## CLAIMS

1. A tangential flow depth filtration (TFDF) system, comprising:

a filter having first and second ends and comprising at least one tubular depth filter (TDF) extending between and open to each of the first and second ends of the filter, each TDF having an inner diameter of at least 1 mm and comprising a porous wall having a thickness of at least 100 μm, the wall of the TDF defining tortuous flow paths that capture particles in settling zones and narrowing channels within the wall while permitting smaller particles to pass therethrough;

a first vessel in fluid communication with the first end of the filter and the at least one TDF and configured to contain a biological fluid; and

a pump operating at a rate to drive a biological fluid through the first vessel and the filter such that the biological fluid flow is above the laminar flow range through at least a portion of the length of the TDF, with a Reynolds number (Re) at the first end of the filter greater than 2300, 2500, 3000, 3500 or 4000.

2. The TFDF system of claim 1, wherein each TDF has an inner diameter between 2 and 5 mm.

3. The TFDF system of claim 1 or 2, wherein the pump is configured to provide a feed velocity greater than 2 m/s.

4. The TFDF system of any one of claims 1-3, further comprising:

a second vessel fluidly isolated from the first and second ends of the filter and in fluid communication with at least one external surface of the at least one TDF; and

a third vessel fluidly connected to the second end of the filter and the at least one TDF, and fluidly connected to the first vessel.

5. The TFDF system of claim 4, wherein operation of the pump drives fluid flow from the first vessel through the at least one TDF and into the second and third vessels.

6. The TFDF system of claim 5, wherein a flow of fluid through the at least one TDF between the first and third vessels is non-laminar.

7. A tangential flow depth filtration (TFDF) system driving a non-laminar flow of a biological fluid through at least a portion of at least one tubular depth filter (TDF) having a wall defining tortuous flow paths that capture particles in settling zones and narrowing channels within the wall while permitting smaller particles to pass therethrough.

8. The TFDF system of claim 7, wherein the TFDF system is configured to operate at shear rates below 16,000 $s^{-1}$.

9. A TFDF system according to any one of claims 1-8, wherein the at least one TDF comprises a sintered polymer or a melt-blown polymer.

10. The TFDF system of claim 9, wherein a density of the at least one TDF is 50%, 51%, 52%, 53%, 54%, 55%, 56%, 57%, 58%, 59% or 60% of the density of an equivalent solid volume of the polymer.

11. The TFDF system of any one of claims 9-10, wherein the at least one TDF has a mean pore size or a first bubble point size between 0.2 and 5 microns as measured by bubble point testing.

12. The TFDF system of any one of claims 9-11, wherein the at least one TDF has an inner diameter between 0.75 and 13 mm and a length between 200 to 2000 mm.

13. A method of filtering the biological fluid, the method comprising:

passing the biological fluid through the TFDF system according to any of claims 1-8 such that the biological fluid flows in a non-laminar manner through the at least one TDF.

14. The method of claim 13, wherein a product of a feed velocity of the system and an inner diameter of the at least one TDF is greater than 2500 $mm^2s^{-1}$.

15. The method of any of claims 13-14, wherein a Reynolds number characterizing the flow of fluid into the filter is greater than 2300, 2500, 3000, 3500, or 4000.

16. A method of filtering a biological fluid, the method comprising:

passing the biological fluid through the TFDF system according to any of claims 4-6 under conditions in which the feed velocity is 2300, 2500, 3000, 3500 or 4000 times greater than the quotient of a kinematic viscosity of the fluid over the diameter of the at least one TDF.

17. The method of any one of claims 13-16, wherein a direction of flow through the at least one TDF is alternated.

18. The method of any one of claims 13-17, further comprising a step of collecting a filter permeate.

19. The method of any one of claims 13-18, wherein the at least one TDF retains a non-desired species.

20. The method of claim 19, wherein the retained non-desired species is selected from the group consisting of: a species of mammalian cell origin; a species of microbial cell origin; a species of viral origin; a protein; a nucleic acid; a polysaccharide; or a complex of any of the foregoing.

21. The method of any one of claims 13-20, wherein a desired species passes through the at least one TDF into a permeate.

22. The method of claim 21, wherein the desired species is selected from the group consisting of: a species of mammalian cell origin; a species of microbial cell origin; a species of viral origin; a protein; a nucleic acid; a polysaccharide; a virus; a microcarrier; a particle; or a complex of any of the foregoing.

23. A method according to one of claims 16-17, wherein the method comprises a step of removing a permeate from the biological fluid, wherein a desired species that is retained by the TDF is concentrated 5X, 10X, 20X, 40X, 50X, 75X or 100X relative to the concentration in the biological fluid.

24. The method of claim 23, wherein the desired species is selected from the group consisting of: a species of mammalian cell origin; a species of microbial cell origin; a species of viral origin; a protein; a nucleic acid; a polysaccharide; a virus; a microcarrier; a particle; or a complex of any of the foregoing.