In still further examples, provided herein is a method for collecting a target biological population from a biological sample in an automated cell culture system, the method comprising: a. binding a non-target biological population to magnetic particles; b. circulating the biological sample through one or more fluidics pathways of the automated cell culture system; c. exposing the non-target biological population bound to the magnetic particles to a magnetic field gradient to capture the non-target biological population bound to the magnetic particles; d. circulating the target of the biological sample through one or more fluidics pathways of the automated cell culture system; e. inserting a magnetic field shield/barrier between the non-target biological population bound to the magnetic particles and the magnetic field to release the non-target biological population bound to the magnetic particles; f. circulating the non-target biological population bound to the magnetic particles through one or more fluidics pathways of the automated cell culture system; g. repeating steps b-f one or more times; and h. collecting the target biological population.

In one aspect, the present disclosure refers to a system for magnetically separating and collecting a target biological population from a biological sample, comprising: a. a magnetic field source; b. a separation tube for flowing the biological sample, aligned with the magnetic field source; c. a magnetic field shield/barrier configured to be positioned between the magnetic field source and the separation tube; and d. a mechanism for rotating the magnetic field shield/barrier between the magnetic field source and the separation tube; wherein rotation of the magnetic field shield/barrier between the magnetic field source and the separation tube releases the target biological population when bound to a plurality of magnetic particles.

Brief Description of the Drawings

The following description of typical aspects described herein will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there are shown in the drawings aspects which are presently typical. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities of the aspects shown in the drawings. It is noted that like reference numerals refer to like elements across different embodiments as shown in the drawings and referred to in the description.

The description herein will be more fully understood in view of the following drawings:

Figure 1 shows magnetic field gradients used to move magnetic particles;

Figure 2 shows different sized magnetic beads used in cell separation applications;

Figure 3 shows effect of bead size on net magnetic force acting on the bead in response to a magnetic field gradient;

Figure 4 shows different conceptual methods for producing an automatically controlled magnetic field;

Figure 5 shows a computational model of the ability of a high magnetic permeability and saturation material to block the magnetic flux density;

Figure 6 shows the incorporation of a magnetic separation tube on a cassette;

What is claimed is:

1. A system for magnetically separating and collecting a target biological population from a biological sample, comprising:
    a. a magnetic field source;
    b. a separation tube for flowing the biological sample, aligned with the magnetic field source;
    c. a magnetic field shield/barrier configured to be positioned between the magnetic field source and the separation tube; and
    d. a mechanism for rotating the magnetic field shield/barrier between the magnetic field source and the separation tube;

    wherein rotation of the magnetic field shield/barrier between the magnetic field source and the separation tube releases the target biological population when bound to a plurality of magnetic particles.
2. The system of claim 1, wherein the system is part of an automated cell culture system.
3. The system of claim 1 or claim 2, wherein the magnetic field shield/barrier is a material with high magnetic permeability and saturation.
4. The system of claim 3, the material with high magnetic permeability and saturation is selected from the group consisting of iron, iron alloy, ferritic steel, Hiperco-50.
5. The system of any one of claims 1-4, wherein the magnetic field source comprises one or more permanent magnets.
6. The system of claim 5, wherein the permanent magnet comprises neodymium, samarium-cobalt, or Alnico.
7. The system of any one of claims 1-5, wherein the magnetic field source comprises multiple permanent magnets configured in a linear array.
8. The system of claim 7, wherein the multiple permanent magnets in a linear array are arranged with opposite pole directions perpendicular to the axis of the linear array.
9. The system of claim 1, wherein the mechanism for rotating is an electro-mechanical drive assembly controlled by software.