CLAIMS

1. A cell engineered to express a light-responsive VChR1 protein from *Volvox carteri,* wherein said protein has an action spectrum maximum of about 535 nm, wherein the VChR1 protein comprises amino acid residues S181, S183 and A256, based on the numbering of SEQ ID NO:3.

2. The cell of claim 1, wherein the VChR1 protein comprises the amino acid sequence set forth in SEQ ID NO:3.

3. The cell of any one of claims 1-2 wherein the cell is a neuronal cell or a stem cell.

4. A population of cells comprising cells of any one of claims 1-3.

5. The population of cells of claim 4 further comprising cells containing a light-responsive ChR2 protein from *Chlamydomonas reinhardtii*, optionally wherein the ChR2 protein comprises the amino acid sequence set forth in SEQ ID NO:2.

6. The population of cells of claim 4 or claim 5 further comprising cells containing a light-responsive NpHR protein from *Natromonas pharaonis*.

7. A polynucleotide encoding a light-responsive VChR1 protein from *Volvox carteri* for use in the preparation of the cell of any one of claims 1-3.

8. The polynucleotide of claim 7, wherein the polynucleotide comprises a nucleotide sequence encoding the amino acid sequence set forth in SEQ ID NO:3.

9. The polynucleotide of claim 7 or 8, wherein the nucleotide sequence is codon optimized for expression in a mammalian cell.

10. The polynucleotide of any one of claims 7-9, wherein the nucleotide sequence is operably linked to a promoter, optionally wherein the promoter is an alpha-CaMKII promoter.

11. The polynucleotide of any one of claims 7-10, wherein the polynucleotide is in an expression vector.

12. The polynucleotide of claim 11, wherein the expression vector is a viral vector.

13. The polynucleotide of claim 12, wherein the viral vector is a lentiviral vector or an adenoassociated virus (AAV) vector.

14. A method of using the cells of any of claims 1-3 comprising activating the VChr1 protein with light.

15. A method of using the population of cells of any of claims 4-6 comprising activating the VChR1 protein and/or the ChR2 protein and/or the NpHR protein with light.

16. The cell of claim 1 containing at least two heterologous light-activated light ion channel molecules, the molecules activating the ion channel in response to light having respective wavelengths so as to allow for independent control of each ion channel.

17. A method of using the cells of claim 16 comprising activating the ion channels at their respective wavelengths.

CLAIMS

1. A cell engineered to express a light-responsive VChR1 protein from *Volvox carteri*.

2. The cell of claim 1, wherein the VChR1 protein exhibits excitation at 535 nm, 531 nm, or 589 nm.

3. The cell of claim 1, wherein the VChR1 protein comprises the amino acid sequence set forth in SEQ ID NO:3.

4. The cell of any one of claims 1-3 wherein the cell is a neuronal cell or a stem cell.

5. A population of cells comprising cells of any one of claims 1-4.

6. The population of cells of claim 5 further comprising cells containing a light-responsive ChR2 protein from *Chlamydomonas reinhardtii*, optionally wherein the ChR2 protein comprises the amino acid sequence set forth in SEQ ID NO:2.

7. The population of cells of claim 5 or claim 6 further comprising cells containing a light-responsive NpHR protein from *Natromonas pharaonis*.

8. A polynucleotide encoding a light-responsive VChR1 protein from *Volvox carteri* for use in the preparation of the cell of any one of claims 1-4.

9. The polynucleotide of claim 8, wherein the polynucleotide comprises a nucleotide sequence encoding the amino acid sequence set forth in SEQ ID NO:3.

10. The polynucleotide of claim 8 or 9, wherein the nucleotide sequence is codon optimized for expression in a mammalian cell.

11. The polynucleotide of any one of claims 8-10, wherein the nucleotide sequence is operably linked to a promoter, optionally wherein the promoter is an alpha-CaMKII promoter.

12. The polynucleotide of any one of claims 8-11, wherein the polynucleotide is in an expression vector.

13. The polynucleotide of claim 12, wherein the expression vector is a viral vector.

14. The polynucleotide of claim 13, wherein the viral vector is a lentiviral vector or an adenoassociated virus (AAV) vector.

15. A method of using the cells of any of claims 1-4 comprising activating the VChr1 protein with light.

16. A method of using the population of cells of any of claims 5-7 comprising activating the VChR1 protein and/or the ChR2 protein and/or the NpHR protein with light.

17. The cell of claim 1 containing at least two heterologous light-activated light ion channel molecules, the molecules activating the ion channel in response to light having respective wavelengths so as to allow for independent control of each ion channel.

18. A method of using the cells of claim 17 comprising activating the ion channels at their respective wavelengths.

19. An animal that is a model for deep brain stimulation (DBS), wherein the animal comprises a population of cells of any of claims 5-7.