CLAIMS

1. A modular RNA molecule comprising:

    (i) a 5’ region comprising a sensor domain comprising a stretch of consecutive nucleotides, optionally comprising about 100 to about 900 nucleotides, that is complementary to a corresponding stretch of consecutive nucleotides of a cellular RNA of a cell of a mammalian central or peripheral nervous system, wherein said sensor domain comprises a stop codon editable by ADAR; and

    (ii) a 3’ region comprising first protein coding domain, wherein said first protein coding domain is downstream of and in-frame with said sensor domain,

wherein, upon introduction of said modular RNA into said cell comprising an Adar enzyme, said stretch of consecutive nucleotides of said sensor domain and said corresponding nucleotide stretch of said cellular RNA form an RNA duplex comprising said stop codon, wherein said stop codon comprised in said RNA duplex is edited by ADAR in said cell, thereby to permit translation of said protein, optionally wherein said modular RNA molecule is encoded by a DNA vector.

2. The modular RNA molecule of claim 1, wherein :

    (a) said stretch of consecutive nucleotides of said sensor domain is able to form an RNA duplex with at least a portion of an mRNA, said portion comprising a corresponding stretch of consecutive nucleotides ; and/or

    (b) said first protein coding domain encodes an effector protein; and/or

    (c) the molecule further encodes a self-cleaving 2A peptide positioned between the sensor domain and the 3’ protein coding domain, optionally wherein said self-cleaving 2A peptide is selected from the group consisting of one or more of T2A peptide, P2A peptide, E2A peptide, and F2A peptide; and/or

    (d) the first protein coding domain encodes a protein selected from the group of a label, a transcriptional activator, a recombinase and a transcriptional repressor.

3. A composition comprising:

i) a first nucleic acid comprising a modular RNA molecule according to claim 1, wherein said cell is a cell of the mammalian central nervous system, optionally a mammalian cortex cell, and the first protein coding domain encodes an effector protein, and

ii) a second nucleic acid comprising a second protein coding domain.

4. A composition comprising:

i) a first nucleic acid comprising a modular RNA molecule according to claim 1, wherein said cell is a cell of the mammalian peripheral nervous system, optionally a mammalian schwann cell or a mammalian satellite cell of the peripheral nervous system, and the first protein-coding domain encodes an effector protein, and

ii) a second nucleic acid comprising a second protein coding domain.

5. The composition of claim 3 or claim 4, wherein:

a. said first and second nucleic acids comprise a single nucleic acid molecule;

b. said first and second nucleic acids comprise two nucleic acid molecules;

c. said first and second nucleic acid are covalently linked;

d. said second protein coding domain is comprised within a gene comprising a transcription control element, optionally, a promoter, optionally wherein said effector protein binds to said gene;

e. expression of said second protein coding domain is modulated by said effector protein;

f. the first protein-coding domain encodes a transcriptional activator or transcriptional repressor;

g. the first protein-coding domain encodes a DNA recombinase; or

h. the first protein-coding region encodes an effector protein selected from the following:

i. a cell killing protein selected from the group consisting of: thymidine kinase (TK) and cytosine deaminase (CD),

ii. a programmed cell death protein selected from the group consisting of CASP3, CASP9, BCL, GSDME, GSDMD, GZMA and GZMB,

iii. a neural activating protein selected from the group consisting of: ChR2 and DREADD-M3Dq,

iv. an immunity enhancer protein selected from the group consisting of IFNB, IFNG, TNFA, IL2, IL12, IL15 and CD40L,

v. a physiological editing protein selected from the group consisting of NaChBac and Kir2.1, f) a protein synthesis inhibition protein including ricin,

vi. a neural inhibitor protein selected from the group consisting of DREADD-hM4D, NpHR and GtACR1,

vii. a protein involved in neural cell fate such as NEUROD, and

viii. a protein involved with cell regeneration including Epidermal growth factors.

6. The composition of claim 3, wherein the first protein-coding domain encodes an effector protein comprising a transcriptional activator and/or wherein said stretch of consecutive nucleotides of said sensor domain is complementary to a stretch of consecutive nucleotides of a selected cellular RNA of a cortex cell encoded by the *Fezf2* gene and/or wherein said second nucleic acid comprises a second protein coding region under the transcriptional control of an inducible promoter.

7. The composition of claim 4, wherein the first protein-coding domain encodes an effector protein comprising a transcription activator and/or wherein said stretch of consecutive nucleotides of said sensor domain is complementary to a stretch of consecutive nucleotides of a selected cellular RNA of a peripheral CNS cell and/or wherein said second nucleic acid comprises a second protein coding region under the transcriptional control of an inducible promoter.

8. A nucleic acid delivery vehicle comprising the modular RNA molecule of claim 1 or the composition of claim 3 or claim 4.

9. The nucleic acid delivery vehicle according to claim 8: (a) selected from the group consisting of a nanoparticle, a liposome, a vector, an exosome, a micro-vesicle, a gene-gun, and a Selective Endogenous encapsulation for cellular Delivery (SEND) system; or (b) comprising a viral vector, optionally wherein the viral vector is selected

from the group consisting of adeno-associated virus (AAV), adenovirus, retrovirus, lentivirus, herpes virus, vesicular stomatitis virus.

10. A pharmaceutical composition comprising the modular RNA molecule of claim 1, the composition of claim 3 or claim 4, or the delivery vehicle of claim 8, and a pharmaceutically acceptable carrier, excipient and/or diluent.

11. A cell comprising the modular RNA molecule of claim 1, the composition of claim 3 or claim 4, or the delivery vehicle of claim 8, optionally wherein the cell is a mammalian cell.

12. A kit comprising the modular RNA molecule of claim 1, the composition of claim 3 or claim 4, or the delivery vehicle of claim 8, and packaging therefore.

13. An agent for use in a method for treating a disease or disorder in a mammal, said method comprising:

providing said agent comprising a modular RNA molecule according to claim 1, or a nucleic acid composition according to claim 3 or claim 4, or a delivery vehicle according to claim 8; and

wherein said agent is to be administered to said mammal in a therapeutically effective amount to permit translation of said 3' encoded protein or said effector protein in selected cells of said mammal, thereby to produce said protein in said cells, wherein production of said protein in said cells provides for treatment of said disease or disorder in said mammal.

14. The agent for use according to claim 13, wherein: (a) said agent comprises said composition of claim 3 or claim 4, or said delivery vehicle of claim 8, and said first protein coding region encoding said effector protein comprised in said agent encodes a transactivator protein that activates expression of said second protein coding region, and wherein expression of said second protein coding region in said selected cells is therapeutically effective in treating said disease or disorder; or (b) a second gene is operably linked to the TRE-3G eukaryotic inducible promoter, said second gene

encoding enhanced yellow fluorescent protein (eYFP), and wherein said administration provides for production of enhanced yellow fluorescent protein.

15. The agent for use according to claim 13, wherein:

(a) said method is a method to suppress a neural activity that promotes focal epileptic seizure in a mammal,

wherein said stretch of consecutive nucleotides of said sensor domain is complementary to a stretch of consecutive nucleotides of a selected cellular RNA of a cortex cell encoded by an SST gene, and

wherein the first protein-coding domain encodes a) a transcription activator and b) a first effector protein, and

wherein said second nucleic acid comprises a coding region for a second effector protein under the control of an inducible promoter induced by said transcriptional activator,

wherein said modular RNA molecule further comprises a gene encoding a third effector protein upstream of said sensor domain, and

wherein said composition further comprises a gene encoding a DREADD receptor or a gene encoding a PSAM, and

wherein in the presence of a drug effective to activate said receptor encoded by said DREADD or said PSAM gene, said DREADD receptor or said PSAM receptor is activated, thereby permitting production of one or more said effector proteins and treatment of epilepsy in said mammal;

(b) said method is a method to suppress in a mammal a neural activity that promotes focal epileptic seizure,

wherein said stretch of consecutive nucleotides of said sensor domain of said modular RNA is complementary to a stretch of consecutive nucleotides of a selected cfos cellular RNA of a cortex cell, wherein the first protein-coding domain encodes a first effector protein comprising transcription activator and a second effector protein comprising the gene encoding osmFlag, and

wherein said second nucleic acid comprises a coding region for a first reporter protein under the control of an inducible promoter,

wherein said first nucleic acid comprising said modular RNA molecule is under the control of a promoter and

wherein said modular RNA molecule comprises the gene encoding a second reporter protein upstream of said sensor domain and under the control of said promoter,

wherein said agent further comprises a gene encoding a DREADD receptor or a gene encoding PSAM, and

wherein said administration permits translation of said effector protein in selected cells of said mammal in the presence of a drug that activates said DREADD or said PSAM receptor, thereby to produce said protein in said cells, wherein production of said protein in said cells is effective to suppress in said mammal a neural activity that promotes focal epileptic seizure;

(c) said method is a method of treating chronic pain in a mammal,

wherein said sensor domain of said modular RNA comprises a stretch of consecutive nucleotides complementary to a stretch of consecutive nucleotides of selected TRPV1 or NaV1.8 cellular RNA, and a said first protein-coding domain encoding an effector protein comprising a transcription activator,

said modular RNA further comprises a domain encoding an shRNA that binds to NaV1.7 or NaV1.8 RNA, said domain encoding said shRNA being under the control of an inducible promoter,

wherein production of said transcriptional activator and said shRNA in said cells of said mammal thereby treats chronic pain in said mammal; or

(d) said method is a method of treating Alzheimer's Disease in a mammal,

wherein said sensor domain of said modular RNA comprises said stretch of consecutive nucleotides complementary to a stretch of consecutive nucleotides of selected cellular RNA encoded by a gene selected from the following genes: a) a human astrocyte marker gene of aldehyde dehydrogenase family 1 member L1 (Aldh1L1), b) a glial fibrillary acidic protein (GFAP) gene, c) an excitatory amino acid transporter 1 (EAAT1) gene, and d) a microglial gene: C-X3-C Motif Chemokine Receptor 1 (CX3CR1), e) a transmembrane protein 119 (TMEM119), and f) an Ionized calcium binding adaptor molecule 1 (IBA-1), and

wherein said first protein-coding domain of said modular RNA encodes a transcription activator,

wherein said modular RNA further comprises a second coding domain which encodes a repressor of ApoE4, said second coding domain being under control of an inducible promoter, and

wherein production of said transcription activator and said repressor in said cells thereby treats and/or prevents progression of Alzheimer's Disease in said mammal.

16. A composition according to claim 3 for use in a method of stimulating a L5b/L6 corticofugal projection neuron signal in the forelimb somatosensory cortex of a mouse, as measured by photometry, in response to mechanical stimulation of the forepaw, wherein said composition is to be administered to said mouse, wherein the sensor domain comprises a stretch of consecutive nucleotides that is complementary to a corresponding stretch of consecutive nucleotides of a cellular RNA encoding Ctip2 or Fezf, wherein the first protein-coding domain encodes an effector protein comprises a transcription activator, and wherein said second nucleic acid comprises a gene encoding a reporter protein under the transcriptional control of an inducible promoter,

wherein said administration provides for production of said effector protein and said reporter protein,

thereby permitting stimulation of said L5b/L6 CFPN signal in said forelimb somatosensory cortex of said mouse.

17. A composition according to claim 3 for use in a method of stimulating forelimb movement in response to light stimulation of a caudal forelimb area (CFA) of a mouse, wherein said composition is to be administered to said mouse, wherein the sensor domain comprises a stretch of consecutive nucleotides that is complementary to a corresponding stretch of consecutive nucleotides of cellular RNA encoding Ctip2, wherein the first protein-coding domain encodes an effector protein comprising a transcription activator, and wherein said second nucleic acid comprises a gene encoding a light-activated reporter protein under the transcriptional control of a an inducible promoter,

wherein said administration provides for production of said effector protein and said light-activated reporter protein, thereby permitting light stimulation of said forelimb movement of said mouse.

18. A composition according to claim 3 for use in a method of identifying GABAergic neurons in a mammalian cortex *in vivo*, wherein said composition is to be administered to said mammal under conditions permitting transfection of said composition to cells of said S1 barrel cortex and hippocampus and expression of said protein coding regions,

wherein said stretch of consecutive nucleotides of said sensor domain is complementary to a stretch of consecutive nucleotides of a selected cellular vGAT RNA of a cortex cell, and

wherein the first protein-coding domain encodes an effector protein comprising a transcription activator and a second effector protein comprising first reporter protein, and said second nucleic acid comprises a coding region for a second reporter protein under the transcriptional control of an inducible promoter,

wherein said first nucleic acid comprising said modular RNA molecule is under the control of a promoter and wherein said modular RNA molecule comprises a gene encoding a third reporter protein upstream of said sensor domain and under the control of a promoter,

wherein said proteins are produced from said coding regions,

wherein identification of GABAergic neurons in said mammalian cortex comprising vGAT mRNA is permitted upon detection of one or more of said first, second and third reporter proteins,

optionally wherein said sesRNA targeting vGAT mRNA is complementary to all or part of exon 1 of vGAT mRNA.

19. A composition according to claim 3 for use in a method of identifying a GABAergic neuron in a mammalian cortex *in vivo*, wherein said composition is to be administered to said mammal under conditions permitting transfection of cells of said mammalian cortex by said composition and production of said proteins encoded by said composition, wherein said stretch of consecutive nucleotides of said sensor domain is complementary to a stretch of consecutive nucleotides of a selected cellular Tle4 RNA of a cortex cell, and

wherein the first protein-coding domain encodes an effector protein comprising a transcription activator and a second effector protein comprising a first reporter protein, and

wherein said second nucleic acid comprises a coding region for a second reporter protein under the transcriptional control of an inducible promoter,

wherein said first nucleic acid comprising said modular RNA molecule is under the control of a promoter and

wherein said modular RNA molecule comprises a gene encoding a third reporter protein upstream of said sensor domain and under the control of a promoter,

wherein detection of one or more of said first, second and third reporter proteins in a cell of said mammalian cortex permits identification of a said TLE4-positive projection neuron, thereby identifying a GABAergic neuron in said mammalian cortex,

optionally wherein said sensor domain is complementary to all or part of exon 15 of Tle4 mRNA.

20. A method of determining the presence of cells comprising forkhead box protein P2 (FOXP2) RNA in a cortical layer of the mammalian cortex in culture, the method comprising:

contacting a cultured cortical layer of a mammalian cortex with the composition of claim 4,

wherein said stretch of consecutive nucleotides of said sensor domain is complementary to a stretch of consecutive nucleotides of a selected FOXP2 cellular RNA of a cortex cell, and

wherein the first protein-coding domain encodes an effector protein comprising a transcription activator and a second effector protein comprising a gene encoding a first reporter protein, and

wherein said second nucleic acid comprises a coding region for a second reporter protein under the control of an inducible promoter,

wherein said modular RNA molecule further comprises a gene encoding a third reporter protein upstream of said sensor domain, and

detecting one or more of said first, second and third reporter proteins, wherein said detection on cell bodies of a said cortical layer is indicative of the presence of said cells.

21. The composition for use according to claim 18 or 19, wherein (a) said composition is to be administered to the S1 barrel cortex and hippocampus of said mammal or (b) wherein said first reporter protein comprises an antigenic protein tag, optionally wherein said antigenic protein tag comprises smV5.

22. The modular RNA molecule of claim 2, the composition of any one of claims 5 to 7, the agent for use according to claim 14 or claim 15, the composition for use according to any one of claims 16 to 19, or the method of claim 20, wherein said transcriptional activator comprises the tetracycline dependent transcription activator tTA2.

23. The modular RNA molecule of claim 2, the composition of any one of claims 3 to 7, the agent for use according to claim 15, the composition for use according to any one of claims 16 to 19, or the method of claim 20, wherein said second protein coding region is under the transcriptional control of a TRE-3G eukaryotic inducible promoter.