

Claims

1. A peptide ~~comprising~~ consisting of an amino acid sequence of alternating hydrophobic amino acids (X) and hydrophilic amino acids (Y), wherein each hydrophobic amino acid is independently selected from isoleucine (I), valine (V) and leucine (L), each hydrophilic amino acid is independently selected from arginine (R), lysine (K), glutamic acid (E), and aspartic acid (D), at least one hydrophilic amino acid is selected from arginine and lysine, at least one hydrophilic amino acid is selected from glutamic acid and aspartic acid, and the amino acid sequence ~~contains at least 8 amino acids~~ of alternating hydrophobic amino acids (X) and hydrophilic amino acids (Y) consists of 8 or 12 amino acids, wherein there is at least one arginine and at least one lysine in the amino acid sequence and the hydrophilic amino acids are selected such that the peptide has a net neutral charge or net positive charge of +2 at a pH of 7, and wherein the amino acid sequence is not IRVEIEVK (SEQ ID No. 8).

2. The peptide according to claim 1, wherein the amino acid sequence has an even number of amino acids.

~~3. The peptide according to any one of claims 1 to 2, wherein the amino acid sequence has 8 or 12 amino acids.~~

4.3. The peptide according to any one of claims 1 to ~~3~~2, wherein four sequential hydrophilic amino acids (Y₁, Y₂, Y₃ and Y₄) in the amino acid sequence of alternating hydrophobic amino acids (X) and hydrophilic amino acids (Y) are selected such that Y₁ and Y₂ are each independently selected from glutamic acid and aspartic acid, and Y₃ and Y₄ are each independently selected from arginine and lysine.

5.4. The peptide according to any one of claims 1 to ~~3~~2, wherein four sequential hydrophilic amino acids (Y₁, Y₂, Y₃ and Y₄) in the amino acid sequence of alternating hydrophobic amino acids (X) and hydrophilic amino acids (Y) are selected such that Y₁ and Y₃ are each independently selected from arginine and

lysine, and Y₂ and Y₄ are each independently selected from glutamic acid and aspartic acid.

6.5. The peptide according to any one of claims 1 to 32, wherein six sequential hydrophilic amino acids (Y₁, Y₂, Y₃, Y₄, Y₅, and Y₆) in the amino acid sequence of alternating hydrophobic amino acids (X) and hydrophilic amino acids (Y) are selected such that Y₁, Y₃, and Y₅ are each independently selected from arginine and lysine, and Y₂, Y₄, and Y₆ are each independently selected from glutamic acid and aspartic acid.

7.6. The peptide according to any one of claims 1 to 352, wherein six sequential hydrophilic amino acids (Y₁, Y₂, Y₃, Y₄, Y₅, and Y₆) in the amino acid sequence of alternating hydrophobic amino acids (X) and hydrophilic amino acids (Y) are selected such that Y₁, Y₂, and Y₃ are each independently selected from glutamic acid and aspartic acid, and Y₄, Y₅, and Y₆ are each independently selected from arginine and lysine.

8.7. The peptide according to any one of claims 1 to 352, wherein six sequential hydrophilic amino acids (Y₁, Y₂, Y₃, Y₄, Y₅, and Y₆) in the amino acid sequence of alternating hydrophobic amino acids (X) and hydrophilic amino acids (Y) are selected such that Y₁, Y₂, Y₅, and Y₆ are each independently selected from arginine and lysine, and Y₃, and Y₄ are each independently selected from glutamic acid and aspartic acid.

9.8. The peptide according to any one of claims 1 to 87, wherein at least half of the hydrophobic amino acids in the amino acid sequence are isoleucine or leucine or wherein there are 12 amino acids in the amino acid sequence and the hydrophobic amino acids are each independently selected from isoleucine and valine.

10.9. The peptide according to any one of claims 1 to 98, wherein the amino acid sequence is any one of the following: SEQ ID No. 9, SEQ ID No. 10, SEQ ID No. 11, SEQ ID No. 12, SEQ ID No. 14, SEQ ID No. 15, SEQ ID No. 16, SEQ ID No.

19, SEQ ID No. 20, SEQ ID No. 21, SEQ ID No. 22, SEQ ID No. 24, SEQ ID No. 25, and SEQ ID No. 26.

5 11.10. A composition comprising a hydrogel formed of a plurality of peptides according to any one of claims 1 to ~~10~~9 in a beta-sheet conformation and water or a dried form of the hydrogel.

10 12.11. The composition according to claim ~~11~~10, wherein a concentration of the plurality of peptides is at least 0.6% w/v.

13.12. The composition according to claim ~~12~~11, wherein the concentration is at most 5% w/v.

15 14.13. The composition according to any one of claims ~~11~~10 to ~~13~~12, comprising a salt selected from PBS, DMEM, MEM, a potassium salt, and a sodium salt.

20 15.14. The composition according to any one of claims ~~11~~10 to ~~14~~13, wherein the peptide has the amino sequence of SEQ ID No. 12, SEQ ID No. 15, SEQ ID No. 16, SEQ ID No. 22, SEQ ID No. 25, or SEQ ID No. 26.

16.15. The composition according to any one of claims ~~11~~10 to ~~15~~14, comprising a therapeutic agent.

25 17.16. The composition according to any one of claims ~~11~~10 to ~~16~~15, comprising a second peptide of SEQ ID No. 17 or SEQ ID No. 18.

18.17. The composition according to any one of claims ~~16~~15 to ~~17~~16 for use as a medicament.

30 19.18. An *in-vitro* method of growing cells, the method comprises providing a mixture of the peptide according to any one of claims 1 to ~~10~~9, cell culture medium, and a population of cells to form the gel containing the population of cells; and

incubating the gel under suitable conditions to grow the population of cells, wherein the cell is any one selected from a healthy cell, stem cell which is used for therapy or to grow tissues, and a cancer cell which is used to grow a tumor for *in vitro* and *in vivo* studies.