WHAT IS CLAIMED IS:

1. A method of processing a fluid comprising a recombinant therapeutic protein, the method comprising:

(a) providing a bioprocessing system comprising: (i) a unit operation, (ii) at least one inlet on the unit operation, (iii) at least one outlet on the unit operation, (iv) an inlet conduit in fluid communication with at least one inlet of the unit operation, (v) an outlet conduit in fluid communication with at least one outlet of the unit operation, (vi) a back pressure regulator disposed in the outlet conduit, and (vii) a booster pump disposed in the outlet conduit that follows downstream of the back pressure regulator;

(b) flowing the fluid comprising the recombinant therapeutic protein through the inlet conduit and into the at least one inlet of the unit operation, processing the fluid within the unit operation to obtain a processed fluid, and then flowing a portion of the processed fluid into the outlet conduit; and

(c) maintaining a target flow rate and/or pressure through the outlet conduit using the back pressure regulator and the booster pump.

2. The method of claim 1, wherein the unit operation is selected from the group consisting of a cell removal unit operation, a cell retention unit operation, a tangential flow filtration unit operation, a chromatography unit operation, a viral inactivation unit operation, a virus removal filtration unit operation, and a formulation unit operation.

3. A method of processing a fluid comprising a recombinant therapeutic protein, the method comprising:

(a) providing a bioprocessing system comprising: (i) a tangential flow filtration (TFF) unit with a permeate side and a retentate side, (ii) at least one inlet on the TFF unit, (iii) at least two outlets on the TFF unit, where one of the at least two outlets is on the permeate side of the TFF unit and one of the at least two outlets is on the retentate side of the TFF unit, (iv) an inlet conduit in fluid communication with at least one inlet of the TFF unit, (v) a permeate conduit in fluid communication with the outlet on the permeate side of the TFF unit, (vi) a retentate conduit in fluid communication with the outlet on the retentate side of the TFF unit, (vii) a back pressure

regulator disposed in the permeate conduit or the retentate conduit, and (viii) a booster pump disposed in the permeate conduit or the retentate conduit that follows downstream of the back pressure regulator;

(b) flowing the fluid comprising the recombinant therapeutic protein through the inlet conduit and into the at least one inlet of the TFF unit, and separating the fluid into retentate and permeate streams based on the pore size or molecular weight cutoff of the TFF unit, and then flowing those permeate and retentate streams into the permeate and retentate conduits, respectively; and

(c) maintaining a target flow rate and/or pressure through the permeate conduit or the retentate conduit using the back pressure regulator and the booster pump.

4. The method of claim 3, wherein the TFF unit has a molecular weight cutoff from about 1 kDa to about 1000 kDa or about 10 kDa to about 100 kDa.

5. The method of claim 3, wherein the TFF unit has an average pore size from about 10 nm to about 100 nm, about 15 nm to about 35 nm, or about 0.1 μm to about 10 μm.

6. The method of any one of claims 3 to 5, wherein:

(i) the recombinant therapeutic protein in the fluid in the inlet conduit has a concentration from about 0.1 g/L to about 300 g/L or about 0.1 g/L to about 150 g/L; and/or

(ii) the recombinant therapeutic protein in the retentate stream in the retentate conduit has a concentration from about 0.1 g/L to about 300 g/L or about 5 g/L to about 225 g/L; and/or

(iii) the recombinant therapeutic protein in the permeate stream in the permeate conduit has a concentration from about 0 g/L to about 100 g/L or about 0.1 g/L to about 25 g/L; and/or

(iv) the TFF unit is comprised of one or more filters each with filter areas of about 50 cm^2 to about 10 m^2 or about 0.1 m^2 to about 5 m^2.

7. The method of any one of claims 1 to 6, wherein the booster pump is a dynamic pump.

8. The method of claim 7, wherein the dynamic pump is a centrifugal pump.

9. The method of any one of claims 3 to 8, wherein step (b) comprises continuously flowing the fluid at an average rate from about 0.1 mL/minute to about 10 L/minute or about 1 mL/minute to about 1 L/minute.

10. The method of any one of claims 3 to 9, wherein the bioprocessing system further comprises one or more sensor(s).

11. The method of claim 10, wherein at least one of the one or more sensor(s) is disposed in the inlet conduit, the permeate conduit and/or the retentate conduit.

12. The method of claim 10 or claim 11, wherein the recombinant therapeutic protein concentration is measured using the one or more sensor(s) that has a sampling time of less than about 2 minutes.

13. The method of any one of claims 3 to 12, wherein the recombinant therapeutic protein concentration is measured using UV absorbance, refractive index, Fourier Transform Infrared Spectroscopy (FTIR), or Raman spectroscopy.

14. The method of any one of claims 3 to 13, wherein the recombinant therapeutic protein concentration is measured using UV absorbance, and wherein the UV absorbance is measured between about 200 nm to about 400 nm or about 260 nm to about 320 nm.

15. The method of claim 13 or claim 14, wherein the UV absorbance is measured with a flowcell with a fixed pathlength or a variable pathlength.

16. The method of any one of claims 1 to 15, further comprises, prior to step (a), performing one or more second unit operation(s) on the recombinant therapeutic protein, wherein the one or more second unit operation(s) is/are integrated upstream of the bioprocessing system, such that one of the one or more second unit operation(s) is in fluid communication with the inlet conduit of the bioprocessing system.

17. The method of claim 16, wherein the one or more second unit operation(s) is/are selected from the group consisting of: a bioreactor unit operation, a cell removal unit operation, a cell retention unit operation, a chromatography unit operation, a viral inactivation unit operation, a virus removal unit operation, an ultrafiltration unit operation, and a diafiltration unit operation.

18. The method of any one of claims 3 to 17, further comprises, after step (c), performing one or more second unit operation(s), such that one of the one or more second unit operation(s) is in fluid communication with the permeate conduit of the bioprocessing system or with the retentate conduit of the bioprocessing system.

19. The method of claim 18, wherein the one or more second unit operation(s) is a chromatography unit operation, a viral inactivation unit operation, a virus removal unit operation, an ultrafiltration unit operation, a diafiltration unit operation, or a formulation unit operation.

20. A bioprocessing system comprising:

(i) a unit operation;

(ii) at least one inlet on the unit operation;

(iii) at least one outlet on the unit operation;

(iv) an inlet conduit in fluid communication with at least one inlet of the unit operation;

(v) an outlet conduit in fluid communication with at least one outlet of the unit operation;

(vi) a back pressure regulator disposed in the outlet conduit, and

(vii) a booster pump disposed in the outlet conduit that follows downstream of the back pressure regulator,

wherein:

the bioprocessing system is configured to flow fluid comprising the recombinant therapeutic protein through the inlet conduit and into the at least one inlet of the unit operation, processing the fluid within the unit operation to obtain a processed fluid, and then flowing a portion of the processed fluid into the outlet conduit and

the back pressure regulator and the booster pump are configured to maintain a target flow rate and/or pressure through the outlet conduit.

21. The bioprocessing system of claim 20, wherein the unit operation is selected from the group consisting of a cell removal unit operation, a cell retention unit operation, a tangential flow filtration unit operation, a chromatography unit operation, a viral inactivation unit operation, a virus removal unit operation, and a formulation unit operation.

22. A bioprocessing system.

comprising:

(i) a tangential flow filtration (TFF) unit having at least one inlet and at least two outlets, wherein one of the at least two outlets is on the permeate side of the TFF unit and one of the at least two outlets is on the retentate side of the TFF unit;

(ii) an inlet conduit in fluid communication with the at least one inlet of the TFF unit;

(iii) a permeate conduit in fluid communication with the outlet on the permeate side of the TFF unit;

(iv) a retentate conduit in fluid communication with the outlet on the retentate side of the TFF unit;

(v) a back pressure regulator disposed in the permeate conduit or the retentate conduit, and

(vi) a booster pump disposed in the permeate conduit or the retentate conduit that follows downstream of the back pressure regulator,

wherein:

the bioprocessing system is configured to flow fluid comprising a recombinant therapeutic protein through the inlet conduit and into the at least one inlet of the TFF unit, and separate the fluid into retentate and permeate streams based on the pore size or molecular weight cutoff of the TFF unit, and then flow those permeate and retentate streams into the permeate and retentate conduits; and

the back pressure regulator and the booster pump are configured to maintain a target flow rate and/or pressure through the permeate conduit or the retentate conduit.

23. The bioprocessing system of claim 22, wherein:

(i) the TFF unit has a molecular weight cutoff from about 1 kDa to about 1000 kDa or 10 kDa to about 100 kDa; or

(ii) the TFF unit has an average pore size from about 10 nm to about 100 nm, about 15 nm to about 35 nm, or about 0.1 μm to about 10 μm.

24. The bioprocessing system of claim 22 or claim 23, wherein:

(i) the recombinant therapeutic protein in the fluid in the inlet conduit has a concentration from about 0.1 g/L to about 300 g/L or about 0.1 g/L to about 150 g/L; and/or

(ii) the recombinant therapeutic protein in the retentate stream in retentate conduit has a concentration from about 0.1 g/L to about 300 g/L or about 5 g/L to about 225 g/L; and/or

(iii) the recombinant therapeutic protein in the permeate stream in the permeate conduit has a concentration from about 0 g/L to about 100 g/L or about 0.1 g/L to about 25 g/L; and/or

(iv) the TFF unit is comprised of one or more filters each with filter areas of about 50 cm^2 to about 10 m^2 or about 0.1 m^2 to about 5 m^2.

25. The bioprocessing system of any one of claims 20 to 24, wherein the booster pump is a dynamic pump.

26. The bioprocessing system of claim 25, wherein the dynamic pump is a centrifugal pump.

27. The bioprocessing system of any one of claims 22 to 26, wherein the bioprocessing system further comprises one or more sensor(s).

28. The bioprocessing system of claim 27, wherein at least one of the one or more sensor(s) is disposed in the inlet conduit, the permeate conduit, and/or the retentate conduit.

29. The bioprocessing system of claim 27 or claim 28, wherein the one or more sensors are configured to measure the recombinant therapeutic protein concentration with a sampling time of less than about 2 minutes.

30. The bioprocessing system of any one of claims 27 to 29, wherein the one or more sensors are configured to measure the recombinant therapeutic protein concentration using UV absorbance, refractive index, Fourier Transform Infrared Spectroscopy (FTIR), or Raman spectroscopy.

31. The bioprocessing system of claim 30, wherein the one or more sensors are configured to measure the recombinant therapeutic protein concentration using UV absorbance between about 200 nm to about 400 nm or about 260 nm to about 320 nm.

32. The bioprocessing system of claim 31, wherein at least one of one of the one or more sensors comprises a flowcell with a fixed pathlength or a variable pathlength.

33. The bioprocessing system of any one of claims 20 to 32, wherein one or more second unit operation(s) is/are integrated upstream of the bioprocessing system, such that one of the one or more second unit operation(s) is in fluid communication with the inlet conduit of the bioprocessing system.

34. The bioprocessing system of claim 33, wherein the one or more second unit operation(s) is/are selected from the group consisting of: a bioreactor unit operation, a cell removal unit operation, a cell retention unit operation, a chromatography unit operation, a viral inactivation unit operation, a virus removal unit operation, an ultrafiltration unit operation, and a diafiltration unit operation.

35. The bioprocessing system of any one of claims 22 to 32, wherein one or more second unit operation(s) is/are integrated downstream of the bioprocessing system, such that one of the one or more second unit operation(s) is in fluid communication with the permeate conduit of the bioprocessing system or with the retentate conduit of the bioprocessing system.

36. The bioprocessing system of claim 35, wherein the one or more second unit operation(s) is selected from the group consisting of: a chromatography unit operation, a viral inactivation unit operation, a virus removal unit operation, an ultrafiltration unit operation, a diafiltration unit operation, and a formulation unit operation.