CLAIMS

1. A peptide having a length of up to 30 amino acids and comprising an amino acid sequence selected from the group consisting of SEQ ID No. 1, 3, 6, 12, 40 and 118; or a pharmaceutical acceptable salt thereof, wherein the peptide is non-naturally occurring.

2. The peptide according to claim 1, wherein said peptide has an overall length of up to 16 amino acids.

3. An antibody, in particular a soluble or membrane-bound antibody, that specifically recognizes an amino acid sequence selected from the group consisting of SEQ ID No. 1, 3, 6, 12, 40 and 118 when bound to an MHC molecule.

4. A T-cell receptor, preferably soluble or membrane-bound, that is reactive with an HLA ligand, optionally wherein said ligand is part of a peptide-MHC complex, wherein said ligand has at least 88% identity to an amino acid sequence selected from the group consisting of SEQ ID No. 1, 3, 6, 12, 40 and 118.

5. The T-cell receptor according to 4, wherein said T-cell receptor is provided as a soluble molecule and optionally carries a further effector function such as an immune stimulating domain or toxin.

6. An aptamer that specifically recognizes an amino acid sequence selected from the group consisting of SEQ ID No. 1, 3, 6, 12, 40 and 118 that is bound to an MHC molecule.

7. A nucleic acid, encoding for the peptide according to any one of claims 1 or 2, the antibody according to claim 3, the TCR according to claim 4 or 5, or an aptamer according to claim 6, wherein said nucleic acid is optionally linked to a heterologous promoter sequence, or an expression vector expressing said nucleic acid.

8. A recombinant host cell comprising the peptide according to claim 1 to 2 or the nucleic acid or the expression vector according to claim 7, wherein said host cell preferably is an antigen presenting cell such as a dendritic cell, or a T cell or NK cell.

9. The peptide according to any one of claims 1 or 2, the antibody according to claim 3, the TCR according to claim 4 or 5, the aptamer according to claim 6, the nucleic acid or the expression vector according to claim 7, or the host cell according to claim 8 for use in medicine.

10. A method for producing the peptide according to any one of claims 1 or 2, the antibody according to claim 3 or the TCR according to claim 4 or 5 said method comprising culturing the host cell according to claim 8 expressing the nucleic acid or the expression vector according to claim 7, and isolating the peptide, the antibody or the TCR from the host cell or its culture medium.

11. An *in vitro* method for producing activated T lymphocytes, the method comprising contacting *in vitro* T cells with antigen loaded human class I or II MHC molecules expressed on the surface of a suitable antigen-presenting cell or an artificial construct mimicking an antigen-presenting cell for a period of time sufficient to activate said T cells in an antigen specific manner, wherein said antigen is a peptide according to any one of claims 1 or 2.

12. An activated T lymphocyte, produced by the method according to claim 11,that selectively recognizes a cell presenting an amino acid sequence selected from the group consisting of SEQ ID No. 1, 3, 6, 12, 40 and 118.

13. A pharmaceutical composition comprising at least one active ingredient selected from the group consisting of

a) a peptide selected from the group consisting of SEQ ID No. 1, 3, 6, 12, 40 and 118;

b) a T-cell receptor reactive with a peptide and/or the peptide-MHC complex according to a);

c) a fusion protein comprising a peptide according to a), and the N-terminal amino acids 1 to 80 of the HLA-DR antigen-associated invariant chain (Ii);

d) a nucleic acid encoding for any of a) to c) or an expression vector comprising said nucleic acid,

e) a host cell comprising the expression vector of d),

f) an activated T-lymphocyte, obtained by a method comprising contacting in vitro T cells with a peptide according to a) expressed on the surface of a suitable antigen presenting cell for a period of time sufficient to activate said T cell in an antigen specific manner, as well as a method to transfer these activated T cells into the autologous or other patients;

g) an antibody, or soluble T-cell receptor, reactive to a peptide and/or the peptide – MHC complex according to a) and/or a cell presenting a peptide according to a), and potentially modified by fusion with for example immune-activating domains or toxins,

h) an aptamer recognizing a peptide selected from the group consisting of SEQ ID No. 1, 3, 6, 12, 40 and 118 and/or a complex of a peptide selected from the group consisting of SEQ ID No. 1, 3, 6, 12, 40 and 118 with a MHC molecule,

i) a conjugated or labelled peptide or scaffold according to any of a) to h), and a pharmaceutically acceptable carrier, and optionally, pharmaceutically acceptable excipients and/or stabilizers.

14. Use of the peptide according to any one of claims 1 or 2, the antibody according to claim 3, the TCR according to claim 4 or 5, the activated T lymphocyte according to claim 12, the nucleic acid or the expression vector according to claim 7, or the host cell according to claim 8, in the manufacture of a medicament for the treatment of cancer, wherein said cancer preferably is selected from the group of head and neck squamous cell carcinoma, acute myelogenous leukemia, breast cancer, bile duct cancer, brain cancer, chronic lymphocytic leukemia, colorectal carcinoma, esophageal cancer, gallbladder cancer, gastric cancer, hepatocellular cancer, melanoma, non-Hodgkin lymphoma, non-small cell lung cancer, ovarian cancer, pancreatic cancer, prostate cancer, renal cell cancer, small cell lung cancer, urinary bladder

cancer, uterine cancer and other tumors that show an overexpression of a protein from which a peptide SEQ ID No. 1, 3, 6, 12, 40 and 118 is derived from.

15. A kit comprising:

a) a container comprising a pharmaceutical composition comprising a peptide according to any one of claims 1 to 2, the antibody according to claim 3, the TCR according to claim 4 or 5, the activated T lymphocyte according to claim 12, the nucleic acid or the expression vector according to claim 7, or the host cell according to claim 8, in solution or in lyophilized form;

b) optionally, a second container containing a diluent or reconstituting solution for the lyophilized formulation;

c) optionally, at least one more peptide selected from the group consisting of SEQ ID No. 1 to SEQ ID No. 156, preferably SEQ ID No. 1 to SEQ ID No. 91, and

d) optionally, instructions for (i) use of the solution or (ii) reconstitution and/or use of the lyophilized formulation.

16. A method for producing a personalized anti-cancer vaccine or a compound-based and/or cellular therapy for an individual patient, said method comprising:

a) identifying tumor-associated peptides (TUMAPs) presented by a tumor sample from said individual patient, whereby said peptides include at least one peptide of SEQ ID No. 1, 3, 6, 12, 40 and 118;

b) comparing the peptides as identified in a) with a warehouse of peptides that have been pre-screened for immunogenicity and/or over-presentation in tumors as compared to normal tissues;

c) selecting at least one peptide from the warehouse that matches a TUMAP identified in the patient; and

d) manufacturing and/or formulating the personalized vaccine or compound-based or cellular therapy based on step c).

17. The method according to claim 16, wherein said TUMAPs are identified comprising:

a1) comparing expression data from the tumor sample to expression data from a sample of normal tissue corresponding to the tissue type of the tumor sample to identify proteins that are over-expressed or aberrantly expressed in the tumor sample; and

a2) correlating the expression data with sequences of MHC ligands bound to MHC class I and/or class II molecules in the tumor sample to identify MHC ligands derived from proteins over-expressed or aberrantly expressed by the tumor.

18. The method according to claim 16 or 17, wherein the peptides included in the warehouse are identified based on the following steps:

aa. Performing genome-wide messenger ribonucleic acid (mRNA) expression analysis by highly parallel methods, such as microarrays or sequencing-based expression profiling, comprising identify genes that over-expressed in a malignant tissue, compared with a normal tissue or tissues;

ab. Selecting peptides encoded by selectively expressed or over-expressed genes as detected in step aa, and

ac. Determining an induction of in vivo T-cell responses by the peptides as selected comprising *in vitro* immunogenicity assays using human T cells from healthy donors or said patient; or

ba. Identifying HLA ligands from said tumor sample using mass spectrometry;

bb. Performing genome-wide messenger ribonucleic acid (mRNA) expression analysis by highly parallel methods, such as microarrays or sequencing-based expression profiling, comprising identify genes that over-expressed in a malignant tissue, compared with a normal tissue or tissues;

bc. Comparing the identified HLA ligands to said gene expression data;

bd. Selecting peptides encoded by selectively expressed or over-expressed genes as detected in step bc;

be. Re-detecting of selected TUMAPs from step bd on tumor tissue and lack of or infrequent detection on healthy tissues and confirming the relevance of over-expression at the mRNA level; and

bf. Determining an induction of *in vivo* T-cell responses by the peptides as selected comprising *in vitro* immunogenicity assays using human T cells from healthy donors or said patient.

19. The method according to any of claims 16 to 18, further comprising identifying at least one mutation that is unique to the tumor sample relative to normal corresponding tissue from the individual patient, and selecting a peptide that correlates with the mutation for inclusion in the vaccine or for the generation of cellular therapies.