphate, aluminum hydroxide, calcium phosphate, β-Glucan Peptide, CpG DNA, GPI-0100, lipid A, monophosphorylated lipid A (MPL), lipopolysaccharide, Lipovant, Montanide, N-acetyl-muramyl-L-alanyl-D-isoglutamine, Pam3CSK4, quil A, or trehalose dimycolate.

~~15~~8. The pharmaceutical composition of claim ~~14~~7, wherein the adjuvant comprises a TLR9 agonist.

~~16. The pharmaceutical composition of claim 14 or 15, wherein the adjuvant comprises an oligodeoxynucleotide (ODN).~~

~~17~~9. The pharmaceutical composition of ~~16~~8, wherein the ~~adjuvant~~ TLR9 agonist is a CpG ODN or an amphiphilic CpG ODN.

10. The pharmaceutical composition of claim 9, wherein the nucleic acid encoding the CpG ODN comprises the nucleic acid sequence set forth in SEQ ID NO. 45.

~~18. The pharmaceutical composition of any one of claims 14 to 17, wherein the adjuvant is an amphiphilic CpG ODN.~~

~~19. The pharmaceutical composition of any one of claims 8 to 17, comprising gp350, and further comprising a CpG ODN adjuvant.~~

~~20~~11. A multivalent vaccine, comprising the pharmaceutical composition of any one of claims ~~8 to 19~~1-10.

~~21. An isolated nucleic acid encoding the immunogenic polypeptide of any one of the preceding claims.~~

~~22~~12. ~~The~~ An isolated nucleic acid encoding the polyepitope protein of any one of claim~~s~~ ~~21~~1-11, comprising a nucleic acid sequence selected from SEQ ID NOs. 22-~~41~~42.

~~23~~13. An expression vector comprising the isolated nucleic acid of ~~any one of~~ claim~~s~~ ~~21 or 22~~12 operably linked to one or more regulatory sequences.

~~24~~14. A host cell comprising the expression vector of claim ~~23~~13.

~~25~~15. A method ~~for~~ of producing the polyepitope protein ~~immunogenic polypeptide~~ of any one of claims ~~1 to 7~~1-11, wherein said method includes steps for purifying the polyepitope protein ~~immunogenic polypeptide~~ under conditions that maintain the polyepitope protein ~~immunogenic polypeptide~~ in a substantially non-aggregated form.

~~26~~16. A prophylactic or therapeutic composition~~, for eliciting an immunogenic response in a subject against a herpesvirus~~, the composition comprising:

i. a~~n~~ polyepitope protein ~~immunogenic polypeptide~~ comprising amino acid sequences derived from ~~each of a plurality of~~ two or more cytotoxic T-cell (CTL) epitopes, wherein the polyepitope protein ~~polypeptide~~ comprises the amino acid sequences set forth in SEQ ID NOs. 1 and 11; or a nucleic acid encoding the polyepitope protein;

ii. at least one herpesvirus glycoprotein; or a nucleic acid encoding the at least one herpesvirus glycoprotein; and

iii. at least one adjuvant; or a nucleic acid encoding the at least one adjuvant; wherein the composition elicits an immunogenic response in a subject against a herpesvirus.

17. The composition of claim 16, wherein the composition comprises the polyepitope protein, the at least one herpesvirus glycoprotein, and the at least one adjuvant.

18. The composition of claim 16, wherein the composition comprises one or more nucleic acid sequences encoding the polyepitope protein, the at least one herpesvirus glycoprotein, and the at least one adjuvant.

19. The composition of claim 18, wherein the nucleic acid sequence encodes one or more of the polyepitope protein, the at least one herpesvirus glycoprotein, and the at least one adjuvant.

20. The composition of any one of claims 16-19, wherein the nucleic acid encoding the polyepitope protein comprises the nucleic acid sequences set forth in SEQ ID NOs. 22 and 32.

~~27~~21. The composition of any one of claims ~~26~~16-20, wherein the polyepitope protein ~~immunogenic polypeptide~~ further comprises at least one of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 12-20; or

wherein the nucleic acid encoding the polyepitope protein further comprises at least one of the CTL epitope nucleic acid sequences set forth in SEQ ID NOs. 33-41.

~~28~~22. The composition of any one of claims 16-21~~26~~, wherein the polyepitope protein ~~immunogenic polypeptide~~ comprises each of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20, or ~~.~~

~~29. The composition of any one of claims 26 to 28, wherein the immunogenic polypeptide comprises~~ the amino acid sequence set forth in SEQ ID NO. 21; or

wherein the nucleic acid encoding the polyepitope protein comprises each of the CTL epitope nucleic acid sequences set forth in SEQ ID NOs. 22-41, or the nucleic acid sequences set forth in SEQ ID NO. 42.

~~30~~23. The composition of any one of claims ~~26 to 29~~16-22, wherein each of the epitopes of the polyepitope protein ~~immunogenic polypeptide~~ are restricted by any one of the HLA class I specificities selected from HLA A*03, HLA A11, HLA A*0201, HLA A*1101, HLA A*2301, HLA A*3002, HLA B27, HLA B35.08/B35.01, HLA B*44:0, HLA B57*03, HLA B*0702,

HLA B*0801, HLA B*1501, HLA B*3501, HLA B*3508, HLA B*4001, HLA B*4402, HLA B*4402, HLA B*4403, HLA B*4405, HLA B*5301, HLA B*5701, or HLA B*5801.

~~31. The composition of any one of claims 26 to 30, wherein each of the epitopes of the immunogenic polypeptide are derived from any one of EBV antigens EBNA1, EBNA3A, EBNA3B, EBNA3C, LMP2, LMP2a, BMLF1, BZLF1, or BRLF1.~~

~~32~~24. The composition of any one of claim~~s 26~~16-23, wherein the herpesvirus glycoprotein is derived from EBV optionally selected from ~~.~~

~~33. The composition of claim 32, comprising at least one of~~ gp350, gB, gH, gL, gHgL complex, gp42, any fragment thereof, or any combination thereof.

25. The composition of claim 24, wherein the glycoprotein comprises the amino acid sequence set forth in SEQ ID NO. 43; or

wherein the nucleic acid encoding the glycoprotein comprises the nucleic acid sequence set forth in SEQ ID NO. 44.

~~34~~26. The composition of any one of claim~~s 26~~16-25, wherein the adjuvant comprises a TLR agonist.

~~35~~27. The composition of claim ~~34~~26, wherein the TLR agonist comprises a~~n~~ CpG ODN or a CpG ODN conjugated to a lipid.

28. The composition of claim 27, wherein the nucleic acid encoding the CpG ODN comprises the nucleic acid sequence set forth in SEQ ID NO. 45.

~~36. The composition of claim 34 or 35, wherein the wherein the adjuvant is a CpG ODN.~~

~~37. The composition of claim 36, wherein the adjuvant is a CpG ODN conjugated to a lipid.~~

~~38~~29. A multivalent EBV vaccine comprising:

i. a~~n~~ polyepitope protein ~~immunogenic polypeptide~~ as set forth in SEQ ID NO. 21; or a nucleic acid encoding the polyepitope protein;

ii. at least one EBV glycoprotein; or a nucleic acid encoding the at least one EBV glycoprotein; and

iii. at least one adjuvant; or a nucleic acid encoding the at least one adjuvant.

30. The multivalent EBV vaccine of claim 29, wherein the composition comprises the polyepitope protein, the at least one EBV glycoprotein, and the at least one adjuvant.

31. The multivalent EBV vaccine of claim 29, wherein the composition comprises one or more nucleic acid sequences encoding the polyepitope protein, the at least one EBV glycoprotein, and the at least one adjuvant.

32. The multivalent EBV vaccine of claim 31, wherein the nucleic acid sequence encodes one or more of the polyepitope protein, the at least one EBV glycoprotein, and the at least one adjuvant.

33. The multivalent EBV vaccine of any one of claims 29-32, wherein the nucleic acid encoding the polyepitope protein comprises the nucleic acid sequence set forth in SEQ ID NO. 42.

~~39~~34. The multivalent EBV vaccine of any one of claims ~~38~~29-33, wherein the EBV glycoprotein is selected from ~~at least one of~~ gp350, gB, gH, gL, gHgL complex, gp42, any fragment thereof, or any combination thereof.

~~40. The multivalent EBV vaccine of claim 38, wherein the EBV glycoprotein is gp350, or a fragment thereof.~~

35. The multivalent EBV vaccine of claim 34, wherein the glycoprotein comprises the amino acid sequence set forth in SEQ ID NO. 43; or

wherein the nucleic acid encoding the glycoprotein comprises the nucleic acid sequence set forth in SEQ ID NO. 44.

~~41~~36. The multivalent EBV vaccine of any one of claims ~~38 to 40~~29-35, wherein the adjuvant comprises a TLR agonist.

~~42~~37. The multivalent EBV vaccine of claim ~~41~~36, wherein the TLR agonist ~~adjuvant~~ is a CpG ODN or a CpG ODN conjugated to a lipid.

38. The multivalent EBV vaccine of claim 37, wherein the nucleic acid encoding the CpG ODN comprises the nucleic acid sequence set forth in SEQ ID NO. 45.

~~43. The multivalent EBV vaccine of claim 42, wherein the adjuvant is a CpG ODN conjugated to a lipid.~~

~~44~~39. A method for generating a ~~prophylactic or therapeutic treatment~~ composition for the prophylactic or therapeutic treatment of herpesvirus infection, wherein the method comprises~~ing~~ combining an isolated polyepitope protein~~immunogenic polypeptide~~, or a nucleic acid encoding the isolated polyepitope protein, at least one herpesvirus glycoprotein, or a nucleic acid encoding the at least one herpesvirus glycoprotein, at least one adjuvant comprising a TLR agonist, or a nucleic acid encoding the at least one adjuvant, and a pharmaceutically acceptable excipient, in a formulation suitable for administration to a subject;

wherein the polyepitope protein ~~immunogenic polypeptide~~ comprises at least one of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1 and 11.

~~45~~40. The method of claim ~~44~~39, wherein the nucleic acid encoding the polyepitope protein ~~immunogenic polypeptide is encoded by a nucleic acid~~ comprises~~ing~~ at least one of the nucleic acid sequences set forth in SEQ ID NOs. 22-41, or any combination thereof.

~~46. The method of claim 44, wherein the immunogenic polypeptide is encoded by a nucleic acid comprising each of the nucleic acid sequences set forth in SEQ ID NOs. 22-41.~~

~~47~~41. The method of claim ~~44~~39, wherein the nucleic acid encoding the polyepitope protein ~~immunogenic polypeptide is encoded by a nucleic acid~~ comprises~~ing~~ the nucleic acid sequence set forth in SEQ ID NO. 42.

~~48~~42. The method of any one of claims ~~44 to 47~~39-41, wherein the polyepitope protein ~~immunogenic polypeptide~~ comprises the amino acid sequence set forth in SEQ ID NO. 21.

~~49~~43. The method of any one of claims ~~44 to 48~~39-42, wherein the herpesvirus glycoprotein is derived from EBV, optionally selected from ~~.~~

~~50. The method of claim 49, wherein the herpesvirus glycoprotein comprises at least one of~~ gp350, gB, gH, gL, gHgL complex, gp42, any fragment thereof, or any combination thereof.

44. The method of claim 43, wherein the glycoprotein comprises the amino acid sequence set forth in SEQ ID NO. 43; or

wherein the nucleic acid encoding the glycoprotein comprises the nucleic acid sequence set forth in SEQ ID NO. 44.

~~51~~45. The method of any one of claims ~~44 to 50~~39-44, wherein the adjuvant comprises a TLR9 agonist.

~~52. The method of any one of claims 44 to 51, wherein the adjuvant comprises an ODN.~~

~~53~~46. The method of ~~any one of~~ claim~~s~~ ~~44 to 52~~45, wherein the TLR9 agonist ~~adjuvant~~ is a CpG ODN or a CpG ODN conjugated to a lipid.

~~54. The method of any one of claims 44 to 53, wherein the adjuvant is a CpG ODN conjugated to a lipid.~~

47. The method of claim 46, wherein the nucleic acid encoding the CpG ODN comprises the nucleic acid sequence set forth in SEQ ID NO. 45.

~~55~~48. ~~A method~~Use of a composition in the manufacture of a medicament for the prophylactic~~ally~~ or therapeutic~~ally~~ treatment~~ing~~ of a herpesvirus infection in a subject, wherein the medicament comprises~~comprising administering to the subject a composition comprising~~:

i. a~~n~~ polyepitope protein ~~immunogenic polypeptide~~ comprising amino acid sequences derived from ~~each of a plurality of~~two or more cytotoxic T-cell (CTL) epitopes, wherein the polyepitope protein ~~polypeptide~~ comprises the amino acid sequences set forth in SEQ ID NOs. 1 and 11; or a nucleic acid encoding the polyepitope protein;

ii. at least one herpesvirus glycoprotein; or a nucleic acid encoding the herpesvirus glycoprotein; and

iii. ~~and~~ an adjuvant; or a nucleic acid encoding the adjuvant.

49. The use of claim 48, wherein the nucleic acid encoding the polyepitope protein comprises the nucleic acid sequences set forth in SEQ ID NOs. 22 and 32.

~~56~~50. The ~~method~~ use of claim ~~55~~48 or 49, wherein the polyepitope protein ~~immunogenic polypeptide~~ further comprises at least one of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20, or any combination~~s~~ thereof; or

wherein the nucleic acid encoding the polyepitope protein further comprises at least one of the CTL epitope nucleic acid sequences set forth in SEQ ID NOs. 22-41, or any combination thereof.

~~57. The method of claim 55, wherein the immunogenic polypeptide comprises each of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20.~~

~~58~~51. The ~~method~~ use of any one of claims ~~55 to 57~~48-50, wherein the polyepitope protein ~~immunogenic polypeptide~~ comprises the amino acid sequence set forth in SEQ ID NO. 21; or

wherein the nucleic acid encoding the polyepitope protein comprises the nucleic acid sequence set forth in SEQ ID NO. 42.

~~59~~52. The ~~method~~ use of any one of claims ~~55 to 58~~48-51, wherein each of the epitopes are restricted by any one of the HLA class I specificities selected from HLA class I specificities selected from HLA A*03, HLA A11, HLA A*0201, HLA A*1101, HLA A*2301, HLA A*3002, HLA B27, HLA B35.08/B35.01, HLA B*44:0, HLA B57*03, HLA B*0702, HLA B*0801, HLA B*1501, HLA B*3501, HLA B*3508, HLA B*4001, HLA B*4402, HLA B*4402, HLA B*4403, HLA B*4405, HLA B*5301, HLA B*5701, or HLA B*5801.

~~60. The method of any one of claims 55 to 59, wherein the epitopes are derived from any one of EBV antigens EBNA1, EBNA3A, EBNA3B, EBNA3C, LMP2, LMP2a, BMLF1, BZLF1, or BRLF1.~~

~~61~~53. The ~~method~~ use of any one of claims ~~58 to 60~~48-52, ~~comprising~~ wherein the composition comprises 20-50 µg of the polyepitope protein~~immunogenic polypeptide~~.

~~62~~54. The ~~method~~ use of claim ~~61~~53, wherein the composition comprises ~~comprising~~ 40 µg of the polyepitope protein~~immunogenic polypeptide~~.

~~63~~55. The ~~method~~ use of any one of claims ~~55 to 62~~48-54, wherein the glycoprotein is selected from gp350, gB, gH, gL, gHgL complex, gp42, any fragment thereof, or any combination thereof.

~~64. The method of any one of claims 55 to 63, wherein the glycoprotein is gp350, or a fragment thereof.~~

56. The use of claim 55, wherein the glycoprotein comprises the amino acid sequence set forth in SEQ ID NO. 43; or

wherein the nucleic acid encoding the glycoprotein comprises the nucleic acid sequence set forth in SEQ ID NO. 44.

~~65~~57. The ~~method~~ use of any one of claims ~~55 to 64~~48-56, wherein the adjuvant comprises a TLR agonist.

~~66. The method of any one of claims 55 to 65, wherein the adjuvant comprises an oligodeoxynucleotide (ODN).~~

~~67~~58. The ~~method~~ use of ~~any one of~~ claim~~s 55 to 66~~57, wherein the TLR agonist ~~adjuvant~~ is a CpG ODN or a CpG ODN conjugated to a lipid.

~~68. The method of any one of claims 55 to 67, wherein the adjuvant is a CpG ODN conjugated to a lipid.~~

59. The use of claim 58, wherein the nucleic acid encoding the CpG ODN comprises the nucleic acid sequence set forth in SEQ ID NO. 45.

~~69. A method of inducing proliferation of herpesvirus-specific CTLs, comprising bringing a sample comprising CTLs into contact with one or more peptides comprising CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20, or combinations thereof.~~

~~70. The method of claim 69, comprising bringing the sample into contact with a pool of peptides comprising at least one of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20, or combinations thereof.~~

~~71. The method of claim 69, comprising bringing the sample into contact with a pool of peptides comprising each of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20.72. The method of claim 69, comprising incubating a sample comprising CTLs with antigen-presenting cells (APCs) that present at least one peptide comprising at least one of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20.~~

~~73. The method of claim 72, wherein the APCs present a plurality of peptides comprising at least one of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20, or combinations thereof.~~

~~74. The method of claim 72 or 73, wherein the APCs present a plurality of peptides comprising each of the CTL epitope amino acid sequences set forth in SEQ ID NOs. 1-20.~~

~~75. An antigen-presenting cell (APC) comprising a peptide of any one of claims 1 to 7 presented on a class I MHC.~~

~~76. A method of producing an APC that presents one or more EBV peptides comprising incubating an antigen-presenting cell with the one or more peptides of any one of claims 1 to 7 or one or more nucleic acids encoding the one or more peptides of any one of claims 1 to 7.~~