Further, MMTV-PymT mice vaccinated with Estrogen Receptor peptides or with Estrogen Receptor antibody have reduced burden of mammary tumors compared to mice immunized with GST (negative control).

We therefore provide for methods of treating cancers and preventing cancer metastasis with fragments of intracellular oncoprotein. The term “intracellular oncoprotein” as used herein may include oncoproteins that have an intracellular region. For example, membrane anchored proteins may have extracellular, transmembrane, and intracellular domains or regions.

The fragment may be a fragment of a region of the oncoprotein that comprises a mutation as compared to the wild-type, or non-oncogenic protein. The mutation may be associated with, or causative of, cancer (i.e. an oncogenic mutation).

There is provided, according to an example of the present disclosure, use of a vaccine therapy comprising an intracellular oncoprotein fragment for vaccination to stimulate a host to produce its own antibodies to prevent tumor formation.

Also provided is a polypeptide for use in a method of stimulating the production of anti-intracellular oncoprotein antibodies in a subject in need thereof, the polypeptide being a fragment of the intracellular oncoprotein having between 10 and 150 amino acids, preferably between 10 and 100 amino acids. In one aspect, provided is a use of a polypeptide in the manufacture of a medicament for the treatment or prevention of cancer by stimulating the production of anti-intracellular oncoprotein antibodies in a patient in need thereof, the polypeptide being a fragment of an intracellular oncoprotein having between 10 and 100 amino acids, wherein the intracellular oncoprotein fragment does not comprise an extracellular domain or a transmembrane domain, wherein the intracellular oncoprotein is VHZ. In another aspect, provided is a use of a fragment of between 10 and 100 amino acids of an intracellular oncoprotein or peptide based on a fragment of said intracellular oncoprotein in the manufacture of a medicament for preventing cancer metastasis in a patient with cancer, wherein the use comprises: identification of the intracellular oncoprotein specific to the patients cancer for administration of the fragment to the patient, wherein the intracellular oncoprotein is VHZ. In another aspect, provided is a use of a fragment of an intracellular oncoprotein or peptide based on a fragment of said intracellular oncoprotein, the fragment or peptide being between 10 and 100 amino acids in length in the manufacture of a medicament for treating or preventing cancer

in a patient, wherein the use comprises: determination of whether a patient is suffering from, or likely to develop, a cancer associated with an intracellular oncoprotein before administration to that person the fragment of that intracellular oncoprotein or peptide based on the fragment of that intracellular oncoprotein, wherein the intracellular oncoprotein is VHZ.A method of stimulating the production of anti-intracellular oncoprotein antibodies in a subject in need thereof, comprising administering a polypeptide which is a fragment of the intracellular oncoprotein, having between 10 and 150 amino acids is also provided.

The polypeptide may be a fragment of an oncoprotein that is intracellular, or a fragment of an intracellular region of an oncoprotein. The fragment may comprise an oncogenic mutation.

The polypetide may comprise a plurality of fragments. Thus, more than one fragment of an oncoprotein may be provided in one polypeptide. More than one polypeptide may be administered to a patient. Some or all of those polypeptides may comprise more than one oncoprotein fragment. The one or more oncoprotein fragments may be fragments of the same oncoprotein, or may be fragments from different oncoproteins. In some cases, the polypeptide comprises more than one copy of the same fragment.

We provide, according to another example of the present disclosure, a method of treatment of cancer, preferably metastatic cancer, in an individual suffering or suspected to be suffering from cancer. In one aspect, provided is a use according to the disclosure, wherein the medicament is for preventing or reducing cancer metastasis. The method may comprise administering a therapeutically effective amount of a fragment of an intracellular oncoprotein to the individual. The intracellular oncoprotein may have been determined as being expressed in the cancer that the individual is suffering from.

The fragment may correspond to a region of the oncoprotein that comprises a mutation. That is, the fragment may comprise an oncogenic mutation. An advantage of targeting an oncogenic mutation, for example using a peptide that comprises a fragment of an oncoprotein that includes an oncogenic mutation, is that an immune response specific to a cancer may be generated, leaving normal cells unharmed. The patient may be administered a plurality of oncoprotein fragments. The plurality of oncoprotein fragments may be combined into one or more peptides that each comprises a plurality of different peptides, each optionally linked by a peptide linker. The fragments may be from the same oncoprotein, or different oncoproteins. The method may involve inducing the patient to produce anti-cancer antibodies, for example antibodies against the oncoprotein or oncogenic

CLAIMS

1. Use of a polypeptide in the manufacture of a medicament for the treatment or prevention of cancer by stimulating the production of anti-intracellular oncoprotein antibodies in a patient in need thereof, the polypeptide being a fragment of an intracellular oncoprotein having between 10 and 100 amino acids, wherein the intracellular oncoprotein fragment does not comprise an extracellular domain or a transmembrane domain, wherein the intracellular oncoprotein is VHZ.

2. Use according to claim 1 wherein the polypeptide is a fragment comprising an oncogenic mutation.

3. Use according to any one of the preceding claims wherein the patient is to be administered a plurality of fragments from VHZ.

4. Use according to any one of the preceding claims, wherein the medicament is for preventing or reducing cancer metastasis.

5. Use according to any one of the preceding claims wherein the patient has a primary cancer that expresses the intracellular oncoprotein.

6. Use of a fragment of between 10 and 100 amino acids of an intracellular oncoprotein or peptide based on a fragment of said intracellular oncoprotein in the manufacture of a medicament for preventing cancer metastasis in a patient with cancer, wherein the use comprises: identification of the intracellular oncoprotein specific to the patients cancer for administration of the fragment to the patient, wherein the intracellular oncoprotein is VHZ.

7. Use of a fragment of an intracellular oncoprotein or peptide based on a fragment of said intracellular oncoprotein, the fragment or peptide being between 10 and 100 amino acids in length in the manufacture of a medicament for treating or preventing cancer in a patient, wherein the use comprises: determination of whether a patient is suffering from, or likely to develop, a cancer associated with an intracellular oncoprotein before administration to that person of the fragment of that intracellular oncoprotein or peptide based on the fragment of that intracellular oncoprotein, wherein the intracellular oncoprotein is VHZ.

8. The use of claim 6 or claim 7 wherein the fragment comprises an oncogenic mutation.

9. The use of any one of claims 6 to 8 wherein the patient is to be administered a plurality of oncoprotein fragments.

10. The use of claim 9 wherein the plurality of oncoprotein fragments are combined into one or more peptides that each comprises a plurality of different peptides, each optionally linked by a peptide linker.

11. The use of any one of claims 6 to 10 wherein the patient is to be induced to produce antibodies against the peptide.

12. The use of any one of claims 7 to 11 wherein the patient is to be administered with the intracellular oncoprotein fragment or peptide before they develop the cancer.

13. The use of any one of claims 6 to 12 wherein the patient is to be administered with a further dose of the intracellular oncoprotein fragment or peptide.

14. The use of any one of claims 7 to 13 wherein the patient is identified as being likely to suffer from a cancer associated with an intracellular oncoprotein by assessing the prevalence of the cancer in family members.

15. The use according to any preceding claim, in which the cancer is associated with or caused by over-expression of the intracellular oncoprotein.

16. The use according to any preceding claim, in which the cancer is selected from the group consisting of: breast cancer, hepatocellular cancer, acute lymphocytic leukemia (ALL), acute myeloid leukemia (AML), adrenocortical cancer, anal cancer, bladder cancer, blood cancer, bone cancer, brain tumor, cancer of the female genital system, cancer of the male genital system, central nervous system lymphoma, cervical cancer, childhood rhabdomyosarcoma, childhood sarcoma, chronic lymphocytic leukemia (CLL), chronic myeloid leukemia (CML), colon and rectal cancer, colon cancer, endometrial cancer, endometrial sarcoma, esophageal cancer, eye cancer, gallbladder cancer, gastric cancer, gastrointestinal tract cancer, hairy cell leukemia, head and neck cancer, Hodgkin's disease, hypopharyngeal cancer, Kaposi's sarcoma, kidney cancer, laryngeal cancer, leukemia, leukemia, liver cancer, lung cancer, malignant fibrous histiocytoma, malignant thymoma, melanoma, mesothelioma, multiple myeloma, myeloma, nasal cavity and paranasal sinus cancer, nasopharyngeal cancer, nervous system cancer, neuroblastoma, non-Hodgkin's lymphoma, oral cavity cancer, oropharyngeal cancer, osteosarcoma, ovarian cancer, pancreatic cancer, parathyroid cancer, penile cancer, pharyngeal cancer, pituitary tumor, plasma cell neoplasm, primary CNS lymphoma, prostate cancer, rectal cancer, respiratory system, retinoblastoma, salivary gland cancer, skin cancer, small intestine cancer, soft tissue sarcoma, stomach cancer, stomach cancer, testicular cancer, thyroid cancer, urinary

system cancer, uterine sarcoma, vaginal cancer, vascular system, Waldenstrom's macroglobulinemia and Wilms' tumor.