fragments of the antigens comprising the T cell epitopes, are useful for inducing specific immune responses against tumor cells expressing these antigens and for treating or preventing cancer.

In one aspect, the present disclosure provides a pharmaceutical composition or pharmaceutical kit comprising a peptide that is 20 to 30 amino acids in length and that comprises a fragment of the gastric cancer-associated antigen DPPA2, wherein the fragment comprises the amino acid sequence of SEQ ID NO: 1.

In another aspect, the present disclosure provides a pharmaceutical composition or pharmaceutical kit comprising a nucleic acid that encodes a peptide, wherein the peptide is 20 to 30 amino acids in length and comprises a fragment of the gastric cancer-associated antigen DPPA2, wherein the fragment comprises the amino acid sequence of SEQ ID NO: 1.

In another aspect, the present disclosure provides a pharmaceutical composition or pharmaceutical kit comprising a panel of peptides, or comprising nucleic acid that encodes a panel of peptides, wherein the panel comprises (a) one peptide that is 20 to 30 amino acids in length and comprises a fragment of DPPA2, wherein the fragment comprises the amino acid sequence of SEQ ID NO: 1; and (b) a second peptide that is 20 to 30 amino acids in length and that comprises an amino acid sequence selected from SEQ ID NOs: 2 to 30.

In yet another aspect, the present disclosure provides a pharmaceutical composition or pharmaceutical kit as described herein, for use in therapy for vaccination, providing immunotherapy or inducing a cytotoxic T cell response in a subject, wherein the pharmaceutical composition is to be administered to the subject, optionally wherein the therapy is prophylactic and/or for treating or preventing gastric cancer.

In yet another aspect, the present disclosure provides a use of the pharmaceutical composition as described herein in the manufacture of a medicament for treating or preventing gastric cancer.

In yet another aspect, the present disclosure provides a method of identifying a human subject who is predicted to have a cytotoxic T cell response to administration of a pharmaceutical composition as described herein, the method comprising (i) determining that the active ingredient peptide(s) of the pharmaceutical composition or kit comprise a sequence that is a T cell epitope capable of binding to at least three HLA class I molecules of the subject; and (ii) identifying the subject as predicted to have a cytotoxic T cell response.

In yet another aspect, the present disclosure provides a method of identifying a subject who is predicted to have a clinical response to the administration of a pharmaceutical composition as described herein, the method

comprising (i) determining that the active ingredient peptide(s) of the pharmaceutical composition or kit comprise two or more different amino acid sequences each of which is a. a T cell epitope capable of binding to at least three HLA class I molecules of the subject; and b. a fragment of a cancer-associated antigen expressed by cancer cells of the subject, optionally wherein the cancer-associated antigen is present in a sample obtained from the subject; and (ii) identifying the subject as predicted to have a clinical response to the use.

In yet another aspect, the present disclosure provides a method of determining the probability that a specific human subject will have a clinical response to the administration of a pharmaceutical composition as described herein, wherein one or more of the following factors corresponds to a higher probability of a clinical response: (a) presence in the active ingredient peptide(s) of a higher number of amino acid sequences and/or different amino acid sequences that are each a T cell epitope capable of binding to at least three HLA class I of the subject; (b) a higher number of target polypeptide antigens, comprising at least one amino acid sequence that is both A. comprised in an active ingredient peptide; and B. a T cell epitope capable of binding to at least three HLA class I of the subject; optionally wherein the target polypeptide antigens are expressed in the subject, further optionally wherein the target polypeptides antigens are in one or more samples obtained from the subject; (c) a higher probability that the subject expresses target polypeptide antigens that have been determined to comprise at least one amino acid sequence that is both A. comprised in an active ingredient peptide; and B. a T cell epitope capable of binding to at least three HLA class I of the subject; and/or (d) a higher number of target polypeptide antigens that the subject is predicted to express that have been determined to comprise at least one amino acid sequence that is both A. comprised in an active ingredient peptide; and B. a T cell epitope capable of binding to at least three HLA class I of the subject.

In a further aspect, the present disclosure refers to a use as described herein, wherein the medicament is manufactured for a specific subject, and the subject has been identified as predicted to have a clinical response or as having above a threshold minimum probability of having a clinical response to the treatment by a method as described herein. In a further aspect, the present disclosure refers to a method of identifying a human subject who is predicted not have a clinical response to the administration of a pharmaceutical composition as described herein, the method

CLAIMS

1. A pharmaceutical composition or pharmaceutical kit comprising a peptide that is 20 to 30 amino acids in length and that comprises a fragment of the gastric cancer-associated antigen DPPA2, wherein the fragment comprises the amino acid sequence of SEQ ID NO: 1.

2. A pharmaceutical composition or pharmaceutical kit comprising a nucleic acid that encodes a peptide, wherein the peptide is 20 to 30 amino acids in length and comprises a fragment of the gastric cancer-associated antigen DPPA2, wherein the fragment comprises the amino acid sequence of SEQ ID NO: 1.

3. The pharmaceutical composition or pharmaceutical kit according to claim 1 or claim 2, wherein the peptide, or the peptide encoded by the nucleic acid, comprises a further fragment of DPPA2or a fragment of a further gastric cancer associated antigen selected from CAGE-1, TSP50, HIWI, SURVIVIN, 5T4, PRAME, KK-LC-1, MAGE-A2, MAGE-A3, LAGE-1, MAGE-A10, MAGE-A1 and SSX1, wherein the further fragment comprises an amino acid sequence selected from SEQ ID NOs: 2 to 30.

4. The pharmaceutical composition or pharmaceutical kit according to claim 3, wherein the further fragment is of a gastric cancer-associated antigen selected from CAGE-1, TSP50, HIWI, SURVIVIN, 5T4, PRAME, KK-LC-1, MAGE-A2, MAGE-A3, LAGE-1, MAGE-A10, MAGE-A1 and SSX1 and comprises an amino acid sequence selected from SEQ ID NOs: 2, 3, and 5 to 30.

5. The pharmaceutical composition or pharmaceutical kit according to claim 1 or claim 2, wherein the peptide, or the peptide encoded by the nucleic acid, comprises the amino acid sequence of SEQ ID NO: 31.

6. The pharmaceutical composition or kit according to any one of claims 1 to 5, wherein the peptide, or the peptide encoded by the nucleic acid, consists of the amino acid sequence of SEQ ID NOs: 61.

7. A pharmaceutical composition or pharmaceutical kit comprising a panel of peptides, or comprising nucleic acid that encodes a panel of peptides, wherein the panel comprises
(a) one peptide that is 20 to 30 amino acids in length and comprises a fragment of DPPA2, wherein the fragment comprises the amino acid sequence of SEQ ID NO: 1; and
(b) a second peptide that is 20 to 30 amino acids in length and that comprises an amino acid sequence selected from SEQ ID NOs: 2 to 30.

8. The pharmaceutical composition or pharmaceutical kit according to claim 7, wherein the panel of peptides, or the panel of peptides encoded by the nucleic acid, comprises fifteen peptides having the amino acid sequences of SEQ ID NOs: 61 to 75.

9. A pharmaceutical composition or pharmaceutical kit according to claim 1, for use in therapy for vaccination, providing immunotherapy or inducing a cytotoxic T cell response in a subject, wherein the pharmaceutical composition is to be administered to the subject, optionally wherein the therapy is prophylactic and/or for treating or preventing gastric cancer.

10. Use of the pharmaceutical composition of claim 9 in the manufacture of a medicament for treating or preventing gastric cancer.

11. A method of identifying a human subject who is predicted to have a cytotoxic T cell response to administration of a pharmaceutical composition according to claim 1, the method comprising

(i) determining that the active ingredient peptide(s) of the pharmaceutical composition or kit comprise a sequence that is a T cell epitope capable of binding to at least three HLA class I molecules of the subject; and

(ii) identifying the subject as predicted to have a cytotoxic T cell response.

12. A method of identifying a subject who is predicted to have a clinical response to administration of a pharmaceutical composition according to claim 1, the method comprising

(i) determining that the active ingredient peptide(s) of the pharmaceutical composition or kit comprise two or more different amino acid sequences each of which is

a. a T cell epitope capable of binding to at least three HLA class I molecules of the subject; and
b. a fragment of a cancer-associated antigen expressed by cancer cells of the subject, optionally wherein the cancer-associated antigen is present in a sample obtained from the subject; and

(ii) identifying the subject as predicted to have a clinical response to the use.

13. A method of determining the probability that a specific human subject will have a clinical response to administration of a pharmaceutical composition according to claim 1, wherein one or more of the following factors corresponds to a higher probability of a clinical response:

(a) presence in the active ingredient peptide(s) of a higher number of amino acid sequences and/or different amino acid sequences that are each a T cell epitope capable of binding to at least three HLA class I of the subject;

(b) a higher number of target polypeptide antigens, comprising at least one amino acid sequence that is both

A. comprised in an active ingredient peptide; and

B. a T cell epitope capable of binding to at least three HLA class I of the subject;

optionally wherein the target polypeptide antigens are expressed in the subject, further optionally wherein the target polypeptides antigens are in one or more samples obtained from the subject;

(c) a higher probability that the subject expresses target polypeptide antigens that have been determined to comprise at least one amino acid sequence that is both

A. comprised in an active ingredient peptide; and

B. a T cell epitope capable of binding to at least three HLA class I of the subject;

and/or

(d) a higher number of target polypeptide antigens that the subject is predicted to express that have been determined to comprise at least one amino acid sequence that is both

A. comprised in an active ingredient peptide; and

B. a T cell epitope capable of binding to at least three HLA class I of the subject.

14. The method of claim 13, wherein the method comprises

(i) identifying which polypeptide antigens targeted by the active ingredient peptide(s) comprise an amino acid sequence that is both

A. comprised in an active ingredient peptide; and

B. a T cell epitope capable of binding to at least three HLA class I of the subject;

(ii) using population expression data for each antigen identified in step (i) to determine the probability that the subject expresses one or more of the antigens identified in step (i) that together comprise at least two different amino acid sequences of step (i); and

(iii) determining the probability that the subject will have a clinical response to administration of the pharmaceutical composition, kit or panel of peptides, wherein a higher probability determined in step (ii) corresponds to a higher probability of clinical response.

15. The method of claim 14, wherein the at least two different amino acid sequences are comprised in the amino acid sequence of two different polypeptide antigens targeted by the active ingredient peptide(s).

16. The method of any one of claims 12 to 15 further comprising selecting or recommending administration of the pharmaceutical composition or the peptides of the kit for the subject.

17. The use according to claim 10, wherein the medicament is manufactured for a specific subject, and the subject has been identified as predicted to have a clinical response

or as having above a threshold minimum probability of having a clinical response to the treatment by a method according to any one of claims 12 to 15.

18. The pharmaceutical composition for use of claim 9 or the use of claim 10 or claim 17 wherein the medicament is to be administered in combination with chemotherapy, targeted therapy or a checkpoint inhibitor.

19. A method of identifying a human subject who is predicted not have a clinical response to administration of a pharmaceutical composition according to claim 1, the method comprising

(i) determining that the active ingredient peptide(s) of the pharmaceutical composition do not comprise two or more different amino acid sequences each of which is a T cell epitope capable of binding to at least three HLA class I molecules of the subject; and

(ii) identifying the subject as predicted not to have a clinical response to the use.