GRAN cells may be removed and/or specific cells may be further isolated), washing, concentrating, freezing (e.g., cryopreserved), and expanding desired cell populations.

[0094] The following examples further illustrate the invention but, of course, should not be construed as in any way limiting its scope.

EXAMPLE 1

[0095] This example demonstrates leukocytes and stem cells can be recovered from a bone marrow product while reducing red blood cell contamination.

[0096] Five units of porcine bone marrow product are each split for processing according to an embodiment of the invention, and a control. The device is configured as generally shown in Figure 1 and including a diffusing plate having a pattern as shown in Figure 3A (wherein the perforations each have a diameter of .032 inches), and the leukocyte depletion filter is a 3.5 inch disc including a prefilter and 3 layers of melt-blown media prepared as generally described in U.S. Patent 4,925,572. The device is arranged in a system as generally shown in Figure 8.

[0097] The units (100 mL each) are filtered via gravity, and the elution solution (40 mL) comprises saline/10% Dextran-40.

[0098] In contrast with the controls, resulting in 89% red blood cell depletion/11% red blood cell contamination/57% white blood cell recovery, the products processed according to an embodiment of the invention resulted in 92% red blood cell depletion/8% red blood cell contamination/52% white blood cell recovery.

[0099] All references, including publications, patent applications, and patents, cited herein are hereby incorporated by reference to the same extent as if each reference were individually and specifically indicated to be incorporated by reference and were set forth in its entirety herein.

[0100] The use of the terms "a" and "an" and "the" and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms "comprising," "having," "including," and "containing" are to be construed as open-ended terms (i.e., meaning "including, but not limited to,") unless otherwise noted. Recitation of ranges of values herein are merely

intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., "such as") provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.

[0101] Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations of those preferred embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

GRAN cells may be removed and/or specific cells may be further isolated), washing, concentrating, freezing (e.g., cryopreserved), and expanding desired cell populations.

[0094] The following examples further illustrate the invention but, of course, should not be construed as in any way limiting its scope.

EXAMPLE 1

[0095] This example demonstrates leukocytes and stem cells can be recovered from a bone marrow product while reducing red blood cell contamination.

[0096] Five units of porcine bone marrow product are each split for processing according to an embodiment of the invention, and a control. The device is configured as generally shown in Figure 1 and including a diffusing plate having a pattern as shown in Figure 3A (wherein the perforations each have a diameter of .032 inches), and the leukocyte depletion filter is a 3.5 inch disc including a prefilter and 3 layers of melt-blown media prepared as generally described in U.S. Patent 4,925,572. The device is arranged in a system as generally shown in Figure 8.

[0097] The units (100 mL each) are filtered via gravity, and the elution solution (40 mL) comprises saline/10% Dextran-40.

[0098] In contrast with the controls, resulting in 89% red blood cell depletion/11% red blood cell contamination/57% white blood cell recovery, the products processed according to an embodiment of the invention resulted in 92% red blood cell depletion/8% red blood cell contamination/52% white blood cell recovery.

[0099] The use of the terms "a" and "an" and "the" and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms "comprising," "having," "including," and "containing" are to be construed as open-ended terms (i.e., meaning "including, but not limited to,") unless otherwise noted. Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or

otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., "such as") provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.

[0100] Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations of those preferred embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

CLAIM(S):

1. A biological fluid filter device comprising:

(a) a housing comprising an inlet port and an outlet port and defining a fluid path between the inlet port and the outlet port, the housing further comprising an elution fluid inlet port and a drain port and defining a fluid flow path between the elution fluid inlet port and the inlet port;

(b) a porous fibrous leukocyte depletion filter having an upstream surface and a downstream surface, disposed in the housing across the fluid flow paths;

wherein the inlet port is upstream of the upstream surface of the leukocyte depletion filter, and,

the outlet port, the elution fluid inlet port, and the drain port, are downstream of the downstream surface of the leukocyte depletion filter.

2. The device of claim 1, wherein the housing has a wall downstream of the downstream surface of the leukocyte depletion filter, the wall including the elution fluid inlet port, the outlet port, and the drain port, and the elution fluid inlet port is located between the outlet port and the drain port in the wall.

3. The device of claim 1 or 2, further comprising a perforated diffusing plate having a first surface and a second surface, disposed in the housing across the fluid flow paths, wherein the diffusing plate is disposed in the housing between the downstream surface of the leukocyte depletion filter and the outlet port.

4. The device of any one of claims 1-3, further comprising a vent device in communication with the outlet port.

5. A method for processing a biological fluid comprising passing biological fluid through the biological fluid filter device of any one of claims 1-4.

6. A method for processing a biological fluid comprising

(a) passing a biological fluid from a first container through a biological fluid filter device comprising:

a housing comprising an inlet port and an outlet port, and defining a fluid path between the inlet and the outlet, the housing further comprising an elution fluid inlet port and a drain port and defining a fluid flow path between the elution fluid inlet port and the inlet port, and a porous fibrous leukocyte depletion filter having an upstream surface and a downstream surface, disposed in the housing across the fluid flow paths; wherein the inlet port is upstream of the upstream surface of the leukocyte depletion filter, and the outlet, the elution fluid inlet port, and the drain port, are downstream of the downstream surface of the leukocyte depletion filter;

and passing leukocyte-depleted biological fluid from the outlet port into a second container;

(b) passing gas through the outlet port and displacing biological fluid in the downstream chamber from the housing through the drain port into the second container or into a third container; and,

(c) passing elution solution from an elution solution delivery device through the elution fluid inlet port, the leukocyte depletion filter, and the inlet port, into an eluted target cell container; wherein the elution solution elutes leukocytes and/or stem cells from the filter into the eluted target cell container.

7. The method of claim 6, wherein the device further comprises a perforated diffusing plate having a first surface and a second surface, disposed in the housing across the fluid flow paths, and the diffusing plate is disposed in the housing between the downstream surface of the leukocyte depletion filter and the outlet port, wherein the method comprises passing elution solution from the elution solution delivery device through the elution fluid inlet port, the diffusing plate, the leukocyte depletion filter, and the inlet port, into the eluted target cell container.

8. The method of claim 6 or 7, comprising passing gas from the second container through the outlet port and displacing biological fluid in the downstream chamber from the housing through the drain port into the third container.

9. The method of claim 6 or 7, wherein passing leukocyte-depleted biological fluid from the outlet including displacing gas into a gas collection container, and the method further comprises passing collected gas from the gas collection container through the outlet port and displacing biological fluid in the downstream chamber from the housing through the drain port into the second container.

10. The method of claim 6 or 7, comprising passing gas through a vent into the outlet port and displacing biological fluid in the downstream chamber from the housing through the drain port into the second container.

11. A method for processing a biological fluid comprising

(a) passing a biological fluid from a first container through a biological fluid filter device comprising:

a housing comprising an inlet port and an outlet port, and defining a fluid path between the inlet and the outlet, the housing further comprising an elution fluid inlet port and a drain port, and a porous fibrous leukocyte depletion filter having an upstream surface and a downstream surface, disposed in the housing across the fluid flow path; wherein the inlet port is upstream of the upstream surface of the leukocyte depletion filter, and the outlet port, the elution fluid inlet port, and the drain port, are downstream of the downstream surface of the leukocyte depletion filter;

and passing leukocyte-depleted biological fluid from the outlet port into a second container;

(b) passing gas from the second container through the outlet port and displacing biological fluid in the downstream chamber from the housing through the drain port into a third container; and,

(c) passing elution solution from an elution solution delivery device through the elution fluid inlet port, the leukocyte depletion filter, and the inlet port, into a fourth container; wherein the elution solution elutes leukocytes and/or stem cells from the filter into the fourth container.

12. The method of any one of claims 5-11, carried out while maintaining a closed system.

13. A biological fluid processing system comprising

(a) the biological fluid filter device of any one of claims 1-4;

(b) a container for receiving leukocyte-depleted biological fluid, in fluid communication with the outlet port;

(c) a container for receiving gas displaced biological fluid, in fluid communication with the drain port; and,

(d) a container for receiving elution fluid and eluted leukocytes, in fluid communication with the inlet port.

14. The system of claim 13, further comprising (e) an elution fluid delivery device, in fluid communication with the elution fluid inlet port.

15. The system of claim 13 or 14, further comprising (f) a biological fluid source container, in fluid communication with the inlet.

16. The system of claim 14 or 15, wherein the elution fluid delivery device comprises a prefilled syringe containing elution solution or a syringe pump.

17. The system of any one of claims 13-16, wherein the container for receiving elution fluid and eluted leukocytes is a freezable container.

CLAIM(S):

1. A biological fluid filter device comprising:

(a) a housing comprising an inlet port and an outlet port and defining a first fluid flow path between the inlet port and the outlet port, the housing further comprising an elution fluid inlet port and a drain port and defining a second fluid flow path between the elution fluid inlet port and the inlet port, and defining a third fluid flow path between the outlet port and the drain port;

(b) a porous fibrous leukocyte depletion filter having an upstream surface and a downstream surface, disposed in the housing across the fluid flow paths;

wherein the inlet port is upstream of the upstream surface of the leukocyte depletion filter, and,

the outlet port, the elution fluid inlet port, and the drain port, are downstream of the downstream surface of the leukocyte depletion filter; and

(c) a perforated diffusing plate having a first surface and a second surface, disposed in the housing across the first and second fluid flow paths, wherein the diffusing plate is disposed in the housing between the downstream surface of the leukocyte depletion filter and the outlet port.

2. The device of claim 1, wherein the housing has a wall downstream of the downstream surface of the leukocyte depletion filter, the wall including the elution fluid inlet port, the outlet port, and the drain port, and the elution fluid inlet port is located between the outlet port and the drain port in the wall.

3. The device of claim 1 or 2, further comprising a vent device in communication with the outlet port.

4. A method for processing a biological fluid comprising passing biological fluid through the biological fluid filter device of any one of claims 1-3.

5. A method for processing a biological fluid comprising

(a) passing a biological fluid from a first container through a biological fluid filter device comprising:

a housing comprising an inlet port and an outlet port, and defining a fluid path between the inlet and the outlet, the housing further comprising an elution fluid inlet port and a drain port and defining a fluid flow path between the elution fluid inlet port and the inlet port, a porous fibrous leukocyte depletion filter having an upstream surface and a downstream surface, disposed in the housing across the fluid flow paths, and a perforated diffusing plate having a first surface and a second surface, disposed in the housing across the fluid flow paths, such that the diffusing plate is disposed in the housing between the downstream surface of the leukocyte depletion filter and the outlet port; wherein the inlet port is upstream of the upstream surface of the leukocyte depletion filter, and the outlet, the elution fluid inlet port, and the drain port, are downstream of the downstream surface of the leukocyte depletion filter;

and passing leukocyte-depleted biological fluid from the outlet port into a second container;

(b) passing gas through the outlet port and displacing biological fluid in the downstream chamber from the housing through the drain port into the second container or into a third container;

(c) passing elution solution from an elution solution delivery device through the elution fluid inlet port, the perforated diffusing plate, the leukocyte depletion filter, and the inlet port, into an eluted target cell container; wherein the elution solution elutes leukocytes and/or stem cells from the filter into the eluted target cell container.

6. The method of claim 5, comprising passing gas from the second container through the outlet port and displacing biological fluid in the downstream chamber from the housing through the drain port into the third container.

7. The method of claim 5, wherein passing leukocyte-depleted biological fluid from the outlet including displacing gas into a gas collection container, and the method further comprises passing collected gas from the gas collection container through the outlet

port and displacing biological fluid in the downstream chamber from the housing through the drain port into the second container.

8. The method of claim 5, comprising passing gas through a vent into the outlet port and displacing biological fluid in the downstream chamber from the housing through the drain port into the second container.

9. A method for processing a biological fluid comprising

(a) passing a biological fluid from a first container through a biological fluid filter device comprising:

a housing comprising an inlet port and an outlet port, and defining a fluid path between the inlet and the outlet, the housing further comprising an elution fluid inlet port and a drain port, a porous fibrous leukocyte depletion filter having an upstream surface and a downstream surface, disposed in the housing across the fluid flow path, and a perforated diffusing plate having a first surface and a second surface, disposed in the housing across the fluid flow paths; wherein the inlet port is upstream of the upstream surface of the leukocyte depletion filter, and the outlet port, the elution fluid inlet port, and the drain port, are downstream of the downstream surface of the leukocyte depletion filter;

and passing leukocyte-depleted biological fluid from the outlet port into a second container;

(b) passing gas from the second container through the outlet port and displacing biological fluid in the downstream chamber from the housing through the drain port into a third container; and,

(c) passing elution solution from an elution solution delivery device through the elution fluid inlet port, the perforated diffusing plate, the leukocyte depletion filter, and the inlet port, into a fourth container; wherein the elution solution elutes leukocytes and/or stem cells from the filter into the fourth container.

10. The method of any one of claims 4-9, carried out while maintaining a closed system.

11. A biological fluid processing system comprising

(a) the biological fluid filter device of any one of claims 1-3;

(b) a container for receiving leukocyte-depleted biological fluid, in fluid communication with the outlet port;

(c) a container for receiving gas displaced biological fluid, in fluid communication with the drain port; and,

(d) a container for receiving elution fluid and eluted leukocytes, in fluid communication with the inlet port.

12. The system of claim 11, further comprising (e) an elution fluid delivery device, in fluid communication with the elution fluid inlet port.

13. The system of claim 11 or 12, further comprising (f) a biological fluid source container, in fluid communication with the inlet.

14. The system of claim 12 or 13, wherein the elution fluid delivery device comprises a prefilled syringe containing elution solution or a syringe pump.

15. The system of any one of claims 11-14, wherein the container for receiving elution fluid and eluted leukocytes is a freezable container.