CLAIMS

What is claimed is:

1. A skid for use in separating biocomponents, the skid comprising:

a housing bounding a compartment, the compartment being partially bounded by a mounting platform; and

a loading assembly secured to the housing so as to communicate with the compartment, the loading assembly comprising:

an alignment plate having a top surface with cavity recessed therein, the cavity communicating with the compartment;

a drive rotor rotatably disposed below the alignment plate and at least partially encircling the cavity, the drive rotor including one or more magnets;

a motor coupled to the drive rotor for selectively rotating the drive rotor about the cavity; and

a mount at least partially encircling the drive rotor and communicating with the compartment, the mount including a mounting plate having one or more mounting elements upstanding therefrom, the mount being movable between a raised position wherein the mounting plate is aligned with the alignment plate and a second lowered position wherein the mounting plate is disposed at an elevation lower than the alignment plate.

2. The skid as recited in claim 1, further comprising:

a doorway formed on the housing and communicating with the compartment; and

a door mounted on the housing, the door being movable between an open position wherein the doorway is openly exposed and a closed position wherein the door covers the doorway.

3. The skid as recited in claim 2, further comprising notch recessed into an exterior surface of the housing and extending between a side face of the housing and the doorway, the notch bounding a channel the communicates with the compartment whether the door is in the open position or the closed position.

4. The skid as recited in claim 1,

wherein the mounting platform comprises an opening extending therethrough; and

wherein the loading assembly is secured to the housing so that the alignment plate is aligned with the opening extending through the mounting platform.

5. The skid as recited in claim 4, wherein at least a portion of a top surface of the mounting platform, a top surface of the alignment plate, and a top surface of the mounting plate are horizontally aligned when the mount is in the raised position.

6. The skid as recited in claim 1, wherein the loading assembly further comprises:

an annular inner sleeve that encircles an opening, the inner sleeve having an upper end with the alignment plate mounted thereon;

a receiver extending from a bottom surface of the alignment plate and projecting into the opening of the annular sleeve, the receiver bounding the cavity; and

the drive rotor being at least partially disposed within the opening of the inner sleeve.

7. The skid as recited in claim 6, -wherein the loading assembly further comprises an annular outer sleeve encircling the inner sleeve, the outer sleeve having an upper end with the mounting plate mounted thereon, the outer sleeve and the mounting plate being movable relative to the inner sleeve.

8. The skid as recited in claim 7, further comprising:

a support from which the inner sleeve upstands;

a pivot mount block secured to the support at a location spaced apart from the inner sleeve;

a pair of pivot arms each having a first end pivotably mounted to the pivot mount block so that the pair of pivot arms extend along opposing sides of the outer sleeve; and

a pair of support pins outwardly projecting from the opposing sides of the outer sleeve and coupling with corresponding ones of the pair of pivot arms.

9. The skid as recited in claim 7, further comprising a linear actuator positioned to selectively raise and lower the outer sleeve relative to the inner sleeve.

10. The skid as recited in claim 1, wherein the one or more mounting elements comprise one or more L-shaped clips upstanding from the mounting plate and facing toward the cavity.

11. The skid as recited in claim 1, further comprising one or more peristaltic pumps mounted on an exterior surface of the housing.

12. The skid as recited in claim 1, further comprising one or more pinch valves mounted on an exterior surface of the housing.

13. The skid as recited in claim 1, further comprising one or more of a pressure sensor, conductivity sensor, flow meter sensor, pH sensor, temperature sensor, or turbidity sensor mounted on an exterior surface of the housing.

14. A system for separating biocomponents, the system comprising:

the skid as recited in claim 1; and

a centrifugal separator removably disposed within the compartment of the skid, the centrifugal separator being supported on the mounting plate of the loading assembly.

15. The system as recited in claim 14, further comprising a first fluid line fluid coupled to the centrifugal separator within the compartment of the skid, the first fluid line passing out of the compartment and being removably secured to an exterior surface of the housing.

~~16. The system as recited in claim 15, wherein the first fluid line is removably coupled to a peristaltic pump and/or a pinch valve secured to the exterior surface of the housing.~~

~~17. The system as recited in claim 15, further comprising a sensor mounted on the first fluid line, the sensor being removably plugged into an electrical outlet formed on the exterior surface of the housing.~~

~~18. The system as recited in claim 14, wherein the centrifugal separator is at least partially secured to the mounting plate by a magnetic force produced by the one or more magnets of the drive rotor.~~

~~19. The system as recited in claim 14,~~

~~wherein the centrifugal separator comprises:~~

~~a separation stator that bounds a chamber, the separation stator having a floor with a receiver outwardly projecting therefrom, the receiver bounding a recess that communicates with the chamber of the separation stator;~~

~~a separation rotor rotatably disposed within chamber of the separation stator;~~

~~a drive coupling coupled to and extending from the separation rotor so as to project into the recess of the receiver; and~~

~~a driver sleeve that outwardly projects from a floor of the separation stator and at least partially encircles the receiver of the separation stator;~~

~~wherein the centrifugal separator is positioned so that receiver of the separation rotor is aligned with the cavity of the alignment plate and the one or more mounting elements engage the driver sleeve.~~

~~20. The system as recited in claim 19, wherein the receiver of the separation stator is received within the cavity of the alignment plate when the mounting plate is moved to the lowered position and the receiver of the separation stator is removed from within the cavity of the alignment plate when the mounting plate is moved to the raised position.~~

~~21. The system as recited in claim 19, wherein the driver sleeve has one or more apertures or recesses in which a portion of the one or more mounting elements are received.~~

~~22. The system as recited in claim 19, wherein with the one or more mounting elements engaging the driver sleeve, moving the mounting plate to the lowered position rigidly locks the centrifugal separator to the housing of the skid.~~

~~23.~~16. A method for separating biocomponents, the method comprising:

positioning a centrifugal separator on a top surface of the mounting platform of the skid as recited in claim 1;

laterally moving the centrifugal separator within the compartment of the housing so that the centrifugal separator is supported on the mounting plate of the mount and the mounting elements engage the centrifugal separator;

moving the mounting plate to the lowered position so that centrifugal separator is lowered relative to the alignment plate, a drive coupling of the centrifugal separator being received within the cavity of the alignment plate as the mounting plate is moved to the lowered position; and

activating the motor to rotate the drive rotor which magnetically rotates a separation rotor of the centrifugal separator.

~~24.~~17. The method as recited in claim ~~23~~16, wherein laterally moving the centrifugal separator comprises laterally sliding the centrifugal separator on the mounting platform proximate a magnetic field produced by the one or more magnets of the drive rotor, wherein the magnetic field~~-~~ assists in positioning of the centrifugal separator.

~~25.~~18. The method as recited in claim ~~23~~16, wherein moving the mounting plate to the lowered position rigidly locks the centrifugal separator to the housing of the skid.

~~26.~~19. The method as recited in claim ~~23~~16, wherein the step of positioning a centrifugal separator on the top surface of the mounting platform comprises:

passing the centrifugal separator through a doorway formed on the housing and into the compartment; and

closing a door that covers the doorway after the centrifugal separator is within the compartment.

~~27.~~20. The method as recited in claim ~~23~~16, wherein the centrifugal separator is positioned on the top surface of the mounting platform so that a first fluid line coupled with centrifugal separator passes out of the compartment of the housing, the method further comprising removably

securing the first fluid line to a pinch valve and/or a peristaltic pump mounted on an exterior surface of the housing.

28. A method for separating a biological suspension, the method comprising:

growing biological cells or microorganism of a suspension within a bioproduction vessel, the suspension further comprising a growth medium; and

passing an inlet stream of the suspension from the bioproduction vessel to an inlet opening of a centrifugal separator, the centrifugal separator separating the inlet stream into a first outlet stream that passes out of the centrifugal separator through a first outlet opening and a second outlet stream that passes out of the centrifugal separator through a second outlet opening, the first outlet stream having a greater density or percent solids than the second outlet stream.

29. A centrifugal separator comprising:

a separation stator bounding a chamber, the separation stator having an inlet opening, a first outlet opening and a second outlet opening; and

a separation rotor bounding a compartment, the separation rotor being at least partially disposed within the chamber of the separation stator and being rotatable therein about a rotational axis, a heavy component collection recess and light component collection recess being disposed between the separation stator and the separation rotor at spaced apart positions, the heavy component collection recess communicating with the first outlet opening and light component collection recess communicating with the second outlet opening, the separation rotor comprising:

a floor;

a sidewall assembly upstanding from the floor and encircling the compartment, the sidewall assembly comprising a plurality of separated heavy component fluid paths that each communicate upstream with the inlet opening and downstream with the heavy component collection recess; and

a plurality of upper partitions radially inwardly projecting from sidewall assembly into the compartment so as to at least partially divide the compartment into a plurality of separated light component fluid paths that each communicate

upstream with the inlet opening and downstream with the light component collection recess,

wherein each light component fluid path communicates with at least two of the separated heavy component fluid paths but is isolated from at least some of the plurality of separated heavy component fluid paths.

30. A centrifugal separator comprising:

a separation stator bounding a chamber, the separation stator having an inlet opening, a first outlet opening and a second outlet opening;

a separation rotor bounding a compartment, the separation rotor being at least partially disposed within the chamber of the separation stator and being rotatable therein about a rotational axis, the separation rotor having a floor with an interior surface and an opposing bottom surface, a bowl being formed on and outwardly projecting from the bottom surface of the floor, the bowl bounding a recess formed on the interior surface of the floor and communicating with the compartment of the separation rotor; and

an annular bearing assembly extending between the separation stator and the separation rotor so as to enable the separation rotor to rotate relative to the separation stator, the annular bearing assembly encircling and being disposed directly against the exterior surface of the bowl so as to encircle at least a portion of the recess.

31. The centrifugal separator as recited in claim 30, wherein during operation, a fluid flowing between the inlet opening and the first and second outlet openings passes through the recess of the bowl so as to form a heat sink for the bearing.

32. The centrifugal separator as recited in claim 30, further comprising a plurality of fins downwardly projecting from the bottom surface of the floor and radially outwardly projecting away from the bowl.