or isolated stem cells. According to this embodiment, the method involves: (1) culturing the bone marrow cells in the presence of a sufficient amount of a DPIV inhibitor (e.g., a DPIV monomer and/or homoconjugate) to expand the number of early T lineage cells in culture; and (2) culturing the early T lineage cells with a sufficient amount of a heteroconjugate containing a DPIV inhibitor attached to an antigenic peptide (e.g., a tumor- or pathogen-specific antigen) to expand the number of antigen-specific T cells in the culture. Step (2) can be performed in the presence or absence of the specific antigen. Steps (1) and (2) can be performed concurrently or sequentially. In general, the number of antigen-specific T cells is compared to a control culture of bone marrow cells that is treated as described in steps (1) and (2) with the exception that the control culture is not contacted with the heteroconjugate. At each step, the cells are cultured in the presence of the DPIV inhibitor or heteroconjugate for a time sufficient to increase the number of early T lineage cells and to expand the number of antigen-specific T cells, respectively, relative to the numbers of such cells that are present in the control culture.

The second embodiment is directed to stimulating umbilical cord blood cells in culture. This embodiment involves: (1) culturing the umbilical cord blood cells in the presence of a sufficient amount of a DPIV inhibitor (e.g., a DPIV monomer and/or homoconjugate) to expand the number of early T lineage cells in culture; and (2) culturing the early T lineage cells with a heteroconjugate containing DPIV inhibitor attached to an antigenic peptide (e.g., a tumor- or pathogen-specific antigen) to expand the number of antigen-specific T cells that are present in the culture. Step (2) can be performed in the presence or absence of the specific antigen. Steps (1) and (2) can be performed concurrently or sequentially. In general, the number of antigen-specific T cells is compared to a control culture of umbilical cord blood cells that is treated as described in steps (1) and (2) with the exception that the control culture is not contacted with the heteroconjugate. At each step, the cells are cultured in the presence of the DPIV inhibitor or heteroconjugate for a time sufficient to increase the number of early T lineage cells and to expand the number of antigen-specific T cells, respectively, relative to the numbers of such cells that are present in the control culture.

The third embodiment is directed to stimulating peripheral blood stem cells in culture. This embodiment involves: (1) culturing the peripheral blood stem cells in the presence of a sufficient amount of a DPIV inhibitor (e.g., a DPIV monomer and/or homoconjugate) to expand the number of T cells in culture; and (2) culturing the T cells with a sufficient amount of a heteroconjugate containing a DPIV inhibitor attached to an antigenic peptide (e.g.,

a tumor- or pathogen-specific antigen) to expand the number of antigen-specific T cells in the culture. Step (2) can be performed in the presence or absence of the specific antigen. Steps (1) and (2) can be performed concurrently or sequentially. In general, the number of antigen-specific T cells is compared to a control culture of peripheral blood stem cells that is treated as described in steps (1) and (2) with the exception that the control culture is not contacted with the heteroconjugate. At each step, the cells are cultured in the presence of the DPIV inhibitor or heteroconjugate for a time sufficient to increase the number of T cells and to expand the number of antigen-specific T cells, respectively, relative to the numbers of such cells that are present in the control culture. Alternatively, because peripheral blood is known to contain T cells, it is possible to expand the number of antigen-specific T cells in culture without the stimulation step (1), i.e., the method for expanding the number of antigen-specific T cells involves culturing the peripheral blood cells with a sufficient amount of a heteroconjugate containing a DPIV inhibitor attached to an antigenic peptide (e.g., a tumor- or pathogen-specific antigen) to expand the number of antigen-specific T cells in the culture. This step can be performed in the presence or absence of the specific antigen.

EXAMPLES

An exemplary procedure for contacting several representative DPIV inhibitors is provided below.

Experimental Protocol

1. Obtain bone marrow or umbilical cord blood in heparinized (green top) tube. Can be stored at room temperature until use within 48 hours.
2. Mix marrow/blood 1:1 with phosphate-buffered saline, pH 7.4(PBS) that has been stored at 4°C.
3. Carefully layer blood-PBS mixture on a 2x volume quantity of Histopaque (Sigma) that has been stored at 4°C.
4. Centrifuge at 400g x 20 minutes at 37°C.
5. Carefully collect cells at interface and wash x2 in cold PBS.
6. Count viable cells using trypan blue.
7. Set up cells as 1 ml cultures in plastic culture tubes (or 96 well or 24 well microtiter plates) at 104 cells/ml in CellGro Iscove's Modified Dulbecco's medium (Meditech) containing kanamycin (5ug/ml), desired concentration of Xaa-boroPro or other compound of the invention, and the absence or presence of Giant Cell Tumor-

7. The method of claim 6, wherein the immobilized inhibitor comprises the inhibitor attached to an immobilization structure that is a tissue culture vessel.

8. The method of claim 6, wherein the immobilized inhibitor comprises the inhibitor attached to an immobilization structure that is a particle.

9. The method of claim 1, wherein the sufficient amount of inhibitor is that amount necessary to increase the number of hematopoietic cells at least two-fold.

10. An apparatus comprising:

(1) a container; and

(2) an inhibitor of DPIV contained therein or attached thereto, wherein the container is sterile and wherein the inhibitor of DPIV is attached to the surface of the container or is attached to a particle that is contained in the container.

11. Canceled.

12. The apparatus of claim 10, wherein the container is a cell culture vessel and the inhibitor of DPIV is attached to the surface of the cell culture vessel.

13. The apparatus of claim 10, wherein the inhibitor of DPIV is attached to a particle that is contained in the container.

14. A composition comprising:

(1) a magnetic particle; and

(2) an inhibitor of DPIV attached thereto.

15. The composition of claim 14, wherein the composition is sterile.

16. A kit for stimulating hematopoietic cells in vitro, comprising:

(1) the apparatus of any of claims 10, 11, 12, and 13; and

(2) instructions for using the apparatus to increase the number of hematopoietic cells in vitro.

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17. The kit of claim 16, further including one or more growth nutrients for culturing the hematopoietic cells, wherein said growth are provided in the container of the apparatus or in a separate container, the contents of which can be added to the container of the apparatus at the time of culturing the cells.

18. A method for expanding antigen-specific T cells in vitro, comprising:

(1) culturing bone marrow cells in the presence of a sufficient amount of a DPIV inhibitor to expand the number of early T lineage cells in the culture; and

(2) culturing the early T lineage cells in the presence of a sufficient amount of a heteroconjugate containing a DPIV inhibitor attached to an antigenic peptide to expand the number of antigen-specific T cells in the culture.

19. A method for expanding antigen-specific T cells in vitro, comprising:

(1) culturing umbilical cord blood cells in the presence of a sufficient amount of a DPIV inhibitor to expand the number of early T lineage cells in the culture; and

(2) culturing the early T lineage cells in the presence of a sufficient amount of a heteroconjugate containing a DPIV inhibitor attached to an antigenic peptide to expand the number of antigen-specific T cells in the culture.

20. A method for expanding antigen-specific T cells in vitro, comprising:

(1) culturing peripheral blood cells in the presence of a sufficient amount of a DPIV inhibitor to expand the number of T cells in the culture; and

(2) culturing the T cells with a sufficient amount of a heteroconjugate containing a DPIV inhibitor attached to an antigenic peptide to expand the number of antigen-specific T cells in the culture.

21. A method for expanding antigen-specific T cells in vitro, comprising:

(1) culturing peripheral blood cells in the presence of a sufficient amount of a heteroconjugate containing a DPIV inhibitor attached to an antigenic peptide to expand the number of antigen-specific T cells in the culture.

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