

CLAIMS

1. An antibody capable of binding to MUC1, which comprises
 - (i) a heavy chain variable region comprising the complementarity-determining regions (CDRs) CDR-H1 having the amino acid sequence of SEQ ID NO: 1, CDR-H2 having the amino acid sequence of SEQ ID NO: 7 and CDR-H3 having the amino acid sequence of SEQ ID NO: 3, and
 - (ii) a light chain variable region comprising the complementarity-determining regions (CDRs) CDR-L1 having the amino acid sequence of SEQ ID NO: 4, CDR-L2 having the amino acid sequence of SEQ ID NO: 5 and CDR-L3 having the amino acid sequence of SEQ ID NO: 6.
2. The antibody according to claim 1, wherein the heavy chain variable region has the amino acid sequence of SEQ ID NO: 10 or an amino acid sequence which is at least 90% identical to the amino acid sequence of SEQ ID NO: 10; and/or the light chain variable region has the amino acid sequence of SEQ ID NO: 12 or an amino acid sequence which is at least 90% identical to the amino acid sequence of SEQ ID NO: 12.
3. The antibody according to claim 1 or 2, wherein the heavy chain variable region of the antibody has the amino acid sequence of SEQ ID NO: 10 and the light chain variable region of the antibody has the amino acid sequence of SEQ ID NO: 12.
4. The antibody according to any one of claims 1 to 3, wherein the antibody comprises an Fc region and preferably is an IgG1, IgG2 or IgG4-type antibody; more preferably wherein the antibody comprises a heavy chain having the amino acid sequence of SEQ ID NO: 22, and a light chain having the amino acid sequence of SEQ ID NO: 16.
5. The antibody according to any one of claims 1 to 4, wherein the antibody is obtainable by production in a mammalian cell, such as a human cell line selected from the group consisting of NM-H9D8 (DSM ACC 2806), NM-H9D8-E6 (DSM ACC 2807), NM-H9D8-E6Q12 (DSM ACC 2856) and cell lines derived therefrom, or a CHO cell line or a cell line derived therefrom.
6. The antibody according to any one of claims 1 to 5, wherein the antibody competes for the binding to TA-MUC1 with an antibody comprising a heavy chain variable region having the amino acid sequence of SEQ ID NO: 10 and a light chain variable region having the amino acid sequence of SEQ ID NO: 12.
7. A nucleic acid encoding the antibody according to any one of claims 1 to 6.

8. An expression cassette or vector comprising the nucleic acid according to claim 7 and a promoter operatively connected with said nucleic acid.
9. A host cell comprising the nucleic acid according to claim 7 or the expression cassette or vector according to claim 8.
- 5 10. A conjugate comprising the antibody according to any one of claims 1 to 6 conjugated to a further agent, wherein the further agent is a polypeptide or protein, such as a cytokine, an immunomodulatory compound, a tumor-specific antibody or an immune checkpoint blocking or activating antibody.
- 10 11. A composition comprising the antibody according to any one of claims 1 to 6, the nucleic acid according to claim 7, the expression cassette or vector according to claim 8, the host cell according to claim 9, or the conjugate according to claim 10.
12. The antibody according to any one of claims 1 to 6, the conjugate according to claim 10, or the composition according to claim 11 for use in medicine.
- 15 13. The antibody, the conjugate, or the composition for use in medicine according to claim 12 for use in the treatment of cancer, an infection, an autoimmune disease or an immunodeficiency disorder.
14. The antibody, the conjugate or the composition for use in medicine according to claim 12 for use in diagnosis, detecting and/or monitoring of cancer, an infection, an autoimmune disease or an immunodeficiency disorder.
- 20 15. The antibody, the conjugate or the composition for use in medicine according to claim 13 or 14, wherein the cancer is characterized by expressing TA-MUC1; and/or wherein the cancer is selected from the group consisting of ovarian cancer, breast cancer, pancreatic cancer, lung cancer, colon cancer, stomach cancer, liver cancer, kidney cancer, blood cancer, endometrial cancer, thyroid cancer, leukemias, 25 seminomas, melanomas, carcinomas, teratomas, lymphomas, sarcomas, mesotheliomas, neuroblastomas, gliomas, rectal cancer, adrenal cancer, skin cancer, cancer of the brain, cervical cancer, intestinal cancer, intestine cancer, head and neck cancer, gastrointestinal cancer, lymph node cancer, esophagus cancer, colorectal cancer, ear, nose and throat (ENT) cancer, prostate cancer, bladder cancer, cancer of the uterus and the metastases thereof.
- 30 16. The antibody, the conjugate or the composition for use in medicine according to any one of claims 12 to 15, wherein the antibody is used in combination with a further agent.
17. A method of producing an antibody with increased MUC1 binding affinity, comprising

(a) providing a nucleic acid coding for an antibody which comprises

(i) a heavy chain variable region comprising the complementarity-determining regions (CDRs) CDR-H1 having the amino acid sequence of SEQ ID NO: 1, CDR-H2 having the amino acid sequence of SEQ ID NO: 8 and CDR-H3 having the amino acid sequence of SEQ ID NO: 3, and

(ii) a light chain variable region comprising the complementarity-determining regions (CDRs) CDR-L1 having the amino acid sequence of SEQ ID NO: 4, CDR-L2 having the amino acid sequence of SEQ ID NO: 5 and CDR-L3 having the amino acid sequence of SEQ ID NO: 6;

(b) introducing a mutation into said nucleic acid to produce a mutated nucleic acid, wherein the mutation is introduced in the codon coding for the amino acid residue at position 8 of CDR-H2 so that said codon codes for glutamine; and

(c) producing the antibody with increased MUC1 binding affinity by expressing the mutated nucleic acid in a host cell.

18. The method according to claim 17, further comprising the step of

(d) processing the antibody with increased MUC1 binding affinity.