Claims:

1. An ex-vivo method for reducing SARS-CoV-2 virions, or portions thereof, in blood or plasma of a COVID-19 patient in need thereof, comprising:

a) introducing the blood or plasma from a patient infected with COVID-19 into an extracorporeal device comprising a lectin that binds to SARS-CoV-2 virions, or portions thereof;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the SARS-CoV-2 virions, or portions thereof, present in the blood or plasma, to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the SARS-CoV-2 virions, or portions thereof, as compared to the blood or plasma of said patient prior to (b); and

d) optionally, SARS-CoV-2 virions, or portions thereof, in a sample from said patient, such as a nasal (e.g., isolated from a nasal swab), blood, or plasma sample, have been detected or identified prior to (a) or after (b) or both and/or, optionally a patient having COVID-19 has been selected or identified to receive a therapy that reduces SARS-CoV-2 virions, or fragments thereof.

2. An ex-vivo method for reducing COVID-19 mediating nanoparticles in blood or plasma of a COVID-19 patient in need thereof, comprising:

a) introducing the blood or plasma from a patient infected with COVID-19 into an extracorporeal device comprising a lectin that binds to COVID-19 mediating nanoparticles;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the COVID-19 mediating nanoparticles to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the COVID-19 mediating nanoparticles, as compared to the blood or plasma of said patient prior to (b); and

d) optionally, SARS-CoV-2 virions, or portions thereof, or COVID-19 mediating nanoparticles in a sample from said patient, such as a nasal (e.g., isolated from a nasal swab), blood, or plasma sample, have been detected or identified prior to (a) or after (b) or both and/or, optionally selecting or identifying a patient having COVID-19 to receive a therapy that reduces COVID-19 mediating nanoparticles.

3. An ex-vivo method for reducing exosomes comprising a COVID-19 antigen in blood or plasma of a COVID-19 patient, comprising:

a) introducing the blood or plasma from a patient infected with COVID-19 into an extracorporeal device comprising a lectin that binds to the exosomes comprising the COVID-19 antigen;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the exosomes comprising the COVID-19 antigen to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the exosomes comprising the COVID-19 antigen, as compared to the blood or plasma of said patient prior to (b); and

d) optionally, SARS-CoV-2 virions, or portions thereof or the exosomes comprising the COVID-19 antigen in a sample from said patient, such as a nasal (e.g., isolated from a nasal swab), blood, or plasma sample, has been detected or identified prior to (a) or after (b) or both and/or, optionally a patient having COVID-19 has been selected or identified to receive a therapy that reduces exosomes comprising a COVID-19 antigen.

4. An ex-vivo method for reducing interleukin 6 (IL-6) in blood or plasma of a COVID-19 patient comprising:

a) introducing the blood or plasma from a patient infected with COVID-19 into an extracorporeal device comprising a lectin that binds to SARS-CoV-2 virions or fragments thereof or exosomes comprising a COVID-19 antigen;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the SARS-CoV-2 virions or fragments thereof or the exosomes comprising the COVID-19 antigen to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the SARS-CoV-2 virions or fragments thereof, or the exosomes comprising the COVID-19 antigen, as compared to the blood or plasma of said patient prior to (b); and

d) optionally, the level or amount of IL-6 in a sample from said patient, such as a blood or plasma sample, has been measured prior to (a) or after (b) or both and, optionally a patient having COVID-19 has been selected or identified to receive a therapy that reduces IL-6 levels.

5. An ex-vivo method for reducing the amount of circulating D-dimer in blood or plasma of a COVID-19 patient comprising:

a) introducing the blood or plasma from a patient infected with COVID-19 into an extracorporeal device comprising a lectin that binds to SARS-CoV-2 virions or fragments thereof or exosomes comprising a COVID-19 antigen;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the SARS-CoV-2 virions or fragments thereof or the exosomes comprising the COVID-19 antigen to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the SARS-CoV-2 virions or fragments thereof or the exosomes comprising the COVID-19 antigen, as compared to the blood or plasma of said patient prior to (b); and

d) optionally, the level or amount of D-dimer in a sample from said patient, such as a blood or plasma sample, has been measured prior to (a) or after (b) or both and, optionally a patient having COVID-19 has been selected or identified to receive a therapy that reduces D-dimer.

6. An ex-vivo method for reducing the amount of Troponin T in blood or plasma of a COVID-19 patient comprising:

a) introducing the blood or plasma from a patient infected with COVID-19 into an extracorporeal device comprising a lectin that binds to SARS-CoV-2 virions or fragments thereof or exosomes comprising a COVID-19 antigen;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the SARS-CoV-2 virions or fragments thereof or the exosomes comprising the COVID-19 antigen to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the SARS-CoV-2 virions or fragments thereof or the exosomes comprising the COVID-19 antigen, as compared to the blood or plasma of said patient prior to (b); and

d) optionally, the level or amount of Troponin T in a sample from said patient, such as a blood or plasma sample, has been measured prior to (a) or after (b) or both and, optionally a patient having COVID-19 has been selected or identified to receive a therapy that reduces Troponin T.

7. An ex-vivo method of reducing coronavirus, or portions thereof, in blood or plasma of a patient having a coronavirus infection, or a symptom or sequela thereof, comprising:

a) introducing the blood or plasma comprising coronavirus or a portion thereof from ~~a~~ said patient into an extracorporeal device comprising a lectin that binds to said coronavirus or a portion thereof;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the coronavirus or a portion thereof present in the blood or plasma, to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the coronavirus, or portion thereof, as compared to the blood or plasma of said patient prior to (b); and

d) optionally, the coronavirus or portions thereof in a sample from said patient, such as a nasal (e.g., isolated from a nasal swab), blood or plasma sample, has been detected or identified prior to (a) or after (b) or both and/or, a patient having a coronavirus infection, or a symptom or sequela, thereof has been selected or identified to receive a therapy that reduces said coronavirus or a portion thereof.

8. An ex-vivo method of reducing exosomes in blood or plasma of a patient having a coronavirus infection, or a symptom or sequela thereof, comprising:

a) introducing blood or plasma comprising exosomes associated with the coronavirus infection, or the symptom or sequela thereof, from ~~a~~ said patient into an extracorporeal device comprising a lectin that binds to said exosomes;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the exosomes present in the blood or plasma to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the exosomes as compared to the blood or plasma of said patient prior to (b); and

d) optionally, the exosomes in a sample from said patient, such as a nasal, blood or plasma sample, has been detected or identified prior to (a) or after (b) or both and/or, optionally a patient having a coronavirus infection, or a symptom or sequela thereof, has been selected or identified to receive a therapy that reduces said exosomes.

9. An ex-vivo method of reducing exosomes in blood or plasma of a patient having a COVID-19 infection, or a symptom or sequela thereof, wherein the symptom or sequela thereof comprises COVID-19-associated coagulopathy (CAC), comprising:

a) introducing blood or plasma comprising exosomes associated with CAC from a patient having CAC into an extracorporeal device comprising a lectin that binds to said exosomes;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the exosomes present in the blood or plasma to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the exosomes as compared to the blood or plasma of said patient prior to (b); and

d) optionally, the exosomes in a sample from said patient, such as a nasal, blood or plasma sample, has been detected or identified prior to (a) or after (b) or both and/or, optionally a patient having CAC has been selected or identified to receive a therapy that reduces said exosomes.

10. The ex-vivo method of any one of claims 1-9, wherein the patient does not comprise a coronavirus infection prior to step (a) but exhibits symptoms or sequela of the coronavirus infection.

11. The ex-vivo method of any one of claims 1-9, wherein the patient has cleared the coronavirus infection prior to step (a), but the patient still exhibits symptoms or sequela of the coronavirus infection.

12. The ex-vivo method of any one of claims 1-11, wherein the blood or plasma of the patient does not comprise the coronavirus prior to step (a), but the patient still exhibits symptoms or sequela of the coronavirus infection.

13. The ex-vivo method of any one of claims 1-12, wherein whether the patient has early acute lung injury (ALI), early acute respiratory distress syndrome (ARDS), dyspnea, respiratory frequency $\geq$ 30 breaths/min, blood oxygen saturation $\leq$ 93%, partial pressure of arterial oxygen to fraction of inspired oxygen ratio of <300, lung infiltrates >50%, respiratory failure within 24 to 48 hours, elevated ferritin, elevated lactate, elevated lactate dehydrogenase (LDH), low absolute lymphocyte count (ALC), low platelet count, elevated prothrombin time/international normalized ratio (PT/INR), septic shock, or multiple organ dysfunction or failure, or any combination thereof has been determined prior to (a) or after (b) or both.

14. The ex-vivo method of any one of claims 1-12, wherein whether the patient has an elevated IL-6 level or amount has been determined either before (a) or after (b) or both.

15. The ex-vivo method of claim 13, wherein the elevated serum IL-6 level is greater than or equal to 2 pg/mL.

16. The ex-vivo method of any one of claims 1-15, wherein whether the patient has an elevated D-dimer level or amount has been determined either before (a) or after (b) or both.

17. The ex-vivo method of claim 16, wherein the elevated serum D-Dimer level is greater than or equal to 500ng/mL.

18. The ex-vivo method of any one of claims 1-17, wherein whether the patient has an elevated Troponin T level or amount has been determined either before (a) or after (b) or both.

19. The ex-vivo method of claim 17, wherein the elevated serum Troponin T level is greater than or equal to 15 ng/L.

20. The ex-vivo method of any one of claims 1-19, wherein the lectin is *Galanthus nivalis agglutinin* (GNA).

21. The ex-vivo method of any one of claims 1-20, wherein the extracorporeal device comprises a hollow fiber cartridge comprising the lectin and wherein the blood or plasma flows through hollow fibers of the hollow fiber cartridge.

22. The ex-vivo method of claim 21, wherein the hollow fibers of the hollow fiber cartridge comprise a pore size that excludes cellular components of the blood or plasma from contacting the lectin.

23. The ex-vivo method of claim 22, wherein the pore size is 200 nm or about 200 nm.

24. The ex-vivo method of any one of claims 20-23, wherein the lectin is immobilized or adsorbed on to a solid support, and the hollow fiber cartridge comprises the lectin immobilized or adsorbed on the solid support.

25. The ex-vivo method of claim 24, wherein the solid support comprises diatomaceous earth.

26. The ex-vivo method of any one of claims 1-25, further comprising isolating coronavirus virions, or portions thereof, bound to the lectin of the extracorporeal device.

27. The ex-vivo method of any one of claims 1-25, further comprising isolating exosomes associated with the coronavirus infection, or the symptom or sequela thereof, bound to the lectin of the extracorporeal device.

28. The ex-vivo method of claim 27, further comprising determining the contents of the isolated exosomes.

29. The ex-vivo method of claim 27 or 28, wherein the exosomes associated with the coronavirus infection, or the symptom or sequela thereof, comprise miR-424-5p, or miR-16-2-3p, or both.

30. The ex-vivo method of any one of claims 1-29, further comprising observing or measuring a reduction in number of coronavirus virions, or portions thereof; number of exosomes associated with the coronavirus infection, or the symptom or sequela thereof; or measuring the level or amount of IL-1, IL-6, IL-10, IL-15, CXCL10, CCL2, Myeloperoxidase, VCAM-1, TNF alpha, C-reactive protein (CRP), D-dimer, or Troponin-T, or any combination thereof, in a sample of the patient's blood taken after (b) relative to a sample of the patient's blood taken before (b).

31. The ex-vivo method of any one of claims 1-30, wherein an improvement in the coronavirus infection, or the symptom or sequela thereof, in the patient following (b) or (c) or both is to be observed.

32. The ex-vivo method of claim 31, wherein the improvement in the coronavirus infection, or the symptom or sequela thereof, comprises an improvement in early ALI, early ARDS, respiratory frequency, blood oxygen saturation, partial pressure of arterial oxygen to fraction of inspired oxygen ratio, lung infiltrates, respiratory failure, ferritin, lactate, LDH, ALC, platelet count, PT/INR, septic shock, or multiple organ dysfunction or failure, or any combination thereof, in the patient.

33. The ex-vivo method of claim 31 or 32, wherein the improvement in the coronavirus infection, or the symptom or sequela thereof, comprises a reduction in number of coronavirus virions, or portions thereof; exosomes associated with the coronavirus infection, or the symptom or sequela thereof; or measuring the level or amount of IL-1, IL-6, IL-10, IL-15, CXCL10, CCL2, Myeloperoxidase, VCAM-1, TNF alpha, C-reactive protein (CRP), D-dimer, or Troponin-T, or any combination thereof in the patient relative to before the treatment.

34. The ex-vivo method of any one of claims 7-33, wherein the coronavirus infection is caused by a coronavirus selected from SARS-CoV-2, SARS-CoV-1, MERS-CoV, HCoV-229E, HCoV-OC43, HCoV NL63, or HCoV-HKU1.

35. The ex-vivo method of claim 34, wherein the SARS-CoV-2 is a SARS-CoV-2 variant.

36. The ex-vivo method of claim 34, wherein the SARS-CoV-2 variant is selected from 20I/501Y.V1 (B.1.1.7), 20H/501Y.V2 (B.1.351), 20J/501Y.V3 (P.1), B.1.1.207, VUI-202102/03 (B.1.525), VUI-202101/01 (P.2), VUI-202102/01 (A.23.1), VUI 202102/04 (B.1.1.318), VUI 202103/01 (B.1.324.1), or CAL.20C (B.1.429).

37. The ex-vivo method of any one of claims 1-36, wherein the extracorporeal device is primed with an anticoagulant, preferably heparin, to prevent clotting of blood prior to (a).

38. The ex-vivo method of any one of claims 1-37, wherein the blood is flowed at a rate of about 50 to about 600 mL/min, preferably about 200 to about 400 mL/min, preferably about 200 to about 240 ml/min through said extracorporeal device.

39. The ex-vivo method of any one of claims 1-38, wherein reintroduction of the blood back to the patient comprises flushing the extracorporeal device with saline.

40. The ex-vivo method of any one of claims 1-39, wherein the blood or plasma has been contacted with the extracorporeal device for 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 hours, or any amount of time within a range defined by any two of the aforementioned times.

41. The ex-vivo method of any one of claims 1-40, wherein steps (a), (b), (c), and optionally (d) is repeated every day for 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, or 15 days.

42. An extracorporeal device comprising a lectin for use in the treatment of a coronavirus infection, or a symptom or sequela thereof, or to reduce the levels or amount of IL-1, IL-6, IL-10, IL-15, CXCL10, CCL2, Myeloperoxidase, VCAM-1, TNF alpha, C-reactive protein (CRP), D-dimer, or Troponin-T or any combination thereof in a patient in need thereof.

43. An extracorporeal device comprising a lectin for use in the treatment of COVID-19-associated coagulopathy in a patient in need thereof.

44. An extracorporeal device comprising a lectin for use in a method of treating a coronavirus infection, or a symptom or sequela thereof, in a patient in need thereof, the method comprising flowing blood from the patient through the extracorporeal device such that the blood comes in contact with the lectin, thereby resulting in processed blood~~;~~ suitable for reintroduction back to the patient.

45. The extracorporeal device for use of any one of claims 42-44, wherein the lectin is *Galantus nivalis* agglutinin.

46. The extracorporeal device for use of any one of claims 42-45, wherein the extracorporeal device comprises a hollow fiber cartridge comprising the lectin, wherein the blood of the patient flows through hollow fibers of the hollow fiber cartridge.

47. The extracorporeal device for use of claim 46, wherein the lectin is immobilized or adsorbed onto a solid support, and the hollow fiber cartridge comprises the lectin immobilized or adsorbed on the solid support.

48. The extracorporeal device for use of claim 47, wherein the solid support is diatomaceous earth.

49. The extracorporeal device for use of any one of claims 42-48, wherein the lectin selectively binds to coronavirus virions, or portions thereof; exosomes associated with the coronavirus infection, or the symptoms or sequela thereof, or any combination thereof.

50. The extracorporeal device for use of any one of claims 42-49, wherein the coronavirus infection is caused by a coronavirus selected from SARS-CoV-2, SARS-CoV-1, MERS-CoV, HCoV-229E, HCoV-OC43, HCoV NL63, or HCoV-HKU1.

51. The extracorporeal device for use of claim 50, wherein the SARS-CoV-2 is a SARS-CoV-2 variant.

52. The extracorporeal device for use of claim 51, wherein the SARS-CoV-2 variant is selected from 20I/501Y.V1 (B.1.1.7), 20H/501Y.V2 (B.1.351), 20J/501Y.V3 (P.1), B.1.1.207, VUI-202102/03 (B.1.525), VUI-202101/01 (P.2), VUI-202102/01 (A.23.1), VUI 202102/04 (B.1.1.318), VUI 202103/01 (B.1.324.1), or CAL.20C (B.1.429).

53. The extracorporeal device for use of any one of claims 36-52, wherein the extracorporeal device is used for 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 hours at a time, or any amount of time within a range defined by any two of the aforementioned times.

54. The extracorporeal device for use of any one of claims 36-53, wherein the extracorporeal device is used every day for 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, or 15 days.

55. An ex-vivo method for reducing exosomes comprising miR-424-5p, or miR-16-2-3p, or both in the blood from a patient, preferably a patient having a coronavirus infection, such as COVID-19, or a patient that has had a coronavirus infection, such as COVID-19, comprising:

a) introducing blood or plasma from said patient into an extracorporeal device comprising a lectin that binds to the exosomes, e.g., GNA, NPA, or cyanovirin;

b) contacting the blood or plasma from the patient with the lectin in the extracorporeal device for a time sufficient to allow the exosomes to bind to said lectin;

c) wherein the blood or plasma obtained after (b) is to be reintroduced into said patient, wherein the blood or plasma obtained after (b) has a reduced amount of the exosomes, as compared to the blood or plasma of said patient prior to (b); and

d) optionally, exosomes having miR-424-5p, or miR-16-2-3p, or both in a sample from said patient, such as a nasal (e.g., isolated from a nasal swab), blood, or plasma sample, have been detected or identified prior to (a) or after (b) or both and/or, optionally a patient having COVID-19 has been selected or identified to receive a therapy that reduces exosomes comprising miR-424-5p, or miR-16-2-3p, or both.

56. The ex-vivo method of claim 55, wherein the patient does not comprise a coronavirus infection, such as COVID-19, prior to step (a) but exhibits symptoms or sequela of the coronavirus infection.

57. The ex-vivo method of any one of claims 55 or 56, wherein the patient has cleared the coronavirus infection, such as COVID-19, prior to step (a), but the patient still exhibits symptoms or sequela of the coronavirus infection.

58. The ex-vivo method of any one of claims 55-57, wherein the blood or plasma from the patient does not comprise the coronavirus, such as COVID-19, prior to step (a), but the patient still exhibits symptoms or sequela of the coronavirus infection.

59. The ex-vivo method of any one of claims 55-58, wherein whether the patient has early acute lung injury (ALI), early acute respiratory distress syndrome (ARDS), dyspnea, respiratory frequency $\geq$ 30 breaths/min, blood oxygen saturation $\leq$ 93%, partial pressure of arterial oxygen to fraction of inspired oxygen ratio of <300, lung infiltrates >50%, respiratory failure within 24 to 48 hours, elevated ferritin, elevated lactate, elevated lactate dehydrogenase (LDH), low absolute lymphocyte count (ALC), low platelet count, elevated prothrombin time/international normalized ratio (PT/INR), septic shock, or multiple organ dysfunction or failure, or any combination thereof has been determined prior to (a) or after (b) or both.

60. The ex-vivo method of any one of claims 55-59, wherein whether the patient has an elevated IL-6 level or amount has been determined either before (a) or after (b) or both.

61. The ex-vivo method of claim 60, wherein the elevated serum IL-6 level is greater than or equal to 2 pg/mL.

62. The ex-vivo method of any one of claims 55-61, wherein whether the patient has an elevated D-dimer level or amount has been determined either before (a) or after (b) or both.

63. The ex-vivo method of claim 62, wherein the elevated serum D-Dimer level is greater than or equal to 500ng/mL.

64. The ex-vivo method of any one of claims 55-63, wherein whether the patient has an elevated Troponin T level or amount has been determined either before (a) or after (b) or both.

65. The ex-vivo method of claim 64, wherein the elevated serum Troponin T level is greater than or equal to 15 ng/L.

66. The ex-vivo method of any one of claims 55-65, wherein the lectin is *Galanthus nivalis agglutinin* (GNA).

67. The ex-vivo method of any one of claims 55-66, further comprising observing or measuring a reduction in number of coronavirus virions, or portions thereof; number of exosomes associated with the coronavirus infection, or the symptom or sequela thereof; or measuring the level or amount of IL-1, IL-6, IL-10, IL-15, CXCL10, CCL2, Myeloperoxidase, VCAM-1, TNF alpha, C-reactive protein (CRP), D-dimer, or Troponin-T, or any combination thereof, in a sample of the patient's blood taken after (b) relative to a sample of the patient's blood taken before (b).

68. The ex-vivo method of any one of claims 55-67, wherein the coronavirus infection is caused by a coronavirus selected from SARS-CoV-2, SARS-CoV-1, MERS-CoV, HCoV-229E, HCoV-OC43, HCoV NL63, or HCoV-HKU1.

69. The ex-vivo method of claim 68, wherein the SARS-CoV-2 is a SARS-CoV-2 variant.

70. The ex-vivo method of claim 69, wherein the SARS-CoV-2 variant is selected from 20I/501Y.V1 (B.1.1.7), 20H/501Y.V2 (B.1.351), 20J/501Y.V3 (P.1), B.1.1.207, VUI-202102/03 (B.1.525), VUI-202101/01 (P.2), VUI-202102/01 (A.23.1), VUI 202102/04 (B.1.1.318), VUI 202103/01 (B.1.324.1), or CAL.20C (B.1.429).