CLAIMS

1. A light-inducible ion channel, wherein the light-inducible ion channel comprises an amino acid sequence which has at least 70% homology to the amino acid sequence shown in positions 1-309 of SEQ ID NO: 1 (CHOP-2), and which comprises a substitution at a position corresponding to L132 in SEQ ID NO: 1, which substitution increases the polarity of the channel.

2. The light-inducible ion channel of claim 1, wherein the light-inducible ion channel comprises, preferably consists of the amino acid sequence shown in positions 1-309 of SEQ ID NO: 1 (CHOP-2), except for a substitution at position L132,wherein the substitution increases the polarity of the channel.

3. The light-inducible ion channel of claim 1 or 2, wherein the substitution is selected from L132C, L132S, L132E, L132D, and L132T, preferably wherein the substitution is L132C.

4. The light-inducible ion channel of any one of the preceding claims, wherein

   (a) the light-sensitivity is increased by more than 5 times, preferably by more than 10 times, more preferably by more than 20 times, such as 30 times, even more preferably by more than 40 times, such as 50 times, and most preferably by more than 60 times, or even by more than 70 times, as compared to wt CHOP-2 in hippocampal neurons; and/or

   (b) the calcium conductivity is increased at least two-fold, preferably at least three-fold, more preferably at least four-fold compared to wt CHOP-2, as determined by Fura-2-imaging on HEK293 cells; and/or

   (c) the stimulation frequency is increased at least 1.5-fold, more preferably 2-fold, or even more preferably 2.5 fold, compared to wt CHOP-2 as determined by whole-cell electrophysiological recordings in hippocampal neurons.

5. The light-inducible ion channel of any one of the preceding claims, wherein the light-inducible ion channel additionally comprises at least one of the following amino acid residues: aspartic acid at a position corresponding to position 253 of SEQ ID NO: 1; lysine at a position corresponding to position 257 of SEQ ID NO: 1; tryptophan at a position corresponding to position 260 of SEQ ID NO: 1; glutamic acid at a position corresponding to position 123 of SEQ ID NO: 1; histidine or arginine, preferably arginine, at a position corresponding to position 134 of SEQ ID NO: 1; threonine, serine, or alanine at a position corresponding to position 128 of SEQ ID NO: 1; and/or alanine at a position corresponding to position 156 of SEQ ID NO: 1.

6. The light-inducible ion channel of any one of the preceding claims, wherein the light-inducible ion channel comprises the consensus motif L(I)DxxxKxxW(F,Y).

7. A channelrhodopsin, comprising the light-inducible ion channel according to claims 1-6 and a retinal or retinal derivative, preferably wherein the retinal derivative is selected from the group consisting of 3,4-dehydroretinal, 13-ethyiretinal, 9-dm-retinal, 3- hydroxyretinal, 4-hydroxyretinal, naphthylretinal; 3,7,11 -trimethyl-dodeca-2,4,6,8, 10- pentaenai; 3,7-dimethyl-deca-2,4,6,8-tetraenal; 3 ,7-dimethyl-octa-2,4,6-trienal; and 6-7 rotation-blocked retinals, 8-9 rotation-blocked retinals, and 10-11 rotation-blocked retinals.

8. A nucleic acid construct, comprising a nucleotide sequence coding for the light-inducible ion channel according to any one of claims 1-6.

9. An expression vector, comprising a nucleotide sequence coding for the light-inducible ion channel according to any one of claims 1-6 or the nucleic acid construct according to claim 8, preferably wherein the vector is suitable for gene therapy, in particular wherein the vector is suitable for virus-mediated gene transfer.

10. A cell comprising the channelrhodopsin according to claim 7, the nucleic acid construct according to claim 8 or the expression vector according to claim 9.

11. The cell of claim 10, wherein the cell is a mammalian cell or an insect cell, or wherein the cell is a yeast cell, preferably from *Saccharomyces cerevisiae*, *Schizosaccharomyces pombe*, or *Pichia pastoris*.

12. The cell of claim 11, wherein the mammalian cell is

(a) a photoreceptor cell, a retinal rod cell, a retinal cone cell, a retinal ganglion cell, a bipolar neuron, a ganglion cell, a pseudounipolar neuron, a multipolar neuron, a pyramidal neuron, a Purkinje cell, or a granule cell; or

(b) a melanoma cell, a COS cell; a BHK cell; a HEK293 cell; a CHO cell; a myeloma cell; or a MDCK cell.

13. The light-inducible ion channel according to claims 1-6, or the channelrhodopsin according to claim 7, or the nucleic acid construct according to claim 8, or the expression vector according to claim 9, or the cell according to claim 10 for use as a medicament.

14. The expression vector according to claim 10 for use in gene therapy.

15. The light-inducible ion channel according to claims 1-6, or the channelrhodopsin according to claim 7, or the nucleic acid construct according to claim 8, or the expression vector according to claim 9, or the cell according to claim 10 for use in the treatment of blindness or reduced sight.

16. The light-inducible ion-channel according to claim 5 having threonine, serine, or alanine at a position corresponding to position 128 of SEQ ID NO: 1; and/or alanine at a position corresponding to position 156 of SEQ ID NO: 1, for use in the ablation of cancer cells, preferably wherein the cancer cells are melanoma cancer cells.

17. Use of a light-inducible ion channel according to claims 1-6, or a channelrhodopsin according to claim 7, or a cell according to claim 10 in a high-throughput screening.

18. A light-inducible ion channel, wherein the light-inducible ion channel comprises an amino acid sequence which has at least 70% homology to the amino acid sequence shown in positions 1-309 of SEQ ID NO: 1 (CHOP-2), and which comprises a

substitution at a position corresponding to L132 in SEQ ID NO: 1, which substitution increases the polarity of the channel, wherein the calcium conductivity of said light-inducible ion channel is increased at least two-fold, compared to wt CHOP-2, as determined by Fura-2-imaging on HEK293 cells.

19. A light-inducible ion channel, wherein the light-inducible ion channel comprises an amino acid sequence which has at least 70% homology to the amino acid sequence shown in positions 1-309 of SEQ ID NO: 1 (CHOP-2), and which comprises a substitution at a position corresponding to L132 in SEQ ID NO: 1 selected from L132C, L132S, L132E, L132D, and L132T.

CLAIMS

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2. The light-inducible ion channel of claim 1, wherein the light-inducible ion channel comprises, preferably consists of the amino acid sequence shown in positions 1-309 of SEQ ID NO: 1 (CHOP-2), except for a substitution at position L132,wherein the substitution increases the polarity of the channel.

3. The light-inducible ion channel of claim 1 or 2, wherein the substitution is selected from L132C, L132S, L132E, L132D, and L132T, preferably wherein the substitution is L132C.

4. The light-inducible ion channel of any one of the preceding claims, wherein

   (a) the light-sensitivity is increased by more than 5 times, preferably by more than 10 times, more preferably by more than 20 times, such as 30 times, even more preferably by more than 40 times, such as 50 times, and most preferably by more than 60 times, or even by more than 70 times, as compared to wt CHOP-2 in hippocampal neurons; and/or

   (b) the calcium conductivity is increased at least three-fold, more preferably at least four-fold compared to wt CHOP-2, as determined by Fura-2-imaging on HEK293 cells; and/or

(c) the stimulation frequency is increased at least 1.5-fold, more preferably 2-fold, or even more preferably 2.5 fold, compared to wt CHOP-2 as determined by whole-cell electrophysiological recordings in hippocampal neurons.

5. The light-inducible ion channel of any one of the preceding claims, wherein the light-inducible ion channel additionally comprises at least one of the following amino acid residues: aspartic acid at a position corresponding to position 253 of SEQ ID NO: 1; lysine at a position corresponding to position 257 of SEQ ID NO: 1; tryptophan at a position corresponding to position 260 of SEQ ID NO: 1; glutamic acid at a position corresponding to position 123 of SEQ ID NO: 1; histidine or arginine, preferably arginine, at a position corresponding to position 134 of SEQ ID NO: 1; threonine, serine, or alanine at a position corresponding to position 128 of SEQ ID NO: 1; and/or alanine at a position corresponding to position 156 of SEQ ID NO: 1.

6. The light-inducible ion channel of any one of the preceding claims, wherein the light-inducible ion channel comprises the consensus motif L(I)DxxxKxxW(F,Y).

7. A channelrhodopsin, comprising the light-inducible ion channel according to claims 1-6 and a retinal or retinal derivative, preferably wherein the retinal derivative is selected from the group consisting of 3,4-dehydroretinal, 13-ethylretinal, 9-dm-retinal, 3- hydroxyretinal, 4-hydroxyretinal, naphthylretinal; 3,7,11 -trimethyl-dodeca-2,4,6,8, 10- pentaenal; 3,7-dimethyl-deca-2,4,6,8-tetraenal; 3 ,7-dimethyl-octa-2,4,6-trienal; and 6-7 rotation-blocked retinals, 8-9 rotation-blocked retinals, and 10-11 rotation-blocked retinals.

8. A nucleic acid construct, comprising a nucleotide sequence coding for the light-inducible ion channel according to any one of claims 1-6.

9. An expression vector, comprising a nucleotide sequence coding for the light-inducible ion channel according to any one of claims 1-6 or the nucleic acid

construct according to claim 8, preferably wherein the vector is suitable for gene therapy, in particular wherein the vector is suitable for virus-mediated gene transfer.

10. A cell comprising the channelrhodopsin according to claim 7, the nucleic acid construct according to claim 8 or the expression vector according to claim 9.

11. The cell of claim 10, wherein the cell is a mammalian cell or an insect cell, or wherein the cell is a yeast cell, preferably from *Saccharomyces cerevisiae, Schizosaccharomyces pombe*, or *Pichia pastoris*.

12. The cell of claim 11, wherein the mammalian cell is

(a) a photoreceptor cell, a retinal rod cell, a retinal cone cell, a retinal ganglion cell, a bipolar neuron, a ganglion cell, a pseudounipolar neuron, a multipolar neuron, a pyramidal neuron, a Purkinje cell, or a granule cell; or

(b) a melanoma cell, a COS cell; a BHK cell; a HEK293 cell; a CHO cell; a myeloma cell; or a MDCK cell.

13. The light-inducible ion channel according to claims 1-6, or the channelrhodopsin according to claim 7, or the nucleic acid construct according to claim 8, or the expression vector according to claim 9, or the cell according to claim 10 for use as a medicament.

14. The expression vector according to claim 10 for use in gene therapy.

15. The light-inducible ion channel according to claims 1-6, or the channelrhodopsin according to claim 7, or the nucleic acid construct according to claim 8, or the expression vector according to claim 9, or the cell according to claim 10 for use in the treatment of blindness or reduced sight.

16. The light-inducible ion-channel according to claim 5 having threonine, serine, or alanine at a position corresponding to position 128 of SEQ ID NO: 1; and/or alanine

at a position corresponding to position 156 of SEQ ID NO: 1, for use in the ablation of cancer cells, preferably wherein the cancer cells are melanoma cancer cells.

17. Use of a light-inducible ion channel according to claims 1-6, or a channelrhodopsin according to claim 7, or a cell according to claim 10 in a high-throughput screening.