housing vessel, the second end of the culture medium discharge line being in communication with the culturing unit interior via the culture medium discharge port of the culturing unit, and the medium being able to circulate through the culture medium-supply unit and the culturing unit.

[Mode 14]

The method according to any one of modes 1 to 13, wherein the cells are selected from the group consisting of animal cells, insect cells, plant cells, yeast cells and bacteria.

[Mode 15]

The method according to mode 14, wherein the animal cells are cells derived from an animal belonging to the subphylum Vertebrata.

[Mode 16]

The method according to mode 15, wherein the cells are selected from the group consisting of CHO cells, CHO-K1 cell lines, CHO DP-12 cell lines, CHO cell-related lines, Vero cells and MDCK cells.

[Mode 17]

The method according to any one of modes 1 to 16, wherein the porous polyimide film is a porous polyimide film including a polyimide obtained from a tetracarboxylic dianhydride and a diamine.

[Mode 18]

The method according to mode 17, wherein the porous polyimide film is a colored porous polyimide film obtained by forming a polyamic acid solution composition including a polyamic acid solution obtained from a tetracarboxylic dianhydride and a diamine, and a coloring precursor, and then heat treating it at 250°C or higher.

[Mode 19]

A cell culturing apparatus for use in the method according to any one of modes 1 to 18, including a porous polyimide film.

[Mode 20]

A cell culturing apparatus according to mode 19, wherein two or more porous polyimide films are layered either above and below or left and right.

[Mode 21]

A kit for use in the method according to any one of modes 1 to 13, including a porous polyimide film.

[Mode 21a]

A kit for use in the method according to any one of modes 1 to 18, including a porous polyimide film and a cell culture medium,
wherein the porous polyimide film with a multilayer structure, having at least two surface layers (an A-surface and a B-surface), and a macro-void layer sandwiched between the two surface layers,
a mean pore size of the holes in the A-surface is smaller than a mean pore size of the holes in the B-surface, and the macro-void layer has a partition bonded to the surface layers (the A-surface and the B-surface), and a plurality of macro-voids surrounded by the partition and the surface layers (the A-surface and the B-surface).

[Mode 22]

The use of a porous polyimide film for a long term cell culturing method.

What is claimed is:

1. A long term cell culturing method including:

(1) applying cells to a porous polyimide film, and

(2) applying the porous polyimide film to which the cells have been applied, to a cell culture medium and culturing the cells for 30 days or longer,

wherein the porous polyimide film with a multilayer structure, having at least two surface layers (an A-surface and a B-surface), and a macro-void layer sandwiched between the two surface layers,

a mean pore size of the holes in the A-surface is smaller than a mean pore size of the holes in the B-surface, and

the macro-void layer has a partition bonded to the surface layers (the A-surface and the B-surface), and a plurality of macro-voids surrounded by the partition and the surface layers (the A-surface and the B-surface).

2. The method according to claim 1, wherein the cells are cultured without subculture operations in step (2).

3 The method according to claim 1 or 2, wherein the cells are cultured for 60 days or longer in step (2).

4. The method according to claim 1 or 2, wherein the cells are cultured for 120 days or longer in step (2).

5. The method according to any one of claims 1 to 4, using two or more porous polyimide films layered either above and below or left and right in the cell culture medium.

6. The method according to any one of claims 1 to 5, wherein the porous polyimide films are:

i) folded,

ii) wound into a roll,

iii) connected as sheets or fragments by a filamentous structure, or

iv) bound into a rope,

and used by suspension or anchoring in the cell culture medium in the cell culturing vessel.

7. The method according to any one of claims 1 to 6, wherein in the culturing of step (2), all or some of the porous

polyimide films are not in contact with the liquid phase of the cell culture medium.

8. The method according to any one of claims 1 to 7, wherein in the culturing of step (2), the total volume of the cell culture medium in the cell culturing vessel is 10,000 times or less of the total sum of the porous polyimide film volume including a cell survival zone.

9. The method according to any one of claims 1 to 8, wherein in the culturing of step (2), the total volume of the cell culture medium in the cell culturing vessel is 100 times or less of the total sum of the porous polyimide film volume including the cell survival zone.

10. The method according to any one of claims 1 to 9, wherein the culturing in step (2) is carried out in a system in which a cell culture medium is continuously or intermittently supplied to a cell culturing vessel from cell culture medium supply means installed outside of the cell culturing vessel.

11. The method according to claim 10, wherein the cell culture medium is circulated between the cell culture medium supply means and the cell culturing vessel.

12. The method according to claim 10 or 11, wherein the system is a cell culturing apparatus including a culturing unit which is the cell culturing vessel, and a culture medium-supply unit which is the cell culture medium supply means, wherein

the culturing unit is a culturing unit that houses one or more porous polyimide films to support cells, and that comprises a culture medium supply port and a culture medium discharge port, and

the culture medium-supply unit is a culture medium-supply unit comprising a culture medium housing vessel, a culture medium supply line, and a liquid conveyance pump that conveys the medium continuously or intermittently through the culture medium supply line, the first end of the culture medium supply line contacting the medium in the culture medium housing vessel, and the second end of the culture medium supply line being in communication with the culturing unit interior via the culture

medium supply port of the culturing unit.

13. The method according to claim 12, wherein the culturing unit is a culturing unit that does not comprise an air supply port, an air discharge port and an oxygen exchange membrane.

14. The method according to claim 12 or 13, wherein the culturing unit further comprises a culture medium discharge line, the first end of the culture medium discharge line being connected to the culture medium housing vessel, the second end of the culture medium discharge line being in communication with the culturing unit interior via the culture medium discharge port of the culturing unit, and the medium being able to circulate through the culture medium-supply unit and the culturing unit.

15. The method according to any one of claims 1 to 14, wherein the cells are selected from the group consisting of animal cells, insect cells, plant cells, yeast cells and bacteria.

16. The method according to claim 15, wherein the animal cells are cells derived from an animal belonging to the subphylum Vertebrata.

17. The method according to claim 16, wherein the cells are selected from the group consisting of CHO cells, CHO-K1 cell lines, CHO DP-12 cell lines, CHO cell-related lines, Vero cells and MDCK cells.

18. The method according to any one of claims 1 to 17, wherein the porous polyimide film is a porous polyimide film including a polyimide obtained from a tetracarboxylic dianhydride and a diamine.

19. The method according to claim 18, wherein the porous polyimide film is a colored porous polyimide film obtained by forming a polyamic acid solution composition including a polyamic acid solution obtained from a tetracarboxylic dianhydride and a diamine, and a coloring precursor, and then heat treating it at 250°C or higher.

20. A kit for use in the method according to any one

of claims 1 to 19, including a porous polyimide film and a cell culture medium,
wherein the porous polyimide film with a multilayer structure, having at least two surface layers (an A-surface and a B-surface), and a macro-void layer sandwiched between the two surface layers,
a mean pore size of the holes in the A-surface is smaller than a mean pore size of the holes in the B-surface, and
the macro-void layer has a partition bonded to the surface layers (the A-surface and the B-surface), and a plurality of macro-voids surrounded by the partition and the surface layers (the A-surface and the B-surface).

21. Use of a porous polyimide film for a long term cell culturing method which cultures cells for 30 days or longer,
wherein the porous polyimide film with a multilayer structure, having at least two surface layers (an A-surface and a B-surface), and a macro-void layer sandwiched between the two surface layers,
a mean pore size of the holes in the A-surface is smaller than a mean pore size of the holes in the B-surface, and
the macro-void layer has a partition bonded to the surface layers (the A-surface and the B-surface), and a plurality of macro-voids surrounded by the partition and the surface layers (the A-surface and the B-surface).

22. A cell cryopreservation method, including:

(1) a step of supporting cells on a porous polyimide film,

(2) a step of placing the cell-supporting porous polyimide film under conditions in which the cells freeze, to freeze the cells supported on the porous polyimide film, and

(3) a step of storing the cell-supporting porous polyimide film under conditions in which the frozen state is maintained,
wherein the porous polyimide film with a multilayer structure, having at least two surface layers (an A-surface and a B-surface), and a macro-void layer sandwiched between the two

surface layers,
a mean pore size of the holes in the A-surface is smaller than a mean pore size of the holes in the B-surface, and
the macro-void layer has a partition bonded to the surface layers (the A-surface and the B-surface), and a plurality of macro-voids surrounded by the partition and the surface layers (the A-surface and the B-surface).

23. The method according to claim 22, wherein in step (1), the cells are seeded on the porous polyimide film to support the cells on the porous polyimide film.

24. The method according to claim 22, wherein in step (1), the cells are seeded and cultured on the porous polyimide film to support the cells on the porous polyimide film.

25. The method according to any one of claims 22 to 24, which further includes, following step (3),

(4) a step of placing the cell-supporting porous polyimide film under conditions in which the cells thaw, to thaw the cells supported on the porous polyimide film.

26. The method according to claim 25, which further includes, following step (4),

(5) a step of applying the cell-thawed porous polyimide film to a cell culture medium and culturing the cells.

27. The method according to claim 26, wherein in step (5), the cells are cultured until the cultured cells proliferate even outside of the porous polyimide film.

28. The method according to claim 26 or 27, wherein in step (5), the one or more separate non-cell-supporting porous polyimide films are applied onto the cell culture medium together with the cell-thawed porous polyimide film, and culturing is carried out to support the cells on the one or more separate porous polyimide films.

29. The method according to any one of claims 26 to 28, which further includes, following step (5),

(6) a step of placing all or a portion of the cell-supporting porous polyimide film under conditions in which the cells freeze, to freeze the cells supported on the porous

polyimide film, and

(7) a step of storing the cell-supporting porous polyimide film under conditions in which the frozen state is maintained.

30. The method according to claim 29, wherein steps (1) to (7) are repeated several times.

31. The method according to any one of claims 22 to 30, wherein the cells are selected from the group consisting of animal cells, insect cells, plant cells, yeast cells and bacteria.

32. The method according to claim 31, wherein the animal cells are cells derived from an animal belonging to the subphylum Vertebrata.

33. The method according to claim 31 or 32, wherein the cells are adherent cells.

34. The method according to claim 31 or 32, wherein the cells are suspension cells.

35. The method according to any one of claims 22 to 34, wherein the porous polyimide film is a porous polyimide film including a polyimide obtained from a tetracarboxylic

dianhydride and a diamine.

36. The method according to claim 35, wherein the porous polyimide film is a colored porous polyimide film obtained by forming a polyamic acid solution composition including a polyamic acid solution obtained from a tetracarboxylic dianhydride and a diamine, and a coloring precursor, and then heat treating it at 250°C or higher.

37. A porous polyimide film for cryopreservation while supporting cells,
wherein the porous polyimide film with a multilayer structure, having at least two surface layers (an A-surface and a B-surface), and a macro-void layer sandwiched between the two surface layers,
a mean pore size of the holes in the A-surface is smaller than a mean pore size of the holes in the B-surface, and
the macro-void layer has a partition bonded to the surface layers (the A-surface and the B-surface), and a plurality of macro-voids surrounded by the partition and the surface layers (the A-surface and the B-surface).

38. A porous polyimide film to be used in the method according to any one of claims 22 to 36,
wherein the porous polyimide film with a multilayer structure, having at least two surface layers (an A-surface and a B-surface), and a macro-void layer sandwiched between the two surface layers,
a mean pore size of the holes in the A-surface is smaller than a mean pore size of the holes in the B-surface, and
the macro-void layer has a partition bonded to the surface layers (the A-surface and the B-surface), and a plurality of macro-voids surrounded by the partition and the surface layers (the A-surface and the B-surface).

39. A kit for use in the method according to any one of claims 22 to 36, including a porous polyimide film and a cell cryopreservation liquid,
wherein the porous polyimide film with a multilayer structure, having at least two surface layers (an A-surface and a

B-surface), and a macro-void layer sandwiched between the two surface layers,
a mean pore size of the holes in the A-surface is smaller than a mean pore size of the holes in the B-surface, and
the macro-void layer has a partition bonded to the surface layers (the A-surface and the B-surface), and a plurality of macro-voids surrounded by the partition and the surface layers (the A-surface and the B-surface).

40. Use of a porous polyimide film for the method according to any one of claims 22 to 36,
wherein the porous polyimide film with a multilayer structure, having at least two surface layers (an A-surface and a B-surface), and a macro-void layer sandwiched between the two surface layers,
a mean pore size of the holes in the A-surface is smaller than a mean pore size of the holes in the B-surface, and
the macro-void layer has a partition bonded to the surface layers (the A-surface and the B-surface), and a plurality of macro-voids surrounded by the partition and the surface layers (the A-surface and the B-surface).