

WHAT IS CLAIMED IS:

1. A method of treating a virus-associated disease or disorder, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to SEQ ID NO:1 or 2, or a fragment thereof, and
wherein the virus-associated disease or disorder is associated with a virus selected from the group consisting of a coronavirus, a papillomavirus, a pneumovirus, a picornavirus, a flavivirus, an alphavirus, an ebolavirus, a morbillivirus, an enterovirus, an orthopneumovirus, a lentivirus, and a hepatovirus.
2. The method of claim 1, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
3. The method of claim 1 or claim 2, wherein the virus-associated disease or disorder is a virus infection selected from the group consisting of: a coronavirus infection, a papillomavirus infection, a pneumovirus infection, a picornavirus infection, a flavivirus infection, an alphavirus infection, an ebolavirus infection, a morbillivirus infection, an enterovirus infection, an orthopneumovirus infection, a lentivirus infection, and a hepatovirus infection.
4. A method of treating a virus-associated disease or disorder, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:3-50 and 56, or a fragment thereof.
5. The method of claim 4, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
6. The method of claim 4 or claims 5, wherein the virus-associated disease or disorder is associated with a virus selected from the group consisting of an RNA virus, a DNA virus, a coronavirus, a papillomavirus, a pneumovirus, a picornavirus, an influenza virus, an adenovirus,

a cytomegalovirus, a polyomavirus, a poxvirus, a flavivirus, an alphavirus, an ebolavirus, a morbillivirus, an enterovirus, an orthopneumovirus, a lentivirus, and a hepatovirus.

7. The method of any one of claims 4-6, wherein the virus-associated disease or disorder is a virus infection selected from the group consisting of: an RNA virus infection, a DNA virus infection, a coronavirus infection, a papillomavirus infection, a pneumovirus infection, a picornavirus infection, an influenza virus infection, an adenovirus infection, a cytomegalovirus infection, a polyomavirus infection, a poxvirus infection, a flavivirus infection, an alphavirus infection, an ebolavirus infection, a morbillivirus infection, an enterovirus infection, an orthopneumovirus infection, a lentivirus infection, and a hepatovirus infection.

8. The method of any one of claims 1 to 7, wherein the virus-associated disease or disorder comprises a virus infection of an organ or a tissue of the patient.

9. The method of claim 8, wherein the organ or the tissue is selected from the group consisting of an eye, an ear, inner ear, a lung, trachea, bronchus, bronchioli, liver, gall bladder, bile duct, a kidney, bladder, a testicle, cervix, ovary, uterus, skin, and brain.

10. The method of any one of claims 1 to 9, wherein the virus-associated disease or disorder is selected from the group consisting of: acute respiratory distress syndrome; chronic obstructive pulmonary disease (COPD); pneumonia; drug-resistant pneumonia; hand, foot and mouth disease; atopic asthma; and non-atopic asthma.

11. A method of inhibiting genomic replication of a virus, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,

wherein the arginase has at least about 90% sequence identity to SEQ ID NO:1 or 2, or a fragment thereof, and

wherein the virus is selected from the group consisting of a coronavirus, a papillomavirus, a pneumovirus, a picornavirus, a flavivirus, an alphavirus, an ebolavirus, a morbillivirus, an enterovirus, an orthopneumovirus, a lentivirus, and a hepatovirus.

12. The method of claim 11, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.

13. A method of inhibiting genomic replication of a virus, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:3-50 and 56, or a fragment thereof.
14. The method of claim 13, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
15. The method of claim 13 or 14, wherein the virus is selected from the group consisting of an RNA virus, a DNA virus, a coronavirus, a papillomavirus, a pneumovirus, a picornavirus, an influenza virus, an adenovirus, a cytomegalovirus, a polyomavirus, a poxvirus, a flavivirus, an alphavirus, an ebolavirus, a morbillivirus, an enterovirus, an orthopneumovirus, a lentivirus, and a hepatovirus.
16. A method of inhibiting transmission of a virus, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase,
wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:1 or 2, or a pharmaceutically acceptable salt thereof, wherein the virus is selected from the group consisting of a coronavirus, a papillomavirus, a pneumovirus, a picornavirus, a flavivirus, an alphavirus, an ebolavirus, a morbillivirus, an enterovirus, an orthopneumovirus, a lentivirus, and a hepatovirus.
17. The method of claim 16, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
18. A method of inhibiting transmission of a virus, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:3-50 and 56, or a fragment thereof.

19. The method of claim 18, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
20. The method of claim 18 or 19, wherein the virus is selected from the group consisting of an RNA virus, a DNA virus, a coronavirus, a papillomavirus, a pneumovirus, a picornavirus, an influenza virus, an adenovirus, a cytomegalovirus, a polyomavirus, a poxvirus, a flavivirus, an alphavirus, an ebolavirus, a morbillivirus, an enterovirus, an orthopneumovirus, a lentivirus, and a hepatovirus.
21. A method of inhibiting assembly of a virus, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO: 1-50 and 56, or a fragment thereof.
22. The method of claim 21, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
23. A method of inhibiting virus gene expression, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO: 1-50 and 56, or a fragment thereof.
24. The method of claim 23, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
25. The method of claim 23 or 24, wherein the inhibiting comprises inhibiting β gene expression, γ gene expression, or β gene expression and γ gene expression.
26. A method of inhibiting virus release, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,

wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:1-50 and 56, or a fragment thereof.

27. The method of claim 26, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.

28. The method of any one of claims 23-27, wherein the virus is selected from the group consisting of an RNA virus, a DNA virus, a coronavirus, a papillomavirus, a pneumovirus, a picornavirus, an influenza virus, an adenovirus, a cytomegalovirus, a polyomavirus, a poxvirus, a flavivirus, an alphavirus, an ebolavirus, a morbillivirus, an enterovirus, an orthopneumovirus, a lentivirus, and a hepatovirus.

29. The method of any preceding claim, wherein the virus is a coronavirus.

30. The method of claim 29, wherein the coronavirus is selected from the group consisting of: 229E alpha coronavirus, NL63 alpha coronavirus, OC43 beta coronavirus, HKU1 beta coronavirus, Middle East Respiratory Syndrome (MERS) coronavirus (MERS-CoV), severe acute respiratory syndrome (SARS) coronavirus (SARS-CoV), and SARS-CoV-2 (COVID-19).

31. The method of any one of claims 6-10, 13-15, and 18-28, wherein the virus is an influenza virus.

32. The method of claim 31, wherein the influenza virus is selected from the group consisting of influenza virus A (*e.g.*, H1N1 and H5N1), influenza virus B, influenza virus C, influenza virus D.

33. The method of any one of claims 6-10, 13-15, and 18-28, wherein the virus is an adenovirus virus.

34. The method of claim 33, wherein the adenovirus virus is AdV5.

35. The method of any preceding claim, wherein the virus is a drug-resistant virus.

36. The method of any one of claims 1 to 35, further comprising administering a composition comprising an antiviral agent.

37. The method of claim 36, wherein the antiviral agent is selected from the group consisting of lamivudine, an interferon alpha composition, a VAP anti-idiotypic antibody, enfuvirtide, amantadine, rimantadine, pleconaril, aciclovir, zidovudine, fomivirsen, a morpholino, a protease inhibitor, double-stranded RNA activated caspase oligomerizer (DRACO), Rifampicin, zanamivir, peramivir, danoprevir, ritonavir, remdesivir, and oseltamivir.

38. The method of claim 36 or 37, wherein the administering of the antiviral agent is before, during, or after the administering of the arginase.

39. A method of treating a bacterial disease or disorder, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,

wherein the arginase has at least about 90% sequence identity to SEQ ID NO:1 or 2, or a fragment thereof, and

wherein the bacterial disease or disorder is associated with a bacteria selected from the group consisting of: *Streptococcus pneumoniae*, *Mycoplasma pneumoniae*, *Haemophilus influenzae*, *Legionella pneumophila*, *Salmonella enterica*, *Salmonella bongori*, *Escherichia coli*, *Helicobacter pylori*, *Neisseria gonorrhoeae*, *Neisseria meningitidis*, *Staphylococcus aureus*, *Acinetobacter baumannii*, *Burkholderia cepacia*, *Clostridium difficile*, *Clostridium sordellii*, an *Enterobacteriaceae*, *Enterococcus faecalis*, *Klebsiella pneumoniae*, *Morganella morganii*, *Mycobacterium abscessus*, *Mycobacterium tuberculosis*, a Norovirus, *Pseudomonas aeruginosa*, and *Stenotrophomonas maltophilia*.

40. The method of claim 39, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.

41. A method of treating a bacterial disease or disorder, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,

wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:3-50 and 56, or a fragment thereof.

42. The method of claim 41, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
43. The method of claim 41 or 42, wherein the bacterial disease or disorder is associated with a bacteria selected from the group consisting of: *Chlamydia pneumoniae*, *Vibrio cholerae*, *Streptococcus pneumoniae*, *Mycoplasma pneumoniae*, *Haemophilus influenzae*, *Legionella pneumophila*, *Salmonella enterica*, *Salmonella bongori*, *Escherichia coli*, *Helicobacter pylori*, *Neisseria gonorrhoeae*, *Neisseria meningitidis*, *Staphylococcus aureus*, *Acinetobacter baumannii*, *Burkholderia cepacia*, *Clostridium difficile*, *Clostridium sordellii*, an *Enterobacteriaceae*, *Enterococcus faecalis*, *Klebsiella pneumoniae*, *Morganella morganii*, *Mycobacterium abscessus*, *Mycobacterium tuberculosis*, a *Norovirus*, *Pseudomonas aeruginosa*, and *Stenotrophomonas maltophilia*.
44. A method of treating a fungal disease or disorder, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:1-50 and 56, or a fragment thereof.
45. The method of claim 44, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
46. The method of claim 44 or 45, wherein the fungal disease is associated with a fungus selected from the group consisting of a *Pneumocystis* fungus, an *Aspergillus* fungus, and a *Candida* fungus.
47. A method of treating an amoeba disease or disorder, the method comprising administering to a patient in need thereof a therapeutically effective amount of a composition comprising an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:1-50 and 56, or a fragment thereof.
48. The method of claim 47, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.

49. The method of claim 47 or 48, wherein the amoeba disease or disorder is associated with an amoeba selected from the group consisting of *Dientamoeba fragilis*, *Entamoeba histolytica*, *Naegleria fowleri*, an *Acanthamoeba*, *Acanthamoeba keratitis*, *Balamuthia mandrillaris*, and *Sappinia diploidea*.
50. The method of any one of claims 1 to 49, wherein the arginase is administered at a dose of about 1 ng/kg body weight per day to about 1 mg/kg body weight per day.
51. The method of any one of claims 1 to 50, wherein the administering is topical, parenteral, oral, pulmonary, intratracheal, intranasal, intrathecal, transdermal, subcutaneous, intraocular, intravitreal, intraperitoneal, intraduodenal, or by inhalation.
52. The method of any one of claims 1 to 51, wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:3-43, or a fragment thereof, and wherein the arginase includes a protein tag sequence.
53. The method of claim 52, wherein the protein tag sequence comprises a 6xHis tag sequence of SEQ ID NO:51.
54. The method of claim 52 or 53, wherein the protein tag sequence is located at the amino terminus of the arginase.
55. The method of claim 52 or 53, wherein the protein tag sequence is located at the carboxy terminus of the arginase.
56. The method of any one of claims 1 to 55, wherein the arginase is a PEGylated-arginase comprising 2, 3, 4, or more polyethylene glycol molecules conjugated to the arginase.
57. The method of any one of claims 2, 3, 5-10, 12, 14, 15, 17, 19, 20, 22, 24, 25, 27-38, 40, 42, 43, 45, 46, and 48-56, wherein the polyethylene glycol molecule is about 5 kDa, about 10 kDa, about 15 kDa, about 20 kDa, about 30 kDa, or about 40 kDa.
58. The method of any one of claims 2, 3, 5-10, 12, 14, 15, 17, 19, 20, 22, 24, 25, 27-38, 40, 42, 43, 45, 46, and 48-56, wherein the polyethylene glycol is from about 10 kDa to about 30 kDa or from about 20 kDa to about 40 kDa.

59. The method of any one of claims 1 to 58, wherein the composition further comprises a non-native metal cofactor.
60. The method of claim 59, wherein the non-native metal cofactor is selected from the group consisting of cobalt, manganese, iron, and zinc.
61. A composition comprising:
an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:1-50 and 56, or a fragment thereof;
an antiviral agent; and
a pharmaceutically acceptable excipient.
62. The composition of claim 61, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
63. The composition of claim 61 or 62, wherein the antiviral agent is selected from the group consisting of lamivudine, an interferon alpha composition, a VAP anti-idiotypic antibody, enfuvirtide, amantadine, rimantadine, pleconaril, aciclovir, zidovudine, fomivirsen, a morpholino, a protease inhibitor, double-stranded RNA activated caspase oligomerizer (DRACO), Rifampicin, zanamivir, peramivir, danoprevir, ritonavir, remdesivir, and oseltamivir.
64. The composition of any one of claims 61-63, wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:3-43, or a fragment thereof, and wherein the arginase includes a protein tag sequence.
65. The composition of claim 64, wherein the protein tag sequence comprises a 6xHis tag sequence of SEQ ID NO:51.
66. The composition of claim 64 or 65, wherein the protein tag sequence is located at the amino terminus of the arginase.
67. The composition of claim 64 or 65, wherein the protein tag sequence is located at the carboxy terminus of the arginase.

68. The composition of any one of claims 62 to 67, wherein the PEGylated arginase comprises 2, 3, 4, or more polyethylene glycol molecules conjugated to the arginase sequence.
69. The composition of any one of claims 62-68, wherein the polyethylene glycol molecule is about 5 kDa, about 10 kDa, about 15 kDa, about 20 kDa, about 30 kDa, or about 40 kDa.
70. The composition of any one of claims 62-68, wherein the polyethylene glycol molecule is from about 10 kDa to about 30 kDa or from about 20 kDa to about 40 kDa.
71. The composition of any one of claims 61 to 70, wherein the composition further comprises a non-native metal cofactor.
72. The composition of claim 71, wherein the non-native metal cofactor is selected from the group consisting of cobalt, manganese, iron, and zinc.
73. A kit comprising:
an arginase, or a pharmaceutically acceptable salt thereof,
wherein the arginase has at least about 90% sequence identity to a protein
sequence selected from the group consisting of SEQ ID NO:1-50 and 56, or a
fragment thereof; and
buffers, reagents, and detailed instructions for inhibiting production of a virus.
74. The kit of claim 73, wherein the arginase is a PEGylated arginase, comprising at least one polyethylene glycol molecule conjugated to the arginase.
75. The kit of claim 73 or 74, further comprising an antiviral agent.
76. The kit of claim 75, wherein the antiviral agent is selected from the group consisting of lamivudine, an interferon alpha composition, a VAP anti-idiotypic antibody, enfuvirtide, amantadine, rimantadine, pleconaril, aciclovir, zidovudine, fomivirsen, a morpholino, a protease inhibitor, double-stranded RNA activated caspase oligomerizer (DRACO), Rifampicin, zanamivir, peramivir, danoprevir, ritonavir, remdesivir, and oseltamivir.
77. The kit of any one of claims 73 to 76, wherein the kit is for inhibiting production of a coronavirus.

78. The kit of claim 77, wherein the coronavirus is selected from the group consisting of: 229E alpha coronavirus, NL63 alpha coronavirus, OC43 beta coronavirus, HKU1 beta coronavirus, Middle East Respiratory Syndrome (MERS) coronavirus (MERS-CoV), severe acute respiratory syndrome (SARS) coronavirus (SARS-CoV), and SARS-CoV-2 (COVID-19).
79. The kit of any one of claims 73-76, wherein the virus is an influenza virus.
80. The kit of claim 79, wherein the influenza virus is selected from the group consisting of influenza virus A (*e.g.*, H1N1 and H5N1), influenza virus B, influenza virus C, influenza virus D.
81. The kit of any one of claims 73-76, wherein the virus is an adenovirus virus.
82. The kit of claim 81, wherein the adenovirus virus is AdV5.
83. The kit of any one of claims 73-82, wherein the arginase has at least about 90% sequence identity to a protein sequence selected from the group consisting of SEQ ID NO:3-43, or a fragment thereof, and wherein the arginase includes a protein tag sequence.
84. The kit of claim 83, wherein the protein tag sequence is a 6xHis tag sequence of SEQ ID NO:51.
85. The kit of claim 83 or 84, wherein the protein tag sequence is located at the amino terminus of the arginase.
86. The kit of claim 83 or 84, wherein the protein tag sequence is located at the carboxy terminus of the arginase.
87. The kit of any one of claims 74 to 86, wherein the PEGylated-arginase comprises 2, 3, 4, or more polyethylene glycol molecules conjugated to the arginase sequence.
88. The kit of any one of claims 74 to 87, wherein the polyethylene glycol is about 5 kDa, about 10 kDa, about 15 kDa, about 20 kDa, about 30 kDa, or about 40 kDa.
89. The kit of any one of claims 74 to 87, wherein the polyethylene glycol is from about 10 kDa to about 30 kDa or from about 20 kDa to about 40 kDa.

90. The kit of any one of claims 73 to 89, wherein the kit further comprises a non-native metal cofactor.
91. The kit of claim 90, wherein the non-native metal cofactor is selected from the group consisting of cobalt, manganese, iron, and zinc.