cancer and bladder cancer. As described in Table 1, MPHOSPH1 expression was shown to be validly elevated in 30 out of 31 bladder cancers, 8 out of 36 breast cancers, 18 out of 18 cervical cancers, 5 out of 17 cholangincellular carcinomas, 25 out of 31 CMLs, 6 out of 11 colorectal cancers, 6 out of 14 gastric cancers, 5 out of 5 NSCLCs, 7 out of 7 lymphomas, 6 out of 10 osteosarcomas, 7 out of 22 prostate cancers, 10 out of 18 renal carcinomas and 15 out of 21soft tissue tumors. At the same time, DEPDC1 expression was shown to be validly elevated in 23 out of 25 bladder cancers, 6 out of 13 breast cancers, 12 out of 12 cervical cancers, 6 out of 6 cholangin-cellular carcinomas, 3 out of 4 CMLs 2 out of 4 colorectal cancers, 6 out of 6 NSCLCs, 7 out of 7 lymphomas, 10 out of 14 osteosarcomas, 11 out of 24 prostate cancers, 14 out of 14 SCLCs and 22 out of 31 soft tissue tumors as described in Table 1.

In one aspect, the present invention refers to an isolated peptide having cytotoxic T cell inducibility, wherein said peptide derived from the amino acid sequence of SEQ ID NO: 2, wherein the peptide is less than 15 amino acids, wherein the peptide comprises the amino acid sequence selected from the group consisting of SEQ ID NO: 7, 8 and 9 to 11.

In another aspect, the present invention refers to isolated peptide of less than 15 amino acids, wherein the peptide comprises the amino acid sequence selected from the group consisting of:
(a) SEQ ID NO:7;
(b) SEQ ID NO:8;
(c) SEQ ID NO: 7 in which 1 or 2 amino acids are substituted, deleted or added; and
(d) SEQ ID NO: 8 in which 1 or 2 amino acids are substituted, deleted or added; wherein the peptide has cytotoxic T cell inducibility.

In yet another aspect, the present invention refers to an isolated peptide of less than 15 amino acids, wherein the peptide comprises the amino acid sequence selected from the group consisting of:
(a) SEQ ID NO:9;
(b) SEQ ID NO:10;
(c) SEQ ID NO:11;
(d) SEQ ID NO:9 in which 1 or 2 amino acids are substituted, deleted or added;
(e) SEQ ID NO:10 in which 1 or 2 amino acids are substituted, deleted or added; and
(f) SEQ ID NO:11 in which 1 or 2 amino acids are substituted, deleted or added; wherein the peptide has cytotoxic T cell inducibility.

In a further aspect, the present invention refers to an isolated peptide consisting of the amino acid sequence selected from the group consisting of SEQ ID NO: 7, 8 and 9 to 11.

In yet another aspect, the present invention refers to a vector comprising DNA which encodes the peptide as defined herein.

In another aspect, the present invention refers to an exosome that presents on its surface a complex comprising a peptide as defined herein and an HLA antigen.

In one aspect, the present invention refers to an isolated cytotoxic T cell, which is induced by the method as defined herein or which is transduced with the nucleic acids encoding the TCR subunits polypeptides binding with a peptide as defined herein in the context of HLA-A24 or HLA-A2.

In another aspect, the present invention refers to an antigen-presenting cell, which comprises a complex formed between an HLA antigen and a peptide as defined herein.

In a further aspect, the present invention refers to a vaccine for inhibiting proliferation of cells expressing the gene of SEQ ID NO:1, wherein the vaccine comprises a peptide as defined herein as an active ingredient.

[0011] The present ~~invention~~disclosure is based, at least in part, on the identification of specific epitope peptides of the gene products of these genes (MPHOSPH1 and DEPDC1) which possess the ability to induce cytotoxic T lymphocytes (CTLs) specific to the corresponding molecules. As discussed in detail below, Peripheral Blood Mononuclear Cells (PBMC) of healthy donor were stimulated using HLA-A*2402 and HLA-A*0201 binding candidate peptides derived from MPHOSPH1 or DEPDC1. CTL clones and/or lines were then established with specific cytotoxicity against the HLA-A24 or HLA-A2 positive target cells pulsed with each of the candidate peptides. These results demonstrate that these peptides are HLA-A24 or HLA-A2 restricted epitope peptides that can induce potent and specific immune responses against cells expressing MPHOSPH1 or DEPDC1.

In one aspect, the present invention refers to an *in vitro* method of inducing antigen-presenting cells having a high cytotoxic T cell inducibility, said method comprising the step of contacting an antigen-presenting cell with a peptide as defined herein.

In another aspect, the present invention refers to an *in vitro* method of inducing cytotoxic T cells, said method comprising the step of contacting $CD8^+$ T cells with the antigen-presenting cells induced by the method as defined herein.

In yet another aspect, the present invention refers to an *in vitro* method of inducing antigen-presenting cells having high cytotoxic T cell inducibility, said method comprising the step of transferring a gene comprising a polynucleotide encoding a peptide as defined herein to an antigen-presenting cell.

[0012] Accordingly, the present ~~invention~~disclosure provides methods for treating or preventing a disease associated with the over-expression of MPHOSPH1 and/or DEPDC1, e.g. cancer. Such methods involves the step of administering to a subject in need thereof a MPHOSPH1 and/or DEPDC1 polypeptide of the invention. Administration of such peptide(s) results in the induction of anti-tumor immunity. Thus, the present ~~invention~~disclosure

provides methods for inducing anti-tumor immunity in a subject, such methods involving the step of administering to the subject a MPHOSPH1 and/or DEPDC1 polypeptide, as well as pharmaceutical compositions for treating or preventing a disease associated with the over-expression of MPHOSPH1 and/or DEPDC1, e.g cancer, that include the MPHOSPH1 and/or DEPDC1 polypeptides. Exemplary cancers include, but are not limited to, bladder cancer, breast cancer, cervical cancer, cholangincellular carcinoma, CML, colorectal cancer, gastric cancer, NSCLC, lymphoma, osteosarcoma, prostate cancer, renal carcinoma, SCLC, and soft tissue tumor.

[0013] That is, the present application includes following ~~embodiments~~examples, and any combinations thereof.

[1] An isolated peptide having cytotoxic T cell inducibility, wherein said peptide derived from amino acid sequence of SEQ ID NO: 2, 4, or 6.

[2] An isolated peptide of less than about 15 amino acids selected from the group consisting of peptides comprising the amino acid sequences of SEQ ID NO: 7, 8 and 12, or a peptide having cytotoxic T cell inducibility, wherein said peptide comprises an amino acid sequence selected from the group consisting of SEQ ID NO: 7, 8 and 12, wherein 1, 2, or several amino acids are substituted, deleted, or added.

[3] The peptide having cytotoxic T cell inducibility as defined herein~~of [2]~~, wherein the second amino acid from the N-terminus is phenylalanine, tyrosine, methionine, or tryptophan.

[4] The peptide having cytotoxic T cell inducibility as defined herein~~of [2]~~, wherein the C-terminal amino acid is phenylalanine, leucine, isoleucine, tryptophan, or methionine.

[5] An isolated peptide of less than about 15 amino acids selected from the group consisting of peptides comprising the amino acid sequences of SEQ ID NO: 9, 10, 11, 192, 195, 197, 209, 225, 226, 228, 230, 240, 241, 243, 244, 253, 254 and 255, or a peptide having cytotoxic T cell inducibility, wherein said peptide comprises an amino acid sequence selected from the group consisting of SEQ ID NO: 9, 10, 11, 192, 195, 197, 209, 225, 226, 228, 230, 240, 241, 243, 244, 253, 254 and 255, wherein 1, 2, or several amino acids are substituted, deleted, or added.

[6] The peptide having cytotoxic T cell inducibility as defined herein~~of [5]~~, wherein the second amino acid from the N-terminus is leucine or methionine.

[7] The peptide having cytotoxic T cell inducibility as defined herein~~of [5]~~, wherein the C-terminal amino acid is valine or leucine.

[8] A vector in which the DNA encodes peptides as defined herein~~of any one of [1] to [7]~~.

[9] A pharmaceutical composition for treating or preventing a disease associated with over-expression of the genes of SEQ ID NO: 1, 3 and/or 5, said composition comprising one or more peptides as defined herein~~of any one of [1] to [7]~~.

[10] The pharmaceutical composition as defined herein~~of [9]~~, wherein the disease is cancer.

[11] The pharmaceutical composition as defined herein~~of [10]~~, wherein the cancer is selected from the group consisting of bladder cancer, breast cancer, cervical cancer, cholangincellular carcinoma, CML, colorectal cancer, gastric cancer, NSCLC, lymphoma, osteosarcoma, prostate cancer, renal carcinoma, SCLC and soft tissue tumor.

[12]. An exosome that presents on its surface a complex comprising a peptide as defined herein~~of any one of [1] to[7]~~ and an HLA antigen.

[13] The exosome as defined herein~~of [12]~~, wherein the HLA antigen is HLA-A24.

[14] The exosome as defined herein~~of [13]~~, wherein the HLA antigen is HLA-A2402.

[15]. The exosome as defined herein~~of [12]~~, wherein the HLA antigen is HLA-A2.

[16]. The exosome as defined herein~~of [13]~~, wherein the HLA antigen is HLA-A0201.

[17] A method of inducing antigen-presenting cells having a high cytotoxic T cell in-

ducibility comprising the step of contacting an antigen-presenting cell with a peptide as defined hereinof any one of [1] to [7].

[18] A method of inducing cytotoxic T cells by contacting a T cell with a peptide as defined hereinof any one of [1] to [7].

[19] A method of inducing antigen-presenting cells having high cytotoxic T cell inducibility, said method comprising the step of transferring a gene comprising a polynucleotide encoding a peptide as defined hereinof any one of [1] to [7] to an antigen-presenting cell.

[20] An isolated cytotoxic T cell, which is induced by contacting a T cell with a peptide as defined hereinof any one of claims 1 to 7 or which is transduced with the nucleic acids encoding the TCR subunits polypeptides binding with a peptide as defined hereinof any one claims 1 to 7 in the context of HLA-A24 or HLA-A2.

[21] An antigen-presenting cell, which comprises a complex formed between an HLA antigen and a peptide as defined hereinof any one of [1] to [7].

[22] The antigen-presenting cell as defined hereinof [21], induced by the method as defined hereinof [17].

[23] A vaccine for inhibiting proliferation of cells expressing genes of SEQ ID NO: 1, 3 and/or 5, wherein the vaccine comprises a peptide as defined hereinof any one of [1] to [7] as the active ingredient.

[24] The vaccine as defined hereinof [23], wherein the cell is a cancer cell.

[25] The vaccine as defined hereinof [24], wherein the cancer is selected from the group consisting of bladder cancer, breast cancer, cervical cancer, cholangincellular carcinoma, CML, colorectal cancer, gastric cancer, NSCLC, lymphoma, osteosarcoma, prostate cancer, renal carcinoma, SCLC and soft tissue tumor.

[26] The vaccine as defined hereinof [23], formulated for administration to a subject whose HLA antigen is HLA-A24 or HLA-A2.

[27] A method of treating or preventing a disease associated with the over-expression of the genes of SEQ ID NO: 1, 3 and/or 5 in a subject comprising administering to said subject a vaccine comprising one or more peptide as defined hereinof any one of [1] to [7], an immunologically active fragment thereof, or a polynucleotide encoding said peptide or immunologically active fragment.

[28] The method as defined hereinof [27], wherein the disease is cancer.

[29] The method as defined hereinof [28], wherein the cancer is selected from the group consisting of bladder cancer, breast cancer, cervical cancer, cholangincellular carcinoma, CML, colorectal cancer, gastric cancer, NSCLC, lymphoma, osteosarcoma, prostate cancer, renal carcinoma, SCLC and soft tissue tumor.

[0014] Alternatively, the present inventiondisclosure also relates to a method of inducing cytotoxic T cells comprising the step of contacting a T-cell with the antigen-presenting cell produced by the method as defined hereinof [19].

[0015] These and other objects and features of the inventiondisclosure will become more fully

apparent when the following detailed description is read in conjunction with the accompanying figures and examples. However, it is to be understood that both the foregoing summary ~~of the invention~~ and the following detailed description are of preferred ~~embodiments~~examples, and not restrictive of the ~~invention~~disclosure or other alternate ~~embodiments~~examples of the ~~invention~~disclosure.

Brief Description of the Drawings

[0016] [fig.1] Figure 1A depicts the results of an IFN-gamma ELISPOT assay for the screening of epitope peptides which, in turn, demonstrate that MPHOSPH1-A24-9-278 (SEQ ID NO: 7) is a potent producer of IFN-gamma. CTLs for those peptides derived from MPHOSHP1 were generated according to the protocols described in "Materials and Methods" section of the examples below. Resulting CTLs having detectable specific CTL activity are shown. In particular, the cells in the well number #4 stimulated with MPHOSPH1-A24-9-278 showed potent IFN-gamma production to recognize peptide pulsed target cells, as compared to the control. Figure 1B depicts the results of the IFN-gamma ELISPOT assay for the screening of CTL clones after limiting dilution (MPHOSPH1-A24-9-278 CTL clone). The cells in the positive well were expanded and limiting dilution was performed. As the depicted results demonstrate, CTL clones having higher specific CTL activities against the peptide-pulsed target as compared to the activities against target without peptide pulse were established.

[fig.2] Figure 2A depicts the results of an IFN-gamma ELISPOT assay for the screening of epitope peptides cytotoxicity, which, in turn, demonstrate that MPHOSPH1-A24-10-278 (SEQ ID NO: 8) is a potent producer of IFN-gamma . CTLs for those peptides derived from MPHOSHP1 were generated according to the protocols described in "Materials and Methods" section of the examples below. Resulting CTLs having detectable specific CTL activity are shown. In particular, the cells in the well number #8 stimulated with MPHOSPH1-A24-10-278 showed potent IFN-gamma production as compared to the control. Figure 2B depicts the results of an IFN-gamma ELISPOT assay for the screening of CTL clones after limiting dilution (MPHOSPH1-A24-10-278 CTL clone). The cells in the positive well were expanded and limiting dilution was performed. As the depicted results demonstrate, CTL clones having higher specific CTL activities against the MPHOSPH1-A24-10-278-pulsed target as compared to the activities against target without peptide pulse as shown were established.

[fig.3] Figure 3A depicts the establishment of CTL clones stimulated with MPHOSPH1-A24-9-278. (SEQ ID NO: 7). This CTL clone demonstrated high specific CTL activity against target cells (A24LCL) pulsed with MPHOSPH1-A24-9-278, but