

CLAIMS

1. A probiotic composition comprising bacteria selected from the group consisting of *Enterococcus hirae*, *Lactobacillus johnsonii*, segmented filamentous bacteria (SFB), *Porphyromonas*, *Barnesiella*, *Holdemania* and mixtures thereof, for use as an adjuvant to an antineoplastic treatment administered to a cancer patient.

2. The probiotic composition of claim 1, for the use of claim 1, wherein said composition comprises *Enterococcus hirae* and at least one strain selected from the group consisting of *Porphyromonas*, *Barnesiella* and *Holdemania*.

3. The probiotic composition of claim 1 or claim 2, for the use of claim 1, wherein said composition further comprises *Lactobacillus johnsonii* strain.

4. The probiotic composition of any of claims 1 to 3, for the use of claim 1, wherein said *Enterococcus hirae* strain is the strain deposited on November 7, 2013 at the Collection Nationale de Cultures de Microorganismes (CNCM), under the number I-4815.

5. The probiotic composition of any of claims 1 to 4, for the use of claim 1, wherein said probiotic composition is formulated for oral administration.

6. The probiotic composition of any of claims 1 to 5, for the use of claim 1, wherein said probiotic composition is administered to a patient in need thereof after the administration of the antineoplastic treatment.

7. The probiotic composition of any of claims 1 to 5, for the use of claim 1 or claim 6, wherein said antineoplastic treatment is a treatment with a chemotherapeutic agent.

8. The probiotic composition of any of claims 1 to 5, for the use of claim 1 or claim 6, wherein said antineoplastic treatment is an anticancer vaccine with a chemotherapeutic agent as a vaccine adjuvant.

9. The probiotic composition of any of claims 1 to 5, for the use of claim 7 or claim 8, wherein said chemotherapeutic agent is cyclophosphamide (CTX).

10. The probiotic composition of any of claims 1 to 5, for the use of any of claims 1 and 6 to 9, wherein said patient has a dysbiosis with an under-representation of species present in said probiotic composition.

11. A combination of a chemotherapeutic agent and of an antibiotic composition which decreases the firmicutes/bacteroidetes ratio or specifically augments SFB and/or *Porphyromonadaceae* and/or decreases *Clostridium group IV* in the gut microbiota of an individual when administered to said individual, for use in the treatment of cancer.

12. The combination of claim 11, for the use according to claim 11, wherein the antibiotic composition is selected from the group consisting of vancomycin + imipenem and neomycin + cephalothin.

13. The combination of claim 11 or claim 12, for the use according to claim 11, wherein the chemotherapeutic agent is cyclophosphamide (CTX).

14. The combination of any of claims 11 to 13 for the use according to claim 11, wherein the antibiotic composition is administered to a patient suffering from a cancer before administration of the chemotherapeutic agent to said patient.

15. An antibiotic composition which decreases the firmicutes/bacteroidetes ratio or augments specifically *SFB* and/or *Porphyromonadaceae* and/or decreases *Clostridium group IV* in the gut microbiota of an individual when administered to said individual, for use for modulating the gut microbiota of a patient to potentiate the anticancer effects of a chemotherapeutic agent administered to said patient.

16. The antibiotic composition of claim 15, for the use according to claim 15, wherein said antibiotic composition is selected from the group consisting of vancomycin + imipenem and neomycin + cephalothin,

17. The antibiotic composition of claim 15 or claim 16, for the use according to claim 15, wherein said chemotherapeutic agent is cyclophosphamide (CTX).

18. An immunogenic composition comprising fragments of bacteria selected from the group consisting of *Enterococcus hirae*, *Lactobacillus johnsonii*, *Enterococcus faecalis*, segmented filamentous bacteria (SFB), *Porphyromonas*, *Barnesiella*, *Holdemania* and mixtures thereof, for use as an adjuvant to an antineoplastic treatment administered to a cancer patient.

19. The immunogenic composition of claim 18, for the use of claim 18, wherein said composition comprises fragments of *Enterococcus hirae* and fragments of at least one strain selected from the group consisting of *Porphyromonas*, *Barnesiella* and *Holdemania*.

20. The immunogenic composition of claim 18 or claim 19, for the use of claim 18, wherein said *Enterococcus hirae* strain is the strain deposited on November 7, 2013 at the Collection Nationale de Cultures de Microorganismes (CNCM), under the number I-4815.

21. The immunogenic composition of any of claims 18 to 20, for the use of claim 18, wherein said composition is formulated for subcutaneous or intramuscular administration.

22. A cell composition comprising antigen presenting cells (APC) which have been pulsed *ex vivo* with a probiotic composition according to any of claims 1 to 4 or with an immunogenic composition according to any of claims 18 to 20.

23. The cell composition of claim 22, wherein the APC have also been pulsed *ex vivo* with a tumor antigen.

24. The cell composition of claim 22 or 23, which comprises dendritic cells.

5 25. The cell composition of any of claims 22 to 24, for use in adoptive cell transfer in combination with an antineoplastic treatment, for treating cancer.

26. The cell composition of any of claims 22 to 24, for use according to claim 25, wherein said composition is formulated for intra-nodal injection, intravenous injection or subcutaneous injection.

10 27 A cell composition comprising memory T cells obtained by a process comprising *ex vivo* contacting T cells from a cancer patient with a cell composition according to any of claims 22 to 24.

28. The cell composition of claim 27, for use in adoptive cell transfer in combination with an antineoplastic treatment, for treating cancer.

15 29. The cell composition of claim 27, for use according to claim 28, wherein said composition is formulated for intra-nodal injection, intravenous injection or subcutaneous injection.

30. The cell composition according to any of claims 22 to 29, for the use according to any of claims 25 and 28, wherein said antineoplastic treatment comprises a chemotherapy.

31. The cell composition according to any of claims 22 to 29, for the use according to claim 30, wherein said chemotherapy comprises CTX administration.

32. The cell composition according to any of claims 22 to 29, for the use according to claim 30 or 31, wherein said antineoplastic treatment further comprises an antitumoral vaccination.

25 33. An *in vitro* method of identifying a patient likely to be a good responder to a chemotherapy, comprising determining the functionality of TLR 4, NOD1 and NOD2 in said patient, wherein if said patient lacks a functional TLR 4 and/or NOD1 and/or NOD2, the patient is identified as a good responder to a
30 chemotherapy.

CLAIMS

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2. The probiotic composition of claim 1, for the use of claim 1, wherein said composition comprises *Enterococcus hirae* and at least one strain selected from the group consisting of *Porphyromonas*, *Barnesiella* and *Holdemania*.

3. The probiotic composition of claim 1 or claim 2, for the use of claim 1, wherein said composition further comprises *Lactobacillus johnsonii* strain.

4. The probiotic composition of any of claims 1 to 3, for the use of claim 1, wherein said *Enterococcus hirae* strain is the strain deposited on November 7, 2013 at the Collection Nationale de Cultures de Microorganismes (CNCM), under the number I-4815.

5. The probiotic composition of any of claims 1 to 4, for the use of claim 1, wherein said probiotic composition is formulated for oral administration.

6. The probiotic composition of any of claims 1 to 5, for the use of claim 1, wherein said probiotic composition is administered to a patient in need thereof after the administration of the antineoplastic treatment.

7. The probiotic composition of any of claims 1 to 5, for the use of claim 1 or claim 6, wherein said antineoplastic treatment is a treatment with a chemotherapeutic agent.

8. The probiotic composition of any of claims 1 to 5, for the use of claim 1 or claim 6, wherein said antineoplastic treatment is an anticancer vaccine with a chemotherapeutic agent as a vaccine adjuvant.

9. The probiotic composition of any of claims 1 to 5, for the use of claim 7 or claim 8, wherein said chemotherapeutic agent is cyclophosphamide (CTX).

10. The probiotic composition of any of claims 1 to 5, for the use of any of claims 1 and 6 to 9, wherein said patient has a dysbiosis with an under-representation of species present in said probiotic composition.

11. The probiotic composition of any of claims 1 to 5, for the use of any of claims 1 and 6 to 10, wherein said probiotic composition is administered to a patient in need thereof after the administration of a broad-spectrum antibiotic treatment.

12. An immunogenic composition comprising fragments of bacteria selected from the group consisting of *Enterococcus hirae*, *Lactobacillus johnsonii*, *Enterococcus faecalis*, segmented filamentous bacteria (SFB), *Porphyromonas*,

Barnesiella, *Holdemania* and mixtures thereof, for use as an adjuvant to an antineoplastic treatment administered to a cancer patient.

13. The immunogenic composition of claim 12, for the use of claim 12, wherein said composition comprises fragments of *Enterococcus hirae* and fragments
5 of at least one strain selected from the group consisting of *Porphyromonas*, *Barnesiella* and *Holdemania*.

14. The immunogenic composition of claim 12 or claim 13, for the use of claim 12, wherein said *Enterococcus hirae* strain is the strain deposited on November 7, 2013 at the Collection Nationale de Cultures de Microorganismes
10 (CNCM), under the number I-4815.

15. The immunogenic composition of any of claims 12 to 14, for the use of claim 12, wherein said composition is formulated for subcutaneous or intramuscular administration.