

CLAIMS

1. A peptide comprising
 - (i) a cellular uptake signal; and
 - (ii) a BNIP3 fragment comprising positions 13 to 20 of BNIP3 SEQ ID NO: 1, optionally comprising 1, 2 or 3 amino acid substitutions compared to positions 13 to 20 of SEQ ID NO: 1, wherein the BNIP3 fragment has a length of 12 amino acids or less ~~or an amino acid sequence derived therefrom~~;wherein the peptide has a length of 50 amino acids or less.
2. The peptide according to claim 1, wherein the BNIP3 fragment has a length of ~~12 amino acids or less, especially~~ 10 amino acids or less, in particular 8 amino acids.
- ~~3. The peptide according to claim 1 or 2, wherein the BNIP3 fragment comprises positions 13 to 20 of BNIP3, optionally comprising 1, 2 or 3 amino acid substitutions compared to positions 13 to 20 of BNIP3.~~
- ~~43. The peptide according to claim ~~31~~ or 2, wherein the amino acid substitutions are present at one or more of the position corresponding to position 15, 17 and 19 of BNIP3 SEQ ID NO: 1.~~
- ~~54. The peptide according to any one of claims 1 to ~~claim 3~~ or 4, wherein the amino acid substitutions are selected from~~
 - (i) glutamic acid at position 15 of BNIP3 SEQ ID NO: 1 to phenylalanine, isoleucine, leucine, valine, tyrosine, cysteine, histidine, arginine or threonine, and
 - (ii) histidine at position 17 of BNIP3 SEQ ID NO: 1 to valine, and
 - (iii) serine at position 19 of BNIP3 SEQ ID NO: 1 to tyrosine, cysteine, phenylalanine or histidine.
- ~~65. The peptide according to any one of claims 1 to ~~54~~, wherein the BNIP3 fragment comprises a phenylalanine residue at the position corresponding to position 19 of BNIP3 SEQ ID NO: 1.~~
- ~~76. The peptide according to any one of claims 1 to ~~65~~, wherein the BNIP3 fragment~~
 - (i) comprises positions 12 to 20 of BNIP3 SEQ ID NO: 1, optionally comprising 1, 2, ~~3~~ or ~~4~~ 3 amino acid substitutions compared to positions 12 to 20 of BNIP3 SEQ ID NO: 1; or

~~(ii) comprises positions 4 to 20 of BNIP3, optionally comprising 1, 2, 3, 4, 5 or 6 amino acid substitutions compared to positions 4 to 20 of BNIP3; or~~

~~(iii) comprises positions 1 to 20 of BNIP3, optionally comprising 1, 2, 3, 4, 5 or 6 amino acid substitutions compared to positions 1 to 20 of BNIP3; or~~

~~(iv)~~ consists of an amino acid sequence selected from the group consisting of SEQ ID NOs: 3 to 17 and 27 to 30.

87. The peptide according to claim 1, wherein the BNIP3 fragment comprises a D-retro-inverso sequence of positions 13 to 20 of ~~BNIP3~~ SEQ ID NO: 1 or of any of the amino acid sequences defined in claims 2 to 76.

98. The peptide according to any one of claims 1 to 87, wherein the cellular uptake signal

(i) is a peptide having a length of 5 to 30 amino acids, in particular 8 to 20 amino acids or 10 to 16 amino acids, especially 12 amino acids;

(ii) is the protein transduction domain of the TAT protein of HIV; and/or

(iii) comprises an amino acid sequence selected from the group consisting of SEQ ID NOs: 31 to 50.

109. The peptide according to any one of claims 1 to 87, wherein the cellular uptake signal comprises a D-retro-inverso sequence of a cell penetrating peptide, in particular a cell penetrating peptide as defined in claim 98.

1110. The peptide according to any one of claims 1 to 109, consisting of the cellular uptake signal and the BNIP3 fragment, optionally comprising a linker between the cellular uptake signal and the BNIP3 fragment.

1211. The peptide according to any one of claims 1 to 1110, having a length of 40 amino acids or less, in particular 35 amino acids or less, especially 30 amino acids or less.

1312. A pharmaceutical composition comprising the peptide according to any one of claims 1 to 1211.

1413. The peptide according to any one of claims 1 to 1211 for use in the treatment of reperfusion-related and/or mitochondria-related disorders as well as cancer therapy-induced cardiotoxicity.

1514. The peptide for use according to claim 1413, wherein the reperfusion-related and/or mitochondria-related disorder is selected from the group consisting of myocardial

infarction, stroke, acute kidney injury, trauma, circulatory arrest, and cessation of blood flow during organ transplantation.

~~16~~15. The peptide for use according to claim ~~14~~13 or ~~15~~14, wherein the peptide is administered to the patient during or after occurrence of impaired blood supply, especially prior to reperfusion of the tissue affected by the ischemia.

~~17~~16. The peptide for use according to claim ~~16~~15, wherein the peptide is administered to the patient within 2 hours, in particular within 30 minutes prior to reperfusion.

~~18~~17. The peptide according to any one of claims 1 to ~~12~~11 for use in the treatment or prevention of tissue damage due to mitochondria-induced apoptosis or necrosis.

~~19~~. A method of screening for a compound suitable for prevention of reperfusion injury and/or mitochondria-induced disorders and/or cancer therapy-induced cardiotoxicity, comprising

(i) ~~providing one or more candidate compounds;~~

(ii) ~~determining the ability of the candidate compounds to interfere with the binding of BNIP3 and BAX;~~

(iii) ~~selecting those candidate compounds which interfere with the binding of BNIP3 and BAX.~~