Claims

1. A method for screening an antibody or an antigen-binding fragment thereof, which binds to an antigen and is internalized into tumor cells, the method comprising the steps of:

(i) treating patient-derived tumor spheroids, which express the antigen, with a library comprising antibodies or antigen-binding fragments thereof, and then firstly screening antibodies or antigen-binding fragments thereof which bind to the antigen and are internalized into cells of the tumor spheroids by performing phage display;

(ii) treating patient-derived tumor spheroids, which do not express the antigen, with the first screened antibodies or antigen-binding fragments thereof which bind to the antigen and are internalized into cells of the tumor spheroids, to perform negative selection on antibodies or antigen-binding fragments thereof binding to the patient derived tumor spheroids which do not express the antigen;

(iii) administering antibodies or antigen-binding fragments thereof, obtained by separating or removing antibodies or antigen-binding fragments thereof that binds to the patient-derived tumor spheroids of step (ii) from the antibodies or antigen-binding fragments thereof screened in step (i), to animal models transplanted with the patient-

derived tumor spheroids which express the antigen by intra-tumoral injection, and dissociating cancer tissue in the animal models into single cells, to secondly screen antibodies or antigen-binding fragments which bind to the antigen; and

(iv) separating or removing antibodies or antigen-binding fragments thereof, which bind to an antigen other than the antigen, from the second screened antibodies or antigen-binding fragments thereof.

2. The method of claim 1, wherein the patient-derived tumor spheroids expressing the antigen are obtained by performing the following steps:

(a) dissociating isolated cancer patient-derived cancer tissue, and collecting a cell fraction from the dissociated tissue; and

(b) treating the collected cell fraction with protease, followed by filtration, centrifugation and suspension, thereby obtaining single cells.

3. The method of claim 1 or claim 2, wherein the animal models transplanted with patient-derived tumor spheroids expressing the antigen are immunodeficient mice.

4. The method of claim 3, wherein the immunodeficient mice are nude mice, NOD (non-obese diabetic) mice, SCID (Severe combined immunodeficiency) mice, NOD-SCID mice, or NOG (NOD/SCID I12rg-/-) mice.

5. The method of any one of claims 1 to 4, further comprising a step of converting the antibody or antigen-binding fragment thereof screened by the method to an IgG format.

6. An antibody or an antigen-binding fragment thereof, which is screened by the method of any one of claims 1 to 5.

7. Use of the antibody or antigen-binding fragment thereof of claim 6 in the manufacture of a medicament for the treatment of a cancer, wherein the cancer over expresses the antigen of the antibody or antigen-binding fragment thereof.