

CLAIMS

What is claimed is:

1. A separation system, comprising:
a column with an opening on each end to permit a fluid flow therethrough, the column being configured as a fluidized bed to permit introduction and containment of a plurality of support structures that are targeted to at least two different types of cellular material;
an acoustic transducer on one end of the column for generating an acoustic standing wave in the column; and
the acoustic transducer being configured to generate the acoustic standing wave to block and retain the support structures in the column against the fluid flow.
2. The system of claim 1, further comprising an agitator coupled to the column for agitating the fluid.
3. The system of claim 1, wherein the acoustic transducer is configured to operate in a plurality of modes.
4. The system of claim 3, wherein the plurality of modes comprise a clustering mode and an edge effect mode.
5. The system of claim 1, wherein the acoustic transducer is configured to generate a multi-dimensional acoustic standing wave in the column.
6. The system of claim 1, further comprising a ratio of the support structures that are targeted to at least two different types of cellular material to obtain two different types of cellular material in a predetermined ratio.
7. The system of claim 6, wherein the support structures comprise affinity beads that are configured with an antibody specific to a target cell type.
8. The system of claim 7, wherein the affinity beads comprise column packing in a range of from about 10% to about 30% of the column volume.
9. The system of claim 7, wherein the affinity beads are configured with one or more of CD4 or CD8 capturing antibodies.
10. The system of claim 7, wherein the affinity beads are configured as avidin-conjugated methacrylate beads.

11. A method for separating materials, comprising:
providing support structures in a column configured as a fluidized bed for binding with at least two different types of cellular material;
flowing a fluid mixture that includes the at least two different types of cellular material into the column; and
generating an acoustic standing wave with an acoustic transducer near an end of the column to block the support structures from leaving the column with the fluid flow.
12. The method of claim 11, further comprising agitating the fluid mixture in the column.
13. The method of claim 11, further comprising:
binding a first type of cellular material with first support structures in the column; and
binding a second type of cellular material that is distinct from the first type of cellular material with second support structures in the column.
14. The method of claim 13, further comprising eluting at least one of the first type of cellular material or the second type of cellular material from the column while retaining the support structures in the column with the acoustic standing wave.
15. The method of claim 11, further comprising generating a multi-dimensional acoustic standing wave in the column.
16. The method of claim 11, wherein the support structures comprise affinity beads.
17. The method of claim 16, further comprising packing the column in a range of from about 10% to about 30% of the column volume with the affinity beads.
18. The method of claim 16, wherein the affinity beads are configured with one or more of CD4 or CD8 capturing antibodies.
19. The method of claim 16, wherein the affinity beads are configured as avidin-conjugated methacrylate beads.
20. An acoustic affinity separation method, comprising:
providing first affinity beads targeted to a first cellular material in a fluid to a first column;

providing second affinity beads targeted to a second cellular material in a fluid to a second column;
generating an acoustic standing wave with an acoustic transducer near an end of each of the first column and the second column;
flowing a cellular material fluid mixture in the first column and through the acoustic standing wave;
configuring the acoustic standing wave in the first column to prevent the first affinity beads from passing through the acoustic standing wave;
flowing the cellular material fluid mixture that passed through the acoustic standing wave in the first column to the second column and through the acoustic standing wave of the second column; and
configuring the acoustic standing wave in the second column to prevent the second affinity beads from passing through the acoustic standing wave of the second column.