CLAIMS

We claim:

~~1. A depth filter comprising a housing having an inlet, an outlet spaced from said inlet, an internal volume containing filtration media, and a head space in said internal volume, wherein the volume of said head space is from 4 to 14 liters per square meter of filtration media area in said internal volume.~~

~~2. The depth filter of claim 1, wherein the volume of said head space is from 4 to 10 liters per square meter of filtration media area in said internal volume.~~

~~3. The depth filter of claim 1, wherein said filtration media comprises a composite of graded layers of non-woven fibers, cellulose, and diatomaceous earth.~~

~~4. The depth filter of claim 1, wherein the minimum filtration media area is 0.1 m^2.~~

~~5~~1. A filter assembly for filtering particles from a liquid which comprises:

a housing (12, 12') having an inlet (13, 13') for introduction of a liquid to be filtered and an outlet (14, 14')for filtered liquid, said outlet being spaced from said inlet,

depth filter media (16, 16') in said housing;

a head space (15, 15') in said housing and upstream of said depth filter media in the direction of fluid flow during filtration, ~~wherein~~ characterized in that the volume of said head space is from 4 to 14 liters per meter squared of depth filter media area in said housing.

~~6~~2. The filtration assembly of claim ~~5~~ 1, wherein the volume of said head space (15, 15') is from 4 to 10 liters per square meter of filtration media area in said housing.

~~7~~3. The filtration assembly of claim ~~5~~ 1, wherein said filte~~ration~~ media (16, 16') comprises a composite of graded layers of non-woven fibers, cellulose, and diatomaceous earth.

~~8~~4. A process of removing impurities from a biological sample, comprising filtering said sample through a depth filter comprising a housing (12, 12') having a volume, depth filter media (16, 16') in said volume, and a head space (15, 15') in said volume, the head space being upstream of said

media in the direction of fluid flow during filtration, ~~wherein~~ characterized in that the volume of said head space is from 4 to 14 liters per square meter of filtration media area.

~~9. A process for the clarification of a feed containing a target biomolecule of interest and a plurality of cellular debris and/or colloidal particulates by depth filtration, the process comprising:~~

~~a) providing a depth filtration device having a head space and porous depth filter media, wherein the volume of said head space is from 4 to 14 liters per meter squared of said depth filter media area in said device;~~

~~b) providing a feed containing a target biomolecule of interest and a plurality of cellular debris and/or colloidal particulates;~~

~~c) introducing the feed into said head space and contacting the depth filter media with the feed; and~~

~~d) separating the target biomolecule of interest from the cellular debris and the colloidal particulates in the feed.~~

~~10~~5. The process of claim ~~9~~ 4, wherein said depth filtration is carried out without the use of a primary clarification centrifugation step or a primary clarification tangential flow microfiltration step.

~~11~~6. The process of claim ~~9~~ 4, wherein the volume of said head space (15, 15') is from 4 to 10 liters per meter squared of said depth filter media area in said device.

~~12. A process of optimizing the performance of a depth filter, the depth filter having a housing having a fluid inlet, a fluid outlet spaced from said fluid inlet, an internal volume, porous depth filter media in said internal volume, and a head space between said fluid inlet and said porous depth filter media, said process comprising configuring the volume of said head space to be from 4 to 14 liters per meter squared of said porous depth filter media in said housing.~~

~~13. A method of determining an area of a depth filter needed to filter a volume of cell culture comprising a plurality of cells having a cell diameter, and having a total cell density, said method comprising:~~

~~calculating the volume occupied by a single cell (V_c);~~

~~multiplying V_c by the total cell density to determine the volume of cells per volume of cell culture (L cells / L cell culture);~~

~~determining a head space per unit area of a filter (L head space / m^2 of depth filter area) to define a filter headspace per depth filter area;~~

~~dividing the filter headspace per depth filter area by the volume of cells per volume of cell culture to determine a filter capacity (L cell culture / m^2 of depth filter area); and~~

~~dividing said volume of cell culture by said filter capacity to determine an area of the filter sufficient to filter said volume of cell culture.~~

~~14. The method of claim 13, wherein the volume occupied by the cells comprises the volume of a cell multiplied by the total cell density.~~

~~15. The method of claim 14, wherein the volume occupied by the cells is further comprises the void volume between cells.~~

~~16. The method of claim 15, wherein the void volume is between about 0.5-0.38.~~

~~1~~7. A method of determining the optimum volume of cell culture to be filtered by depth filter having a defined head space volume, wherein the volume of cell culture comprises a plurality of cells having a cell diameter, and having a total cell density, said method comprising:

calculating a volume occupied by a cell;

multiplying a volume occupied by a cell with total cell density of cell culture media;

dividing a head space (15, 15') per unit depth filtration area by the multiplication of volume occupied by a cell with total cell density of cell culture media to obtain the optimal volume than can be processed by unit depth filter area with defined head space volume per unit area, wherein said head space volume is from 4 to 14 liters per meter squared of said depth filtration media (16, 16') area.

~~1~~8. The method of claim ~~1~~7, wherein the volume occupied by the cells comprises the volume of a cell multiplied by the total cell density.

~~1~~9. The method of claim ~~1~~8, wherein the volume occupied by the cells further comprises the void volume between cells.

~~2~~10. The method of claim ~~1~~9, wherein the void volume is between approximately 0.5-0.38.

11. The method of claim 7, further comprising determining an area of a depth filter needed to filter a volume of cell culture comprising a plurality of cells having a cell diameter, and having a total cell density, said method comprising:

calculating the volume occupied by a single cell (Vc);

multiplying Vc by the total cell density to determine the volume of cells per volume of cell culture (L cells / L cell culture);

determining a head space per unit area of a filter (L head space / m2 of depth filter area) to define a filter headspace per depth filter area;

dividing the filter headspace per depth filter area by the volume of cells per volume of cell culture to determine a filter capacity (L cell culture / m2 of depth filter area); and

dividing said volume of cell culture by said filter capacity to determine an area of the filter sufficient to filter said volume of cell culture.