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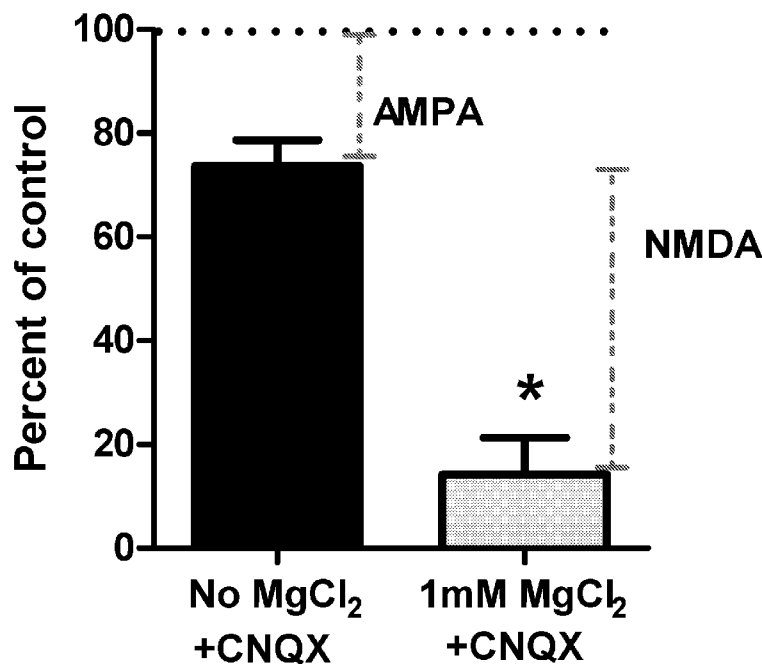
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[Continued on next page]

(54) Title: METHODS OF SELECTING THERAPEUTIC MOLECULES

Figure 1



(57) Abstract: The present disclosure provides methods of using a calcium oscillation assay and/or a sequence score calculation to identify a molecule that is safe for administration. The disclosure also includes a method of selecting or identifying a molecule having tolerable in vivo neurotoxicity using a calcium oscillation assay, a sequence score method, an in vivo tolerability assay, or any combination thereof.



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METHODS OF SELECTING THERAPEUTIC MOLECULES

REFERENCE TO EARLIER FILED APPLICATIONS

[0001] This application is a PCT application claiming the benefit of U.S. Provisional Application No. 62/112,058, filed February 4, 2015, U.S. Provisional Application No. 62/156,684, filed May 4, 2015, and U.S. Provisional Application No. 62/279,610, filed January 15, 2016, all of which are incorporated herein by reference in its entirety.

REFERENCE TO SEQUENCE LISTING SUBMITTED

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[0002] The content of the electronically submitted sequence listing (Name: 3338.035PC03 SL.txt, Size: 339,610 bytes; and Date of Creation: February 4, 2016) submitted in this application is incorporated herein by reference in its entirety.

FIELD OF INVENTION

[0003] The present invention relates to methods for selecting therapeutic molecules that have reduced toxic side effects. The methods can be used *in vitro* or *in silico* to screen molecules before administration to laboratory animals or the methods can be used *in vivo* in laboratory animals.

BACKGROUND

[0004] In the field of specifically-targeted therapeutics, some therapeutic molecules cause toxic side effects, such as by non-specifically interacting with proteins, stimulating an unwanted immune response or accumulating in tissues. One central concern when administering therapeutic molecules to a subject is the potential neurotoxicity of the molecules. Exposure to neurotoxic molecules can lead to damage to the brain and peripheral nervous system, causing long term physiological problems. As such, it is important that therapeutic molecules not only be effective at treating a desired disease or disorder, but also have acceptable toxicity, for example neurotoxicity, when administered.

[0005] Determination of the most effective therapeutic molecules usually involves synthesizing a large number of molecules designed to target a factor in a cell and testing that large number of molecules for activity and toxicity. While animal studies can be performed to determine toxicity, it is neither ethically nor economically desirable to perform animal studies where a large number of animals die due to a large number of the molecules being tested having toxic properties. Thus, improved ways of determining the toxicity, such as the neurotoxicity, of a therapeutic molecule without requiring animal testing are needed.

SUMMARY OF INVENTION

[0006] The present disclosure provides a method of testing or determining *in vivo* acute neurotoxicity of a molecule comprising measuring oscillations in intracellular free calcium concentration ("calcium oscillations") *in vitro* in neuronal cells which are in contact with the molecule.

[0007] The present disclosure also provides a method for selecting a molecule having tolerable *in vivo* acute neurotoxicity comprising measuring calcium oscillations *in vitro* in neuronal cells *in vitro* which are in contact with the molecule, wherein the molecule exhibits a calcium oscillation level comparable to a control.

[0008] The above methods of the present disclosure that involve measuring calcium oscillations can further comprise calculating a sequence score of the molecule, *e.g.*, a polynucleotide comprising a nucleotide sequence, wherein the sequence score is calculated by formula (I):

$$\frac{(\text{number of C nucleotides or analogs thereof in the nucleotide sequence} - \text{number of G nucleotides or analogs thereof in the nucleotide sequence})}{\text{total nucleotide length of the nucleotide sequence}} \quad (\text{I}).$$

[0009] The present invention also provides a method of determining *in vivo* acute neurotoxicity of a molecule comprising a nucleotide sequence, the method comprising calculating a sequence score, wherein the sequence score is calculated by formula (I):

$$\frac{(\text{number of C nucleotides or analogs thereof in the nucleotide sequence} - \text{number of G nucleotides or analogs thereof in the nucleotide sequence})}{\text{total nucleotide length of the nucleotide sequence}} \quad (\text{I}).$$

[0010] The present invention also provides a method of selecting a molecule comprising a nucleotide sequence having tolerable *in vivo* acute neurotoxicity comprising calculating a sequence score using formula (I):

$$\frac{(\text{number of C nucleotides or analogs thereof in the nucleotide sequence} - \text{number of G nucleotides or analogs thereof in the nucleotide sequence})}{\text{total nucleotide length of the nucleotide sequence}} \quad (I),$$

wherein the nucleotide sequence has a sequence score of greater than or equal to 0.2.

[0011] In other embodiments, the present disclosure provides a method of selecting a molecule having tolerable *in vivo* acute neurotoxicity comprising measuring *in vivo* tolerability. The present invention provides methods where the *in vivo* tolerability is graded into one of five tolerability categories. The present invention also provides that the tolerability categories can be 1) hyperactivity; 2) decreased activity and arousal; 3) motor dysfunction and/or ataxia; 4) abnormal posture and breathing; and 5) tremor and/or convulsions. In one embodiment, the *in vivo* tolerability can be measured by injecting a molecule into a brain of a mammal and grading the mammal's tolerability in a tolerability category on a scale of 0 to 20.

[0012] The above methods of the present invention can further comprise measuring tubulin intensity in a culture of neuronal cells, expression of a target protein, or behavioral performance of the molecule.

[0013] The present invention also provides methods for administering a molecule that has been tested according to the above methods to a subject in need of treatment of a disease or condition.

[0014] In certain embodiments, the molecule comprises a protein, a peptide, a small molecule, a polynucleotide (*e.g.*, an antisense oligonucleotide), or any combination thereof.

EMBODIMENTS

[0015] E1. A method of testing or determining *in vivo* acute neurotoxicity of a molecule comprising measuring calcium oscillations *in vitro* in neuronal cells which are in contact with the molecule.

- [0016] E2. The method of embodiment 1, wherein the calcium oscillations of the molecule are compared to the calcium oscillations in neuronal cells that are not exposed to the molecule ("control cells").
- [0017] E3. The method of embodiment 2, wherein the control cells are vehicle control cells.
- [0018] E4. The method of embodiment 3, wherein the calcium oscillations in the neuronal cells that are in contact with the molecule are about 70% or higher, about 75% or higher, about 80% or higher, about 85% or higher, about 90% or higher, about 95% or higher, about 96% or higher, about 97% or higher, about 98% or higher, about 99% or higher, about 100% or higher, about 120% or higher, about 140% or higher, about 160% or higher, about 180% or higher, about 200% or higher, about 220% or higher, about 240% or higher, or about 250% or higher compared to the calcium oscillations in the vehicle control cells.
- [0019] E5. A method of selecting or identifying a molecule having tolerable *in vivo* acute neurotoxicity comprising measuring calcium oscillations *in vitro* in neuronal cells which are in contact with the molecule, wherein the neuronal cells in contact with the molecule exhibit calcium oscillations at a level comparable to or higher than that of vehicle control cells.
- [0020] E6. The method of embodiment 5, wherein the calcium oscillations in the neuronal cells that have been in contact with the molecule are about 70% or higher, about 75% or higher, about 80% or higher, about 85% or higher, about 90% or higher, about 95% or higher, about 96% or higher, about 97% or higher, about 98% or higher, about 99% or higher, about 100% or higher, about 120% or higher, about 140% or higher, about 160% or higher, about 180% or higher, about 200% or higher, about 220% or higher, about 240% or higher, or about 250% or higher compared to the calcium oscillations in the vehicle control cells.
- [0021] E7. The method of any one of embodiments 1 to 6, wherein the neuronal cells are prepared from mammal primary cortical neurons.
- [0022] E8. The method of any one of embodiments 1 to 7, wherein the molecule comprises a small molecule, a polynucleotide, a protein, a peptide, or any combination thereof.

- [0023] E9. The method of embodiment 8, wherein the protein comprises an antibody or antigen-binding fragment thereof, a fusion protein, a cytokine, a cell surface receptor, a hormone, a growth factor, or any combination thereof.
- [0024] E10. The method of any one of embodiments 1 to 9, wherein the calcium oscillations are AMPA receptor-dependent calcium oscillations.
- [0025] E11. The method of any one of embodiments 1 to 10, wherein the calcium oscillations are measured in the presence of Mg^{2+} ions.
- [0026] E12. The method of embodiment 11, wherein the concentration of Mg^{2+} ion is at least about 0.5 mM, at least about 0.6 mM, at least about 0.7 mM, at least about 0.8 mM, at least about 0.9 mM, at least about 1 mM, at least about 1.5 mM, at least about 2.0 mM, at least about 2.5 mM, at least about 3.0 mM, at least about 4 mM, at least about 5 mM, or at least about 10mM.
- [0027] E13. The method of one of embodiments 1 to 12, wherein the calcium oscillations are determined by measuring fluorescence of a calcium dye.
- [0028] E14. The method of one of embodiments 1 to 13, further comprising administering the molecule to a subject in need of treatment of a disease or condition.
- [0029] E15. The method of embodiment 14, wherein the disease or condition is selected from the group consisting of a viral infection, a neurological disorder (*e.g.*, Alzheimer's disease, progressive supranuclear palsy, Down syndrome, dementia pugilistica (chronic traumatic encephalopathy and other traumatic brain injury), frontotemporal dementia with parkinsonism linked to chromosome 17 (FTDP-17), Lytico-Bodig disease (Parkinson-dementia complex of Guam), Tangle-predominant dementia, ganglioglioma, gangliocytoma, meningioangiomas, subacute sclerosing panencephalitis, lead encephalopathy, Hemimegalencephaly, tuberous sclerosis, Hallervorden-Spatz disease, Pick's disease, corticobasal ganglionic degeneration, argyrophilic grain disease, corticobasal degeneration, lipofuscinosis, frontotemporal dementia, supranuclear palsy, and frontotemporal lobar degeneration, a disease of brain network dysfunction (*e.g.*, all forms of epilepsy and depression), a spinal cord disorder, a peripheral neuropathy, a cranial nerve disorder (*e.g.*, Trigeminal neuralgia), an autonomic nervous system disorder (*e.g.*, dysautonomia or multiple system atrophy), a movement disorder of a central and peripheral nervous system (*e.g.*, Parkinson's disease, essential tremor, amyotrophic lateral sclerosis, Tourette's Syndrome, multiple sclerosis or various types of peripheral neuropathy), a sleep disorder (*e.g.*, Narcolepsy), migraine or other

types of headache (*e.g.*, cluster headache and tension headache), lower back and neck pain, central neuropathy, a neuropsychiatric illness, attention deficit hyperactivity disorder, autism, Huntington's disease, Rett Syndrome, Angelman Syndrome, organic psychosis, an infection of the brain or spinal cord (including meningitis), or a prion disease), anemia, cancer, leukemia, an inflammatory condition or an autoimmune disease (*e.g.* arthritis, psoriasis, lupus erythematosus, multiple sclerosis), a bacterial infection, frontotemporal dementia-tau (FTD-tau), frontotemporal dementia and parkinsonism linked to chromosome 17 (FTDP-17), corticobasal degeneration (CBD), traumatic brain injury, chronic traumatic encephalopathy, HIV associated neurocognitive disorders, Argrophilic grain disease, Down syndrome-Alzheimer's disease, Amnestic mild cognitive impairment-Alzheimer's disease, Parkinson's disease dementia, Hallervorden-Spatz disease (Pantothenate kinase-associated neurodegeneration), Niemann Pick disease type C, Myotonic dystrophy, Amyotrophic lateral sclerosis, Hemimegalencephaly, Tuberous sclerosis complex, Focal cortical dysplasia type 2b, Ganglion cell tumors, Dravet Syndrome (severe myoclonic epilepsy of infancy), Temporal lobe epilepsy, Ohtahara syndrome (early infantile epileptic encephalopathy with suppression bursts), Lafora body disease, Generalized epilepsy with febrile seizures, Infantile spasms (West syndrome), Lennox Gastaut syndrome, Angelman Syndrome, Rett Syndrome, Landau Kleffner syndrome, focal seizures, simple focal seizures (no loss of consciousness), focal dyscognitive seizures (impairment of consciousness), focal seizure evolving to generalised tonic-clonic (GTC) convulsions, generalised seizures (convulsive or non-convulsive with bilateral discharges involving subcortical structures), absence seizures, myoclonic seizures, clonic seizures, tonic seizures, tonic-clonic seizures and atonic seizures, an autistic disorder, an autism spectrum disorder, an Asperger's disorder, a pervasive developmental disorder, and any combination thereof.

[0030] E16. The method of any one of embodiments 1 to 15, wherein the molecule comprises a polynucleotide.

[0031] E17. The method of embodiment 16, further comprising calculating a sequence score, wherein the sequence score is calculated by formula (I):

$$\text{(number of C nucleotides or analogs thereof in the polynucleotide - number of G nucleotides or analogs thereof in the polynucleotide)} / \text{total nucleotide length (number) of the polynucleotide} \quad (\text{I}).$$

- [0032] E18. A method of determining *in vivo* acute neurotoxicity of a molecule comprising a polynucleotide, the method comprising calculating a sequence score, wherein the sequence score is calculated by formula (I):
(number of C nucleotides or analogs thereof in the polynucleotide – number of G nucleotides or analogs thereof in the polynucleotide) / total nucleotide length (number) of the polynucleotide (I).
- [0033] E19. A method of selecting a molecule comprising a polynucleotide having tolerable *in vivo* acute neurotoxicity comprising calculating a sequence score using formula (I):
(number of C nucleotides or analogs thereof in the polynucleotide – number of G nucleotides or analogs thereof in the polynucleotide) / total nucleotide length (number) of the polynucleotide (I),
wherein the polynucleotide has a sequence score of greater than or equal to 0.2.
- [0034] E20. The method of any one of embodiments 17 to 19, wherein the sequence score is greater than or equal to 0.2, greater than or equal to 0.25, greater than or equal to 0.3, greater than or equal to 0.35, greater than or equal to 0.4, greater than or equal to 0.45, greater than or equal to 0.5, greater than or equal to 0.55, greater than or equal to 0.6, greater than or equal to 0.65, greater than or equal to 0.7, greater than or equal to 0.75, greater than or equal to 0.8, greater than or equal to 0.85, greater than or equal to 0.9, greater than or equal to 0.95, greater than or equal to 1.0, greater than or equal to 1.5, greater than or equal to 2.0, greater than or equal to 3.0, or greater than or equal to 4.0.
- [0035] E21. The method of any one of embodiments 16 to 20, wherein the polynucleotide comprises DNA or RNA.
- [0036] E22. The method of any one of embodiments 16 to 21, wherein the polynucleotide is single stranded.
- [0037] E23. The method of any one of embodiments 16 to 22, wherein the polynucleotide is an antisense oligonucleotide (*i.e.*, oligomer) of about 10 to about 50 nucleotides in length.
- [0038] E24. The method of embodiment 23, wherein the antisense oligonucleotide modulates an expression of a target protein.
- [0039] E25. The method of embodiment 23, wherein the antisense oligonucleotide targets an mRNA of the target protein.

- [0040] E26. The method of embodiment 25, wherein the mRNA is pre-mRNA or mature mRNA.
- [0041] E27. The method of any one of embodiments 25 to 26, wherein the mRNA is expressed in a cell.
- [0042] E28. The method of embodiment 27, wherein the mRNA is expressed in a neuronal cell.
- [0043] E29. The method of any one of embodiments 23 to 28, wherein the antisense oligonucleotide modulates mRNA expression of the target gene in the culture of neuronal cells.
- [0044] E30. The method of any one of embodiments 23 to 29, wherein the antisense oligonucleotide modulates protein expression encoded by the target protein in the culture of the neuronal cells.
- [0045] E31. The method of any one of embodiments 23 to 30, wherein the antisense oligonucleotide is complementary to an mRNA or a pre-mRNA of the target gene.
- [0046] E32. The method of any one of embodiments 1 to 31, further measuring reduction of *in vitro* expression of a target protein of the molecule.
- [0047] E33. The method of any one of embodiments 1 to 32, further comprising measuring an *in vivo* tolerability of the molecule.
- [0048] E34. The method of embodiment 33, wherein the *in vivo* tolerability is measured by administering the molecule to a mammal and grading the mammal's tolerability in a tolerability category.
- [0049] E35. The method of embodiment 33, wherein the molecule is administered to the brain of the mammal.
- [0050] E36. A method of testing or determining *in vivo* tolerability of a molecule comprising administering the molecule to a mammal and grading the mammal's tolerability in a tolerability category.
- [0051] E37. The method of any one of embodiments 34 to 36, wherein the tolerability category comprises at least one, at least two, at least three, at least four, or at least five tolerability categories.
- [0052] E38. The method of embodiment 37, wherein the tolerability category is selected from the group consisting of: 1) hyperactivity; 2) decreased activity and arousal; 3) motor dysfunction and/or ataxia; 4) abnormal posture and breathing; 5) tremor and/or convulsions, and two or more combinations thereof.

- [0053] E39. The method of embodiment 38, wherein the molecule exhibits an *in vivo* tolerability score of 0 to 4 in each of the tolerability category.
- [0054] E40. The method of embodiment 39, wherein the molecule exhibits a sum of the *in vivo* tolerability scores between 0 and 8.
- [0055] E41. The method embodiment 39 or 40, wherein the molecule exhibits a sum of the *in vivo* tolerability scores is between 0 and 6, between 0 and 5, between 0 and 4, between 0 and 3, between 0 and 2, or between 0 and 1.
- [0056] E42. The method of any one of embodiments 1 to 41, further comprising measuring a behavioral test score of the molecule.
- [0057] E43. The method of embodiment 42, wherein the behavioral test score is measured by administering the molecule to a mammal and grading the mammal's behavioral performance.
- [0058] E44. The method of any one of embodiments 41 to 43, wherein the behavioral test is a short term memory test, a spatial learning and memory test, a gait analysis test, or any combination thereof.
- [0059] E45. The method of any one of embodiments 1 to 44, further comprising measuring tubulin intensity of the molecule in a culture of neuronal cells.
- [0060] E46. The method of embodiment 45, wherein the tubulin intensity of the molecule is compared to the tubulin intensity in neuronal cells not exposed to the molecule.
- [0061] E47. The method of embodiment 46, wherein the molecule reduces less than about 25%, less than about 20%, less than about 15%, less than about 10%, less than about 5%, or less than about 1% of the tubulin intensity in the culture of neuronal cells.
- [0062] E48. The method of any one of embodiments 1 to 47, further comprising administering the molecule to a subject in need of treatment for a disease or condition.
- [0063] E49. The method of embodiment 48, wherein the disease or a condition is selected from the group consisting of a viral infection, a neurological disorder (*e.g.*, Alzheimer's disease, progressive supranuclear palsy, Down syndrome, dementia pugilistica (chronic traumatic encephalopathy and other traumatic brain injury), frontotemporal dementia with parkinsonism linked to chromosome 17 (FTDP-17), Huntington's disease, Rett Syndrome, Angelman Syndrome, Lytico-Bodig disease (Parkinson-dementia complex of Guam), Tangle-predominant dementia, ganglioglioma, gangliocytoma, meningioangiomatosis, subacute sclerosing panencephalitis, lead

encephalopathy, Hemimegalencephaly, tuberous sclerosis, Hallervorden-Spatz disease, Pick's disease, corticobasal ganglionic degeneration, argyrophilic grain disease, corticobasal degeneration, lipofuscinosis, frontotemporal dementia, supranuclear palsy, and frontotemporal lobar degeneration, a disease of brain network dysfunction (*e.g.*, all forms of epilepsy and depression), a spinal cord disorder, a peripheral neuropathy, a cranial nerve disorder (*e.g.*, Trigeminal neuralgia), an autonomic nervous system disorder (*e.g.*, dysautonomia or multiple system atrophy), a movement disorder of a central and peripheral nervous system (*e.g.*, Parkinson's disease, essential tremor, amyotrophic lateral sclerosis, Tourette's Syndrome, multiple sclerosis or various types of peripheral neuropathy), a sleep disorder (*e.g.*, Narcolepsy), migraine or other types of headache (*e.g.*, cluster headache and tension headache), lower back and neck pain, central neuropathy, a neuropsychiatric illness, attention deficit hyperactivity disorder, autism, Huntington's disease, organic psychosis, an infection of the brain or spinal cord (including meningitis), or a prion disease), anemia, cancer, leukemia, an inflammatory condition or an autoimmune disease (*e.g.* arthritis, psoriasis, lupus erythematosus, multiple sclerosis), a bacterial infection, frontotemporal dementia-tau (FTD-tau), frontotemporal dementia and parkinsonism linked to chromosome 17 (FTDP-17), corticobasal degeneration (CBD), traumatic brain injury, chronic traumatic encephalopathy, HIV associated neurocognitive disorders, Argyrophilic grain disease, Down syndrome-Alzheimer's disease, Amnestic mild cognitive impairment-Alzheimer's disease, Parkinson's disease dementia, Hallervorden-Spatz disease (Pantothenate kinase-associated neurodegeneration), Niemann Pick disease type C, Myotonic dystrophy, Amyotrophic lateral sclerosis, Hemimegalencephaly, Tuberous sclerosis complex, Focal cortical dysplasia type 2b, Ganglion cell tumors, Dravet Syndrome (severe myoclonic epilepsy of infancy), Temporal lobe epilepsy, Ohtahara syndrome (early infantile epileptic encephalopathy with suppression bursts), Lafora body disease, Generalized epilepsy with febrile seizures, Infantile spasms (West syndrome), Lennox Gastaut syndrome, Angelman Syndrome, Rett Syndrome, Landau Kleffner syndrome, focal seizures, simple focal seizures (no loss of consciousness), focal dyscognitive seizures (impairment of consciousness), focal seizure evolving to generalised tonic-clonic (GTC) convulsions, generalised seizures (convulsive or non-convulsive with bilateral discharges involving subcortical structures), absence seizures, myoclonic seizures, clonic seizures, tonic seizures, tonic-clonic seizures and atonic seizures, an autistic disorder, an autism

spectrum disorder, an Asperger's disorder, a pervasive developmental disorder, and any combination thereof.

- [0064] E50. The method of embodiment 49, wherein the molecule treats or prevents a disease or condition.
- [0065] E51. The method of any one of embodiments 16 to 50, wherein the polynucleotide is an antisense oligonucleotide.
- [0066] E52. The method of any one of embodiments 16 to 51, wherein the polynucleotide comprises at least one nucleotide analog.
- [0067] E53. The method of any one of embodiments 16 to 52, wherein the polynucleotide comprises at least two, at least three, at least four, at least five, at least six, at least seven, at least eight, at least nine, or at least ten nucleotide analogs.
- [0068] E54. The method of embodiment 52 or 53, wherein the nucleotide analog or analogs are Locked Nucleic Acid (LNA); 2'-O-alkyl-RNA; 2'-amino-DNA; 2'-fluoro-DNA; arabino nucleic acid (ANA); 2'-fluoro-ANA, hexitol nucleic acid (HNA), intercalating nucleic acid (INA), constrained ethyl nucleoside (cEt), 2'-O-methyl nucleic acid (2'-OMe), 2'-O-methoxyethyl nucleic acid (2'-MOE), or any combination thereof.
- [0069] E55. The method of any one of embodiments 23 to 54, wherein the antisense oligonucleotide comprises an internucleoside linkage selected from: a phosphodiester linkage, a phosphotriester linkage, a methylphosphonate linkage, a phosphoramidate linkage, a phosphorothioate linkage, and combinations thereof.
- [0070] E56. The method of any one of embodiments 23 to 55, wherein the antisense oligonucleotide is a gapmer, a blockmer, a mixmer, or a wingmer.
- [0071] E57. The method of any one of embodiments 1 to 56, wherein when the molecule is administered to laboratory animals, more than 20% of the animals survive.
- [0072] E58. The method of any one of embodiments 1 to 57, wherein when the molecule is administered to laboratory animals, more than 50% of the animals survive.
- [0073] E59. The method of any one of embodiments 1 to 58, wherein when the molecule is administered to laboratory animals, more than 85% of the animals survive.
- [0074] E60. A molecule selected from the method of any one of embodiments 1 to 59.
- [0075] E61. A method of treating a disease or condition comprising administering the molecule of embodiment 60.
- [0076] E62. The method of embodiment 61, wherein the disease or condition associated with a neuronal cell.

- [0077] E63. A method of testing or determining *in vivo* acute neurotoxicity of a molecule comprising the steps of 1) adding the molecule to a culture of neuronal cells and 2) measuring calcium oscillations *in vitro* in the neuronal cells.
- [0078] E64. The method of Embodiment 63, further comprising comparing the calcium oscillations in the neuronal cells with the calcium oscillations in neuronal cells that are not exposed to the molecule ("control cells").
- [0079] E65. The method of Embodiment 63 or 64, wherein the neuronal cells are prepared from mammalian cortical neurons.
- [0080] E66. The method of any one of Embodiments 63 to 65, wherein the calcium oscillations are AMPA receptor dependent.
- [0081] E67. The method of any one of Embodiments 63 to 66, wherein the calcium oscillations are measured in the presence of Mg^{2+} ions.
- [0082] E68. The method of Embodiment 67, wherein the concentration of Mg^{2+} ion is at least about 0.5 mM, at least about 0.6 mM, at least about 0.7 mM, at least about 0.8 mM, at least about 0.9 mM, at least about 1 mM, at least about 1.5 mM, at least about 2.0 mM, at least about 2.5 mM, at least about 3.0 mM, at least about 4 mM, at least about 5 mM, or at least about 10mM.
- [0083] E69. The method of any one of Embodiments 63 to 68, wherein the molecule comprises a small molecule, a polynucleotide, a protein, a peptide, or any combination thereof.
- [0084] E70. The method of Embodiment 69, further comprising a step of calculating a sequence score, wherein the sequence score is calculated by formula (I):
(number of C nucleotides or analogs thereof in the polynucleotide– number of G nucleotides or analogs thereof in the polynucleotide) / total nucleotide number in the polynucleotide (I).
- [0085] E71. A method of determining *in vivo* acute neurotoxicity of a molecule comprising a nucleotide sequence, the method comprising calculating a sequence score, wherein the sequence score is calculated by formula (I):
(number of C nucleotides or analogs thereof in the nucleotide sequence– number of G nucleotides or analogs thereof in the nucleotide sequence) / total nucleotide number in the nucleotide sequence (I),
wherein the nucleotide sequence has a sequence score of greater than or equal to 0.2.
- [0086] E72. The method of any one of Embodiments 63 to 71, further comprising measuring *in vivo* tolerability of the molecule.

- [0087] E73. The method of any one of Embodiments 63 to 72, further comprising measuring tublin intensity in a culture of neuronal cells.
- [0088] E74. The method of any one of Embodiments 63 to 73, wherein the molecule is an antisense oligonucleotide.
- [0089] E75. The method of any one of Embodiments 63 to 74, wherein when the molecule is administered to laboratory animals, more than 50% of the animals survive.
- [0090] E76. The method of any one of Embodiments 63 to 74, wherein when the molecule is administered to laboratory animals, more than 85% of the animals survive.
- [0091] E77. A molecule for use in treating a disease or condition, wherein the molecule is determined or identified to have tolerable *in vivo* acute neurotoxicity by the method of Embodiments 63 to 76.
- [0092] E78. The molecule of Embodiment 77, wherein the disease or condition is associated with a neuronal cell.
- [0093] E79. An antisense oligonucleotide for use in treating a neurological disease or condition in a subject in need thereof, wherein calcium oscillations in neuronal cells that are in contact with the antisense oligonucleotide are about 70% or higher, about 75% or higher, about 80% or higher, about 85% or higher, about 90% or higher, about 95% or higher, about 96% or higher, about 97% or higher, about 98% or higher, about 99% or higher, about 100% or higher, about 120% or higher, about 140% or higher, about 160% or higher, about 180% or higher, about 200% or higher, about 220% or higher, about 240% or higher, or about 250% or higher compared to the calcium oscillations in vehicle control cells.
- [0094] E80. An antisense oligonucleotide for use in treating a neurological disease or condition having the sequence score greater than or equal to 0.2, greater than or equal to 0.25, greater than or equal to 0.3, greater than or equal to 0.35, greater than or equal to 0.4, greater than or equal to 0.45, greater than or equal to 0.5, greater than or equal to 0.55, greater than or equal to 0.6, greater than or equal to 0.65, greater than or equal to 0.7, greater than or equal to 0.75, greater than or equal to 0.8, greater than or equal to 0.85, greater than or equal to 0.9, greater than or equal to 0.95, greater than or equal to 1.0, greater than or equal to 1.5, greater than or equal to 2.0, greater than or equal to 3.0, or greater than or equal to 4.0.

- [0095] E81. In a method of testing or determining *in vivo* neurotoxicity of a molecule, the improvement comprising measuring calcium oscillations *in vitro* in neuronal cells which are in contact with the molecule.
- [0096] E82. In a method of selecting or identifying a molecule having tolerable *in vivo* neurotoxicity, the improvement comprising measuring calcium oscillations *in vitro* in neuronal cells which are in contact with the molecule, wherein the neuronal cells in contact with the molecule exhibit calcium oscillations at a level comparable to or higher than that of vehicle control cells.
- [0097] E83. In the method of Embodiments 81 or 82, the improvement further comprising calculating a sequence score, wherein the molecule comprises a polynucleotide and wherein the sequence score of the polynucleotide is calculated by formula (I):
- $$\frac{(\text{number of C nucleotides or analogs thereof in the polynucleotide} - \text{number of G nucleotides or analogs thereof in the polynucleotide})}{\text{total nucleotide number in the polynucleotide}} \quad (\text{I}).$$
- [0098] E84. In the method of determining *in vivo* acute neurotoxicity of a molecule comprising a polynucleotide, the improvement comprising calculating a sequence score of the polynucleotide, wherein the sequence score is calculated by formula (I):
- $$\frac{(\text{number of C nucleotides or analogs thereof in the polynucleotide} - \text{number of G nucleotides or analogs thereof in the polynucleotide})}{\text{total nucleotide number in the polynucleotide}} \quad (\text{I}).$$
- [0099] E85. In a method of selecting a molecule comprising a polynucleotide having tolerable *in vivo* acute neurotoxicity, the improvement comprising calculating a sequence score using formula (I):
- $$\frac{(\text{number of C nucleotides or analogs thereof in the polynucleotide} - \text{number of G nucleotides or analogs thereof in the polynucleotide})}{\text{total nucleotide number in the polynucleotide}} \quad (\text{I}),$$
- wherein the polynucleotide has a sequence score of greater than or equal to 0.2.
- [0100] E86. In the methods of Embodiments 81 to 85, the improvement further comprising measuring reduction of *in vitro* expression of a target protein of the molecule.
- [0101] E87. In the method of any one of Embodiments 81 to 85, the improvement further comprising measuring an *in vivo* tolerability of the molecule.

- [0102] E88. In the method of Embodiment 87, wherein the *in vivo* tolerability is measured by administering the molecule to a mammal and grading the mammal's tolerability in a tolerability category.

BRIEF DESCRIPTION OF FIGURES

- [0103] **Figure 1:** Graph demonstrating primary neuronal spontaneous calcium oscillations. Primary neuronal spontaneous calcium oscillations were measured as described previously (Murphy et.al., 1992, J. Neurosci. 12:4834-4845). Addition of the α -amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) receptor antagonist, 6-Cyano-7-nitroquinoxaline-2,3-dione (CNQX; 3 μ M), reduced calcium oscillations by 20% representing the total AMPA response in the assay (AMPA labeled bar shown). Calcium oscillations were reduced further, by about 80%, when N-methyl-D-aspartate (NMDA) receptor function was blocked by 1mM MgCl₂ (NMDA labeled bar shown).
- [0104] **Figure 2:** Graph showing inhibition of AMPA mediated calcium oscillations by antisense oligomers as an indication of neuronal network activity disruption. Antisense oligomer inhibition of spontaneous calcium oscillations mediated by either NMDA or AMPA was assessed in the presence or absence of 1mM MgCl₂ (representing 100% control in each case). Addition of 25 μ M antisense oligomers (TGTgatgcaggaGTT) (SEQ ID NO: 304) (ASO-00007) inhibited AMPA receptor but not NMDA receptor mediated oscillations. The ASO and other oligomers that behaved similarly, were shown to negatively impact central nervous system (CNS) network activity *in vivo* and electrophysiologic spontaneous neuronal activity *in vitro* (data not shown).
- [0105] **Figure 3:** Correlation analysis of sequence score vs. *in vivo* tolerability score. Sequence score for each oligomer was calculated by inserting appropriate numbers in the formula: ((number of C nucleotides or the analogs – number of G nucleotides)/nucleotide length (number) in the oligomer). *In vivo* tolerability scores were calculated based upon observations following a single intra-cerebroventricular (*i.c.v.*) administration of 100 μ g oligomers in mice or intra-theal (*i.t.*) administration of 900 μ g oligomers or up to 1500 μ g in rats. The rodents were observed under five categories: 1) hyperactivity; 2) decreased activity and arousal; 3) motor dysfunction and/or ataxia; 4) abnormal posture and breathing; and 5) tremor and/or convulsions. The total *in vivo* tolerability score is the sum of five unit scores; each of the unit scores is measured on a scale of 0-4. Therefore, the

total score of *in vivo* tolerability can range from 0 to 20. The sequence score calculated by the formula is on the X-axis, and the *in vivo* tolerability score is on the Y-axis.

- [0106] **Figure 4:** shows the impact of Tau antisense oligonucleotide on spontaneous calcium oscillations in primary neurons. Figure 4 lists the oligomer name, ASO identification number, ASO sequence, SEQ ID Number, target start and end positions on the *MAPT* pre-mRNA sequence, and calcium oscillation data as a percent of control (as discussed in Example 2 below). Examples of oligomers with mismatched bases are provided in Figure 4 as "mm." The specific mismatched base-pairs are bolded, underlined, italicized, and highlighted.
- [0107] **Figure 5:** shows *in vivo* tolerability of exemplary antisense oligonucleotides. Figure 5 lists the ASO identification number, ASO sequence, SEQ ID Number, target start and end positions on the *MAPT* pre-mRNA sequence, *in vivo* acute tolerability score (as discussed in Example 6 below) and the percent of brain *MAPT* mRNA remaining after administration (as also discussed in Example 6 below).
- [0108] **Figure 6:** shows Tau protein reduction by exemplary antisense oligonucleotides. Figure 6 lists the SEQ ID number, oligomer name, ASO identification number, ASO sequence, target start and end positions on the *MAPT* pre-mRNA sequence, target start on the mature mRNA sequence and normalized Tau/Tuj-1 and Tuj-1 immunocytochemistry values (as discussed in Example 7 below). Examples of oligomers with mismatched bases are provided in Figure 7 as "mm." The specific mismatched base-pairs are bolded, underlined, italicized, and highlighted.

DETAILED DESCRIPTION OF INVENTION

I. Definitions

- [0109] It is to be noted that the term "a" or "an" entity refers to one or more of that entity; for example, "a molecule," is understood to represent one or more molecules. As such, the terms "a" (or "an"), "one or more," and "at least one" can be used interchangeably herein.
- [0110] Furthermore, "and/or" where used herein is to be taken as specific disclosure of each of the two specified features or components with or without the other. Thus, the term "and/or" as used in a phrase such as "A and/or B" herein is intended to include "A and B," "A or B," "A" (alone), and "B" (alone). Likewise, the term "and/or" as used in a phrase such as "A, B, and/or C" is intended to encompass each of the following aspects: A, B,

and C; A, B, or C; A or C; A or B; B or C; A and C; A and B; B and C; A (alone); B (alone); and C (alone).

- [0111] It is understood that wherever aspects are described herein with the language "comprising," otherwise analogous aspects described in terms of "consisting of" and/or "consisting essentially of" are also provided.
- [0112] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure is related. For example, the Concise Dictionary of Biomedicine and Molecular Biology, Juo, Pei-Show, 2nd ed., 2002, CRC Press; The Dictionary of Cell and Molecular Biology, 3rd ed., 1999, Academic Press; and the Oxford Dictionary Of Biochemistry And Molecular Biology, Revised, 2000, Oxford University Press, provide one of skill with a general dictionary of many of the terms used in this disclosure.
- [0113] Units, prefixes, and symbols are denoted in their *Système International de Unites* (SI) accepted form. Numeric ranges are inclusive of the numbers defining the range. Unless otherwise indicated, nucleotide sequences are written left to right in 5' to 3' orientation. Amino acid sequences are written left to right in amino to carboxy orientation. The headings provided herein are not limitations of the various aspects of the disclosure, which can be had by reference to the specification as a whole. Accordingly, the terms defined immediately below are more fully defined by reference to the specification in its entirety.
- [0114] The term "about" is used herein to mean approximately, roughly, around, or in the regions of. When the term "about" is used in conjunction with a numerical range, it modifies that range by extending the boundaries above and below the numerical values set forth. In general, the term "about" can modify a numerical value above and below the stated value by a variance of, e.g., 10 percent, up or down (higher or lower). For example, about 70% can include 70% - 7% to 70% + 7%, *i.e.*, 63% to 77%.
- [0115] The term "therapeutic molecule" refers to any compound having a therapeutic effect *in vivo* for treatment of a disease or condition. Non-limiting examples of the therapeutic molecules include oligomers, one or more nucleotides, one or more nucleosides, one or more amino acids, polynucleotides, peptides, proteins, polypeptides, or small molecule compounds that are naturally occurring, modified, recombinantly produced, or chemically synthesized. Proteins that are therapeutic molecules include, but

are not limited to, antibodies or antigen-binding fragments thereof, fusion proteins, cytokines, cell surface receptors, hormones, growth factors, or any combination thereof.

[0116] The term "oligomer" in the context of the present invention, refers to a molecule formed by covalent linkage of two or more nucleotides (*i.e.*, an oligonucleotide). The oligomer comprises a contiguous nucleotide sequence of from about 10 to about 50, such as 10 – 20, 16-20, 10 – 30, 10 – 35, 10 – 40, or 10 – 45 nucleotides in length. The terms "antisense oligomer," "antisense oligonucleotide," and "ASO" as used herein are interchangeable with the term "oligomer." In various embodiments, the oligomer of the invention does not comprise RNA (units). In some embodiments, the oligomer comprises one or more DNA units. In one embodiment, the oligomer according to the invention is a linear molecule or is synthesized as a linear molecule. In some embodiments, the oligomer is a single stranded molecule, and does not comprise short regions of, for example, at least 3, 4 or 5 contiguous nucleotides, which are complementary to equivalent regions within the same oligomer (*i.e.* duplexes) - in this regard, the oligomer is not (essentially) double stranded. In some embodiments, the oligomer is essentially not double stranded. In some embodiments, the oligomer is not a siRNA. In various embodiments, the oligomer of the invention consists entirely of the contiguous nucleotide region. Thus, in some embodiments the oligomer is not substantially self-complementary.

[0117] The term "nucleic acids," "nucleotides," "nucleotide sequence," or "nucleic acid sequence" is intended to encompass plural nucleic acids (*e.g.*, two or more, three or more, etc.). The term "nucleic acid" or "nucleoside" refers to a single nucleic acid segment, *e.g.*, a DNA, an RNA, or an analog thereof, present in a polynucleotide. In some embodiments, the terms "nucleotide", "unit" and "monomer" are used interchangeably. It will be recognized that when referring to a sequence of nucleotides or monomers, what is referred to is the sequence of bases, such as A, T, G, C or U, and analogs thereof. The term "nucleotide sequence" refers to a molecule comprising at least two nucleotides connected to each other.

[0118] The term "nucleotide" as used herein, refers to a glycoside comprising a sugar moiety, a base moiety and a covalently linked group (linkage group), such as a phosphate or phosphorothioate internucleotide linkage group, and covers both naturally occurring nucleotides, such as DNA or RNA, and non-naturally occurring nucleotides comprising modified sugar and/or base moieties, which are also referred to as "nucleotide analogs" herein. Herein, a single nucleotide (unit) can also be referred to as a monomer or nucleic

acid unit. In certain embodiments, the term "nucleotide analogs" refers to nucleotides having modified sugar moieties. Non-limiting examples of the nucleotides having modified sugar moieties (e.g., LNA) are disclosed elsewhere herein, *e.g.*, 2'-O-methyl, 2'-fluoro (2'-F), 2'-O-methoxyethyl (2'-MOE), and 2',4'-constrained 2'-O-ethyl (cEt). In other embodiments, the term "nucleotide analogs" refers to nucleotides having modified base moieties. The nucleotides having modified base moieties include, but are not limited to, 5-methylcytosine, isocytosine, pseudoisocytosine, 5-bromouracil, 5-propynyluracil, 6-aminopurine, 2-aminopurine, inosine, diaminopurine, or 2-chloro-6-aminopurine,. In certain embodiments when referring to the sequence score formula disclosed herein, the nucleotide analog of cytosine is 5-methyl cytosine.

[0119] The term "polynucleotide" as used herein refers to two or more nucleotides linked in sequence. Exemplary polynucleotides can comprise a nucleotide sequence having two nucleotides, three nucleotides, four nucleotides, five nucleotides, six nucleotides, seven nucleotides, eight nucleotides, nine nucleotides, ten nucleotides, oligonucleotides, 50 nucleotides, 51 nucleotides, or more. In some embodiments, polynucleotides comprise a nucleotide sequence longer than 10 nucleotides, 11 nucleotides, 12 nucleotides, 13 nucleotides, 14 nucleotides, 15 nucleotides, 16 nucleotides, 17 nucleotides, 18 nucleotides, 19 nucleotides, 20 nucleotides, 21 nucleotides, 22 nucleotides, 23 nucleotides, 24 nucleotides 26 nucleotides, 27 nucleotides, 28 nucleotides, 29 nucleotides, 30 nucleotides. In other embodiments, polynucleotides comprise an oligomer (*e.g.*, antisense oligonucleotide). In yet other embodiments, polynucleotides comprise a nucleotide sequence encoding a protein or polypeptide. In still other embodiments, polynucleotides comprise a nucleotide sequence longer than 100 nucleotides, longer than 200 nucleotides, longer than 300 nucleotides, longer than 400 nucleotides, longer than 500 nucleotides, longer than 1000 nucleotides, longer than 1500 nucleotides, longer than 2000 nucleotides, longer than 3000 nucleotides, longer than 4000 nucleotides, or longer than 5000 nucleotides.

[0120] The term "nucleoside" as used herein is used to refer to a glycoside comprising a sugar moiety and a base moiety, and can therefore be used when referring to the nucleotide units, which are covalently linked by the internucleotide linkages between the nucleotides of the oligomer. In the field of biotechnology, the term "nucleotide" is often used to refer to a nucleic acid monomer or unit, and as such in the context of an oligonucleotide can refer to the base – such as the "nucleotide sequence," typically refer

to the nucleobase sequence (*i.e.*, the presence of the sugar backbone and internucleoside linkages are implicit). Likewise, particularly in the case of oligonucleotides where one or more of the internucleoside linkage groups are modified, the term "nucleotide" can refer to a "nucleoside" for example the term "nucleotide" can be used, even when specifying the presence or nature of the linkages between the nucleosides.

[0121] The term "nucleotide length" as used herein means the total number of the nucleotides (monomers) in a given sequence. For example, the sequence of AAAGatgaaatttgctcTTA (SEQ ID NO: 4) has 20 nucleotides; thus the nucleotide length of the sequence is 20. The term "nucleotide length" is used herein interchangeably with "nucleotide number."

[0122] The term "transcript" as used herein can refer to a primary transcript that is synthesized by transcription of DNA and becomes a messenger RNA (mRNA) after processing, *i.e.*, a precursor messenger RNA (pre-mRNA), and the processed mRNA itself. The term "transcript" can be interchangeably used with "pre-mRNA" and "mRNA." After DNA strands are transcribed to primary transcripts, the newly synthesized primary transcripts are modified in several ways to be converted to their mature, functional forms to produce different proteins and RNAs such as mRNA, tRNA, rRNA, lncRNA, miRNA and others. Thus, the term "transcript" can include exons, introns, 5' UTRs, and 3' UTRs.

[0123] The term "expression" as used herein refers to a process by which a polynucleotide produces a gene product, for example, a RNA or a polypeptide. It includes, without limitation, transcription of the polynucleotide into messenger RNA (mRNA) and the translation of an mRNA into a polypeptide. Expression produces a "gene product." As used herein, a gene product can be either a nucleic acid, e.g., a messenger RNA produced by transcription of a gene, or a polypeptide which is translated from a transcript. Gene products described herein further include nucleic acids with post transcriptional modifications, e.g., polyadenylation or splicing, or polypeptides with post translational modifications, e.g., methylation, glycosylation, the addition of lipids, association with other protein subunits, or proteolytic cleavage.

[0124] In determining the degree of "complementarity" between oligomers of the invention (or regions thereof) and the target region of the nucleic acid which encodes the mammalian gene, such as those disclosed herein, the degree of "complementarity" (also, "homology" or "identity") is expressed as the percentage identity (or percentage homology) between the sequence of the oligomer (or region thereof) and the sequence of

the target region (or the reverse complement of the target region) that best aligns therewith. The percentage is calculated by counting the number of aligned bases that are identical between the two sequences, dividing by the total number of contiguous monomers in the oligomer, and multiplying by 100. In such a comparison, if gaps exist, it is preferable that such gaps are merely mismatches rather than areas where the number of monomers within the gap differs between the oligomer of the invention and the target region.

[0125] The term "complement" as used herein indicates a sequence that is complementary to a reference sequence. It is well known that complementarity is the base principle of DNA replication and transcription as it is a property shared between two DNA or RNA sequences, such that when they are aligned antiparallel to each other, the nucleotide bases at each position in the sequences will be complementary, much like looking in the mirror and seeing the reverse of things. Therefore, for example, the complement of a sequence of 5'"ATGC"3' can be written as 3'"TACG"5' or 5'"GCAT"3'. The terms "reverse complement", "reverse complementary" and "reverse complementarity" as used herein are interchangeable with the terms "complement", "complementary" and "complementarity."

[0126] The term "comparable to" is used herein to mean a value that is as much as 30% less than or more than the reference value to which it is being compared. As an example, if a value is as much as 30% less than the reference value, then the value is considered "comparable to" the reference value: *e.g.*, 70 is comparable to 100, 80 is comparable to 100, 90 is comparable to 100, 100 is comparable to 100, 110 is comparable to 100, 120 is comparable to 100, and 130 is comparable to 100. A calcium oscillation level of a molecule that is comparable to the calcium oscillation level of a control means that the calcium oscillation level of the molecule is $\pm 30\%$, $\pm 20\%$, $\pm 10\%$, or $\pm 5\%$ of the calcium oscillation level of the control.

[0127] The term "design" or "oligomer design" or "ASO Sequence" as used herein refers to a pattern of nucleotides (*e.g.*, DNA) and nucleotide analogs (*e.g.*, LNA) in a given sequence. As used herein, the design of an oligomer is shown by a combination of upper case letters and lower case letters. For example, an oligomer sequence of tatttccaaattcactttta (SEQ ID NO: 573) can have oligomer designs of ASO-002350 (TAtTTccaaattcactTTTA), ASO-002374 (TAtTTccaaattcacTtTTA), ASO-002386 (TATtTccaaattcaCTtTTA), ASO-002227 (TATtTccaaattcactTTTA), ASO-002245 (TAttTCcaaattcactTTTA), ASO-002261 (TATtTccaaattcacTTtTA), ASO-002276

(ATtTcCaaattcactTTTA), ASO-002228 (TATTtccaaattcaCtTtTA), ASO-002255 (TATTtccaaattcactTTTA), ASO-002285 (TATTtccaaattcacTTtTA), ASO-002230 (TATTtccaaattcacTtTTA), ASO-002256 (TATTtccaaattcAcTtTtTA), or ASO-002279 (TATTtccaaattcActTtTA), wherein the upper case letter indicates a nucleotide analog (*e.g.*, LNA) and the lower case letter indicates a nucleotide (*e.g.*, DNA)

[0128] The term "chemical structure" of an oligomer as used herein refers to a detailed description of the components of the oligomers, *e.g.*, nucleotides (*e.g.*, DNA), nucleotide analogs (*e.g.*, beta-D-oxy-LNA), nucleotide base (*e.g.*, A, T, G, C, U, or MC), and backbone structure (*e.g.*, phosphorothioate or phosphorodiester). For example, a chemical structure of ASO-002350 can be OxyTs OxyAs DNAts OxyTs OxyTs DNACs DNACs DNAas DNAas DNAas DNAts DNAts DNACs DNAas DNACs DNAts OxyTs OxyTs OxyTs OxyAs. Figures 2, 16B, and 20B lists non-limiting examples of chemical structures that can be applied to any one of the oligomers disclosed herein.

[0129] "Potency" is normally expressed as an IC50 or EC50 value, in nM or pM unless otherwise stated. IC50 is the median inhibitory concentration of a therapeutic molecule. EC50 is the median effective concentration of a therapeutic molecule relative to a vehicle or saline control. In functional assays, IC50 is the concentration that reduces a biological response, e.g., transcription of mRNA or protein expression, by 50% of the biological response that is achieved without the therapeutic molecule. In functional assays, EC50 is the concentration of a therapeutic molecule that produces 50% of the biological response, e.g., transcription of mRNA or protein expression. IC50 or EC50 can be calculated by any number of means known in the art.

[0130] By "toxic side effect" is meant an effect that causes debilitation of a living subject, including, but not limited to, death, pain, tremors, convulsions, seizures, an inhibition of movement, or loss of memory. A "toxic" compound can cause toxic side effects when a subject is exposed to the toxic compound, such as by injection, ingestion, inhalation or other routes, and is not suitable for administration in mammal, e.g., rodent. In one embodiment, the toxic side effect includes neurotoxicity *in vivo*. In another embodiment, the toxic side effect is *in vivo* acute neurotoxicity. A "neurotoxic" compound can alter the normal activity of the nervous system in such a way as to cause damage to nervous tissue, including brain tissue, such as neurons, and peripheral nervous tissue.

[0131] By "tolerable" is meant a molecule that is well tolerated by a live subject, e.g., a molecule that, when administered, causes no harmful effects that are either visible or can

be tested for using general quality of life tests or by measuring *in vivo* tolerability scores as described herein.

[0132] By "subject" or "individual" or "animal" or "patient" or "mammal," is meant any subject, particularly a mammalian subject, for whom diagnosis, prognosis, or therapy is desired. Mammalian subjects include humans, domestic animals, farm animals, sports animals, and zoo animals including, e.g., humans, non-human primates, dogs, cats, guinea pigs, rabbits, rats, mice, horses, cattle, bears, and so on.

[0133] An "effective amount" of a therapeutic molecule as disclosed herein is an amount sufficient to carry out a specifically stated purpose. An "effective amount" can be determined empirically and in a routine manner, in relation to the stated purpose.

[0134] Terms such as "treating" or "treatment" or "to treat" or "alleviating" or "to alleviate" refer to both (1) therapeutic measures that cure, slow down, lessen symptoms of, and/or halt progression of a diagnosed pathologic condition or disorder and (2) prophylactic or preventative measures that prevent and/or slow the development of a targeted pathologic condition or disorder. Thus, those in need of treatment include those already with the disorder; those prone to have the disorder; and those in whom the disorder is to be prevented. In certain embodiments, a subject is successfully "treated" for a disease or condition disclosed elsewhere herein according to the methods provided herein if the patient shows, e.g., total, partial, or transient alleviation or elimination of symptoms associated with the disease or disorder.

II. Methods of Using Calcium Oscillation Assays to Determine In Vivo Neurotoxicity

[0135] The present disclosure provides methods for testing or determining the toxicity (e.g., *in vivo* acute neurotoxicity) of a molecule by measuring certain characteristics of the molecule. The present disclosure also provides methods for selecting a molecule having reduced toxic side effects. Such methods are helpful to reduce unnecessary killing of animals during testing of the molecule's toxicity and/or enhance the possibilities that the molecules will be safe for *in vivo* administration. The present methods can also improve efficiency (*i.e.*, shorten) the evaluation period of candidate molecules by reducing the screening time period for selection of molecules that do not exhibit *in vivo* acute neurotoxicity. The present methods comprise identifying molecules that have lower or reduced toxicity. For example, molecules can be assayed to determine if they have low

toxicity (e.g., *in vivo* acute neurotoxicity), and if they are found to have low toxicity, the molecules are selected for use in further testing or administration to a subject such as a mammal. In some embodiments, if the molecule is found to have low toxicity, it is administered to a laboratory animal for further testing of the molecule.

[0136] Not being bound by any theory, the present disclosure identifies (i) a correlation between calcium oscillations of a molecule *in vitro* in neuronal cells and the sequence score of the molecule (e.g., polynucleotide comprising a sequence), (ii) a correlation between calcium oscillations of a molecule and the *in vivo* neurotoxicity of the molecule; (iii) a correlation between the sequence score of a molecule (e.g., polynucleotide comprising a sequence) and the *in vivo* neurotoxicity of the molecule, or (iv) any combination thereof. In one embodiment, the disclosure shows that a molecule exhibiting calcium oscillations in neuronal cells comparable to (*i.e.*, less than 30% or higher than) the calcium oscillations in neuronal cells not exposed to the molecule shows less *in vivo* neurotoxicity when administered to a mammal *in vivo*. In another embodiment, the disclosure shows that a molecule exhibiting calcium oscillations in neuronal cells comparable to (*i.e.*, less than 30% or higher than) the calcium oscillations in neuronal cells not exposed to the molecule has a sequence score equal to or greater than 0.2. In other embodiments, the disclosure shows that a molecule having a sequence score equal to or greater than 0.2 exhibits less *in vivo* neurotoxicity when the molecule is administered to a mammal *in vivo*. Therefore, identification of the correlations among the calcium oscillation assay, sequence score, and *in vivo* neurotoxicity allows one to predict the *in vivo* neurotoxicity based on the calcium oscillation *in vitro* assay and the sequence score. In a further embodiment, the present invention allows one to predict the *in vivo* neurotoxicity based on the calcium oscillation *in vitro* assay, the sequence score and the change in tubulin intensity in a cell as discussed further *supra*.

[0137] In one aspect, the disclosure sets forth a calcium oscillation assay as one way of measuring or predicting toxicity of a molecule. In another aspect, the disclosure provides a sequence score method to measure or predict toxicity of a molecule. In other aspects, the disclosure provides a combined method of using a calcium oscillation assay and a sequence score method. The disclosure also provides an *in vivo* tolerability assay that can be used separately or combined with the calcium oscillation assay and/or the sequence score method. Any other methods disclosed in this application and/or known in the art

can further be combined with the calcium oscillation assay and/or the sequence score method.

II.A. Calcium Oscillation Assays

[0138] In one embodiment, the toxicity, e.g., *in vivo* acute neurotoxicity, of the molecule is tested by measuring intracellular free calcium oscillations (calcium oscillations) *in vitro* in neuronal cells which are in contact or have been in contact with the molecule. Examples of assays measuring calcium oscillations are discussed in further detail below. In some embodiments, the molecule is considered to have an acceptable toxicity (e.g., *in vivo* acute neurotoxicity) if the molecule does not significantly reduce calcium oscillations in a cell exposed to the molecule compared to the calcium oscillations in a control cell. In some embodiments, the control cell is a cell that has not been exposed to the test molecule, but otherwise is under the same condition as the cells exposed to the test molecule. In some embodiments, the calcium oscillation assay can include a positive control cell (*i.e.*, a cell exposed to a molecule that is known to reduce calcium oscillations to an intolerable level) or a negative control cell (*i.e.*, a cell exposed to a molecule that is known not to affect calcium oscillations in the cell). In another embodiment, the control cell is exposed to a medium that carries the tested molecule to the culture of neuronal cells, e.g., water, buffer, or saline, without the test molecule (*i.e.*, vehicle control).

[0139] In one embodiment, the disclosure provides a method of testing, identifying, or determining *in vivo* acute neurotoxicity of a molecule comprising measuring calcium oscillations *in vitro* in neuronal cells which are in contact or have been in contact with the molecule. In another embodiment, the disclosure includes a method of testing, identifying, or determining *in vivo* acute neurotoxicity of a molecule comprising (1) adding the molecule to a culture of neuronal cells and (2) measuring calcium oscillations *in vitro* in the neuronal cells. In another embodiment, the disclosure provides a method of predicting *in vivo* acute neurotoxicity of a molecule comprising a step of (1) adding the molecule to a culture of neuronal cells and (2) measuring calcium oscillations *in vitro* in the neuronal cells.

[0140] In certain embodiments, the disclosure provides a method of testing, identifying, or determining *in vivo* acute neurotoxicity of a molecule or selecting or identifying a molecule having tolerable *in vivo* acute neurotoxicity comprising (i) measuring calcium oscillations *in vitro* in neuronal cells after adding the molecule in a culture of the neuronal

cells, wherein the calcium oscillations in the neuronal cells are comparable to or higher than the calcium oscillations of vehicle controls and (ii) administering the molecule to a human in need thereof..

[0141] In other embodiments, the disclosure includes a method of selecting or identifying a molecule having tolerable *in vivo* acute neurotoxicity comprising measuring calcium oscillations *in vitro* in neuronal cells which are in contact with the molecule, wherein the contacted neuronal cells exhibit calcium oscillations at a level comparable to or higher than that of control cells. In some embodiments, the disclosure provides a method of selecting or identifying a molecule having tolerable *in vivo* acute neurotoxicity comprising a step of (i) adding a molecule to a culture of neuronal cells and (ii) measuring calcium oscillations in the neuronal cells *in vitro*, wherein the neuronal cells with the molecule exhibit calcium oscillations at a level comparable to or higher than that of control cells.

[0142] Calcium oscillations are important for the proper functions of neuronal cells. Networks of cortical neurons have been shown to undergo spontaneous calcium oscillations resulting in the release of the neurotransmitter glutamate. Calcium oscillations can also regulate interactions of neurons with associate glia, in addition to other associated neurons in the network, to release other neurotransmitters in addition to glutamate. Regulated calcium oscillations are required for homeostasis of neuronal networks for normal brain function. (See, Shashank *et al.*, *Brain Research*, 1006(1): 8–17 (2004); Rose *et al.*, *Nature Neurosci.*, 4:773 – 774 (2001); Zonta *et al.*, *J Physiol Paris.*, 96(3-4):193-8 (2002); Pasti *et al.*, *J. Neurosci.*, 21(2): 477-484 (2001).) Glutamate also activates two distinct ion channels, α -amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) receptors and N-methyl-D-aspartate (NMDA) receptors.

[0143] In some embodiments, the calcium oscillations measured in the present methods are AMPA-dependent calcium oscillations. In some embodiments, the calcium oscillations are NMDA-dependent calcium oscillations. In some embodiments, the calcium oscillations are gamma-aminobutyric acid (GABA)-dependent calcium oscillations. In some embodiments, the calcium oscillations can be a combination of two or more of AMPA-dependent, NMDA-dependent or GABA-dependent calcium oscillations.

[0144] In certain embodiments, the calcium oscillations measured in the present methods are AMPA-dependent calcium oscillations. In order to measure AMPA-dependent

calcium oscillations, the calcium oscillations can be measured in the presence of Mg^{2+} ions (e.g., MgCl_2). In certain embodiments, the method further comprises adding Mg^{2+} ions (e.g., MgCl_2) at an amount that allows for detection of AMPA-dependent calcium oscillations. In some embodiments, the effective ion concentration allowing for detection of AMPA-dependent calcium oscillations is at least about 0.5 mM. In other embodiments, the effective ion concentration of Mg^{2+} ions (e.g., MgCl_2) to induce AMPA-dependent calcium oscillations is at least about 0.6 mM, at least about 0.7 mM, at least about 0.8 mM, at least about 0.9 mM, at least about 1 mM, at least about 1.5 mM, at least about 2.0 mM, at least about 2.5 mM, at least about 3.0 mM, at least about 4 mM, at least about 5 mM, at least about 6 mM, at least about 7 mM, at least about 8 mM, at least about 9 mM, or at least about 10mM. In a particular embodiment, the concentration of Mg^{2+} ions useful for the methods is 1mM. In certain embodiments, the concentration of Mg^{2+} ions (e.g., MgCl_2) useful for the present methods is about 1 mM to about 10 mM, about 1 mM to about 15mM, about 1 mM to about 20 mM, or about 1 mM to about 25 mM. Mg^{2+} ions may be added by the addition of magnesium salts, such as magnesium carbonate, magnesium chloride, magnesium citrate, magnesium hydroxide, magnesium oxide, magnesium sulfate, and magnesium sulfate heptahydrate.

[0145] In some embodiments, calcium oscillations are measured in the present method through the use of fluorescent probes which detect the fluctuations of intracellular calcium levels. For example, detection of intracellular calcium flux can be achieved by staining the cells with fluorescent dyes which bind to calcium ions (known as fluorescent calcium indicators) with a resultant, detectable change in fluorescence (e.g., Fluo-4 AM and Fura Red AM dyes available from Molecular Probes, Eugene, OR, United States of America).

[0146] Fluorescent dyes useful for the calcium oscillation assay often provide for ratiometric detection on intracellular calcium flux by calibrating fluorescence intensities measured a wavelength. In some embodiments, fluorescence of the stained cells (including stained individual cells) can be measured by confocal, or standard, fluorescence microscopy, optionally at a number of time points or continuously (e.g., real-time) to provide, for example, time lapse measurements. Those skilled in the art will appreciate that there can be other suitable methods for measuring intracellular calcium flux, for example, by viral transduction of genetically encoded calcium indicators, etc.

[0147] In one embodiment, the calcium oscillations measured in the present methods are the cumulative increase in calcium oscillations within a culture of neuronal cells, whereby the time to reach the maximum fluorescence signal constitutes the magnitude of the calcium response. The fluorescent measurements can be analyzed to identify oscillations in intracellular calcium flux and/or a "threshold" representing a point at which the intracellular calcium flux of a given oscillation is progressing either to a maximum or minimum. In another embodiment, the calcium oscillations measured in the present methods are the frequency of calcium oscillations. The term "oscillation frequency" refers to the time between oscillations. In an embodiment, the oscillation frequency can be determined by a time interval from commencement of a first oscillation in intracellular calcium flux to a commencement of a second oscillation in intracellular calcium flux. In other embodiments, the calcium oscillations measured in the present methods are the combination of the oscillation frequency and magnitude.

[0148] In some embodiments, the calcium oscillations were measured by using any methods known in the art. In certain embodiments, the calcium oscillations can be measured by a fluorescent plate reader, *e.g.*, Flexstation 2 and 3 plate reader or FLIPR™ (Fluorescence Imaging Plate Reader). In other embodiments, the calcium oscillations can be measured as shown in Murphy *et al.*, *J. Neurosci.* 12, 4834-4845 (1992).

[0149] Neuronal cells useful for the invention can be isolated from mammalian neuronal cells, *e.g.*, mouse neuronal cells, rat neuronal cells, human neuronal cells, or other neuronal cells. In certain embodiments, the neuronal cells do not express an endogenous transcript encoding a protein, for example, if a human protein is targeted in a mouse cell, the mouse cell has the endogenous version of the transcript deleted from its genome. In certain embodiments, primary neurons can be generated by papain digestion according to manufacturer's protocol (Worthington Biochemical Corporation, LK0031050). In one embodiment, forebrains are prepared by the following example. Forebrains can be dissected from hTau mouse E18 BAC-Tg embryos expressing the entire target gene on a murine MAPT-null background and can be incubated at 37°C for 30-45 minutes in papain/DNase/Earle's balanced salt solution (EBSS) solution. After trituration and centrifugation of cell pellet, the reaction is stopped by incubation with EBSS containing protease inhibitors, bovine serum albumin (BSA) and DNase. The cells can be trituated and washed with Neurobasal (NB, Invitrogen) supplemented with 2% B-27, 100 µg/ml penicillin, 85 µg/ml streptomycin, 0.5mM glutamine. The cells are plated in

supplemented NB media onto poly-D-lysine-coated 96-well optical imaging plates (BD Biosciences) at 15,000 cells/well.

[0150] In some embodiments, the calcium oscillations for a molecule having tolerable *in vivo* acute neurotoxicity are compared with the calcium oscillations in a cell not exposed to the molecule. In some embodiments, calcium oscillations for a molecule with tolerable *in vivo* acute toxicity are greater than or equal to about 250%, greater than or equal to about 240%, greater than or equal to about 230%, greater than or equal to about 220%, greater than or equal to about 210%, greater than or equal to about 200% greater than or equal to about 190%, greater than or equal to about 180%, greater than or equal to about 170%, greater than or equal to about 160%, greater than or equal to about 150%, greater than or equal to about 140%, greater than or equal to about 130%, greater than or equal to about 120%, greater than or equal to about 110%, greater than or equal to about 100%, greater than or equal to about 99%, greater than or equal to about 98%, greater than or equal to about 97%, greater than or equal to about 96%, greater than or equal to about 95%, greater than or equal to about 90%, greater than or equal to about 85%, greater than or equal to about 80%, greater than or equal to about 75%, or greater than or equal to about 70% of calcium oscillations in a vehicle control cell (*e.g.*, water or saline). As used herein, the term "greater than or equal to" can be interchangeably used with "at least." In other embodiments, the calcium oscillations with tolerable *in vivo* acute toxicity are greater than or equal to 100% of the calcium oscillations in the vehicle control cells. In certain embodiments, the calcium oscillations with tolerable *in vivo* acute toxicity are greater than or equal to about 70% of the calcium oscillations in the vehicle control cells. In certain embodiments, the calcium oscillations with tolerable *in vivo* acute toxicity are greater than or equal to about 75% of the calcium oscillations in the vehicle control cells. In other embodiments, the calcium oscillations with tolerable *in vivo* acute toxicity are about 70% to about 250%, about 70% to about 200%, about 75% to about 200%, about 70% to about 180%, about 75% to about 150%, about 80% to about 200%, about 90% to about 200%, about 100% to about 200%, or about 80% to about 250% of the calcium oscillations in the vehicle control cells.

[0151] In some embodiments, the calcium oscillations in a cell exposed to a molecule having a tolerable *in vivo* acute neurotoxicity exhibits less than about 25%, less than about 20%, less than about 15%, less than about 10%, less than about 5%, or less than about 1% reduction compared to the calcium oscillations in a vehicle control cell. In other

embodiments, the calcium oscillations in a cell exposed to a molecule having tolerable *in vivo* acute neurotoxicity are less than about 30%, less than about 25%, about 20%, about 15%, about 10%, about 5%, about 4%, about 3%, about 2%, or about 1% reduced compared to the calcium oscillations in a vehicle control cell.

[0152] In certain embodiments, molecules that cause greater than desired reductions in calcium oscillations are considered to be molecules that have unacceptable neurotoxicity. In these embodiments, molecules that cause a greater than desired reduction in calcium oscillations are considered as having a risk of toxic side effects if administered to a subject. In certain embodiments, the present disclosure provides a method of identifying or determining a molecule having intolerable *in vivo* neurotoxicity comprising measuring calcium oscillations *in vitro* in neuronal cells after being in contact with the molecule in the neuronal cells. In some embodiments, the calcium oscillations of a molecule having intolerable *in vivo* neurotoxicity are less than 70%, 60%, 50%, 40%, 30%, 20%, 10%, 5%, or 1% of the calcium oscillations in a vehicle control cell. In certain embodiments, the present disclosure includes a method of identifying or determining a molecule having intolerable *in vivo* neurotoxicity comprising measuring calcium oscillations *in vitro* in neuronal cells after being in contact with the molecule in the neuronal cells, wherein the calcium oscillations of the molecule is equal to or less than 50% of the calcium oscillations in a vehicle control cell.

[0153] In some embodiments, the molecule is a therapeutic molecule. In other embodiments, the molecule comprises a small molecule, a polynucleotide, a protein, a peptide, or any combination thereof. Non-limiting examples of the molecules are described elsewhere herein.

II.B. Sequence Score Methods

[0154] The present disclosure is also directed to a method of testing or determining *in vivo* neurotoxicity of a molecule (*e.g.*, polynucleotide) comprising a nucleotide sequence. In some embodiments, the method comprises measuring a sequence score calculated by formula (I):

$$\frac{\text{\# of C nucleotides and analogs thereof} - \text{\# of G nucleotides and analogs thereof}}{\text{Total nucleotide length (number)}} \quad (I)$$

In other embodiments, the oligomer of the invention has a sequence score greater than or equal to 0.2.

[0155] In some embodiments, the method comprises measuring a sequence calculated by formula (IA):

$$\frac{\text{\# of C nucleotides and 5-methylcytosine nucleotides} - \text{\# of G nucleotides}}{\text{Total nucleotide length}} \quad (\text{IA})$$

In other embodiments, the oligomer of the invention has a sequence score greater than or equal to 0.2.

[0156] In these embodiments, a sequence score of greater than or equal to a cut off value corresponds to a reduced neurotoxicity of the oligomer.

[0157] For example, a nucleotide sequence of ATGCATGCATGCATGC (SEQ ID NO: 3) has a sequence score of 0 ((4Cs – 4Gs)/16). The sequence of GTGCGTGCGTGCGTGC (SEQ ID NO: 732) has a sequence score of -0.25 ((4Cs – 8Gs)/16). The sequence of CTGCCTGCCTGCCTGC (SEQ ID NO: 733) has a sequence score of 0.25 ((8Cs – 4Gs)/16). In certain embodiments, a polynucleotide comprising a nucleotide sequence (e.g., an oligomer) is considered to have an acceptable neurotoxicity if it has a sequence score greater than or equal to about 0.2, greater than or equal to about 0.25, greater than or equal to about 0.3, greater than or equal to about 0.35, greater than or equal to about 0.4, greater than or equal to about 0.45, greater than or equal to about 0.5, greater than or equal to about 0.55, greater than or equal to about 0.6, greater than or equal to about 0.65, greater than or equal to about 0.7, greater than or equal to about 0.75, greater than or equal to about 0.8, greater than or equal to about 0.85, greater than or equal to about 0.9, greater than or equal to about 0.95, greater than or equal to about 1.0, greater than or equal to about 1.5, greater than or equal to about 2.0, greater than or equal to about 3.0 or greater than or equal to about 4.0. In certain embodiments, a polynucleotide is considered to have an acceptable neurotoxicity if it has a sequence score greater than or equal to 0.2, greater than or equal to 0.25, greater than or equal to 0.3, greater than or equal to 0.35, greater than or equal to 0.4, greater than or equal to 0.45, greater than or equal to 0.5, greater than or equal to 0.55, greater than or equal to 0.6, greater than or equal to 0.65, greater than or equal to 0.7, greater than or equal to 0.75, greater than or equal to 0.8, greater than or equal to 0.85, greater than or equal to 0.9, greater than or equal to 0.95, greater than or equal to 1.0, greater than or equal to 1.5, greater than or equal to 2.0, greater than or equal to 3.0 or greater than or equal to 4.0. In some embodiments, the sequence score of a polynucleotide with acceptable neurotoxicity is equal to or greater than 0.2.

- [0158] In certain embodiments, molecules comprising nucleotide sequences that have a sequence score below the set thresholds are considered to be molecules that have unacceptable neurotoxicity. In these embodiments, molecules having a sequence score below the set thresholds are considered as having a risk of toxic side effects if administered to a subject.
- [0159] In certain embodiments, any of the above methods for selecting a molecule can be used in combination. When used in combination, if the molecule is selected as a molecule with acceptable neurotoxicity for more than one method, then the molecule is considered to have a greater chance of having acceptable neurotoxicity when administered to a test subject or patient.
- [0160] In certain embodiments, the present disclosure includes a method of selecting a polynucleotide having tolerable *in vivo* acute neurotoxicity comprising (i) performing a calcium oscillation assay disclosed herein and (ii) calculating a sequence score disclosed herein, wherein the calcium oscillations of the polynucleotide are equal to or greater than 75% of the calcium oscillations in a vehicle cell and the sequence score of the polynucleotide is greater than or equal to 0.25. In some embodiments, the calcium oscillation assay and/or the sequence score method are sufficient to predict, identify, or determine *in vivo* acute neurotoxicity of a molecule and do not require additional *in vivo* tolerability studies. The calcium oscillation assay and/or the sequence score method can be especially useful for screening numerous candidate molecules to determine their *in vivo* neurotoxicities.

II.C. In Vivo Tolerability Assays

- [0161] In other embodiments, the present invention is also directed to a method of selecting or identifying a molecule having tolerable *in vivo* neurotoxicity by performing *in vivo* tolerability studies. When the number of candidate molecules are small, an *in vivo* tolerability study can provide a direct indication of *in vivo* neurotoxicity. In other embodiments, an *in vivo* tolerability study can be used in combination with the calcium oscillation assay and/or the sequence score method. The *in vivo* tolerability study can also be used after selecting a small number of candidate molecules after performing the calcium oscillation assay and/or sequence score calculation. In some embodiments, the *in vivo* tolerability score is measured by administering the molecule to a mammal, *e.g.*, to

the brain of the mammal, *e.g.*, via intracerebroventricular (ICV) administration or intrathecal (IT) administration.

[0162] For example, molecules can be injected into a laboratory animal by ICV or IT. The laboratory animal can be a rodent, such as a mouse, rat, guinea pig or hamster, but can also be another animal typically used in laboratory testing. In certain embodiments, the animals are observed at 0.5 hour, 1 hour, 1.5 hours, 2 hours, 2.5 hours, 3 hours, 3.5 hours, 4 hours, 4.5 hours or 5 hours following the injection of a molecule. Animals are observed for behavioral side effects and scored for the severity of side effects on a scale of zero (no side effects) to 20 (convulsions resulting in euthanasia). The tolerability scale can be divided into at least one of the following neurobehavioral categories: 1) hyperactivity 2) decreased activity and arousal 3) motor dysfunction /ataxia 4) abnormal posture and breathing and 5) tremor/convulsions. In some embodiments, the tolerability scale comprises at least two, at least three, at least four, or at least five neurobehavioral categories. Each category is scored on a scale of 0-4, with the worst possible total score of 20 and the best possible total score of 0. Animals are observed for changes in behavior, for example in the home cage, but they can be observed in other environments. In some embodiments, animals are removed from the home cage for more detailed observations which included measurement of grip strength and righting reflex.

[0163] In certain embodiments, an *in vivo* cumulative tolerability threshold following an injection of a molecule is set at 4. For example, the correlation analysis in Figure 3 shows that the molecules having *in vivo* tolerability lower than 4 tend to have a sequence score equal to or higher than 0.2.

[0164] In other embodiments, the disclosure includes a method of identifying or selecting a molecule having tolerable *in vivo* neurotoxicity comprising (i) performing a calcium oscillation assay, (ii) calculating sequence score, (iii) performing an *in vivo* tolerability study, and (iv) administering the molecule to a mammal in need of treatment of a disease or condition.

II.D. Tubulin Intensity Assays

[0165] In certain embodiments, the methods of the disclosure further comprise measuring long term *in vivo* toxicities of a molecule. For example, long term toxicities can be determined by measuring the change in tubulin intensity in a cell by the molecule when the cell comes in contact with a molecule. In certain embodiments, the change in tubulin intensity is measured along with one or both of the change in calcium oscillation,

sequence score, and/or *in vivo* tolerability assay. Examples of assays measuring the change in tubulin intensity in a cell are provided below. In some embodiments, the molecule exhibits tubulin intensity in a cell greater than or equal to 99%, greater than or equal to 98%, greater than or equal to 97%, greater than or equal to 96%, greater than or equal to 95%, greater than or equal to 90%, greater than or equal to 85%, greater than or equal to 80%, greater than or equal to 75%, or greater than or equal to 70% of tubulin intensity in a cell that is not exposed to the molecule, *i.e.*, a control cell, as defined above. In some embodiments, the tubulin intensity in a cell that is not exposed to the tested molecule is referred to as the tubulin intensity in a control cell. In some embodiments, the molecule reduces less than about 30%, less than about 25%, less than about 20%, less than about 15%, less than about 10%, less than about 5%, or less than about 1% of the tubulin intensity in a vehicle control cell.

II.E. Behavioral Test

[0166] The present methods can further comprise measuring a behavioral performance of an animal by a molecule. In one embodiment, the method comprises a behavioral test score, which can be measured by administering the molecule to a mammal and grading the mammal's behavioral performance. In certain embodiments, the behavioral test is a short term memory test, a spatial learning and memory test, a gait analysis test, or any combination thereof. In one embodiment, the behavioral performance is measured by injecting the molecule to a mammal, *e.g.*, a brain of a mammal, *e.g.*, intracerebroventricular (ICV) or intrathecal (IT) administration, and grading the mammal's behavioral performance on a scale of 0 to 4. In certain embodiments, the behavioral score is less than or equal to the total score of 3, the total score of 2, the total score of 1, or the total score of 0. In some embodiments, the behavioral score is determined as described in Example 5 below.

[0167] In some embodiments, the behavioral score is measured by the following methods, including a novel object rejection test, a water maze test, a gait analysis test, and/or any combination thereof. Therapeutic molecules are injected into a laboratory animal by ICV or IT. The laboratory animal can be a mammal, *e.g.*, a rodent, such as a mouse, rat, guinea pig or hamster, but can also be another animal typically used in laboratory testing. In certain embodiments, the animals are observed at about 0.5 hour, about 1 hour, about 1.5 hours, about 2 hours, about 2.5 hours, about 3 hours, about 3.5

hours, about 4 hours, about 4.5 hours or about 5 hours following the injection of the molecule.

- [0168] In one embodiment, a behavioral score is obtained with a novel object recognition test. Short term recognition memory can be measured using the novel object recognition (NOR) task. NOR testing is based on the spontaneous behavior of rodents to explore a novel object more than a familiar one (Dodart et. al., *Neuroreport* (1997) 8(5): 1173-8; Ennaceur and Delacour, *Behav. Brain Res.* (1988) 31 (1):47-59). The NOR testing can be used similar to the test shown in Example 5, or can be modified as necessary.
- [0169] In one embodiment, a behavioral score is obtained with a water maze test, such as the Morris Water Maze. Spatial learning and memory can be assessed based on a Morris Water Maze test as shown in Morris J. *Neurosci.* (1984) 11(1):47-60) or the test shown in Example 5 herein. In another embodiment, a spatial learning and memory test can be assessed by a modified Morris Water Maze test as necessary.
- [0170] In one embodiment, a behavioral score is obtained with a gait analysis test, such as the Catwalk. The Catwalk (Noldus, The Netherlands) is an automated and computerized gait-analysis technique that allows objective quantification of multiple static and dynamic gait parameters. The gait analysis test can be measured by the Catwalk assay shown in Example 5 or a modified Catwalk test as necessary.
- [0171] Statistical analysis of behavioral test data can be analyzed using statistical analysis methods known to those of skill in the art. In some embodiments, statistical analyses for behavioral tests are conducted using GraphPad Prism (GraphPad Software, Inc., La Jolla, CA). For NOR, data are analyzed using either a paired t-test for within-group analyses or by an ANOVA followed by a Dunnett's post-hoc test for between group analyses. For Morris Water Maze (MWM), a repeated MWM ANOVA is used to analyze the acquisition phase and a one-way ANOVA followed by Dunnett's post-hoc for probe trial analyses.
- [0172] Not being bound by any theory, the molecule with less reduction (70% or higher) in calcium oscillations compared to a control (*e.g.*, saline) has a higher sequence score (*e.g.*, higher than 0.2). Also not being bound by any theory, the molecule with less reduction (70% or higher) in calcium oscillations compared to a control and a higher sequence score (higher than 0.2) has a lower *in vivo* behavioral score (*e.g.*, less than 4). In other embodiments, the molecule with less reduction (70% or higher) in calcium

oscillations compared to a control and a higher sequence score (higher than 0.2) has tolerable *in vivo* acute neurotoxicity.

II.F. Diagnostic or Therapeutic Methods

- [0173] The molecules selected according to the present methods can be utilized as research reagents for, for example, diagnostics, therapeutics and prophylaxis. In certain embodiments, the invention provides a method for both selecting a molecule and then utilizing the molecule.
- [0174] In other embodiments, the molecules selected according to the present methods are therapeutic molecules. In still other embodiments, the method comprising a calcium oscillation assay, a sequence score method, and/or *in vivo* tolerability test can further comprise administering the selected molecule to a subject in need thereof.
- [0175] Therefore, for therapeutics, an animal or a human, suspected of having a disease or disorder can be treated by administering molecules in accordance with this disclosure. Further provided are methods of treating a mammal, such as treating a human, suspected of having or being prone to a disease or condition by administering a therapeutically or prophylactically effective amount of one or more of the molecules of the disclosure. In some embodiments, the disclosure provides a method of treating a mammal, *e.g.*, a human, comprising (1) selecting a molecule having tolerable *in vivo* acute neurotoxicity as described elsewhere herein (*e.g.*, calcium oscillation assay, sequence score calculation, and/or *in vivo* tolerability study) and (2) administering the molecule to the mammal. The molecules, a conjugate or a pharmaceutical composition according to the invention is typically administered in an effective amount. In some embodiments, the molecules or conjugate of the invention is used in therapy.
- [0176] The disclosure also provides a method of administering a molecule to a subject for the treatment of a neurological disease or condition. In certain embodiments, the neurological disorder is a neurodegenerative disorder, an epileptic disorder, an idiopathic adult epileptic disorder, or any combination thereof. In other embodiments, the disease or condition is a neurodegenerative disorder with tauopathy (*i.e.*, (a neurodegenerative disease which involves accumulation of tau protein in the brain), an epileptic disorder with tauopathy (an epileptic disorder which involves accumulation of tau protein in the brain), an epileptic disorder without tauopathy (an epileptic disorder which does not involve accumulation of tau protein in the brain), an idiopathic adult epileptic disorder without tauopathy (an idiopathic adult epileptic disorder which does not involve

accumulation of tau protein in the brain), or any combination thereof. In certain other embodiments, the disease or condition for treatment or prophylaxis is a neurodegenerative disease with tauopathy.

[0177] In certain embodiments, the disease or condition is progressive supranuclear palsy, Down syndrome, dementia pugilistica (chronic traumatic encephalopathy and other traumatic brain injury), frontotemporal dementia with parkinsonism linked to chromosome 17 (FTDP-17), Lytico-Bodig disease (Parkinson-dementia complex of Guam), Tangle-predominant dementia, ganglioglioma, gangliocytoma, meningioangiomas, subacute sclerosing panencephalitis, lead encephalopathy, Hemimegalencephaly, tuberous sclerosis, Hallervorden-Spatz disease, Pick's disease, corticobasal ganglionic degeneration, argyrophilic grain disease, corticobasal degeneration, lipofuscinosis, frontotemporal dementia, supranuclear palsy, and frontotemporal lobar degeneration, a disease of brain network dysfunction (*e.g.*, all forms of epilepsy and depression), dravet syndrome, a spinal cord disorder, a peripheral neuropathy, a cranial nerve disorder (*e.g.*, Trigeminal neuralgia), an autonomic nervous system disorder (*e.g.*, dysautonomia or multiple system atrophy), a movement disorder of a central and peripheral nervous system (*e.g.*, Parkinson's disease, essential tremor, amyotrophic lateral sclerosis, Tourette's Syndrome, multiple sclerosis or various types of peripheral neuropathy), a sleep disorder (*e.g.*, Narcolepsy), migraine or other types of headache (*e.g.*, cluster headache and tension headache), lower back and neck pain, central neuropathy, a neuropsychiatric illness, attention deficit hyperactivity disorder, autism, Huntington's disease, Rett Syndrome, Angelman syndrome, organic psychosis, an infection of the brain or spinal cord (including meningitis), or a prion disease), anemia, cancer, leukemia, an inflammatory condition or an autoimmune disease (*e.g.* arthritis, psoriasis, lupus erythematosus, multiple sclerosis), a bacterial infection, and any combination thereof.

[0178] In certain other embodiments, the disease or condition is a neurodegenerative disease with tauopathy, *e.g.*, progressive supranuclear palsy, frontotemporal dementia-tau (FTD-tau), frontotemporal dementia and parkinsonism linked to chromosome 17 (FTDP-17), corticobasal degeneration (CBD), traumatic brain injury, chronic traumatic encephalopathy, HIV associated neurocognitive disorders, Argyrophilic grain disease, Down syndrome-Alzheimer's disease, Amnesic mild cognitive impairment-Alzheimer's disease, Parkinson's disease dementia, Hallervorden-Spatz disease (Pantothenate kinase-

associated neurodegeneration), Niemann Pick disease type C, Myotonic dystrophy, Amyotrophic lateral sclerosis, Parkinson's disease or Huntington's disease. In certain embodiments, the disease or condition is an epileptic disorder with tauopathy, e.g., Hemimegalencephaly, Tuberous sclerosis complex, Focal cortical dysplasia type 2b, or Ganglion cell tumors. In certain embodiments, the disease or condition is an epileptic disorder without tauopathy, e.g., Dravet Syndrome (severe myoclonic epilepsy of infancy), Temporal lobe epilepsy, Ohtahara syndrome (early infantile epileptic encephalopathy with suppression bursts), Lafora body disease, Generalized epilepsy with febrile seizures, Infantile spasms (West syndrome), Lennox Gastaut syndrome, Angelman Syndrome, Rett Syndrome, Landau Kleffner syndrome. In certain embodiments, the disease or condition is an idiopathic adult epileptic disorder without tauopathy, e.g., focal seizures, simple focal seizures (no loss of consciousness), focal dyscognitive seizures (impairment of consciousness), focal seizure evolving to generalised tonic-clonic (GTC) convulsions, generalised seizures (convulsive or non-convulsive with bilateral discharges involving subcortical structures), absence seizures, myoclonic seizures, clonic seizures, tonic seizures, tonic-clonic seizures or atonic seizures. In certain embodiments, the disease or condition is an autistic disorder, an autism spectrum disorder (e.g., as defined in the Diagnostic and Statistical Manual of Mental Disorders V (DSM-V)), an Asperger's disorder or a pervasive developmental disorder.

[0179] The invention further provides for a molecule according to the invention, for use for the treatment of one or more of the diseases associated with neuronal cells or referred to herein, such as a disease selected from Alzheimer's disease, progressive supranuclear palsy, Down syndrome, dementia pugilistica (chronic traumatic encephalopathy and other traumatic brain injury), frontotemporal dementia with parkinsonism linked to chromosome 17 (FTDP-17), LYTIC-BODIG disease (Parkinson-dementia complex of Guam), Tangle-predominant dementia, ganglioglioma, gangliocytoma, meningioangiomas, subacute sclerosing panencephalitis, lead encephalopathy, Hemimegalencephaly, tuberous sclerosis, Hallervorden-Spatz disease, Pick's disease, corticobasal ganglionic degeneration, argyrophilic grain disease, corticobasal degeneration, lipofuscinosis, frontotemporal dementia, supranuclear palsy, and frontotemporal lobar degeneration (reviewed in Frost et.al., Trends Cell Biol (2015) 25: 216-53; Dymment et. al., Neurobiol. Aging (2014) Sept 6: S0197-4580; Moussaud et. al., Mol. Neurodegen (2014) 29:43 Ross et. al., South Med. J. (2014) 107: 715-21),

Huntington's disease, Rett Syndrome, and Angelman syndrome. In addition, the invention provides for therapeutic molecule use for the treatment diseases of brain network dysfunction including all forms of epilepsy and depression (Inoue et. al., Epilepsy (2012) 102: 8-12; Xi et. al., Med Hypotheses (2011) 76: 897-900; Hou et. al., Can. J. Psychiatry (2004) 3: 164-71).

[0180] The disclosure also provides for the use of the molecules or conjugates of the invention as described for the manufacture of a medicament for the treatment of a disease or disorder as referred to herein, or for a method of the treatment of as a disorder as referred to herein. Also provided is a composition for use in treating a disease or disorder as referred to herein.

III. Molecules (e.g., Therapeutic Molecules)

[0181] The molecules to be screened or selected according to the present invention include therapeutic molecules. In one embodiment, a therapeutic molecule comprises a protein, a peptide, a polynucleotide (*e.g.*, an oligomer), a saccharide, a lipid, a liposome and a particulate, a biomaterial, a pharmaceutical, a vitamin, a nucleic acid, an amino acid, a polypeptide, an enzyme cofactor, a steroid, a carbohydrate, heparin, a metal containing agent, a receptor antagonist, a receptor agonist, a receptor or a portion of a receptor, an extracellular matrix protein, a cell surface molecule, an antigen, a hapten, a small molecule, or any combination thereof.

[0182] In certain embodiments, a therapeutic molecule is a protein comprising cytokines, enzymes, growth factors, monoclonal antibody, antibody fragments, single-chain antibodies, albumin, immunoglobulins, clotting factors, somatropin, amylase, lipase, protease, cellulose, urokinase, galactosidase, staphylokinase, hyaluronidase, tissue plasminogen activator, or any combination thereof.

[0183] In one embodiment, a molecule of the invention comprises at least one of a therapeutic molecule that is an antigen binding site (*e.g.*, an antigen binding site of an antibody, antibody variant, or antibody fragment), a receptor binding portion of ligand, or a ligand binding portion of a receptor.

[0184] In another embodiment, a molecule of the invention targets one or more endogenously produced proteins or peptides *in vivo*, one or more mRNAs or pre-mRNAs encoding the proteins or peptides, or one or more genes encoding the proteins or peptides. In some embodiments, the molecule comprises a polynucleotide (*e.g.*, oligomer), a nucleotide, or a small molecule.

- [0185] A molecule also can comprise any therapeutic small molecule or drug as the therapeutic molecule useful for the methods disclosed herein. Small molecules can comprise any therapeutic molecules that is not a peptide, a polypeptide, a protein, and a polynucleotide. Small molecule can include a single nucleotide or nucleoside, *e.g.*, RNA or DNA.
- [0186] In one embodiment, the therapeutic molecule modulates cellular activation or inhibition (*e.g.*, by binding to a cell surface receptor and resulting in transmission of an activating or inhibitory signal). In one embodiment, the therapeutic molecule is capable of initiating transduction of a signal which results in death of the cell (*e.g.*, by a cell signal induced pathway, by complement fixation or exposure to a payload (*e.g.*, a toxic payload) present on the binding molecule), or which modulates a disease or disorder in a subject (*e.g.*, by mediating or promoting cell killing, or by modulating the amount of a substance which is bioavailable (*e.g.*, by enhancing or reducing the amount of a ligand such as TNF α in the subject)). In another embodiment, the molecules of the invention have at least one binding site specific for an antigen targeted for reduction or elimination, *e.g.*, a cell surface antigen or a soluble antigen.
- [0187] In another embodiment, binding of a therapeutic molecule of the invention to a target molecule (*e.g.* antigen) results in the reduction or elimination of the target molecule or a cell expressing the target molecule, *e.g.*, from a tissue or from circulation. In another embodiment, the therapeutic molecule has at least one binding site specific for a target molecule that can be used to detect the presence of the target molecule (*e.g.*, to detect a contaminant or diagnose a condition or disorder). Exemplary therapeutic molecules are discussed further below.

III.A. Antigen Binding Portions

- [0188] In certain embodiments, a molecule useful for the disclosure comprises at least one therapeutic molecule which is a binding site, *e.g.*, an antigen binding portion of an antibody. In one embodiment, the molecule for the methods disclosed herein is a polypeptide.
- [0189] In other embodiments, a binding site of a molecule of the invention comprises an antigen binding portion of an antibody. The term "antigen-binding portion" refers to a polypeptide fragment of an immunoglobulin, antibody, or antibody variant which binds antigen or competes with intact antibody (*i.e.*, with the intact antibody from which they

were derived) for antigen binding (*i.e.*, specific binding). For example, the antigen binding portions can be derived from any of the antibodies or antibody variants known in the art. Antigen binding portions can be produced by recombinant or biochemical methods that are well known in the art. Exemplary antigen-binding fragments include VH and VL regions, Fv, Fab, Fab', and (Fab')₂.

- [0190] In other embodiments, a therapeutic molecule of the invention comprises a binding site from a single chain binding molecule (*e.g.*, a single chain variable region or scFv). Techniques described for the production of single chain antibodies (U.S. Pat. No. 4,694,778; Bird, *Science* 242:423-442 (1988); Huston et al., *Proc. Natl. Acad. Sci. USA* 85:5879-5883 (1988); and Ward et al., *Nature* 334:544-554 (1989)) can be adapted to produce single chain molecules. Single chain antibodies are formed by linking the heavy and light chain fragments of the Fv region via an amino acid bridge, resulting in a single chain antibody. Techniques for the assembly of functional Fv fragments in *E. coli* may also be used (Skerra et al., *Science* 242:1038-1041 (1988)).
- [0191] Polypeptides useful for the disclosure can comprise a variable region or portion thereof (*e.g.* a VL and/or VH domain) derived from an antibody using art recognized protocols or may be obtained from an art-recognized antibody using standard molecular biology techniques.
- [0192] In one embodiment, a molecule useful for the invention binds to a molecule which is useful in treating cancer.
- [0193] In still other embodiments, a molecule useful for the invention binds to a molecule which is useful in treating an autoimmune or inflammatory disease or disorder.
- [0194] For example, a molecule, *e.g.*, a polypeptide, can bind to an antigen present on an immune cell (*e.g.*, a B or T cell) or an autoantigen responsible for an autoimmune disease or disorder. Examples of autoimmune diseases that can be diagnosed, prevented or treated by the methods and compositions of the present invention include, but are not limited to, Crohn's disease; Inflammatory bowel disease (IBD); systemic lupus erythematosus; ulcerative colitis; rheumatoid arthritis; Goodpasture's syndrome; Grave's disease; Hashimoto's thyroiditis; pemphigus vulgaris; myasthenia gravis; scleroderma; autoimmune hemolytic anemia; autoimmune thrombocytopenic purpura; polymyositis and dermatomyositis; pernicious anemia; Sjögren's syndrome; ankylosing spondylitis; vasculitis; type I diabetes mellitus; neurological disorders, multiple sclerosis, and secondary diseases caused as a result of autoimmune diseases.

[0195] In other embodiments, a therapeutic molecule of the invention that binds to a target molecule associated with an inflammatory disease or disorder. As used herein the term "inflammatory disease or disorder" includes diseases or disorders which are caused, at least in part, or exacerbated by inflammation, *e.g.*, increased blood flow, edema, activation of immune cells (*e.g.*, proliferation, cytokine production, or enhanced phagocytosis). For example, a molecule of the invention can bind to an inflammatory factor (*e.g.*, a matrix metalloproteinase (MMP), $\text{TNF}\alpha$, an interleukin, a plasma protein, a cytokine, a lipid metabolite, a protease, a toxic radical, a mitochondrial protein, an apoptotic protein, an adhesion molecule, etc.) involved or present in an area in aberrant amounts, *e.g.*, in amounts which may be advantageous to alter, *e.g.*, to benefit the subject. The inflammatory process is the response of living tissue to damage. The cause of inflammation may be due to physical damage, chemical substances, micro-organisms, tissue necrosis, cancer or other agents. Acute inflammation is short-lasting, *e.g.*, lasting only a few days. If it is longer-lasting however, then it may be referred to as chronic inflammation.

[0196] Inflammatory disorders include acute inflammatory disorders, chronic inflammatory disorders, and recurrent inflammatory disorders. Acute inflammatory disorders are generally of relatively short duration, and last for from about a few minutes to about one to two days, although they may last several weeks. The main characteristics of acute inflammatory disorders include increased blood flow, exudation of fluid and plasma proteins (edema) and emigration of leukocytes, such as neutrophils. Chronic inflammatory disorders, generally, are of longer duration, *e.g.*, weeks to months to years or even longer, and are associated histologically with the presence of lymphocytes and macrophages and with proliferation of blood vessels and connective tissue. Recurrent inflammatory disorders include disorders which recur after a period of time or which have periodic episodes. Examples of recurrent inflammatory disorders include asthma and multiple sclerosis. Some disorders may fall within one or more categories. Inflammatory disorders are generally characterized by heat, redness, swelling, pain and loss of function. Examples of causes of inflammatory disorders include, but are not limited to, microbial infections (*e.g.*, bacterial, viral and fungal infections), physical agents (*e.g.*, burns, radiation, and trauma), chemical agents (*e.g.*, toxins and caustic substances), tissue necrosis and various types of immunologic reactions. Examples of inflammatory disorders include, but are not limited to, osteoarthritis, rheumatoid arthritis, acute and

chronic infections (bacterial, viral and fungal); acute and chronic bronchitis, sinusitis, and other respiratory infections, including the common cold; acute and chronic gastroenteritis and colitis; acute and chronic cystitis and urethritis; acute respiratory distress syndrome; cystic fibrosis; acute and chronic dermatitis; acute and chronic conjunctivitis; acute and chronic serositis (pericarditis, peritonitis, synovitis, pleuritis and tendinitis); uremic pericarditis; acute and chronic cholecystitis; acute and chronic vaginitis; acute and chronic uveitis; drug reactions; and burns (thermal, chemical, and electrical).

[0197] In yet other embodiments, a therapeutic molecule of the invention binds to a molecule which is useful in treating a neurological disease or disorder. For example, a polypeptide may bind to an antigen present on a neural cell (*e.g.*, a neuron or a glial cell). In certain embodiments, the antigen associated with a neurological disorder may be an autoimmune or inflammatory disorder described supra. As used herein, the term “neurological disease or disorder” includes disorders or conditions in a subject wherein the nervous system either degenerates (*e.g.*, neurodegenerative disorders, as well as disorders where the nervous system fails to develop properly or fails to regenerate following injury, *e.g.*, spinal cord injury. Examples of neurological disorders that can be diagnosed, prevented or treated by the methods and compositions of the present invention include, but are not limited to, Multiple Sclerosis, Huntington’s Disease, Rett Syndrome, Angelman Syndrome, Alzheimer’s Disease, Parkinson’s Disease, progressive supranuclear palsy, epilepsy, dravet syndrome, neuropathic pain, traumatic brain injury, Guillain-Barré syndrome and chronic inflammatory demyelinating polyneuropathy (CIDP).

[0198] In other aspects, the therapeutic molecule of the invention comprises antigen binding sites, or portions thereof, derived from modified forms of antibodies. Exemplary such forms include, *e.g.*, minibodies, diabodies, triabodies, nanobodies, camelids, Dabs, tetravalent antibodies, intradiabodies (*e.g.*, Jendreyko et al. 2003. J. Biol. Chem. 278:47813), fusion proteins (*e.g.*, antibody cytokine fusion proteins, proteins fused to at least a portion of an Fc receptor), and bispecific antibodies.

III.B. Non-Immunoglobulin Binding Molecules

[0199] In certain other embodiments, a therapeutic molecule of the invention comprises one or more binding sites derived from a non-immunoglobulin binding molecule. As used herein, the term “non-immunoglobulin binding molecules” are binding molecules whose

binding sites comprise a portion (*e.g.*, a scaffold or framework) which is derived from a polypeptide other than an immunoglobulin, but which can be engineered (*e.g.*, mutagenized) to confer a desired binding specificity.

- [0200] Other examples of therapeutic molecules not derived from antibody molecules include receptor binding sites and ligand binding sites which are discussed in more detail *infra*.
- [0201] Non-immunoglobulin therapeutic moieties can comprise binding site portions that are derived from a member of the immunoglobulin superfamily that is not an immunoglobulin (*e.g.* a T-cell receptor or a cell-adhesion protein (*e.g.*, CTLA-4, N-CAM, telokin)). Such binding molecules comprise a binding site portion which retains the conformation of an immunoglobulin fold and is capable of specifically binding an IGF1-R epitope. In other embodiments, non-immunoglobulin binding molecules of the invention also comprise a binding site with a protein topology that is not based on the immunoglobulin fold (*e.g.*, such as ankyrin repeat proteins or fibronectins) but which nonetheless are capable of specifically binding to a target (*e.g.* an IGF-1R epitope).
- [0202] In one embodiment, a therapeutic moiety is derived from a fibronectin binding molecule. Fibronectin binding molecules (*e.g.*, molecules comprising the Fibronectin type I, II, or III domains) display CDR-like loops which, in contrast to immunoglobulins, do not rely on intra-chain disulfide bonds. In one exemplary embodiment, the fibronectin polypeptide is as AdNectin® (Adnexus Therapeutics, Waltham, MA).
- [0203] In another embodiment, a therapeutic molecule of the invention comprises a binding site from an Affibody® (Abcam, Cambridge, MA). In another embodiment, a therapeutic molecule of the invention comprises a binding site from an Anticalin® (Pieris AG, Friesing, Germany). In another embodiment, a therapeutic molecule of the invention comprises a binding site from a cysteine-rich polypeptide. In other embodiments, a therapeutic molecule of the invention comprises a binding site from a repeat protein. Other non-immunoglobulin binding sites which may be employed in molecules of the invention include binding sites derived from Src homology domains (*e.g.* SH2 or SH3 domains), PDZ domains, beta-lactamase, high affinity protease inhibitors, or small disulfide binding protein scaffolds such as scorpion toxins.

III.C. Binding Portions of Receptors or Ligands

[0204] In other aspects, a molecule of the invention comprises a ligand binding site of a receptor and/or a receptor binding portion of a ligand. Exemplary binding portions of receptors or ligands that can be present in a molecule of the invention are set forth below:

III.C.1. Cytokines and Cytokine Receptors

[0205] Cytokines have pleiotropic effects on the proliferation, differentiation, and functional activation of lymphocytes. Various cytokines, or receptor binding portions thereof, can be utilized in the fusion proteins of the invention as therapeutic molecules, binding sites and/or domains. Exemplary cytokines include the interleukins (e.g. IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-11, IL-12, IL-13, and IL-18), the colony stimulating factors (CSFs) (e.g. granulocyte CSF (G-CSF), granulocyte-macrophage CSF (GM-CSF), and monocyte macrophage CSF (M-CSF)), tumor necrosis factor (TNF) alpha and beta, cytotoxic T lymphocyte antigen 4 (CTLA-4), and interferons such as interferon- α , β , or γ (US Patent Nos. 4,925,793 and 4,929,554).

[0206] Cytokine receptors typically consist of a ligand-specific alpha chain and a common beta chain. Exemplary cytokine receptors include those for GM-CSF, IL-3 (US Patent No. 5,639,605), IL-4 (US Patent No. 5,599,905), IL-5 (US Patent No. 5,453,491), IL10 receptor, IFN γ (EP0240975), and the TNF family of receptors (e.g., TNF α (e.g. TNFR-1 (EP 417, 563), TNFR-2 (EP 417,014) lymphotoxin beta receptor).

III.C.2. Adhesion Proteins

[0207] Adhesion molecules are membrane-bound proteins that allow cells to interact with one another. Various adhesion proteins, including leukocyte homing receptors and cellular adhesion molecules, or receptor binding portions thereof, can be incorporated in a fusion protein of the invention as therapeutic molecules, binding sites and/or domains. Leukocyte homing receptors are expressed on leukocyte cell surfaces during inflammation and include the β -1 integrins (e.g. VLA-1, 2, 3, 4, 5, and 6) which mediate binding to extracellular matrix components, and the β 2-integrins (e.g. LFA-1, LPAM-1, CR3, and CR4) which bind cellular adhesion molecules (CAMs) on vascular endothelium. Exemplary CAMs include ICAM-1, ICAM-2, VCAM-1, and MAdCAM-1. Other CAMs include those of the selectin family including E-selectin, L-selectin, and P-selectin.

III.C.3. Chemokines

[0208] Chemokines, chemotactic proteins which stimulate the migration of leucocytes towards a site of infection, can also be incorporated into a fusion protein of the invention. Exemplary chemokines include Macrophage inflammatory proteins (MIP-1- α and MIP-1- β), neutrophil chemotactic factor, and RANTES (regulated on activation normally T-cell expressed and secreted).

III.C.4. Hormones

[0209] Exemplary growth hormones for use as therapeutic moieties in the fusion proteins of the invention include renin, human growth hormone (HGH; US Patent No. 5,834,598), N-methionyl human growth hormone; bovine growth hormone; growth hormone releasing factor; parathyroid hormone (PTH); thyroid stimulating hormone (TSH); thyroxine; proinsulin and insulin (US Patent Nos. 5,157,021 and 6,576,608); follicle stimulating hormone (FSH); calcitonin, luteinizing hormone (LH), leptin, glucagons; bombesin; somatropin; mullerian-inhibiting substance; relaxin and prorelaxin; gonadotropin-associated peptide; prolactin; placental lactogen; OB protein; or mullerian-inhibiting substance.

III.C.5. Receptors and Ligands

[0210] In one embodiment, a polypeptide of the invention combines the binding site(s) of the ligand or receptor (e.g. the extracellular domain (ECD) of a receptor) with at least one genetically-fused Fc region (*i.e.*, scFc region). In certain embodiments, the ligand binding portion of a receptor is derived from a receptor selected from a receptor of the Immunoglobulin (Ig) superfamily (*e.g.*, a soluble T-cell receptor, *e.g.*, mTCR® (Medigene AG, Munich, Germany), a receptor of the TNF receptor superfamily described supra (*e.g.*, a soluble TNF α receptor of an immunoadhesin), a receptor of the Glial Cell-Derived Neurotrophic Factor (GDNF) receptor family (*e.g.*, GFR α 3), a receptor of the G-protein coupled receptor (GPCR) superfamily, a receptor of the Tyrosine Kinase (TK) receptor superfamily, a receptor of the Ligand-Gated (LG) superfamily, a receptor of the chemokine receptor superfamily, IL-1/Toll-like Receptor (TLR) superfamily, and a cytokine receptor superfamily.

[0211] In other embodiments, the binding site or domain of the receptor-binding portion of a ligand is derived from a ligand bound by an antibody or antibody variant described

supra. For example, the ligand can bind a receptor selected from the group consisting of a receptor of the Immunoglobulin (Ig) superfamily, a receptor of the TNF receptor superfamily, a receptor of the G-protein coupled receptor (GPCR) superfamily, a receptor of the Tyrosine Kinase (TK) receptor superfamily, a receptor of the Ligand-Gated (LG) superfamily, a receptor of the chemokine receptor superfamily, IL-1/Toll-like Receptor (TLR) superfamily, and a cytokine receptor superfamily. In one exemplary embodiment, the binding site of the receptor-binding portion of a ligand is derived from a ligand belonging to the TNF ligand superfamily described supra (*e.g.*, CD40L).

[0212] Growth factors or their receptors (or receptor binding or ligand binding portions thereof) may be incorporated in the fusion proteins of the invention. Exemplary growth factors include Vascular Endothelial Growth Factor (VEGF) and its isoforms (U.S. Pat. No. 5,194,596); Fibroblastic Growth Factors (FGF), including aFGF and bFGF; atrial natriuretic factor (ANF); hepatic growth factors (HGFs; US Patent Nos. 5,227,158 and 6,099,841), neurotrophic factors such as bone-derived neurotrophic factor (BDNF), glial cell derived neurotrophic factor ligands (*e.g.*, GDNF, neuturin, artemin, and persephin), neurotrophin-3, -4, -5, or -6 (NT-3, NT-4, NT-5, or NT-6), or a nerve growth factor such as NGF- β platelet-derived growth factor (PDGF) (U.S. Pat. Nos. 4,889,919, 4,845,075, 5,910,574, and 5,877,016); transforming growth factors (TGF) such as TGF- α and TGF- β (WO 90/14359), osteoinductive factors including bone morphogenetic protein (BMP); insulin-like growth factors-I and -II (IGF-I and IGF-II; US Patent Nos. 6,403,764 and 6,506,874); Erythropoietin (EPO); Thrombopoietin (TPO; stem-cell factor (SCF), thrombopoietin (TPO, c-Mpl ligand), and the Wnt polypeptides (US Patent No. 6,159,462).

[0213] Exemplary growth factor receptors which may be used as therapeutic moieties of the invention include EGF receptors; VEGF receptors (*e.g.* Flt1 or Flk1/KDR), PDGF receptors (WO 90/14425); HGF receptors (US Patent Nos. 5,648,273, and 5,686,292), and neurotrophic receptors including the low affinity receptor (LNGFR), also termed as p75NTR or p75, which binds NGF, BDNF, and NT-3, and high affinity receptors that are members of the trk family of the receptor tyrosine kinases (*e.g.* trkA, trkB (EP 455,460), trkC (EP 522,530)).

III.C.6. Heterodimeric Receptors

[0214] In one embodiment, antagonists to cytokines that utilize an β specificity determining component which, when combined with the cytokine, binds to a first β signal transducing component to form a nonfunctional intermediate which then binds to a second β signal transducing component causing β -receptor dimerization and consequent signal transduction can be made using the methods of the invention. Such molecules are described in the art (see *e.g.*, US Patent 6,927,044). In one example, a soluble specificity determining component of the receptor and the extracellular domain of the first β signal transducing component of the cytokine receptor are combined to form a heterodimer that binds the cytokine to form a nonfunctional complex. Exemplary cytokines that can be inhibited using such heterodimeric receptors include: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-14, IL-15, GM-CSF, LIF, $\text{INF}\alpha$, and $\text{TGF}\beta$.

III.D. Molecule Comprising a Polynucleotide

[0215] A molecule for the disclosure can also comprise a polynucleotide (*e.g.*, oligomers). In some embodiments, the nucleotide sequence encodes any polypeptide disclosed above in Sections III.A, III.B, and III.C.1-III.C.5. In certain embodiments, the nucleotide sequence binds or hybridizes to a nucleic acid sequence (DNA or RNA, *e.g.*, pre-mRNA or mRNA) encoding one or more polypeptides disclosed above in Sections III.A, III.B, and III.C.1-III.C.5. The term "nucleotide sequence" herein means the molecule in which more than two nucleotides are connected to each other as a sequence. In one embodiment, the nucleotide sequence for the present disclosure is DNA. In another embodiment, the nucleotide sequence for the present disclosure is RNA. In other embodiments, the nucleotide sequence for the present disclosure is a combination of DNA and RNA. In still other embodiments, the nucleotide sequence for the disclosure comprises one or more chemically modified nucleotides. In yet other embodiments, the nucleotide sequence comprises at least two nucleotides, at least three nucleotides, at least four nucleotides, at least five nucleotides, at least six nucleotides, at least seven nucleotides, at least eight nucleotides, at least nine nucleotides, at least 10 nucleotides, or at least 11 nucleotides in length. In other embodiments, the nucleotide sequence comprises at least 15 nucleotides, at least 20 nucleotides, at least 25 nucleotides, at least 30 nucleotides, at least 35 nucleotides, at least 40 nucleotides, at least 45 nucleotides, at least 50 nucleotides, at least 55 nucleotides, at least 60 nucleotides, at least 65

nucleotides, at least 70 nucleotides, at least 80 nucleotides, at least 90 nucleotides, at least 100 nucleotides, at least 150 nucleotides, at least 200 nucleotides, at least 300 nucleotides, at least 400 nucleotides, at least 500 nucleotides, at least 600 nucleotides, at least 700 nucleotides, at least 800 nucleotides, at least 900 nucleotides, at least 1000 nucleotides, at least 2000 nucleotides, at least 3000 nucleotides, or at least 4000 nucleotides. In this regard, the nucleotide sequence of the invention can affect indirect inhibition of the protein through a reduction in mRNA levels, typically in a mammalian cell, such as a human cell, such as a neuronal cell. Nucleotide sequences of any type can be analyzed using the methods of the current invention. In certain embodiments, nucleotide sequences targeting pre-mRNA or mRNAs that are primarily expressed in neuronal cells as proteins are analyzed for selected characteristics as discussed elsewhere herein. Examples of genes that can be targeted by nucleotide sequences selected by the methods of the present invention include, but are not limited to, microtubule-associated protein tau (encoded by the MAPT gene), brain acid soluble protein 1 (encoded by the BASP1 gene), or amyloid precursor protein (encoded by the APP gene). In some embodiments, the nucleotide sequence for the present methods is an oligomer.

III.D.1. Oligomers (Antisense Oligonucleotide)

- [0216] In certain embodiments, the therapeutic molecule useful for the invention is an oligomer. Oligomers have a nucleotide sequence from 10 – 50, such as 10 – 30 nucleotides in length which comprises a contiguous nucleotide sequence of a total of from 10 – 30 nucleotides.
- [0217] In certain embodiments, the oligomers target microtubule-associated protein tau (MAPT). In a pathologic state associated with disease, MAPT is also known as neurofibrillary tangle protein or paired helical filament-tau (PHF-tau). The sequence for the MAPT gene can be found under publicly available Accession Number NC_000017.11 and the sequence for the MAPT pre-mRNA transcript can be found under publicly available Accession Number NG_007398. The sequence for Tau protein can be found under publicly available Accession Numbers: P10636, P18518, Q14799, Q15549, Q15550, Q15551, Q1RMF6, Q53YB1, Q5CZI7, Q5XWF0, Q6QT54, Q9UDJ3, Q9UMH0, Q9UQ96, each of which is incorporated by reference herein in its entirety. Natural variants of the MAPT gene product are known. For example, natural variants of Tau protein can contain one or more amino acid substitutions selected from: R5H, R5L,

D285N, V289A, K574T, L583V, G589V, N596K, N613H, P618L, P618S, G620V, S622N, K634M, S637F, V654M, E659V, K686I, G706R, R723W, or any combinations thereof. Therefore, the oligomers of the present invention can be designed to reduce or inhibit expression of the natural variants of the Tau protein. The Tau protein sequence is provided as SEQ ID NO: 1, and a nucleotide sequence is provided as SEQ ID NO: 2.

[0218] In certain embodiments, the oligomers target a pre-mRNA or mRNA encoding brain acid soluble protein 1 (BASP1). BASP1 is also known as 22 kDa neuronal tissue-enriched acidic protein, neuronal axonal membrane protein NAP-22, NAP22, CAP-23, NAP-22, CAP23, or Neuronal Tissue-Enriched Acidic Protein. The BASP1 gene encodes a membrane bound protein with several transient phosphorylation sites and PEST motifs. Conservation of proteins with PEST sequences among different species supports their functional significance. PEST sequences typically occur in proteins with high turnover rates. Immunological characteristics of this protein are species specific. This protein also undergoes N-terminal myristoylation.

[0219] Another example of a target nucleic acid sequence of the oligomers is BASP1 pre-mRNA or BASP1 mRNA. BASP1 cDNA which corresponds to BASP1 mRNA is known as GenBank Accession No. NM_006317.4.

[0220] In certain embodiments, the therapeutic molecules (*e.g.*, oligomers) target a pre-mRNA encoding an amyloid precursor protein. Amyloid precursor protein (APP) is an integral membrane protein expressed in many tissues and concentrated in the synapses of neurons. Its function has been implicated as a regulator of synapse formation, neural plasticity and iron export. APP is best known as the precursor molecule whose proteolysis generates beta amyloid (A β), a 37 to 49 amino acid peptide whose amyloid fibrillar form is the primary component of amyloid plaques found in the brains of Alzheimer's disease patients.

[0221] In humans, the gene for APP is located on chromosome 21 and contains 18 exons spanning 290 kilobases. Several alternative splicing isoforms of APP have been observed in humans, ranging in length from 365 to 770 amino acids, with certain isoforms preferentially expressed in neurons; changes in the neuronal ratio of these isoforms have been associated with Alzheimer's disease. Mutations in critical regions of Amyloid Precursor Protein, including the region that generates amyloid beta (A β), cause familial susceptibility to Alzheimer's disease. For example, several mutations outside the A β

region associated with familial Alzheimer's have been found to dramatically increase production of A β .

- [0222] A further example of a target nucleic acid sequence of the oligomers is APP pre-mRNA or APP mRNA. APP cDNA which corresponds to APP mRNA is known as GenBank Accession No. Y00264.
- [0223] In some embodiments, the present method is utilized to select any therapeutic molecules comprising a nucleotide sequence (*e.g.*, oligomers) that hybridize to a region within a MAPT transcript, *e.g.*, SEQ ID NO: 2 (SEQ ID NO: 2 can be mRNA if "t" is replaced with "u"), a BASP1 transcript or an APP transcript.
- [0224] In one embodiment, random therapeutic molecules comprising nucleotide sequences (*e.g.*, oligomers) targeting certain regions of pre-mRNA or mRNA encoding MAPT, BASP1, or APP are prepared to test their toxicities. The therapeutic molecules comprising nucleotide sequences can then be subject to the methods of the present invention described elsewhere herein. In certain embodiments, examples of the oligomers (*i.e.*, antisense oligonucleotides) include, but are not limited to, the oligomers listed in Figures 4 and 5.
- [0225] The oligomers can include any oligomer design, *e.g.*, a pattern of nucleoside sugar modifications. In an embodiment, the oligomer comprises at least 1 modified nucleoside, such as at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, at least 10, at least 11, at least 12, at least 13, at least 14, at least 15 or at least 16 modified nucleosides.
- [0226] In an embodiment, the oligomer of the invention comprises modifications, which are independently selected from these three types of modifications (modified sugar, modified nucleobase and modified internucleoside linkage) or a combination thereof.
- [0227] In a further embodiment the oligonucleotide comprises at least one modified internucleoside linkage. In other embodiments, the internucleoside linkages within the contiguous nucleotide sequence are phosphorothioate or boranophosphate internucleoside linkages.
- [0228] In some embodiments, the oligomer of the invention comprises at least one LNA unit or at least one 2' substituted modified nucleoside.
- [0229] The oligomer of the invention can comprise a nucleotide sequence which comprises both nucleotides and nucleotide analogs, and can be in the form of a gapmer, blockmer, mixmer, headmer, tailmer, or totalmer. Examples of configurations of a

gapmer, blockmer, mixmer, headmer, tailmer, or totalmer that can be used with the oligomer of the invention are described in U.S. Patent Appl. Publ. No. 2012/0322851.

[0230] The nucleotides of the oligomer of the invention or contiguous nucleotides sequence thereof can be coupled together via linkage groups. Suitably each nucleotide is linked to the 3' adjacent nucleotide via a linkage group. Suitable internucleotide linkages include those listed within WO2007/031091, for example the internucleotide linkages listed on the first paragraph of page 34 of WO2007/031091.

[0231] US Publication No. 2011/0130441, which was published June 2, 2011, refers to oligomeric compounds having at least one bicyclic nucleoside attached to the 3' or 5' termini by a neutral internucleoside linkage. The oligomers of the invention can therefore have at least one bicyclic nucleoside attached to the 3' or 5' termini by a neutral internucleoside linkage, such as one or more phosphotriester, methylphosphonate, MMI, amide-3, formacetal or thioformacetal. The remaining linkages can be phosphorothioate.

[0232] In the context the term "conjugate" is intended to indicate a heterogeneous molecule formed by the covalent or non-covalent attachment ("conjugation") of the oligomer as described herein to one or more non-nucleotide, or non-polynucleotide moieties. Examples of non-nucleotide or non-polynucleotide moieties include macromolecular agents such as proteins, fatty acid chains, sugar residues, glycoproteins, polymers, or combinations thereof. Typically proteins can be antibodies for a target protein. In some embodiments, typical polymers are polyethylene glycol.

[0233] Therefore, in various embodiments, the oligomer of the invention comprises both a polynucleotide region which typically consists of a contiguous sequence of nucleotides, and a further non-nucleotide region. When referring to the oligomer of the invention comprising a contiguous nucleotide sequence, the compound can comprise non-nucleotide components, such as a conjugate component.

[0234] The invention also provides for a conjugate comprising the oligomer according to the invention as herein described, and at least one non-nucleotide or non-polynucleotide moiety covalently attached to said oligomer. Therefore, in various embodiments where the oligomer of the invention comprises a specified nucleic acid or nucleotide sequence, as herein disclosed, the compound can also comprise at least one non-nucleotide or non-polynucleotide moiety (*e.g.*, not comprising one or more nucleotides or nucleotide analogs) covalently attached to said oligomer.

[0235] Conjugation (to a conjugate moiety) can enhance the activity, cellular distribution or cellular uptake of the oligomer of the invention. Such moieties include, but are not limited to, antibodies, polypeptides, lipid moieties such as a cholesterol moiety, cholic acid, a thioether.

[0236] The oligomers of the invention can also be conjugated to active drug substances, for example, aspirin, ibuprofen, a sulfa drug, an antidiabetic, an antibacterial or an antibiotic.

[0237] In certain embodiments the conjugated moiety is a sterol, such as cholesterol.

IV. Pharmaceutical Composition and Administration Routes

[0238] The therapeutic molecules of the invention can be used in pharmaceutical formulations and compositions. Suitably, such compositions comprise a pharmaceutically acceptable diluent, carrier, salt or adjuvant.

[0239] The therapeutic molecules of the invention can be included in a unit formulation such as in a pharmaceutically acceptable carrier or diluent in an amount sufficient to deliver to a patient a therapeutically effective amount without causing serious side effects in the treated patient. However, in some forms of therapy, serious side effects may be acceptable in terms of ensuring a positive outcome to the therapeutic treatment.

[0240] The formulated drug may comprise pharmaceutically acceptable binding agents and adjuvants. Capsules, tablets, or pills can contain for example the following compounds: microcrystalline cellulose, gum or gelatin as binders; starch or lactose as excipients; stearates as lubricants; various sweetening or flavoring agents. For capsules the dosage unit may contain a liquid carrier like fatty oils. Likewise coatings of sugar or enteric agents may be part of the dosage unit. The therapeutic molecule formulations can also be emulsions of the active pharmaceutical ingredients and a lipid forming a micellar emulsion.

[0241] The pharmaceutical compositions of the present invention can be administered in a number of ways depending upon whether local or systemic treatment is desired and upon the area to be treated. Administration can be (a) oral (b) pulmonary, *e.g.*, by inhalation or insufflation of powders or aerosols, including by nebulizer; intratracheal, intranasal, (c) topical including epidermal, transdermal, ophthalmic and to mucous membranes including vaginal and rectal delivery; or (d) parenteral including intravenous, intraarterial, subcutaneous, intraperitoneal or intramuscular injection or infusion; or

intracranial, *e.g.*, intrathecal, intra-cerebroventricular, or intraventricular, administration. In one embodiment the therapeutic molecule is administered IV, IP, orally, topically or as a bolus injection or administered directly in to the target organ. In another embodiment, the therapeutic molecule is administered intrathecal or intra-cerebroventricular as a bolus injection.

[0242] Pharmaceutical compositions and formulations for topical administration can include transdermal patches, ointments, lotions, creams, gels, drops, sprays, suppositories, liquids and powders. Conventional pharmaceutical carriers, aqueous, powder or oily bases, thickeners and the like may be necessary or desirable. Examples of topical formulations include those in which the oligomer of the invention are in admixture with a topical delivery agent such as lipids, liposomes, fatty acids, fatty acid esters, steroids, chelating agents and surfactants. Compositions and formulations for oral administration include but are not limited to powders or granules, microparticulates, nanoparticulates, suspensions or solutions in water or non-aqueous media, capsules, gel capsules, sachets, tablets or minitables. Compositions and formulations for parenteral, intrathecal, intra-cerebroventricular, or intraventricular administration can include sterile aqueous solutions which can also contain buffers, diluents and other suitable additives such as, but not limited to, penetration enhancers, carrier compounds and other pharmaceutically acceptable carriers or excipients.

[0243] Pharmaceutical compositions of the present invention include, but are not limited to, solutions, emulsions, and liposome-containing formulations. These compositions may be generated from a variety of components that include, but are not limited to, preformed liquids, self-emulsifying solids and self-emulsifying semisolids. Delivery of drug to the target tissue can be enhanced by carrier-mediated delivery including, but not limited to, cationic liposomes, cyclodextrins, porphyrin derivatives, branched chain dendrimers, polyethylenimine polymers, nanoparticles and microspheres (Dass CR. J Pharm Pharmacol 2002; 54(1):3-27).

[0244] The pharmaceutical formulations of the present invention, which can conveniently be presented in unit dosage form, can be prepared according to conventional techniques well known in the pharmaceutical industry. Such techniques include the step of bringing into association the active ingredients with the pharmaceutical carrier(s) or excipient(s). In general the formulations are prepared by uniformly and intimately bringing into

association the active ingredients with liquid carriers or finely divided solid carriers or both, and then, if necessary, shaping the product.

[0245] For parenteral, subcutaneous, intradermal or topical administration the formulation can include a sterile diluent, buffers, regulators of tonicity and antibacterials. The therapeutic molecules can be prepared with carriers that protect against degradation or immediate elimination from the body, including implants or microcapsules with controlled release properties. For intravenous administration the carriers can be physiological saline or phosphate buffered saline. International Publication No. WO2007/031091 (A2), published March 22, 2007, further provides suitable pharmaceutically acceptable diluent, carrier and adjuvants.

[0246] The practice of the present invention will employ, unless otherwise indicated, conventional techniques of cell biology, cell culture, molecular biology, transgenic biology, microbiology, recombinant DNA, and immunology, which are within the skill of the art. Such techniques are explained fully in the literature. See, for example, Sambrook *et al.*, ed. (1989) *Molecular Cloning A Laboratory Manual* (2nd ed.; Cold Spring Harbor Laboratory Press); Sambrook *et al.*, ed. (1992) *Molecular Cloning: A Laboratory Manual*, (Cold Springs Harbor Laboratory, NY); D. N. Glover ed., (1985) *DNA Cloning*, Volumes I and II; Gait, ed. (1984) *Oligonucleotide Synthesis*; Mullis *et al.* U.S. Pat. No. 4,683,195; Hames and Higgins, eds. (1984) *Nucleic Acid Hybridization*; Hames and Higgins, eds. (1984) *Transcription And Translation*; Freshney (1987) *Culture Of Animal Cells* (Alan R. Liss, Inc.); Immobilized Cells And Enzymes (IRL Press) (1986); Perbal (1984) *A Practical Guide To Molecular Cloning*; the treatise, *Methods In Enzymology* (Academic Press, Inc., N.Y.); Miller and Calos eds. (1987) *Gene Transfer Vectors For Mammalian Cells*, (Cold Spring Harbor Laboratory); Wu *et al.*, eds., *Methods In Enzymology*, Vols. 154 and 155; Mayer and Walker, eds. (1987) *Immunochemical Methods In Cell And Molecular Biology* (Academic Press, London); Weir and Blackwell, eds., (1986) *Handbook Of Experimental Immunology*, Volumes I-IV; *Manipulating the Mouse Embryo*, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y., (1986);); Crooks, *Antisense drug Technology: Principles, strategies and applications*, 2nd Ed. CRC Press (2007) and in Ausubel *et al.* (1989) *Current Protocols in Molecular Biology* (John Wiley and Sons, Baltimore, Md.).

[0247] All of the references cited above, as well as all references cited herein, are incorporated herein by reference in their entirety.

[0248] The following examples are offered by way of illustration and not by way of limitation.

EXAMPLES

Example 1: Construction of Molecules

[0249] A number of molecules (*e.g.*, oligomers) are designed to target the 3' UTR of MAPT pre-mRNA. For example, the oligomers were constructed to target nucleotides 134,821-138,940 and 72,802-73,072 of SEQ ID NO: 2. The exemplary sequences of the oligomers are described in Figures 4, 5, and 6. In some embodiments, the oligomers were designed to be gapmers or mixmers. The same methods can be applied to any other sequences disclosed herein. The gapmers were constructed to contain LNAs (upper case letters), for example, Beta-deoxy LNA at the 5' end and the 3' end and contain a phosphorothioate backbone, but the LNAs can be substituted with any other nucleotide analogs and the backbone can be other types of backbones (*e.g.*, a phosphodiester linkage, a phosphotriester linkage, a methylphosphonate linkage, a phosphoramidate linkage, or combinations thereof).

[0250] The oligomers were synthesized using methods well known in the art. Exemplary methods of preparing such oligomers are described in Barciszewski et al., Chapter 10 – "Locked Nucleic Acid Aptamers" in *Nucleic Acid and Peptide Aptamers: Methods and Protocols*, vol. 535, Gunter Mayer (ed.) (2009).

Example 2: Spontaneous Calcium Oscillation Measurement of Antisense Oligonucleotides

[0251] To measure primary cortical neuron spontaneous calcium oscillation, rat primary cortical neurons were prepared from Sprague-Dawley rat embryos (E19). Cells were plated 25,000 cells/well onto 384 well poly-D-lysine coated FLIPR plates (Greiner Bio-One) in 25 µl/well Neurobasal media containing B27 supplement and 2 mM glutamine (day 1 *in vitro*, DIV1). Cells were grown for 11 days at 37°C in 5% CO₂ and fed with 25 µl of additional media on day 4 *in vitro* ("DIV04") and day 8 *in vitro* ("DIV08") for use on day 11 *in vitro* ("DIV11"). On the day of the experiment, media was removed from the plate and the cells were washed once with 50 µl/well of 37°C assay buffer (Hank's

Balanced Salt Solution with 2 mM CaCl_2 and 10 mM HEPES pH 7.4). Oscillations were tested in the presence and absence of 1mM MgCl_2 (Figure 1). Cells were loaded with a cell permeant fluorescent calcium dye, fluo-4 AM (Life Technologies). Fluo-4 AM was prepared at 2.5 mM in DMSO containing 20% pluronic F-127 then diluted 1:1000 in assay buffer. Cells were incubated 1 hr with 20 μl of 2.5 μM fluo-4 AM at 37°C in 5% CO_2 . After 1 hr 20 μl of room temperature assay buffer was added and the cells were allowed to equilibrate to room temperature for 10 additional minutes and placed in the fluorescent imaging plate reader (FLIPR). Baseline signal (measurement of intracellular calcium) was read for 100 seconds (1 reading/second) before the addition of anti-sense oligomers. Oligomers were added with a 384 well head in the FLIPR in 20 μl of assay buffer at 75 μM for a final concentration of 25 μM . FLIPR signal was read for an additional 200 seconds (1 reading/second) after the addition of oligomer. A second 5 minute post addition plate read (300 one second points) on the FLIPR was conducted to allow for additional data capture. Raw data from the 5 minute read was exported and, using Excel, spike amplitude and frequency was calculated. Calculations were performed by measuring the average FLIPR signal over the 300 second read for control (non-treated) wells. For treated wells, a scoring system was developed where a score of 1 was given for each 1 second read where signal increase greater than 50% of the average control value (calculated above). A score of 0 was given for each 1 second read that increase less than 50% of average control value. For each treatment a total score was calculated and converted to percent control for graphical purposes. If the antisense oligomer produced a calcium oscillation response greater than that of the untreated cell, percent of control is expressed as greater than 100% (Figure 4).

[0252] Effect of oligomers on primary neuronal spontaneous calcium oscillations was measured under two conditions, in the presence and absence of 1mM MgCl_2 as described previously (Murphy et.al., 1992, *J. Neurosci.* 12:4834-4845). This was done to isolated N-methyl-D-aspartate (NMDA)- and α -amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA)- receptor mediated calcium oscillations. Data presented in Figure 1 show that, addition of the AMPA receptor antagonist, 6-Cyano-7-nitroquinoxaline-2,3-dione (CNQX; 3 μM), reduced calcium oscillations by 20% representing the total AMPA response in the assay (Figure 1 AMPA labeled bar shown). Calcium oscillations were reduced further, by about 80%, when (NMDA) receptor function was blocked by 1mM MgCl_2 (Figure 1 NMDA labeled bar shown).

- [0253] Antisense oligomer inhibition of spontaneous calcium oscillations mediated by either NMDA or AMPA was assessed in the presence or absence of 1mM MgCl₂ (representing 100% control in each case; Figure 2). Addition of 25 μM antisense oligomers (ASO) inhibited AMPA receptor but not NMDA receptor mediated oscillations (Figure 2). ASOs, and other oligomers that behaved similarly, were shown to negatively impact central nervous system (CNS) network activity *in vivo* and electrophysiologic spontaneous neuronal activity *in vitro* (data not shown). Tau antisense oligonucleotide impact on spontaneous calcium oscillations in primary neurons is summarized in Figure 4. See Murphy et al., *J. Neurosci.* 12, 4834 – 4845 (1992).
- [0254] Calcium oscillation reduction in the neuronal cells was measured for the oligomers of the invention and compared with that of the control cells (*i.e.*, the calcium oscillations in the neuronal cells that are not treated with the oligomers). Tau antisense oligonucleotide impact on spontaneous calcium oscillations in primary neurons is shown in Figure 4. The oligomers in neuronal cells showing AMPA-mediated oscillations that are equal to or greater than 75% of the calcium oscillations in the untreated control cells were selected for further analysis.

Example 3: Calcium Oscillation Measurement Using Small Molecules

- [0255] The effect of small molecules on calcium oscillations will be measured using substantially the same method provided in Example 2. To measure primary cortical neuron spontaneous calcium oscillation, rat primary cortical neurons will be prepared. Cells will be plated and be grown for use on the appropriate date. As discussed in Example 2, the effect of small molecules on primary neuronal spontaneous calcium oscillations will be measured under two conditions, in the presence and absence of 1mM MgCl₂ as described previously (Murphy et.al., 1992, *J. Neurosci.* 12:4834-4845). Cells will be loaded with a cell permanent fluorescent calcium dye. Cells will be incubated and allowed to equilibrate to room temperature to measure the fluorescent intensity. Raw data will be exported, and spike amplitude and frequency will be calculated.
- [0256] Small molecule inhibition of spontaneous calcium oscillations mediated by either NMDA or AMPA will be assessed. Addition of small molecule will inhibit AMPA receptor mediated oscillations. Small molecules that reduce calcium oscillations to levels

below 70% of control will be expected to negatively impact CNS network activity *in vivo* and electrophysiologic spontaneous neuronal activity *in vitro*.

Example 4: Calcium Oscillation Measurement Using Therapeutic Proteins

[0257] The effect of therapeutic proteins, such as antibodies or antigen-binding fragments thereof, fusion proteins, cytokines, cell surface receptors, hormones or growth factors, on calcium oscillations will be measured using substantially the same method provided in Example 2. To measure primary cortical neuron spontaneous calcium oscillation, rat primary cortical neurons will be prepared. Cells will be plated and be grown for use on the appropriate date. As discussed in Example 2, the effect of therapeutic proteins on primary neuronal spontaneous calcium oscillations will be measured under two conditions, in the presence and absence of 1mM MgCl₂ as described previously (Murphy et.al., 1992, J. Neurosci. 12:4834-4845). Cells will be loaded with a cell permanent fluorescent calcium dye. Cells will be incubated and allowed to equilibrate to room temperature to measure the fluorescent intensity. Raw data will be exported, and spike amplitude and frequency will be calculated.

[0258] Therapeutic protein inhibition of spontaneous calcium oscillations mediated by either NMDA or AMPA will be assessed. Addition of therapeutic protein will inhibit AMPA receptor mediated oscillations. Therapeutic proteins that reduce calcium oscillations to levels below 70% of control will be expected to negatively impact CNS network activity *in vivo* and electrophysiologic spontaneous neuronal activity *in vitro*.

Example 5: Sequence Score Calculation

[0259] The Sequence score of each oligomer was calculated to predict the suitability of the oligomers. Sequence score is a mathematical calculation determined for all oligomers and is based on the percent of G and C nucleotides, or analogs thereof, within a given oligomer sequence. The following formula was applied to all oligomers in order to calculate sequence score:

$$\frac{\text{number of C nucleotides or analogs thereof} - \text{number of G nucleotides or analogs thereof}}{\text{nucleotide length}} (I)$$

[0260] An example calculation is given for oligomer ASO-000013 (SEQ ID NO: 686; sequence score 0.25): ATTtcaaattcaCTT : 4-0/16 = sequence score of 0.25.

- [0261] The sequence score of the selected oligomers were calculated for further studies. To determine the cut off value for the sequence score, an *in vivo* tolerability study was performed as shown in Example 6.

Example 6: *In Vivo* Tolerability

- [0262] The *in vivo* tolerability of the oligomers was tested to see how the oligomer was tolerated when injected into an animal.

Subject

- [0263] *In vivo* tolerability of the oligomers were tested in mice and rats. Animals for Tau qPCR and behavioral studies were adult, C57Bl/6J female mice (20-30g; Jackson Laboratories, Bar Harbor, ME) housed 3-4 per cage. Animals were held in colony rooms maintained at constant temperature ($21 \pm 2^{\circ}\text{C}$) and humidity ($50 \pm 10\%$) and illuminated for 12 hours per day (lights on at 0600 hours). In some cases, male and female transgenic mice (30-40g) expressing a tau transgene derived from a human PAC, H1 haplotype driven by the tau promoter (Polydoro et. al., J. Neurosci. (2009) 29(34): 10741-9), and in which the native mouse Tau gene was deleted, were used to assess pharmacodynamic endpoints and tissue drug concentrations. For intrathecal infusion studies, female Sprague-Dawley rats (180-225 g at testing; Harlan) were singly housed in colony rooms maintained at a constant temperature ($21 \pm 2^{\circ}\text{C}$) and humidity ($50 \pm 10\%$) and illuminated for 12 hours per day (lights on at 0600 h). All animals had ad libitum access to food and water throughout the studies. Behavioral studies were conducted between 0700 and 1500 hours. Animals were maintained in accordance with the guidelines of the Animal Care and Use Committee of the Bristol-Myers Squibb Company, and the "Guide for Care and Use of Laboratory Animals" published by the National Institutes of Health. Research protocols were approved by the Bristol-Myers Squibb Company Animal Care and Use Committee.

Administration Routes -Intra-cerebroventricular or Intrathecal Injections.

- [0264] The oligomers were administered to mice by either intracerebroventricular (*i.c.v.*) injection or intrathecal injection. Intracerebroventricular injections were performed using a Hamilton micro syringe fitted with a 27 or 30-gauge needle, according to the method of Haley and McCormick. The needle was equipped with a polyethylene guard at 2.5 mm

from the tip in order to limit its penetration into the brain. Mice were anesthetized using isoflurane anesthetic (1.5-4%). The mouse to be injected, weighing 20-30g, was held by the loose skin at the back of the neck with the thumb and first fingers of one hand. Applying gentle but firm pressure, the head of the animal was then immobilized by pressing against a firm flat level surface. The needle tip was then inserted through the scalp and the skull, about 1 mm lateral and 1 mm caudal to bregma. Once the needle was positioned, antisense oligonucleotide was given in a volume of 5 microliters in saline vehicle and injected into the right (or left) lateral ventricle over 20-30 seconds. The needle was left in place for 10 seconds before removal. This procedure required no surgery or incision. Animals were warmed on heating pads until they recovered from the procedure. Brain tissue (right, frontal cortical region) was collected on dry ice or RNAlater for drug concentration analysis and Tau qPCR respectively at multiple time points following dosing, *e.g.*, 1 week through 16 weeks post-dosing.

[0265] For intrathecal (IT) injections of mice, animals were maintained under light isoflurane anesthesia (1.5-5%). The mouse was held securely in one hand by the pelvic girdle and inserting a 30G 1/2 inch needle connected to a Hamilton syringe into the tissue between the dorsal aspects of L5 and L6, perpendicular to the vertebral column. When the needle enters the subarachnoid space, a sudden lateral movement of the tail was observed. This reflex was used as an indicator of successful placement of the needle for IT administration. A 5-10 μ L volume of antisense oligonucleotide was injected slowly (over approximately 60 seconds) into the subarachnoid space.

[0266] For intrathecal injections in rats, intrathecal catheters were surgically implanted using methods described by Yaksh and Rudy, *Physiol. Behav.* (1976) 17(6): 1031-6. The rat was mounted to a stereotaxic frame with isoflurane anesthesia maintained through a nose cone. A skin incision was made beginning approximately at the line joining the ears and extending caudally about 3 cm along the midline. The muscle where it attached to the occipital crest of the skull was cut about 3 mm lateral on both sides of the muscle midline. Using retractors or forceps, the muscle was peeled caudally to expose the cisternal membrane at the base of the skull. The fascia and tissue were carefully removed from the membrane. The bent beveled end of a 16-22 gauge needle was used to make a 1-2 mm lateral incision in the cisternal membrane. A sterilized IT catheter, made of polyethylene tubing (PE10 tubing stretched to approximately 1.3 mm outer diameter), was inserted through the incision and carefully advanced caudally through the subarachnoid space

while it was rotated between thumb and forefinger and while the base of the tail was gently pulled to align the spinal cord using the other hand. If any resistance was encountered, the catheter was retracted slightly, and slowly advanced again. Once the catheter had been advanced to the desired area, it was flushed with 20 μ L sterile saline and the cranial end was passed through the skin using a 19 gauge needle about 1 cm from the incision. The catheter was plugged with a pin. Rats were given oral antibiotics for 5 days following the surgery. At least five days after surgery, a single antisense oligonucleotide injection was diluted in water and delivered via a programmable infusion pump (Knopf) at a rate of 10 μ L/minute in a volume of 10 to 50 μ L. A brief saline flush of 5 μ L was given just prior to the antisense oligonucleotide delivery and a 10 μ L saline flush was given just following the oligonucleotide delivery at a rate of 10 μ L/minute to cover the dead volume of the catheter (6-7 μ L). A saline flush of 20 μ L was also given to animals 1-2X/week until used for an experiment.

Acute Tolerability Behavioral Assessments

[0267] For one hour following the single injection of antisense oligonucleotide ICV or IT, animals were observed for behavioral side effects and scored for the severity of side effects on a scale of zero (no side effects) to 20 (convulsions resulting in euthanasia). The tolerability scale was divided into 5 neurobehavioral categories: 1) hyperactivity 2) decreased activity and arousal 3) motor dysfunction /ataxia 4) abnormal posture and breathing and 5) tremor/convulsions. Each category was scored on a scale of 0-4, with the worst possible total score of 20. Animals were observed for changes in behavior in the home cage, and then they were removed from the home cage for more detailed observations which included measurement of grip strength and righting reflex.

Novel object recognition

[0268] Short term recognition memory was measured using the novel object recognition (NOR) task. NOR testing was based on the spontaneous behavior of rodents to explore a novel object more than a familiar one (Dodart et. al., *Neuroreport* (1997) 8(5): 1173-8; Ennaceur and Delacour, *Behav. Brain Res.* (1988) 31 (1):47-59). After a one hour retention interval between training (T1) and testing (T2) sessions, mice remembering the objects from the training session will show a preference for the novel object on the test session. For these experiments, animals were handled for 3 days and habituated to the

chamber (48 cm x 38 cm x 20 cm) on the day prior to the test session. The chamber was made of polyethylene and lined with vinyl flooring. On the test day, animals were placed in the rectangular test chamber and allowed to explore two identical objects (7.6 cm high x 5.1 cm wide) for a 15 minute training period. One hour later, mice were placed back into the test chamber for a 10 minute test session, this time with one object they had observed during training and one novel object. Objects were cleaned thoroughly with 25% ethanol between training and testing sessions and between subjects, and were cleaned again at the end of the day with mild detergent. Object exploration was only considered when the animal's nose was pointed at the object. Exploration was recorded using ObjectScan tracking software (Cleversys, Reston, VA). Data are reported as percent of time spent exploring objects (*i.e.*, novel time/novel+familiar time *100).

Morris Water Maze

- [0269] Spatial learning and memory was assessed based on Morris Water Maze assay (Morris J. Neurosci. (1984) 11(1):47-60). Water maze represents a pool with the diameter of 120 cm. Water was made opaque using white, non-toxic tempura paint ($20^{\circ}\text{C} \pm 1$). The pool was surrounded with distinct extra-maze cues.
- [0270] Prior to hidden platform training, all mice were exposed to the water maze pool by allowing them to swim down the rectangular channel during 2 pre-training trials. The escape platform was placed in the middle of the channel. If a mouse was not able to find and mount the platform during 60 sec trial, it was guided to it and allowed to sit for up to 10 sec. After pre-training, mice underwent hidden platform training, during which a 10x10 cm platform was submerged 1.5 cm below the surface. The platform location remained the same throughout training whereas the drop location varied randomly between the four daily trials as well as across the 4 days of training. Mice received 2 sessions per day for 4 consecutive days. Each session consisted of 2 trials with a 10-min inter-trial interval. The maximum time allowed per trial was 60 sec. If a mouse did not find or mount the platform, it was guided to the platform by the experimenter. All mice were allowed to sit on the platform for 10 sec after each training trial.
- [0271] For probe trials, the platform was removed and each mouse was allowed to swim for 60 sec. The drop location for the probe trials was 180° from the platform location used during hidden platform training. After 60 sec, mice were guided to the platform location before retrieval from the pool. For early memory retrieval mice were probed 2h after the

last hidden platform training; long term memory recall was assessed 16h following the last hidden platform training. 2h following the 16h probe trial, all mice underwent the visible platform training, where a local cue (pole built using legos) was placed above the hidden platform. Mice were given 2 training trials. All behavior was recorded with a video tracking system (Cleversys Inc). Escape latencies, distance traveled, swim paths, swim speeds, and platform crossings were recorded automatically for subsequent analysis.

Catwalk

- [0272] The Catwalk (Noldus, The Netherlands) is an automated and computerized gait-analysis technique that allows objective quantification of multiple static and dynamic gait parameters. Mice were placed on one end of the catwalk and allowed free exploration for 3 min or until they have 5 compliant trials, whichever comes first. Data were exported and classified using the Catwalk software. An average of classified trials was used for data analysis. Measures of interest include but are not limited to: print position or the distance between the position of the hind paw and previous placement of the ipsilateral front paw, initial and terminal dual stances, paw swing speed, and paw stand or the duration of paw contact with the glass plate in a step cycle.

Behavioral statistics

- [0273] Statistical analyses for all behavioral tests were conducted using GraphPad Prism (GraphPad Software, Inc., La Jolla, CA). For NOR, data were analyzed using either a paired t-test for within-group analyses or by an ANOVA followed by a Dunnett's post-hoc test for between group analyses. For MWM, a repeated MWM ANOVA was used to analyze the acquisition phase and a one-way ANOVA followed by Dunnett's post-hoc for probe trial analyses.

Results

- [0274] *In vivo* acute tolerability for the oligomers determined based on the above assays is shown in Figure 5. *In vivo* cumulative tolerability threshold following an ICV injection of 100 µg of an oligomer was set at 4.
- [0275] Furthermore, the correlation between the sequence score of each oligomer and the *in vivo* acute tolerability of the oligomer was studied. The correlation analysis shows that

the oligomers having *in vivo* tolerability lower than 4 tend to have a sequence score equal to or higher than 0.2. See Figure 3. Therefore, Figure 3 indicates that the sequence score of oligomers can be used to predict *in vivo* tolerability of the oligomers.

Example 7: *In Vitro* Reduction in Tau Protein

[0276] Each of the oligomers targeting the 3' UTR of an *MAPT* transcript was tested for its ability to decrease Tau protein in mouse primary neurons expressing the entire human *MAPT* gene as a bacmid containing transgene (C57-bl6 BAC-Tg hTau; Polydoro et. al., *J. Neurosci.* (2009) 29 (34): 10747-9). Primary hTau mouse embryonic forebrain neuronal cultures do not express endogenous mouse tau as mouse tau was knocked out. Primary neurons were generated by papain digestion according to manufacturer's protocol (Worthington Biochemical Corporation, LK0031050). Briefly, forebrains were dissected from hTau mouse E18 BAC-Tg embryos expressing the entire human microtubule-associated protein Tau (*MAPT*) gene on a murine *MAPT*-null background and were incubated at 37°C for 30-45 minutes in papain/DNase/Earle's balanced salt solution (EBSS) solution. After trituration and centrifugation of cell pellet, the reaction was stopped by incubation with EBSS containing protease inhibitors, bovine serum albumin (BSA) and DNase. The cells were trituated and washed with Neurobasal (NB, Invitrogen) supplemented with 2% B-27, 100 µg/ml penicillin, 85 µg/ml streptomycin, and 0.5mM glutamine. The cells were plated in supplemented NB media onto poly-D-lysine-coated 96-well optical imaging plates (BD Biosciences) at 15,000 cells/well.

[0277] After obtaining the primary hTau mouse embryonic forebrain neuronal cultures expressing a human *MAPT* gene, the cultures were treated with oligomers to inhibit the Tau mRNA and protein expression. The cultures were then subject to immunocytochemistry and imaging to measure the inhibition. One day post plating (DIV 1), half of the supplemented neurobasal (NB) media on the primary hTau mouse embryonic forebrain neuronal cultures was removed and replaced with supplemented NB media containing various concentrations of LNA oligomers. Primary hTau neuronal cultures were cultured with LNA oligomers until 13 days post plating (DIV 13). On DIV 13, the cultures were rinsed with Dulbecco's phosphate-buffered saline lacking calcium and magnesium (DPBS, Invitrogen) and fixed in 4% paraformaldehyde/4% sucrose/DPBS for 15 min. Cultures were rinsed and then blocked and permeabilized in

DPBS plus 0.1% Triton X-100 (TX-100) and 3% BSA for one hour at room temperature. Cultures were rinsed and then incubated for two hours at room temperature with primary antibody 1:500, Tau5 antibody to measure Tau protein, Invitrogen AHB0042; and 1:500, β -III tubulin (TuJ-1) antibody to measure neurite area, Abcam ab41489) in DPBS plus 3% BSA and 0.1% TX-100. Cultures were rinsed and incubated with Hoeschst 33342 nuclear dye (1:800, Invitrogen) and AlexaFluor fluorescence-conjugated secondary antibodies (Invitrogen, 1:500) in DPBS plus 3% BSA and 0.1% TX-100 for one hour at room temperature. Cultures were rinsed abundantly and stored in DPBS until imaging. Imaging was conducted using the Cellomics VTi automated immunofluorescence imaging system. In brief, using untreated wells, saturation levels for each fluorophore channel were set to 70%. Then 12 sequential images were acquired from each well, and total fluorescence intensity and total fluorescence area were calculated for both Tau and TuJ-1 proteins using the Cellomics VTi SpotDetector (version 4) image analysis software. To evaluate Tau protein reduction resulting from oligomer treatment, a Tau5 total fluorescence intensity-to-TuJ-1 total fluorescence area ratio (Tau/TuJ-1) was created for each well and then all data were normalized to the average Tau/TuJ-1 ratio of the untreated wells. TuJ-1 intensity acts as an internal standard for each sample. To evaluate neurite/neuronal toxicity from oligomer treatment, the TuJ-1 total fluorescence area from each well was normalized to the average TuJ-1 total fluorescence area of the untreated wells. Nuclei counts from each well were also acquired as an alternative measure of toxicity associated with LNA oligomer treatment. Data are expressed as mean $\pm$ S.D. For immunocytochemistry, data points represent the mean $\pm$ S.D. from wells treated in triplicate. Potency values were generated using wells treated with a broad concentration range of LNA oligomer, from which the resulting normalized Tau/TuJ-1 and TuJ-1 values were analyzed compared to normalized values from saline control samples. Analysis was done using non-linear regression with top and bottom values set at fixed values of 100% and 0%, respectively, where 100% inhibition represents a complete reduction of signal compared to the control sample (Figure 3). For qPCR, data were analyzed using a one-way ANOVA with a Dunnett's multiple comparison test to compare saline- and LNA oligomer-treated groups. Statistical significance was set at a value of $p < 0.05$.

[0278] The reduction of Tau protein by each oligomer was compared with saline. The results of the Tau protein reduction compared to Saline are shown in Figure 6. If the Tau protein level in antisense oligonucleotide treated neurons was equal to or higher than in

control cells, percent inhibition is expressed as zero inhibition. If present, 'N.D.' indicates 'not determined' and 'TBD' indicates 'to be determined'.

Example 8: Oligomer Prioritization

[0279] Properties of selected oligomers can be described as shown in Table 1. Based on these criteria, certain oligomers were selected for additional dose-response testing *in vitro* and *in vivo*.

Table 1: Summary of criteria used to prioritize oligomers for additional testing.

Assay	Prioritization Criteria
Tau protein reduction	>70% reduction in Tau protein (5 μ M oligomer)
Calcium oscillations	<25% reduction in calcium oscillations
Sequence score	Sequence score ≥ 0.20

[0280] In other embodiment, oligomers can be selected based on the following characteristics: (1) Tau protein reduction >30% reduction in Tau protein (5 μ M oligomer); (2) calcium oscillations <25% reduction in calcium oscillations; and (3) sequence score equal to or higher than 0.2.

CLAIMS

1. A method of testing or determining *in vivo* acute neurotoxicity of a molecule comprising measuring calcium oscillations *in vitro* in neuronal cells which are in contact with the molecule.
2. The method of claim 1, wherein the calcium oscillations in the neuronal cells that are in contact with the molecule are about 70% or higher, about 75% or higher, about 80% or higher, about 85% or higher, about 90% or higher, about 95% or higher, about 96% or higher, about 97% or higher, about 98% or higher, about 99% or higher, about 100% or higher, about 120% or higher, about 140% or higher, about 160% or higher, about 180% or higher, about 200% or higher, about 220% or higher, about 240% or higher, or about 250% or higher compared to the calcium oscillations in vehicle control cells.
3. A method of selecting or identifying a molecule having tolerable *in vivo* acute neurotoxicity comprising measuring calcium oscillations *in vitro* in neuronal cells which are in contact with the molecule, wherein the neuronal cells in contact with the molecule exhibit calcium oscillations at a level comparable to or higher than that of vehicle control cells.
4. The method of claim 3, wherein the calcium oscillations in the neuronal cells that have been in contact with the molecule are about 70% or higher, about 75% or higher, about 80% or higher, about 85% or higher, about 90% or higher, about 95% or higher, about 96% or higher, about 97% or higher, about 98% or higher, about 99% or higher, about 100% or higher, about 120% or higher, about 140% or higher, about 160% or higher, about 180% or higher, about 200% or higher, about 220% or higher, about 240% or higher, or about 250% or higher compared to the calcium oscillations in the vehicle control cells.
5. The method of any one of claims 1 to 4, wherein the molecule comprises a small molecule, a polynucleotide, a protein, a peptide, or any combination thereof.

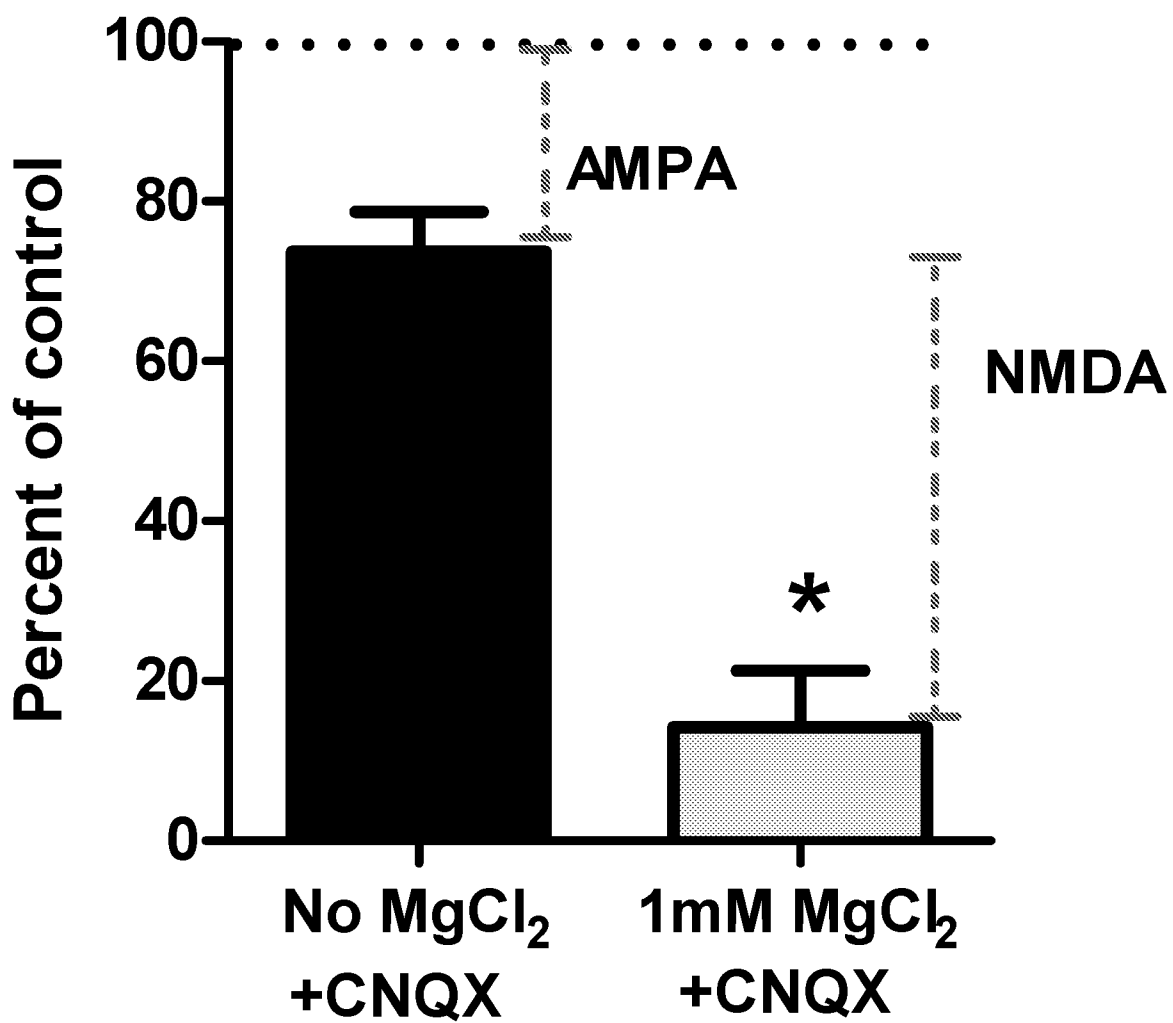
6. The method of any one of claims 1 to 5, wherein the calcium oscillations are AMPA receptor-dependent calcium oscillations.
7. The method of any one of claims 1 to 6, wherein the calcium oscillations are measured in the presence of Mg^{2+} ions.
8. The method of claim 1 or 3, wherein the molecule comprises a polynucleotide, the method further comprising calculating a sequence score, wherein the sequence score is calculated by formula (I):
(number of C nucleotides or analogs thereof in the polynucleotide – number of G nucleotides or analogs thereof in the polynucleotide) / total nucleotide length (number) of the polynucleotide (I).
9. A method of determining *in vivo* acute neurotoxicity of a molecule comprising a polynucleotide, the method comprising calculating a sequence score, wherein the sequence score is calculated by formula (I):
(number of C nucleotides or analogs thereof in the polynucleotide – number of G nucleotides or analogs thereof in the polynucleotide) / total nucleotide length (number) of the polynucleotide (I).
10. A method of selecting a molecule comprising a polynucleotide having tolerable *in vivo* acute neurotoxicity comprising calculating a sequence score using formula (I):
(number of C nucleotides or analogs thereof in the polynucleotide – number of G nucleotides or analogs thereof in the polynucleotide) / total nucleotide length (number) of the polynucleotide (I),
wherein the polynucleotide has a sequence score of greater than or equal to 0.2.
11. The method of any one of claims 1 to 10, further comprising measuring an *in vivo* tolerability of the molecule.
12. The method of claim 11, wherein the tolerability category is selected from the group consisting of: 1) hyperactivity; 2) decreased activity and arousal; 3) motor dysfunction

and/or ataxia; 4) abnormal posture and breathing; 5) tremor and/or convulsions, and two or more combinations thereof.

13. The method of claim 12, wherein the molecule exhibits a sum of the *in vivo* tolerability scores between 0 and 8.
14. The method of any one of claims 1 to 13, further comprising measuring a behavioral test score of the molecule.
15. The method of claim 14, wherein the behavioral test is a short term memory test, a spatial learning and memory test, a gait analysis test, or any combination thereof.
16. The method of any one of claims 1 to 15, further comprising measuring tubulin intensity of the molecule in a culture of neuronal cells.
17. The method of claim 16, wherein the molecule reduces less than about 25%, less than about 20%, less than about 15%, less than about 10%, less than about 5%, or less than about 1% of the tubulin intensity in the culture of neuronal cells.
18. The method of any one of claims 1 to 17, wherein when the molecule is administered to laboratory animals, more than 20% of the animals survive.
19. A molecule selected from the method of any one of claims 1 to 18.
20. A method of treating a disease or condition comprising administering the molecule of claim 19.

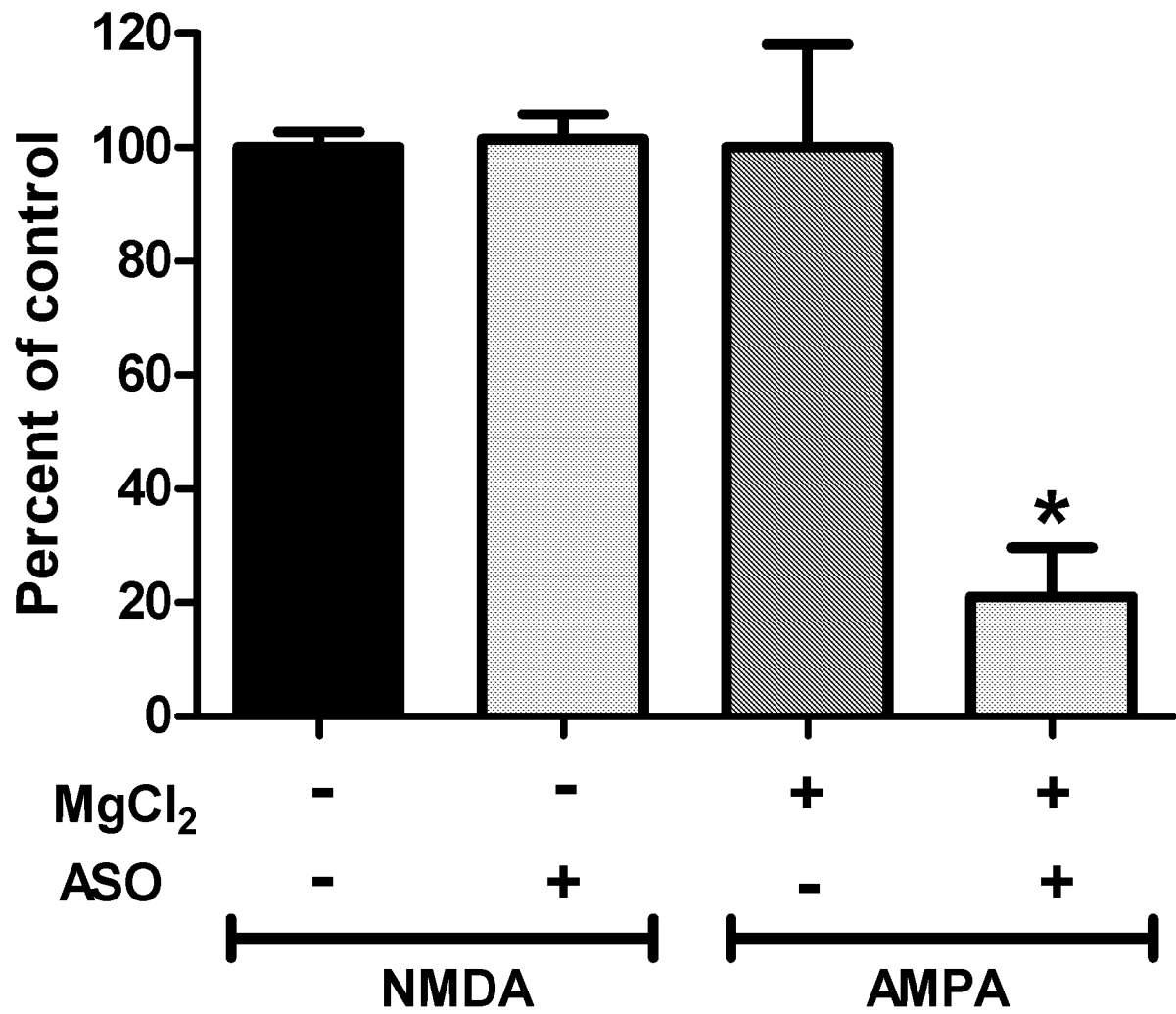
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Figure 1



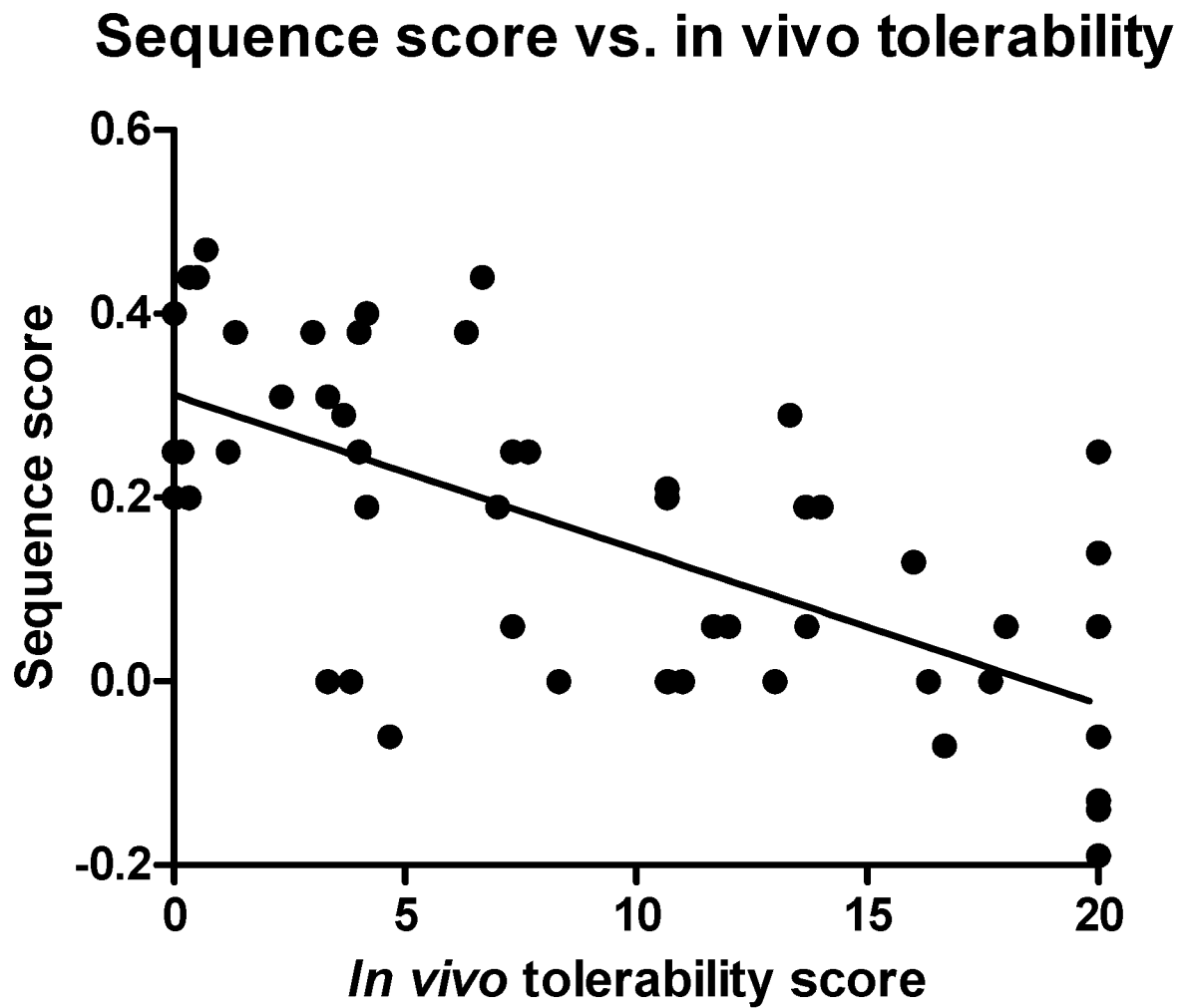
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Figure 2



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Figure 3



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Figure 4

Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-001167	ASO-001167	AAAgatgaaatttgctCTA	4	134947	134966	>100%
ASO-001168	ASO-001168	GAAgatgaaatttgctCTT	5	134948	134967	100%
ASO-001169	ASO-001169	GGAaagatgaaatttgctCT	6	134949	134968	74%
ASO-000829	ASO-000829	AAGatgaaatttgctCTC	7	134950	134965	>100%
ASO-001170	ASO-001170	TGGaagatgaaatttgCTC	8	134950	134969	6%
ASO-001171	ASO-001171	TTGgaaagatgaaatttgCT	9	134951	134970	1%
ASO-001172	ASO-001172	TTTggaaagatgaaattTGC	10	134952	134971	8%
ASO-001173	ASO-001173	ATTtggaaagatgaaattTG	11	134953	134972	0%
ASO-001174	ASO-001174	AATtggaaagatgaaattTT	12	134954	134973	0%
ASO-001175	ASO-001175	CAAttggaaagatgaaATT	13	134955	134974	4%
ASO-001176	ASO-001176	TCAattggaaagatgaAAT	14	134956	134975	0%
ASO-001177	ASO-001177	ATCaattggaaagatgAAA	15	134957	134976	10%
ASO-001178	ASO-001178	CATcaattggaaagatGAA	16	134958	134977	62%
ASO-001181	ASO-001181	ACCatcaatttggaaaGAT	17	134961	134980	73%
ASO-001179	ASO-001179	CCAtcaatttggaaagaTGA	18	134959	134978	52%
ASO-001180	ASO-001180	CCCatcaatttggaaagATG	19	134960	134979	58%
ASO-001182	ASO-001182	CACcatcaatttggaaAGA	20	134962	134981	92%
ASO-001183	ASO-001183	CCAccatcaatttggaaAAG	21	134963	134982	58%
ASO-001184	ASO-001184	CCCaccatcaatttggAAA	22	134964	134983	12%
ASO-001062	ASO-001062	GCCcaccatcaatttgGAA	23	134965	134984	1%
ASO-001063	ASO-001063	TAGcccaccatcaattTGG	24	134967	134986	8%
ASO-001064	ASO-001064	CTAgcccaccatcaatTTG	25	134968	134987	0%
ASO-001065	ASO-001065	ACTagcccaccatcaaTTT	26	134969	134988	13%
ASO-001066	ASO-001066	TACtagcccaccatcaATT	27	134970	134989	54%
ASO-000830	ASO-000830	TACtagcccaccATC	28	134974	134989	>100%
ASO-000260	ASO-000260	CCCtcttctacatGGA	29	135077	135092	
ASO-000305	ASO-000305	TGCctctgtgacaCCC	30	135171	135186	
ASO-000304	ASO-000304	TTCaatcctttgTTG	31	135194	135209	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000324	ASO-000324	CACacaaggttgCAT	32	135242	135257	
ASO-000268	ASO-000268	CGTcacactcacaCAA	33	135251	135266	
ASO-000223	ASO-000223	GCCaccaaggacaGGC	34	135441	135456	
ASO-000224	ASO-000224	CAGcttgcttctCTT	35	135533	135548	
ASO-000319	ASO-000319	ATCaaggtcagtcTTT	36	135585	135600	
ASO-000208	ASO-000208	CCTtcagaactcaATA	37	135690	135705	
ASO-000689	ASO-000689	AAAgctccaggtcTGC	38	135737	135752	
ASO-000434	ASO-000434	CTAaagctccagTCT	39	135739	135754	59%
ASO-000409	ASO-000409	TAAagctccagTCT	40	135739	135753	>100%
ASO-000432	ASO-000432	CCTaaagctccagGTC	41	135740	135755	63%
ASO-000391	ASO-000391	TAAagctccagGTC	42	135740	135753	72%
ASO-001779	ASO-001779	TAGccctaaagctccagGTC	43	135740	135759	54%
ASO-000899	ASO-000899	CTAaagctccagGTC	44	135740	135754	
ASO-000398	ASO-000398	CCCTaaagctccaGGT	45	135741	135756	76%
ASO-001778	ASO-001778	TTAgccctaaagctccaGGT	46	135741	135760	86%
ASO-000414	ASO-000414	GCCctaaagctccAGG	47	135742	135757	42%
ASO-000403	ASO-000403	CCCTaaagctccAGG	48	135742	135756	72%
ASO-001780	ASO-001780	GTTagccctaaagctccAGG	49	135742	135761	28%
ASO-000433	ASO-000433	GCCctaaagctccCAG	50	135743	135757	34%
ASO-000411	ASO-000411	CCCTaaagctccCAG	51	135743	135756	51%
ASO-001781	ASO-001781	GGTtagccctaaagctccCAG	52	135743	135762	37%
ASO-000389	ASO-000389	TAGccctaaagctCCA	53	135744	135759	96%
ASO-001939	ASO-001939	TAGccctaaagctCCA	54	135744	135759	>100%
ASO-001932	ASO-001932	TAGccctaaagctCCA	55	135744	135759	86%
ASO-001925	ASO-001925	TAGccctaaagctCCA	56	135744	135759	>100%
ASO-001924	ASO-001924	TAGccctaaagctCCA	57	135744	135759	100%
ASO-001952	ASO-001952	TAGccctaaagctCCA	58	135744	135759	79%
ASO-001931	ASO-001931	TAGccctaaagctCCA	59	135744	135759	83%
ASO-001953	ASO-001953	TAGccctaaagctCCA	60	135744	135759	97%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-001945	ASO-001945	TAGccctaaagtcCCA	61	135744	135759	68%
ASO-001946	ASO-001946	TAGccctaaagtcCCA	62	135744	135759	>100%
ASO-001971	ASO-001971	TAGccctaaagtcCCA	63	135744	135759	81%
ASO-001938	ASO-001938	TAGccctaaagtcCCA	64	135744	135759	87%
ASO-001959	ASO-001959	TAGccctaaagtcCCA	65	135744	135759	83%
ASO-001965	ASO-001965	TAGccctaaagtcCCA	66	135744	135759	83%
ASO-001782	ASO-001782	TGGttagccctaaagtcCCA	67	135744	135763	75%
ASO-000900	ASO-000900	TAGccctaaagtcCCA	68	135744	135759	
ASO-000435	ASO-000435	TTAgccctaaagtCCC	69	135745	135760	29%
ASO-000423	ASO-000423	GTTtagccctaaagTCC	70	135746	135761	>100%
ASO-000442	ASO-000442	TAGccctaaagTCC	71	135746	135759	88%
ASO-000416	ASO-000416	GGTtagccctaaagTTC	72	135747	135762	
ASO-000438	ASO-000438	GTTtagccctaaAGT	73	135748	135761	61%
ASO-000581	ASO-000581	ACTgggttagccctAAA	74	135750	135765	4%
ASO-000639	ASO-000639	AACTgggttagcccTAA	75	135751	135766	31%
ASO-000558	ASO-000558	GAActgggttagccCTA	76	135752	135767	80%
ASO-000597	ASO-000597	GAGaactgggttagCCC	77	135754	135769	2%
ASO-000245	ASO-000245	TACaaagagaactGGT	78	135760	135775	
ASO-000897	ASO-000897	CACaagtccttacAAA	79	135770	135785	
ASO-000185	ASO-000185	GGCacaagtccttACA	80	135772	135787	
ASO-000426	ASO-000426	AGGcacaagtcctTTA	81	135774	135788	>100%
ASO-000417	ASO-000417	GAGgcacaagtcctTTA	82	135774	135789	76%
ASO-000393	ASO-000393	AGAggcacaagtcCTT	83	135775	135790	78%
ASO-000449	ASO-000449	AAGaggcacaagtcCCT	84	135776	135791	82%
ASO-000406	ASO-000406	AGAggcacaagtcCCT	85	135776	135790	74%
ASO-000392	ASO-000392	CCAagaggcacaagTTC	86	135778	135793	74%
ASO-000444	ASO-000444	CAAgaggcacaagTTC	87	135778	135792	>100%
ASO-000443	ASO-000443	CCCaaaggcacaagTTC	88	135779	135794	90%
ASO-000450	ASO-000450	CAAgaggcacaagTTC	89	135779	135792	36%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000258	ASO-000258	CTCccaagaggcaCAA	90	135781	135796	
ASO-000205	ASO-000205	TGGcctgggaagGAC	91	135876	135891	
ASO-000213	ASO-000213	GGTgaggctgggaATT	92	135984	135999	
ASO-000293	ASO-000293	GTGaggctgggaATT	93	135984	135998	
ASO-000321	ASO-000321	TGGtgaggctgggAAT	94	135985	136000	
ASO-000226	ASO-000226	CTCagtatggagtAGG	95	136040	136055	
ASO-000682	ASO-000682	AATttcacctcaGTA	96	136049	136064	73%
ASO-000673	ASO-000673	TTAatttcacctCAG	97	136051	136066	42%
ASO-000578	ASO-000578	CTTaatttcacccTCA	98	136052	136067	40%
ASO-000540-21	ASO-002180	CCTTaatttcaccCTCA	99	136052	136068	
ASO-000540-22	ASO-002192	CCTTaatttcacCctCA	100	136052	136068	
ASO-000540-23	ASO-002109	CCTTaatttcacCctCA	101	136052	136068	
ASO-000540-24	ASO-002121	TcCctTaatttcaccCT	102	136054	136070	
ASO-000540-25	ASO-002133	TcCCTaatttcaccCT	103	136054	136070	
ASO-000540-26	ASO-002145	TcCCTaatttcAccCT	104	136054	136070	
ASO-000540-27	ASO-002157	TcCCTTaatttcaccCT	105	136054	136070	
ASO-000540-28	ASO-002169	TCcCTTaatttcaccCT	106	136054	136070	
ASO-000540-29	ASO-002181	TCCcttaatttcacCCT	107	136054	136070	
ASO-000540-3	ASO-002154	CCCTtaatttcacCcTC	108	136053	136069	
ASO-000540-42	ASO-002147	CCCTtaatttcacccTCA	109	136052	136069	
ASO-000540-43	ASO-002159	CCCTtaatttcaccCtCA	110	136052	136069	
ASO-000540-44	ASO-002171	CCCTtaatttcaccCTCA	111	136052	136069	
ASO-000540-45	ASO-002183	CCCTtaatttcacCctCA	112	136052	136069	
ASO-000540-46	ASO-002195	CCCTtaatttcacCcTCA	113	136052	136069	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000540-47	ASO-002196	CCCTtaatttcaCcctCA	114	136052	136069	
ASO-000540-48	ASO-002200	CCCTtaatttcaCccTCA	115	136052	136069	
ASO-000540-49	ASO-002204	CCCTtaatttcaCcCtCA	116	136052	136069	
ASO-000540-5	ASO-002178	CCCTtaatttcAcccTC	117	136053	136069	
ASO-000540-50	ASO-002208	CCCTtaatttcAccCtCA	118	136052	136069	
ASO-000540-51	ASO-002212	CCCTtaatttcAcCctCA	119	136052	136069	
ASO-000540-52	ASO-002216	TcCCTtaatttcacCcTC	120	136053	136070	
ASO-000540-53	ASO-002220	TcCCTtaatttcacccTC	121	136053	136070	
ASO-000540-54	ASO-002224	TcCCTtaatttcacCcTC	122	136053	136070	
ASO-000540-55	ASO-002197	TCCcttaatttcaccCTC	123	136053	136070	
ASO-000540-69	ASO-002222	TCCcTtaatttcacCctCA	124	136052	136070	
ASO-000540-70	ASO-002226	TCCCTtaatttcaccCTCA	125	136052	136070	
ASO-000540-71	ASO-002199	TCCCTtaatttcacCcTCA	126	136052	136070	
ASO-000540-72	ASO-002203	TCCCTtaatttcacCctCA	127	136052	136070	
ASO-000540-73	ASO-002207	TCCCTtaatttcaCcCtCA	128	136052	136070	
ASO-000540-74	ASO-002211	TCCCTtaatttcACcCtCA	129	136052	136070	
ASO-000540-75	ASO-002215	TCCCTtaatttcaccCTCA	130	136052	136070	
ASO-000540-76	ASO-002219	TCCCTtaatttcacCctCA	131	136052	136070	
ASO-000540-77	ASO-002223	TCCCTtaatttcacCCTCA	132	136052	136070	
ASO-000540-8	ASO-002119	CCCTtaatttcaccCTC	133	136053	136069	
ASO-000540-9	ASO-002131	CCCTtaatttcacCcTC	134	136053	136069	
TBD-mm10	ASO-002382	CCCTgATtgcgcctCA	135	136053	136069	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
TBD-mm11	ASO-002299	CCttgATttcacctCT	136	136052	136068	
TBD-mm12	ASO-002311	CCttaGTTtcacccctCG	137	136054	136070	
TBD-mm19	ASO-002300	CCcttgatttcacccctCA	138	136052	136069	
TBD-mm20	ASO-002312	CCcttaatttcacccctCG	139	136054	136071	
TBD-mm21	ASO-002324	CCcttagtttcacccctCA	140	136052	136069	
TBD-mm22	ASO-002336	CCcttgatttcgacccctCA	141	136052	136069	
TBD-mm23	ASO-002348	CCcttgatttcacccctCG	142	136053	136070	
TBD-mm24	ASO-002360	CCcttgatttcacccctCT	143	136052	136069	
TBD-mm31	ASO-002349	TCcCTtgatttcacCctCA	144	136053	136071	
TBD-mm32	ASO-002361	TCcCTaatttcacCctCG	145	136052	136070	
TBD-mm33	ASO-002373	ACcCTaatttcacCctCA	146	136053	136071	
TBD-mm34	ASO-002385	TCcCTtgatttcgacCctCA	147	136052	136070	
TBD-mm35	ASO-002302	TCcCTtagtttcacCctCG	148	136054	136072	
TBD-mm36	ASO-002314	ACcCTtgatttcacCctCA	149	136054	136072	
TBD-mm7	ASO-002346	CCttgATttcacccctCA	150	136053	136069	
TBD-mm8	ASO-002358	CCttaGTTtcacccctCA	151	136053	136069	
TBD-mm9	ASO-002370	CCttaATttcacccctCG	152	136052	136068	
ASO-000540	ASO-000540	CCTtaatttcaccCTC	153	136053	136068	>100%
ASO-000555	ASO-000555	CTTaatttcaccCTC	154	136053	136067	>100%
ASO-000579	ASO-000579	TTAatttcaccCTC	155	136053	136066	44%
ASO-000540-1	ASO-002130	CCCTtaatttcaccTC	156	136053	136069	
ASO-000540-10	ASO-002143	CCCTtaatttcaccCTC	157	136053	136069	
ASO-000540-11	ASO-002155	CCCTtaatttcacCcTC	158	136053	136069	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000540-12	ASO-002167	CCCTtaatttcacCCTC	159	136053	136069	
ASO-000540-13	ASO-002179	CCCTtaatttcacCcTC	160	136053	136069	
ASO-000540-14	ASO-002191	CCttaATttcacctCA	161	136052	136068	
ASO-000540-15	ASO-002108	CCTtaatttcacccTCA	162	136052	136068	
ASO-000540-16	ASO-002120	CCTtaaTttcacctCA	163	136052	136068	
ASO-000540-17	ASO-002132	CCTtaAtttcacctCA	164	136052	136068	
ASO-000540-18	ASO-002144	CCTtaATttcacctCA	165	136052	136068	
ASO-000540-19	ASO-002156	CCTtaATttcacccTCA	166	136052	136068	
ASO-000540-2	ASO-002142	CCCTtaatttcacCCTC	167	136053	136069	
ASO-000540-20	ASO-002168	CCTTaatttcacCcCA	168	136052	136068	
ASO-000540-56	ASO-002201	TCCctaatttcacCcTC	169	136053	136070	
ASO-000540-57	ASO-002205	TCCcTtaatttcacccTC	170	136053	136070	
ASO-000540-58	ASO-002209	TCCcTtaatttcacCcTC	171	136053	136070	
ASO-000540-59	ASO-002213	TCCcTtaatttcacCcTC	172	136053	136070	
ASO-000540-6	ASO-002190	CCCTtaatttcAcCcTC	173	136053	136069	
ASO-000540-60	ASO-002217	TCCcTtaatttcAcCcTC	174	136053	136070	
ASO-000540-61	ASO-002221	TCCCTtaatttcacCCTC	175	136053	136070	
ASO-000540-62	ASO-002225	TCCCTtaatttcacCcCTC	176	136053	136070	
ASO-000540-63	ASO-002198	TCCCTtaatttcacCcTC	177	136053	136070	
ASO-000540-64	ASO-002202	TCCCTtaatttcacCcTC	178	136053	136070	
ASO-000540-65	ASO-002206	TCCCTtaatttcacCcTC	179	136053	136070	
ASO-000540-66	ASO-002210	TCcCTtaatttcacCcCA	180	136052	136070	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000540-67	ASO-002214	TCCcttaatttcacccTCA	181	136052	136070	
ASO-000540-68	ASO-002218	TCCcTtaatttcaccCtCA	182	136052	136070	
ASO-000540-mm1	ASO-002297	CCTtgatttcaccCTC	183	136053	136068	
ASO-000540-mm2	ASO-002309	CCTtaatttcgccCTC	184	136053	136068	
ASO-000540-mm3	ASO-002321	CCTtagtttcaccCTC	185	136053	136068	
ASO-000540-mm4	ASO-002333	CCTtgatttcgccCTC	186	136053	136068	
ASO-000540-mm5	ASO-002345	CCTtgatttcaccCTC	187	136053	136068	
ASO-000540-mm6	ASO-002357	CCTtagtttcgccCTC	188	136053	136068	
TBD-mm1	ASO-002369	CCCTtgatttcacccTC	189	136052	136068	
TBD-mm2	ASO-002381	CCCTtagtttcacccTC	190	136053	136069	
TBD-mm25	ASO-002372	TcCCTtgatttcacCcTC	191	136052	136069	
TBD-mm26	ASO-002384	TcCCTtaatttcgcCcTC	192	136052	136069	
TBD-mm27	ASO-002301	TcCCTtagtttcacCcTC	193	136052	136069	
TBD-mm28	ASO-002313	TcCCTtgatttcgcCcTC	194	136054	136071	
TBD-mm29	ASO-002325	TcCCTtagtttcgcCcTC	195	136052	136069	
TBD-mm3	ASO-002298	CCCTtaatttcgccTC	196	136053	136069	
TBD-mm30	ASO-002337	AcCCTtgatttcacCcTC	197	136053	136070	
TBD-mm4	ASO-002310	CCCTtgatttcgccTC	198	136054	136070	
TBD-mm5	ASO-002322	CCCTtgatttcacccTC	199	136052	136068	
TBD-mm6	ASO-002334	CCCTtagtttcgccTC	200	136052	136068	
ASO-000662	ASO-000662	CCCTtaatttcacCCT	201	136054	136069	81%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000566	ASO-000566	CCTtaatttcacCCT	202	136054	136068	>100%
ASO-000540-30	ASO-002193	TCCcTtaatttcaccCT	203	136054	136070	
ASO-000540-31	ASO-002110	TCCcTtaatttcAccCT	204	136054	136070	
ASO-000540-32	ASO-002122	TCCcTTaatttcaccCT	205	136054	136070	
ASO-000540-33	ASO-002134	TCCcTtaatttcacCCT	206	136054	136070	
ASO-000540-34	ASO-002146	TCCcTtaatttcacCCT	207	136054	136070	
ASO-000540-35	ASO-002158	TCCcTtaatttcacCCT	208	136054	136070	
ASO-000540-36	ASO-002170	TCCcTtaatttcacCCT	209	136054	136070	
ASO-000540-37	ASO-002182	CCcTtaatttcaccctCA	210	136052	136069	
ASO-000540-38	ASO-002194	CCcTtaatttcaccctCA	211	136052	136069	
ASO-000540-39	ASO-002111	CCcTtaatttcacCctCA	212	136052	136069	
ASO-000540-4	ASO-002166	CCcTtaatttcacCctCA	213	136053	136069	
ASO-000540-40	ASO-002123	CCcTtaatttcacCctCA	214	136052	136069	
ASO-000540-41	ASO-002135	CCcTtaatttcacCctCA	215	136052	136069	
TBD-mm13	ASO-002323	TcCCTgatttcaccCT	216	136053	136069	
TBD-mm14	ASO-002335	TcCCTaatttcaccCA	217	136052	136068	
TBD-mm15	ASO-002347	TcCCTaatttcaccCT	218	136053	136069	
TBD-mm16	ASO-002359	TcCCTgatttcaccCA	219	136053	136069	
TBD-mm17	ASO-002371	TcCCTgatttcaccCG	220	136052	136068	
TBD-mm18	ASO-002383	TcCCTagtttcaccCT	221	136052	136068	
ASO-000628	ASO-000628	CCTtaatttcacCCC	222	136055	136068	67%
ASO-000642	ASO-000642	CCcTtaatttcacCCC	223	136055	136069	>100%
ASO-000274	ASO-000274	TCCcTtaatttcacCCC	224	136055	136070	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000339	ASO-000339	CCttaattcaCCC	225	136055	136068	
ASO-000536	ASO-000536	TTCcctaatttcACC	226	136056	136071	>100%
ASO-000603	ASO-000603	TCCcctaatttcACC	227	136056	136070	80%
ASO-000666	ASO-000666	TCCcctaatttcCAC	228	136057	136070	>100%
ASO-000272	ASO-000272	AGAgtagagagctGGG	229	136099	136114	
ASO-000255	ASO-000255	TGGatgagtggaaCTG	230	136115	136130	
ASO-000336	ASO-000336	GGAtgagtggaaACT	231	136116	136129	
ASO-000206	ASO-000206	GTTggatgagtGAA	232	136118	136132	
ASO-000271	ASO-000271	AGTtggatgagtGGA	233	136119	136133	
ASO-000340	ASO-000340	GTTggatgagtGGA	234	136119	136132	
ASO-000229	ASO-000229	CAGggaaccgaatCAG	235	136160	136175	
ASO-000273	ASO-000273	GCCctggctcacaTCT	236	136193	136208	
ASO-000264	ASO-000264	ACAaggcagaaacACC	237	136229	136244	
ASO-000341	ASO-000341	TGTcaacaaggCAG	238	136236	136249	
ASO-000198	ASO-000198	TGCcttggtgccTTG	239	136355	136370	
ASO-000210	ASO-000210	AGCgggactgtggGCC	240	136371	136386	
ASO-000342	ASO-000342	GGgacagcgggACT	241	136378	136391	
ASO-000333	ASO-000333	GCGggctgggctgTCT	242	136427	136442	
ASO-000199	ASO-000199	CAGaacagacagcATG	243	136541	136556	
ASO-000280	ASO-000280	TCTatgtatatgtTCA	244	136567	136582	
ASO-000211	ASO-000211	ATCtatgtatatgtTTC	245	136568	136583	
ASO-000347	ASO-000347	CATctatgtataTGT	246	136570	136584	
ASO-000352	ASO-000352	ACAAtctatgtataTGT	247	136570	136585	
ASO-000232	ASO-000232	CAAcagggtgcagATG	248	136600	136615	
ASO-000257	ASO-000257	AGCataaacagacAAA	249	136629	136644	
ASO-000388	ASO-000388	ATAgctactctggTGA	250	136650	136665	86%
ASO-000390	ASO-000390	TAGtctactctggTGA	251	136650	136664	78%
ASO-000413	ASO-000413	AGTcactctggTGA	252	136650	136663	97%
ASO-000405	ASO-000405	CATagctactctgGTG	253	136651	136666	2%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000430	ASO-000430	TAGtcactctgGTG	254	136651	136664	82%
ASO-000447	ASO-000447	TCAtagtcactctGGT	255	136652	136667	86%
ASO-000396	ASO-000396	TACatgcgtccTTT	256	136693	136706	92%
ASO-000395	ASO-000395	GATacatgcgtccTTT	257	136693	136708	>100%
ASO-000394	ASO-000394	AAGatacatgcgtCCT	258	136695	136710	>100%
ASO-000421	ASO-000421	TTCaagatacatgCGT	259	136698	136713	
ASO-000400	ASO-000400	ATTtcaagatacaTGC	260	136700	136715	
ASO-000248	ASO-000248	GCAtttcaagataCAT	261	136702	136717	
ASO-000451	ASO-000451	AAGcattttcaagaTAC	262	136704	136719	67%
ASO-000707	ASO-000707	ACAagcatttcaaGAT	263	136706	136721	
ASO-000619	ASO-000619	TTAcaagcatttcAAG	264	136708	136723	37%
ASO-000671	ASO-000671	AACctctttacaaGCA	265	136715	136730	
ASO-000221	ASO-000221	GTTagaacaccttTTA	266	136721	136736	
ASO-000298	ASO-000298	CCAcacaggccacACG	267	136776	136791	
ASO-000311	ASO-000311	GTCTctgttgggtCCC	268	136842	136857	
ASO-000290	ASO-000290	TGAacggcctcctTAG	269	136871	136886	
ASO-000437	ASO-000437	CTGtgcttcaggcCTT	270	136896	136911	51%
ASO-000446	ASO-000446	TCCtggtgcttcagGCC	271	136898	136913	76%
ASO-000685	ASO-000685	AATcctgtgcttcAGG	272	136900	136915	73%
ASO-000410	ASO-000410	TCCtggtgcttcAGG	273	136900	136913	>100%
ASO-000604	ASO-000604	AATcctgtgcttcCAG	274	136901	136915	57%
ASO-000490	ASO-000490	TAAcctgtgcttcCAG	275	136901	136916	76%
ASO-000529	ASO-000529	AATcctgtgctTCA	276	136902	136915	10%
ASO-000532	ASO-000532	CTAatcctgtgctTCA	277	136902	136917	100%
ASO-000508	ASO-000508	TAAcctgtgctTCA	278	136902	136916	87%
ASO-000219	ASO-000219	CCTaatcctgtgcTTC	279	136903	136918	
ASO-000656	ASO-000656	TAAcctgtgcTTC	280	136903	136916	2%
ASO-000522	ASO-000522	CTAatcctgtgcTTC	281	136903	136917	73%
ASO-000513	ASO-000513	CCTaatcctgtgCTT	282	136904	136918	58%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000640	ASO-000640	TCCtaatcctgtgCTT	283	136904	136919	23%
ASO-000661	ASO-000661	CTAatcctgtgCTT	284	136904	136917	26%
ASO-000478	ASO-000478	GTCctaatacctgtGCT	285	136905	136920	88%
ASO-000500	ASO-000500	TCCtaatcctgtGCT	286	136905	136919	>100%
ASO-000601	ASO-000601	CCTaatacctgtGCT	287	136905	136918	63%
ASO-000643	ASO-000643	AGTcctaatacctgtGTC	288	136906	136921	25%
ASO-000600	ASO-000600	GTCctaatacctgtGTC	289	136906	136920	37%
ASO-000525	ASO-000525	TCCtaatacctgtGTC	290	136906	136919	65%
ASO-000453	ASO-000453	TCAGtcctaataccTGT	291	136908	136923	53%
ASO-000553	ASO-000553	CTTcagtcctaataCCT	292	136910	136925	96%
ASO-000622	ASO-000622	GCTtcagtcctaATC	293	136912	136926	11%
ASO-000325	ASO-000325	CTGacacagggagCCC	294	136956	136971	
ASO-000215	ASO-000215	GCCagaccagccaCAA	295	136987	137002	
ASO-000482	ASO-000482	CAGgagttgtaAGC	296	137065	137078	78%
ASO-000337	ASO-000337	TGCaggagttgtaAGC	297	137065	137080	
ASO-000480	ASO-000480	ATGcaggagttgtAAG	298	137066	137081	41%
ASO-000644	ASO-000644	GATgcaggagttgTAA	299	137067	137082	0%
ASO-000695	ASO-000695	TGCaggagttgTAA	300	137067	137080	
ASO-000455	ASO-000455	TGAtgcaggagttGTA	301	137068	137083	8%
ASO-000531	ASO-000531	GTGatgcaggagtTGT	302	137069	137084	14%
ASO-000651	ASO-000651	TGTgatgcaggagTTG	303	137070	137085	29%
ASO-000007	ASO-000007	TGTgatgcaggagGTT	304	137071	137085	
ASO-000419	ASO-000419	GTGatgcaggagGTT	305	137071	137084	65%
ASO-000730	ASO-000730	TGTgatgcaggagGTT	306	137071	137085	
ASO-000728	ASO-000728	TGTgatgcaggagGTT	307	137071	137085	
ASO-000729	ASO-000729	TGTgatgcaggagGTT	308	137071	137085	
ASO-000727	ASO-000727	TGTgatgcaggagGTT	309	137071	137085	
ASO-000715	ASO-000715	TGtgatgcaggagTT	310	137071	137085	
ASO-000716	ASO-000716	GAtgcaggagTT	311	137071	137082	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000721	ASO-000721	TGTgatgcaggaGTT	312	137071	137085	
ASO-000722	ASO-000722	TGTgatgcaggaGTT	313	137071	137085	
ASO-000723	ASO-000723	TGTgatgcaggaGTT	314	137071	137085	
ASO-000724	ASO-000724	TGTgatgcaggaGTT	315	137071	137085	
ASO-000725	ASO-000725	TGTgatgcaggaGTT	316	137071	137085	
ASO-000726	ASO-000726	TGTgatgcaggaGTT	317	137071	137085	
ASO-000731	ASO-000731	TGTgatgcaggaGTT	318	137071	137085	
ASO-000718	ASO-000718	TGatgcaggaGT	319	137072	137083	
ASO-000445	ASO-000445	TTGtgatgcagGAG	320	137073	137086	0%
ASO-000436	ASO-000436	CTTgtgatgcagGAG	321	137073	137087	88%
ASO-000717	ASO-000717	GTgatgcaggAG	322	137073	137084	
ASO-000570	ASO-000570	TTCTgtgatgcaGGA	323	137074	137089	61%
ASO-000408	ASO-000408	TCTgtgatgcaGGA	324	137074	137088	92%
ASO-000401	ASO-000401	CTTgtgatgcaGGA	325	137074	137087	70%
ASO-000719	ASO-000719	TGtgatgcagGA	326	137074	137085	
ASO-000313	ASO-000313	CAGagggcgagctTGG	327	137173	137188	
ASO-000331	ASO-000331	AATccctgctgtGTC	328	137223	137238	
ASO-000251	ASO-000251	AGGcaattcatCCC	329	137239	137252	
ASO-000574	ASO-000574	TGGtcaaggctttGGG	330	137326	137341	0%
ASO-000218	ASO-000218	TCTgggtcaaggctTTG	331	137328	137343	
ASO-000634	ASO-000634	CTCtgggtcaaggctTTT	332	137329	137344	0%
ASO-000497	ASO-000497	GGTgctctgtgcaAGG	333	137333	137348	15%
ASO-000569	ASO-000569	GGTgctctgtgcaAA	334	137335	137348	>100%
ASO-000565	ASO-000565	GCTgaggtgctctGGT	335	137338	137353	19%
ASO-000296	ASO-000296	AGTttgtgcaaggTCA	336	137358	137373	
ASO-000663	ASO-000663	GAGtttgtgcaagGTC	337	137359	137374	0%
ASO-000670	ASO-000670	AGTtttgtgcaagGTC	338	137359	137373	0%
ASO-000261	ASO-000261	GGAgtttgtgcaGGT	339	137360	137375	
ASO-000262	ASO-000262	GGAgtttgtgcaAGG	340	137361	137375	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000275	ASO-000275	TGGagttgtgcaAGG	341	137361	137376	
ASO-000247	ASO-000247	ATGgagttgtgcAAG	342	137362	137377	
ASO-000303	ASO-000303	TGGagttgtgcAAG	343	137362	137376	
ASO-000299	ASO-000299	ATGgagttgtgCAA	344	137363	137377	
ASO-000270	ASO-000270	AGAtggagttgtGCA	345	137364	137379	
ASO-000297	ASO-000297	AGCagatggagttTGT	346	137367	137382	
ASO-000259	ASO-000259	TTcttaggcagcAAT	347	137416	137431	
ASO-000220	ASO-000220	TGTaccacaaccaGAA	348	137462	137477	
ASO-000278	ASO-000278	GTTgccttaacTGT	349	137475	137489	
ASO-000334	ASO-000334	GCCctggatttctACT	350	137505	137520	
ASO-000241	ASO-000241	TGGtggagagttcTGG	351	137583	137598	
ASO-000289	ASO-000289	TTctcagatccctTCA	352	137643	137658	
ASO-000233	ASO-000233	CTCtaaccaccacCAA	353	137682	137697	
ASO-000201	ASO-000201	AGGgcacaagaacTTC	354	137765	137780	
ASO-000645	ASO-000645	ATCtaggctggCCC	355	137851	137865	51%
ASO-000546	ASO-000546	GATcttaggctggCCC	356	137851	137866	91%
ASO-000692	ASO-000692	TGAtcttaggctGCC	357	137852	137867	
ASO-000511	ASO-000511	GATcttaggctgGCC	358	137852	137866	8%
ASO-000538	ASO-000538	TGAtcttaggctGGC	359	137853	137867	44%
ASO-000214	ASO-000214	ATGatcttaggctGGC	360	137853	137868	
ASO-000653	ASO-000653	GATcttaggctGGC	361	137853	137866	5%
ASO-000615	ASO-000615	CATgatcttaggcTGG	362	137854	137869	8%
ASO-000524	ASO-000524	CCAtgatcttaggCTG	363	137855	137870	18%
ASO-000492	ASO-000492	CATgatcttaggCTG	364	137855	137869	46%
ASO-000468	ASO-000468	ACCatgatcttagGCT	365	137856	137871	88%
ASO-000698	ASO-000698	CCAtgatcttagGCT	366	137856	137870	
ASO-000593	ASO-000593	CATgatcttagGCT	367	137856	137869	25%
ASO-000519	ASO-000519	AAAccatgatcttAGG	368	137858	137873	81%
ASO-000582	ASO-000582	CTAaaccatgatcTTA	369	137860	137875	21%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000635	ASO-000635	CCCtaaaccatgaTCT	370	137862	137877	90%
ASO-000471	ASO-000471	CACcctaaaccatGAT	371	137864	137879	71%
ASO-000701	ASO-000701	ATCaccctaaaccATG	372	137866	137881	
ASO-000533	ASO-000533	TGAtcaccctaaCCA	373	137868	137883	>100%
ASO-000323	ASO-000323	GAGgagtgcccgCCC	374	137947	137962	
ASO-000329	ASO-000329	TGCaggtgggagaAGT	375	137973	137988	
ASO-000194	ASO-000194	TATctagcccaCCC	376	138003	138016	
ASO-000192	ASO-000192	CTAtctagcccaCCC	377	138003	138017	
ASO-000343	ASO-000343	TAtcctatctaGCC	378	138008	138021	
ASO-000212	ASO-000212	TTGataaagtgaGTC	379	138050	138064	
ASO-000230	ASO-000230	ATTgataaagtAGT	380	138051	138065	
ASO-000188	ASO-000188	AACtattgataaAGT	381	138055	138069	
ASO-000415	ASO-000415	GAActattgatAAA	382	138057	138070	86%
ASO-000448	ASO-000448	GGAactattgaTAA	383	138058	138071	0%
ASO-000190	ASO-000190	AAAtggaactattGAT	384	138060	138075	
ASO-000191	ASO-000191	AATggaactatTGA	385	138061	138074	
ASO-000348	ASO-000348	TCAAtttaaaTGAA	386	138068	138082	
ASO-000349	ASO-000349	GTcaatttaaaTGGA	387	138069	138083	
ASO-000200	ASO-000200	GGAtacagtctcaCCA	388	138089	138104	
ASO-000630	ASO-000630	GCAaacaggatagAGT	389	138096	138111	0%
ASO-000614	ASO-000614	CAAacaggatagAGT	390	138096	138110	50%
ASO-000563	ASO-000563	AAAcaggatagAGT	391	138096	138109	>100%
ASO-000527	ASO-000527	TAGcaaacaggatACA	392	138098	138113	50%
ASO-000617	ASO-000617	ATAgcaaacaggATAC	393	138099	138114	28%
ASO-000539	ASO-000539	AATagcaaacaggATA	394	138100	138115	82%
ASO-000691	ASO-000691	CAAtagcaaacagGAT	395	138101	138116	
ASO-000589	ASO-000589	AATagcaaacagGAT	396	138101	138115	4%
ASO-000509	ASO-000509	GCAatagcaaacaGGA	397	138102	138117	
ASO-000674	ASO-000674	CAAtagcaaacaGGA	398	138102	138116	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000488	ASO-000488	GCAatagcaaacAGG	399	138103	138117	41%
ASO-000507	ASO-000507	AGCaatagcaaacAGG	400	138103	138118	49%
ASO-000521	ASO-000521	AGCaatagcaaaCAG	401	138104	138118	53%
ASO-000288	ASO-000288	AAGcaatagcaaaCAG	402	138104	138119	
ASO-000552	ASO-000552	AAGcaatagcaaACA	403	138105	138119	>100%
ASO-000250	ASO-000250	CAAatgtggtgaAAT	404	138223	138238	
ASO-000294	ASO-000294	GCAaatgtggtgAAA	405	138224	138239	
ASO-000318	ASO-000318	TAGcaaatgtggtTGA	406	138226	138241	
ASO-000308	ASO-000308	CCCaagggcctctAAC	407	138263	138278	
ASO-000254	ASO-000254	AAAgcaaccagatGTC	408	138361	138376	
ASO-000545	ASO-000545	AAGagggcagcagGCC	409	138377	138392	73%
ASO-000476	ASO-000476	GAAagagggcagcAGG	410	138379	138394	0%
ASO-000620	ASO-000620	CTGaaagagggcaGCA	411	138381	138396	37%
ASO-000477	ASO-000477	CCCTgaaagaggcCAG	412	138383	138398	18%
ASO-000562	ASO-000562	TGAttgtgggcttAGG	413	138401	138416	3%
ASO-000547	ASO-000547	ATGattgtgggctTAG	414	138402	138417	24%
ASO-000696	ASO-000696	TGAttgtgggctTAG	415	138402	138416	
ASO-000279	ASO-000279	GATtgtgggctTAG	416	138402	138415	
ASO-000543	ASO-000543	CATgattgtgggcTTA	417	138403	138418	0%
ASO-000626	ASO-000626	TGAttgtgggcTTA	418	138403	138416	29%
ASO-000650	ASO-000650	ATGattgtgggcTTA	419	138403	138417	8%
ASO-000599	ASO-000599	CATgattgtgggCTT	420	138404	138418	0%
ASO-000542	ASO-000542	GCAtgattgtgggCTT	421	138404	138419	47%
ASO-000463	ASO-000463	GGCatgattgtggGCT	422	138405	138420	6%
ASO-000605	ASO-000605	GCAtgattgtggGCT	423	138405	138419	0%
ASO-000479	ASO-000479	CATgattgtggGCT	424	138405	138418	
ASO-000474	ASO-000474	GCAtgattgtgGGC	425	138406	138419	86%
ASO-000675	ASO-000675	GGCatgattgtgGGC	426	138406	138420	5%
ASO-000537	ASO-000537	AGGcatgattgtgGGC	427	138406	138421	0%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000287	ASO-000287	AGGgaggcatgatTGT	428	138410	138425	
ASO-000292	ASO-000292	GGGaggcatgatTGT	429	138410	138424	
ASO-000216	ASO-000216	TTAgggaggcatgATT	430	138412	138427	
ASO-000266	ASO-000266	TTAgggaggcatGAT	431	138413	138427	
ASO-000256	ASO-000256	TCTtagggaggcaTGA	432	138414	138429	
ASO-000269	ASO-000269	GAGgtgacacagaGGT	433	138460	138475	
ASO-000350	ASO-000350	CAGtgtgagaggtGG	434	138469	138483	
ASO-000353	ASO-000353	CAGtgtgagaggTG	435	138470	138483	
ASO-000310	ASO-000310	ACAaagatgaggaGGG	436	138532	138547	
ASO-000309	ASO-000309	AACaagatgaggAGG	437	138533	138548	
ASO-000263	ASO-000263	GAAgagaaatcagAAG	438	138631	138646	
ASO-000197	ASO-000197	TCTagggcagtgcCCA	439	138667	138682	
ASO-000239	ASO-000239	AGTctattaggAGG	440	138689	138702	
ASO-000267	ASO-000267	GCTcaacatggcaAAC	441	138714	138729	
ASO-000306	ASO-000306	TGCaagtgccagAAA	442	138737	138751	
ASO-000345	ASO-000345	GCAagtgccagAAA	443	138737	138750	
ASO-000193	ASO-000193	AATcatgggacttGCA	444	138748	138763	
ASO-000284	ASO-000284	GATttcatgtcccTCC	445	138788	138803	
ASO-000209	ASO-000209	GCTaagctaagaTGA	446	138802	138816	
ASO-000207	ASO-000207	CTAagctaagaTGA	447	138802	138815	
ASO-000301	ASO-000301	TAGacattcacaGAC	448	138822	138836	
ASO-000234	ASO-000234	TATagacattcaCAG	449	138824	138838	
ASO-000332	ASO-000332	AAAcacacaatacACT	450	138840	138855	
SPC-15693-01	ASO-002268	CAGcaacagtcagtGT	451	138869	138884	
SPC-15692-01	ASO-002268	ACagcaacagtcagTG	452	138870	138885	
SPC-15691-01	ASO-002260	TAcagcaacagtcagT	453	138871	138886	
SPC-15690-01	ASO-002252	TTAcagcaacagtcAG	454	138872	138887	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
SPC-15689-01	ASO-002244	TTTcacagcaacagtCA	455	138873	138888	
SPC-15688-01	ASO-002290	TTttacagcaacaGTC	456	138874	138889	
SPC-15687-01	ASO-002274	CTtttacagcaacaGT	457	138875	138890	
SPC-15686-01	ASO-002275	ACttttacagcaaCAG	458	138876	138891	
SPC-15685-01	ASO-002267	CActtttacagcaaCA	459	138877	138892	
SPC-15684-01	ASO-002259	TCActtttacagcAAC	460	138878	138893	
SPC-15683-01	ASO-002251	TTCacttttacagCAA	461	138879	138894	
SPC-15682-01	ASO-002243	ATTcacttttacagCA	462	138880	138895	
SPC-15681-01	ASO-002234	AATtcacttttacaGC	463	138881	138896	
SPC-15680-01	ASO-002289	AAATtcacttttACAG	464	138882	138897	
SPC-15679-01	ASO-002281	CAAattcactttTACA	465	138883	138898	
ASO-002090	ASO-002090	ATTtCcaaattcactTtTAC	466	138884	138903	>100%
ASO-002043	ASO-002043	ATtTCcaaattcactTTAC	467	138884	138903	>100%
ASO-002076	ASO-002076	ATtTCcaaattcacTTtAC	468	138884	138903	>100%
ASO-002062	ASO-002062	ATTtCcaaattcactTTtAC	469	138884	138903	>100%
ASO-002082	ASO-002082	ATtTCcaaattcactTtTAC	470	138884	138903	>100%
ASO-000753	ASO-000753	ATTTCCaaattcactTTTAC	471	138884	138903	>100%
ASO-001940	ASO-001940	ATtTCcaaattcactTTtAC	472	138884	138903	85%
ASO-001933	ASO-001933	AtTTCcaaattcactTTtAC	473	138884	138903	>100%
ASO-001919	ASO-001919	ATTTccaaattcactTTTAC	474	138884	138903	>100%
ASO-002094	ASO-002094	ATtTCcaaattcacTtTtAC	475	138884	138903	83%
ASO-002034	ASO-002034	ATTtCcaaattcactTtTAC	476	138884	138903	>100%
ASO-002036	ASO-002036	ATtTCcAaattcactTTAC	477	138884	138903	>100%
ASO-002084	ASO-002084	ATTtCcaaattcacTTtAC	478	138884	138903	>100%
ASO-002037	ASO-002037	ATTTccaaattcaCtTtTAC	479	138884	138903	>100%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-002058	ASO-002058	ATTtCcaaattcacTtTAC	480	138884	138903	>100%
ASO-002057	ASO-002057	ATTtCcaaattcaCttTtAC	481	138884	138903	>100%
ASO-001926	ASO-001926	ATTTCcaaattcactTTAC	482	138884	138903	79%
ASO-002092	ASO-002092	ATtTCcaaattcacTtTAC	483	138884	138903	>100%
ASO-002023	ASO-002023	ATTtCcaaattcacTTtTAC	484	138884	138903	>100%
ASO-000758	ASO-000758	ATTtCcaaattcactttTAC	485	138884	138903	>100%
ASO-002065	ASO-002065	ATtTCcaaattcacTTtAC	486	138884	138903	>100%
ASO-002038	ASO-002038	ATTtCcaaattcacTtTtAC	487	138884	138903	>100%
ASO-002039	ASO-002039	ATtTCcaaattcacTtTAC	488	138884	138903	35%
ASO-000763	ASO-000763	ATTtCcaaattcacttttAC	489	138884	138903	>100%
ASO-000768	ASO-000768	AttTCcaaattcacttttAC	490	138884	138903	>100%
ASO-001933-mm1	ASO-002291	GtTTCcaaattcactTTtAC	491	138884	138903	
ASO-001933-mm2	ASO-002303	AtTTCcagattcactTTtAC	492	138884	138903	
ASO-001933-mm3	ASO-002315	TtTTCcaaattcactTTtAC	493	138884	138903	
ASO-001933-mm4	ASO-002327	GtTTCcagattcactTTtAC	494	138884	138903	
ASO-001933-mm5	ASO-002339	AtTTCcaagttcactTTtGC	495	138884	138903	
ASO-001933-mm6	ASO-002351	AtTTCcagattcactTTtAC	496	138884	138903	
SPC-15678-01	ASO-002274	CCaaattcactttTAC	497	138884	138899	
SPC-15857-01	ASO-002326	ATtTcCaaattcactTTAC	498	138884	138903	
SPC-15858-01	ASO-002338	ATTtcCaaattcactTTAC	499	138884	138903	
SPC-15860-01	ASO-002362	ATTtCcaaattcactTTAC	500	138884	138903	
SPC-15864-01	ASO-002236	ATTtCcaaattcacTtTAC	501	138884	138903	
SPC-15868-01	ASO-002269	ATtTCcaaattcacTtTAC	502	138884	138903	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
SPC-15872-01	ASO-002237	ATtCCaaattcactTTAC	503	138884	138903	
SPC-15873-01	ASO-002246	ATTtCcaaattcactTTtAC	504	138884	138903	
SPC-15874-01	ASO-002254	ATTtccaaattcacTtTtAC	505	138884	138903	
SPC-15878-01	ASO-002284	ATtTccAaattcactTTAC	506	138884	138903	
SPC-15879-01	ASO-002229	ATTtccaaattcactTTAC	507	138884	138903	
SPC-15880-01	ASO-002238	ATTtccaaattcactTtTAC	508	138884	138903	
SPC-15883-01	ASO-002263	ATtTcCaaattcactTTtAC	509	138884	138903	
SPC-15888-01	ASO-002239	ATTtccaaattcactTTtAC	510	138884	138903	
ASO-000754	ASO-000754	TATTTccaaattcacTTTtA	511	138885	138904	>100%
ASO-002055	ASO-002055	TAtTtCcaaattcacTTtTA	512	138885	138904	>100%
ASO-002035	ASO-002035	TAtTtcCaaattcactTTTA	513	138885	138904	>100%
ASO-002048	ASO-002048	TATtTccaaattcaCttTTA	514	138885	138904	>100%
ASO-002053	ASO-002053	TAtTtCcaaattcactTTTA	515	138885	138904	>100%
ASO-002067	ASO-002067	TAtTTccaaattcaCTtTA	516	138885	138904	>100%
ASO-001954	ASO-001954	TATTTccaaattcactTTTA	517	138885	138904	>100%
ASO-001947	ASO-001947	TATTtccaaattcacTTTtA	518	138885	138904	>100%
ASO-002081	ASO-002081	TATtTcaaattcacTtTTA	519	138885	138904	>100%
ASO-001966	ASO-001966	TAtTTccaaattcacTTtTA	520	138885	138904	>100%
ASO-002025	ASO-002025	TAttTcCaaattcactTTTA	521	138885	138904	>100%
ASO-002033	ASO-002033	TATtTccaaattcacTtTTA	522	138885	138904	>100%
ASO-001960	ASO-001960	TaTTTccaaattcacTTtTA	523	138885	138904	>100%
ASO-002056	ASO-002056	TAttTCcaaattcacTTtTA	524	138885	138904	>100%
ASO-002063	ASO-002063	TATtTcaaattcacTTtTA	525	138885	138904	>100%
ASO-002089	ASO-002089	TATTtccaaattcaCttTTA	526	138885	138904	>100%
ASO-002073	ASO-002073	TAtTtCcaaattcacTtTTA	527	138885	138904	>100%
ASO-002027	ASO-002027	TATtTccaaattcaCtTtTA	528	138885	138904	>100%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-002075	ASO-002075	TATtTccaaattcaCTtTA	529	138885	138904	>100%
ASO-002028	ASO-002028	TAtTTccaaattcaCtTTA	530	138885	138904	77%
ASO-002085	ASO-002085	TAtTTccaaattcaCtTtTA	531	138885	138904	>100%
ASO-002083	ASO-002083	TAttTCcaaattcacTtTTA	532	138885	138904	>100%
ASO-000759	ASO-000759	TATttccaaattcacttTTA	533	138885	138904	>100%
ASO-000769	ASO-000769	TatttccaaattcactttTA	534	138885	138904	>100%
ASO-000764	ASO-000764	TAttTccaaattcactttTA	535	138885	138904	>100%
ASO-001954-mm1	ASO-002340	TATTTccagattcactTTTA	536	138885	138904	
ASO-001954-mm2	ASO-002352	TATTTccgaattcactTTTA	537	138885	138904	
ASO-001954-mm3	ASO-002364	GATTTccaaattcactTTTA	538	138885	138904	
ASO-001954-mm4	ASO-002376	GGTTTccaaattcactTTTA	539	138885	138904	
ASO-001954-mm5	ASO-002293	AATTTCcagattcactTTTA	540	138885	138904	
ASO-001954-mm6	ASO-002305	TATTTccaaattcactTTTA	541	138885	138904	
SPC-15677-01	ASO-002266	TCCaaattcactttTA	542	138885	138900	
SPC-15859-01	ASO-002350	TAtTTccaaattcactTTTA	543	138885	138904	
SPC-15861-01	ASO-002374	TAtTTccaaattcacTtTTA	544	138885	138904	
SPC-15862-01	ASO-002386	TATTTccaaattcaCTtTA	545	138885	138904	
SPC-15863-01	ASO-002227	TATtTccaaattcactTTTA	546	138885	138904	
SPC-15865-01	ASO-002245	TAttTCcaaattcactTTTA	547	138885	138904	
SPC-15867-01	ASO-002261	TATtTccaaattcacTTtTA	548	138885	138904	
SPC-15869-01	ASO-002276	TATtTccaaattcactTTTA	549	138885	138904	
SPC-15871-01	ASO-002228	TATTTccaaattcaCtTtTA	550	138885	138904	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
SPC-15882-01	ASO-002255	TATTtccaaattcactTTTA	551	138885	138904	
SPC-15886-01	ASO-002285	TATTtccaaattcacTTtTA	552	138885	138904	
SPC-15887-01	ASO-002230	TATTtccaaattcacTtTTA	553	138885	138904	
SPC-15890-01	ASO-002256	TATTtccaaattcAcTtTTA	554	138885	138904	
SPC-15893-01	ASO-002279	TATTtccaaattcActTtTA	555	138885	138904	
ASO-002072	ASO-002072	TTAttTccaaattcaCTtTT	556	138886	138905	>100%
ASO-000755	ASO-000755	TTATTtccaaattcaCTTTT	557	138886	138905	>100%
ASO-002071	ASO-002071	TTaTtTccaaattcacTTTT	558	138886	138905	89%
ASO-000760	ASO-000760	TTAttTccaaattcactTTT	559	138886	138905	>100%
ASO-001920	ASO-001920	TTATtTccaaattcaCTTTT	560	138886	138905	>100%
ASO-002080	ASO-002080	TTaTTtccaaattcacTTTT	561	138886	138905	>100%
ASO-001927	ASO-001927	TTATTtccaaattcacTTTT	562	138886	138905	>100%
ASO-001941	ASO-001941	TTaTtTccaaattcaCTtTT	563	138886	138905	>100%
ASO-002045	ASO-002045	TTaTtTccaaattcacTTTT	564	138886	138905	>100%
ASO-001934	ASO-001934	TtATTtccaaattcaCTtTT	565	138886	138905	70%
ASO-002074	ASO-002074	TTaTTtccaaattcaCTtTT	566	138886	138905	89%
ASO-002093	ASO-002093	TTAtTtccaaattcACtTT	567	138886	138905	>100%
ASO-002054	ASO-002054	TTaTTtccaaattcaCtTTT	568	138886	138905	81%
ASO-002091	ASO-002091	TTaTtTccaaattcaCtTTT	569	138886	138905	>100%
ASO-002064	ASO-002064	TTaTtTccaaattcaCTtTT	570	138886	138905	>100%
ASO-002066	ASO-002066	TTATtTccaaattCacTtTT	571	138886	138905	96%
ASO-002044	ASO-002044	TTAtTtccaaattcaCtTTT	572	138886	138905	>100%
ASO-002047	ASO-002047	TTATtTccaaattCaCtTT	573	138886	138905	>100%
ASO-002046	ASO-002046	TTaTtTccaaattcacTTTT	574	138886	138905	>100%
ASO-000765	ASO-000765	TTatttccaaattcactTT	575	138886	138905	>100%
ASO-000770	ASO-000770	TtatttccaaattcactTT	576	138886	138905	>100%
ASO-001941-mm1	ASO-002317	ATaTTtccaaattcaCTtTT	577	138886	138905	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-001941-mm2	ASO-002329	TTaTTtccaaattcaCTtTA	578	138886	138905	
ASO-001941-mm3	ASO-002341	TTaTTtccaaattcaCTtTG	579	138886	138905	
ASO-001941-mm4	ASO-002353	ATaTTtccagattcaCTtTT	580	138886	138905	
ASO-001941-mm5	ASO-002365	TTaTTtccaaattcaCTtTC	581	138886	138905	
ASO-001941-mm6	ASO-002377	TTaTTtccagattcaCTtTT	582	138886	138905	
SPC-15676-01	ASO-002258	TTCcaaattcactTTT	583	138886	138901	
SPC-15866-01	ASO-002253	TTAtTtccaaattcaCTtTT	584	138886	138905	
SPC-15870-01	ASO-002283	TTAttTccaaattcacTTTT	585	138886	138905	
SPC-15875-01	ASO-002262	TTATtccaaattcacTTTT	586	138886	138905	
SPC-15876-01	ASO-002270	TTATtccaaattcaCtTTTT	587	138886	138905	
SPC-15877-01	ASO-002277	TTATtccaaattcACtTT	588	138886	138905	
SPC-15881-01	ASO-002247	TTaTTtccaaattcacTTTT	589	138886	138905	
SPC-15884-01	ASO-002271	TTAtTtccaaattcacTTTT	590	138886	138905	
SPC-15885-01	ASO-002278	TTaTTtccaaattcACtTT	591	138886	138905	
SPC-15889-01	ASO-002248	TTaTTtccaaattcActTTT	592	138886	138905	
SPC-15891-01	ASO-002264	TTAtTtccaaattcActTTT	593	138886	138905	
SPC-15892-01	ASO-002272	TTaTTtccaaattcAcTtTT	594	138886	138905	
SPC-15894-01	ASO-002286	TTAtTtccaaattcAcTtTT	595	138886	138905	
SPC-15895-01	ASO-002231	TTATtccaaattcActTTT	596	138886	138905	
SPC-15896-01	ASO-002240	TTATtccaaattcAcTtTT	597	138886	138905	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-002020	ASO-002020	AcTTTatttccaaattcactTTaC	598	138884	138908	18%
ASO-000756	ASO-000756	TTTATttccaaattcACTTT	599	138887	138906	>100%
ASO-001967	ASO-001967	TTtATttccaaattcActTT	600	138887	138906	>100%
ASO-001955	ASO-001955	TTTATttccaaattcaCTTT	601	138887	138906	>100%
ASO-001948	ASO-001948	TTTAttccaaattcACTTT	602	138887	138906	>100%
ASO-002086	ASO-002086	AcTTtatttccaaattcactTTTaC	603	138884	138908	77%
ASO-002029	ASO-002029	AcTtatttccaaattcactTTaC	604	138884	138908	29%
ASO-001961	ASO-001961	TtTATttccaaattcActTT	605	138887	138906	83%
ASO-002095	ASO-002095	ACTtatttccaaattcactTtTaC	606	138884	138908	18%
ASO-002059	ASO-002059	ACTtatttccaaattcactTTAC	607	138884	138908	35%
ASO-002077	ASO-002077	ActtatttccaaattcactTTTAC	608	138884	138908	87%
ASO-002021	ASO-002021	AcTTtatttccaaattcactttTAC	609	138884	138908	24%
ASO-000761	ASO-000761	TTTatttccaaattcacTTT	610	138887	138906	>100%
ASO-002068	ASO-002068	AcTtatttccaaattcactTtTAC	611	138884	138908	35%
ASO-000766	ASO-000766	TTtatttccaaattcactTT	612	138887	138906	>100%
ASO-000771	ASO-000771	TttatttccaaattcactTT	613	138887	138906	>100%
ASO-001967-mm1	ASO-002294	A ¹ TtATttccaaattcActTT	614	138887	138906	
ASO-001967-mm2	ASO-002306	TTtATttccaag ¹ ttcActTT	615	138887	138906	
ASO-001967-mm3	ASO-002318	G ¹ TtATttccaaattcActTT	616	138887	138906	
ASO-001967-mm4	ASO-002330	A ¹ TtATttcca ¹ gattcActTT	617	138887	138906	
ASO-001967-mm5	ASO-002342	TTtATttcca ¹ ggttcActTT	618	138887	138906	
ASO-001967-mm6	ASO-002354	C ¹ TtATttccaag ¹ ttcActTT	619	138887	138906	
SPC-15675-01	ASO-002250	TTTCcaaattcacTTT	620	138887	138902	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-002006	ASO-002006	CTtAttccaaattcACTT	621	138888	138907	0%
ASO-000757	ASO-000757	CTTTAttccaaattCACTT	622	138888	138907	>100%
ASO-002017	ASO-002017	CTtAttccaaattcaCTT	623	138888	138907	>100%
ASO-001928	ASO-001928	CTTTAttccaaattcACTT	624	138888	138907	>100%
ASO-001968	ASO-001968	ACTTTAttccaaattCACTT	625	138888	138908	>100%
ASO-001921	ASO-001921	CTTTAttccaaattCACTT	626	138888	138907	>100%
ASO-001989	ASO-001989	CTTTAttccaaattcACTT	627	138888	138907	0%
ASO-001942	ASO-001942	CTtAttccaaattCAcTT	628	138888	138907	>100%
ASO-000128	ASO-000128	TTTccaaattcaCTT	629	138888	138902	
ASO-001935	ASO-001935	CtTTAttccaaattCAcTT	630	138888	138907	>100%
ASO-000013	ASO-000013	ATTtccaaattcaCTT	631	138888	138903	91%
ASO-002002	ASO-002002	CTTtAttccaaattcACTT	632	138888	138907	>100%
ASO-000762	ASO-000762	CTTtatttccaaattcaCTT	633	138888	138907	>100%
ASO-002010	ASO-002010	CTTtatttccaaatTcaCTT	634	138888	138907	>100%
ASO-002005	ASO-002005	CTtTatttccaaattcaCTT	635	138888	138907	>100%
ASO-001998	ASO-001998	CTttAttccaaattcACTT	636	138888	138907	75%
ASO-002001	ASO-002001	CTTTAttccaaattcaCTT	637	138888	138907	>100%
ASO-001994	ASO-001994	CTtTatttccaaattcACTT	638	138888	138907	45%
ASO-002013	ASO-002013	CTTtAttccaaattcaCTT	639	138888	138907	30%
ASO-002009	ASO-002009	CTttAttccaaattcaCTT	640	138888	138907	>100%
ASO-000767	ASO-000767	CTttatttccaaattcacTT	641	138888	138907	>100%
ASO-000772	ASO-000772	CtttatttccaaattcacTT	642	138888	138907	>100%
BMT-214296	BMT-214296	CTTTActtccaaattCACTT	643	138888	138907	
ASO-000013-mm1	ASO-002366	gTTtccaaattcaCTT	644	138888	138903	
ASO-000013-mm2	ASO-002378	ATTtccaagttcaCTT	645	138888	138903	
ASO-000013-mm3	ASO-002295	ATTtccgaattcaCTT	646	138888	138903	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000013-mm4	ASO-002307	<u>G</u> TTccagattcaCTT	647	138888	138903	
ASO-000013-mm5	ASO-002319	<u>G</u> TTccaaattcaCT <u>A</u>	648	138888	138903	
ASO-000013-mm6	ASO-002331	ATTccagattcaCT <u>C</u>	649	138888	138903	
ASO-000898	ASO-000898	ATTccaaattcaCTT	650	138888	138903	
ASO-001942-mm1	ASO-002363	CTtAttccagattCAcTT	651	138888	138907	
ASO-001942-mm2	ASO-002375	CTtAttccaaattCAcT <u>G</u>	652	138888	138907	
ASO-001942-mm3	ASO-002292	CTtAttccaaattC <u>G</u> cTT	653	138888	138907	
ASO-001942-mm4	ASO-002304	CTtAttccagattCAcT <u>A</u>	654	138888	138907	
ASO-001942-mm5	ASO-002316	CTtAttccagattCAcTT	655	138888	138907	
ASO-001942-mm6	ASO-002328	CTtAttccagattCAcTT	656	138888	138907	
SPC-15674-01	ASO-002242	ATTccaaattcACTT	657	138888	138903	
ASO-002004	ASO-002004	CTTTatttccaaatTcaCT	658	138889	138907	>100%
ASO-002012	ASO-002012	CTTtatttccaaatTcACT	659	138889	138907	>100%
ASO-001962	ASO-001962	ACTTTatttccaaattCACT	660	138889	138908	>100%
ASO-001956	ASO-001956	ACTTtatttccaaatTCACT	661	138889	138908	>100%
ASO-001949	ASO-001949	ACTTTatttccaaatTCACT	662	138889	138908	98%
ASO-001987	ASO-001987	CTTTatttccaaatTcACT	663	138889	138907	>100%
ASO-001991	ASO-001991	CTTTatttccaaatTCACT	664	138889	138907	>100%
ASO-001995	ASO-001995	CTTtatttccaaatTCACT	665	138889	138907	>100%
ASO-001992	ASO-001992	CTTTatttccaaatTcaCT	666	138889	138907	>100%
ASO-002000	ASO-002000	CTTTatttccaaatTcACT	667	138889	138907	>100%
ASO-001996	ASO-001996	CTTTatttccaaatTCaCT	668	138889	138907	93%

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-002008	ASO-002008	CTTtatttccaaatTCaCT	669	138889	138907	>100%
ASO-002015	ASO-002015	CTTTAttccaaatTCaCT	670	138889	138907	>100%
ASO-002016	ASO-002016	CTTtatttccaaatTcaCT	671	138889	138907	>100%
ASO-001986	ASO-001986	CTTTAttccaaatTCACT	672	138889	138907	>100%
ASO-001995-mm1	ASO-002343	CTTtatttccaaatTCaCT	673	138889	138907	
ASO-001995-mm2	ASO-002355	CTTtatttccaaatTCaCT	674	138889	138907	
ASO-001995-mm3	ASO-002367	CTTtatttccaaatTCACG	675	138889	138907	
ASO-001995-mm4	ASO-002379	CTTtatttccaaatTCaCT	676	138889	138907	
ASO-001995-mm5	ASO-002296	CTTtatttccaaatTCaCT	677	138889	138907	
ASO-001995-mm6	ASO-002308	CTTtatttccaaatTCaCT	678	138889	138907	
SPC-15673-01	ASO-002233	TATtccaaattcACT	679	138889	138904	
ASO-002003	ASO-002003	CTTTatttccaaatTCAC	680	138890	138907	>100%
ASO-002007	ASO-002007	CTTtatttccaaatTCAC	681	138890	138907	>100%
ASO-002011	ASO-002011	CTtAttccaaatTcAC	682	138890	138907	>100%
ASO-001988	ASO-001988	CTTTAttccaaatTcAC	683	138890	138907	>100%
ASO-001999	ASO-001999	CTTTAttccaaatTCAC	684	138890	138907	>100%
ASO-001993	ASO-001993	CTTTatttccaaatTcAC	685	138890	138907	6%
ASO-001997	ASO-001997	CTTtatttccaaatTcAC	686	138890	138907	>100%
ASO-001997-mm1	ASO-002320	CTTtatttccaaatTcAC	687	138890	138907	
ASO-001997-mm2	ASO-002332	CTTtatttccaaatTcAC	688	138890	138907	
ASO-001997-mm3	ASO-002344	CTTtatttccaaatTcAC	689	138890	138907	
ASO-001997-mm4	ASO-002356	CTTtatttccaaatTcAC	690	138890	138907	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-001997-mm5	ASO-002368	CTTtatttcca gg TcAC	691	138890	138907	
ASO-001997-mm6	ASO-002380	CTT g tttcca ag TcAC	692	138890	138907	
SPC-15672-01	ASO-002288	TTAttccaattCAC	693	138890	138905	
SPC-15671-01	ASO-002280	TTTatttccaaatTCA	694	138891	138906	
SPC-15670-01	ASO-002273	CTTtatttccaaATTC	695	138892	138907	
SPC-15669-01	ASO-002265	ACTTtatttccaAATT	696	138893	138908	
ASO-000139	ASO-000139	AACtttatttccaAAT	697	138894	138909	
SPC-15668-01	ASO-002257	AACtttatttccAAAT	698	138894	138909	
SPC-15667-01	ASO-002249	TAACtttatttcCAAA	699	138895	138910	
SPC-15666-01	ASO-002241	ATAActttatttcCAA	700	138896	138911	
ASO-000118	ASO-000118	AATaactttatttCCA	701	138897	138912	
SPC-15665-01	ASO-002232	AATaactttattTCCA	702	138897	138912	
ASO-000101	ASO-000101	TAAaactttattTCC	703	138898	138913	
SPC-15664-01	ASO-002287	TAAaactttatTTCC	704	138898	138913	
ASO-000148	ASO-000148	GTAataactttatTTC	705	138899	138914	
ASO-000184	ASO-000184	TAAaactttatTTC	706	138899	138913	
ASO-000112	ASO-000112	GTAataactttaTTT	707	138900	138914	
ASO-000170	ASO-000170	AGTaataactttaTTT	708	138900	138915	
ASO-000154	ASO-000154	GAGtaataactttATT	709	138901	138916	
ASO-000125	ASO-000125	AGTaataactttATT	710	138901	138915	
ASO-000167	ASO-000167	GAGtaataacttTAT	711	138902	138916	
ASO-000134	ASO-000134	AGAgtaataacttTAT	712	138902	138917	
ASO-000175	ASO-000175	CAGagtaataactTTA	713	138903	138918	
ASO-000178	ASO-000178	AGAgtaataactTTA	714	138903	138917	
ASO-000138	ASO-000138	CAGagtaataacTTT	715	138904	138918	

Figure 4 cont.

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Oligomer Name	ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	Oscillation data % control
ASO-000171	ASO-000171	TCAgagtaataacTTT	716	138904	138919	
ASO-000236	ASO-000236	ATCagagtaataaCTT	717	138905	138920	
ASO-000127	ASO-000127	TCAgagtaataaCTT	718	138905	138919	
ASO-000177	ASO-000177	CAGagtaataaCTT	719	138905	138918	
ASO-000238	ASO-000238	AATcagagtaataACT	720	138906	138921	
ASO-000222	ASO-000222	TAAtcagagtaatAAC	721	138907	138922	
ASO-000307	ASO-000307	AATcagagtaatAAC	722	138907	138921	
ASO-000204	ASO-000204	TTAatcagagtaaTAA	723	138908	138923	
ASO-000330	ASO-000330	TAAtcagagtaaTAA	724	138908	138922	
ASO-000326	ASO-000326	TTTaatcagagtaATA	725	138909	138924	
ASO-000249	ASO-000249	TTTaatcagagtAAT	726	138910	138924	
ASO-002022	ASO-002022	TTATttccaaattcaCTtTT	727	138886	138905	>100%
ASO-002026	ASO-002026	TTatTTccaaattcaCtTTT	728	138886	138905	>100%
ASO-002024	ASO-002024	TTAttTccaaattcaCtTTT	729	138886	138905	>100%
ASO-002049	ASO-002049	ACTTtatttccaaattcactTTtA C	730	138884	138908	29%
ASO-002019	ASO-002019	ActtTatttccaaattcactTTtA C	731	138884	138908	18%

"mm" indicates mismatches. The mismatched bases are underlined, bolded, italicized, and highlighted.

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Figure 5

ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	<i>In vivo</i> acute tolerability score	brain tau mRNA % remaining
ASO-000013	ATTccaaattcaCTT	686	138888	138903	0	29
ASO-000118	AATaactttatttCCA	773	138897	138912	0.17	59
ASO-000125	AGTaataactttATT	782	138901	138915		
ASO-000128	TTTccaaattcaCTT	684	138888	138902		
ASO-000134	AGAgtaataacttTAT	784	138902	138917		
ASO-000170	AGTaataactttaTTT	780	138900	138915		
ASO-000178	AGAgtaataactTTA	786	138903	138917		
ASO-000204	TTAatcagagtaaTAA	795	138908	138923		
ASO-000249	TTTaatcagagtAAT	798	138910	138924		
ASO-000307	AATcagagtaaatAAC	794	138907	138921		
ASO-000326	TTTaatcagagtaATA	797	138909	138924		
ASO-000330	TAAatcagagtaaTAA	796	138908	138922		
ASO-000388	ATAgtcactctggTGA	250	136650	136665	20	
ASO-000389	TAGccctaaagtcCCA	53	135744	135759	3.83	32
ASO-000390	TAGtcactctggTGA	251	136650	136664	16.67	
ASO-000394	AAGatacatgcgtCCT	258	136695	136710	11.67	
ASO-000396	TACatgcgtccTTT	256	136693	136706	20	
ASO-000411	CCCtaaagtccCAG	51	135743	135756	13.33	
ASO-000435	TTAgccctaaagtCCC	69	135745	135760	7.17	
ASO-000442	TAGccctaaagTCC	71	135746	135759	10	
ASO-000447	TCAtagtcactctGGT	255	136652	136667	13.67	
ASO-000449	AAGaggcacaagtCCT	84	135776	135791	3.83	
ASO-000451	AAGcatttcaagaTAC	262	136704	136719	7.33	
ASO-000468	ACCatgatcttagGCT	365	137856	137871	18	
ASO-000478	GTCCtaatcctgtGCT	285	136905	136920	16	
ASO-000527	TAGcaaacaggatACA	392	138098	138113	8.33	
ASO-000540	CCTtaatttcaccCTC	153	136053	136068	0.33	29

Figure 5 cont.

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ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	<i>In vivo</i> acute tolerability score	brain tau mRNA % remaining
ASO-000543	CATgattgtgggcTTA	417	138403	138418	20	
ASO-000555	CTTaatttcaccCTC	154	136053	136067	4.17	38
ASO-000558	GAActggttagccCTA	76	135752	135767	17.67	
ASO-000566	CCTaatttcacCCT	202	136054	136068	0	42
ASO-000581	ACTggttagccctAAA	74	135750	135765	20	
ASO-000603	TCCttaatttcACC	227	136056	136070	0	48
ASO-000614	CAAacaggatacAGT	390	138096	138110	10.67	
ASO-000635	CCCTaaaccatgaTCT	370	137862	137877	2.33	71
ASO-000642	CCCttaatttcacCCC	223	136055	136069	0.7	30
ASO-000662	CCCttaatttcacCCT	201	136054	136069	0.5	20
ASO-000753	ATTTccaaattcactTTTAC	471	138884	138903	2.33	29
ASO-000755	TTATTtccaaattcaCTTTT	587	138886	138905	1.67	18
ASO-000756	TTTATttccaaattcACTTT	644	138887	138906	0.83	10
ASO-000757	CTTTAttccaaattCACTT	677	138888	138907	0.17	6
ASO-000758	ATTtccaaattcactttTAC	485	138884	138903	0.17	49
ASO-000759	TATtccaaattcacttTTA	548	138885	138904	0.33	77
ASO-000760	TTAttccaaattcactTTT	589	138886	138905	0	63
ASO-000761	TTTatttccaaattcacTTT	655	138887	138906	0.33	44
ASO-000762	CTTtatttccaaattcaCTT	688	138888	138907	0	30
ASO-000829	AAGatgaaatttgCTC	7	134950	134965	4.67	28
ASO-000830	TACtagccaccccATC	28	134974	134989	6.67	
ASO-000898	ATTtccaaattcaCTT	705	138888	138903		
ASO-001778	TTAgccctaaagtccaGGT	46	135741	135760	20	
ASO-001779	TAGccctaaagtcccagGTC	43	135740	135759	20	
ASO-001780	GTTagccctaaagtcccAGG	49	135742	135761	20	
ASO-001781	GGTtagccctaaagtccCAG	52	135743	135762	20	
ASO-001782	TGGttagccctaaagtcCCA	67	135744	135763	12.33	
ASO-001919	ATTTccaaattcactTTTAC	474	138884	138903	4.33	16

Figure 5 cont.

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ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	<i>In vivo</i> acute tolerability score	brain tau mRNA % remaining
ASO-001920	TTATtccaaattcaCTTT	590	138886	138905	1.5	27
ASO-001921	CTTTatttccaaattCACTT	681	138888	138907	1	10
ASO-001925	TAGccctaaagtcca	56	135744	135759	11	
ASO-001926	ATTTcCaaattcacttTTAC	482	138884	138903	0.67	46
ASO-001927	TTATtccaaattcacTTTT	592	138886	138905	1.17	44
ASO-001928	CTTTAttccaaattCACTT	679	138888	138907	1.33	6
ASO-001933	AtTTCaaattcactTTtAC	473	138884	138903	0.83	20
ASO-001934	TtATTccaaattcaCTtTT	595	138886	138905	0.67	43
ASO-001935	CtTTAttccaaattCAcTT	685	138888	138907	1.33	19
ASO-001940	AtTTCaaattcactTTtAC	472	138884	138903	0.29	22
ASO-001941	TTaTTccaaattcaCTtTT	593	138886	138905	2	14
ASO-001942	CTtTAttccaaattCAcTT	683	138888	138907	2	16
ASO-001947	TATTtccaaattcacTTTA	533	138885	138904	3.83	26
ASO-001948	TTTAttccaaattCACTTT	647	138887	138906	0.33	11
ASO-001953	TAGccctaaagtcca	60	135744	135759	4	
ASO-001954	TATTTccaaattcactTTTA	532	138885	138904	1.17	23
ASO-001955	TTTATtccaaattcaCTTT	646	138887	138906	0.5	19
ASO-001956	ACTTtatttccaaatTCACT	716	138889	138908	0	15
ASO-001960	TaTTTccaaattcacTTtTA	538	138885	138904	5	23
ASO-001961	TtTATtccaaattcAcTTT	650	138887	138906	2.17	25
ASO-001962	ACTTTatttccaaattCACT	715	138889	138908	2	9
ASO-001966	TAtTTccaaattcacTTtTA	535	138885	138904	4.33	23
ASO-001967	TTtATtccaaattcAcTTT	645	138887	138906	1	22
ASO-001968	ACTTTatttccaaattCACTT	680	138888	138908	0.67	19
ASO-001995	CTTtatttccaaatTCACT	720	138889	138907	0.17	57
ASO-001997	CTTtatttccaaatTcAC	745	138890	138907		
ASO-001998	CTttAttccaaattCACTT	691	138888	138907		
ASO-002002	CTTtAttccaaattCACTT	687	138888	138907		

Figure 5 cont.

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ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	<i>In vivo</i> acute tolerability score	brain tau mRNA % remaining
ASO-002005	CTtTatttccaaattcaCTT	690	138888	138907		
ASO-002007	CTTtatttccaaatTCAC	740	138890	138907	0.13	26
ASO-002008	CTTtatttccaaatTCaCT	724	138889	138907	0.67	34
ASO-002009	CTtAttccaaattcaCTT	695	138888	138907		
ASO-002010	CTTtatttccaaatTcaCTT	689	138888	138907		
ASO-002011	CTtTatttccaaatTcAC	741	138890	138907		
ASO-002012	CTTtatttccaaatTcACT	714	138889	138907	0	36
ASO-002016	CTTtatttccaaatTcaCT	726	138889	138907		
ASO-002022	TTATtccaaattcaCTtTT	799	138886	138905		
ASO-002023	ATTTccaaattcacTTtAC	484	138884	138903		
ASO-002024	TTAttTccaaattcaCtTTT	801	138886	138905		
ASO-002025	TAttTcCaaattcactTTTA	536	138885	138904		
ASO-002026	TTatTTccaaattcaCtTTT	800	138886	138905		
ASO-002027	TATtTccaaattcaCtTtTA	543	138885	138904		
ASO-002028	TAtTTccaaattcaCttTTA	545	138885	138904		
ASO-002033	TATtTccaaattcacTtTTA	537	138885	138904		
ASO-002034	ATTTcCaaattcactTtTAC	476	138884	138903	0.83	34
ASO-002035	TAtTtcCaaattcactTTTA	528	138885	138904	0.5	42
ASO-002036	ATttCcAaattcacttTTAC	477	138884	138903	0.33	34
ASO-002037	ATTTccaaattcaCtTtAC	479	138884	138903		
ASO-002038	ATTTcCaaattcacTtTAC	487	138884	138903	0	42
ASO-002043	ATtTCaaattcacttTTAC	467	138884	138903	0.83	48
ASO-002044	TTAtTtccaaattcaCtTTT	602	138886	138905		
ASO-002045	TTaTtTccaaattcacTTTT	594	138886	138905		
ASO-002046	TTatTtCaaattcacTTTT	604	138886	138905		
ASO-002047	TTATtccaaattCaCttTT	603	138886	138905		
ASO-002048	TATtTccaaattcaCttTTA	529	138885	138904	1.17	59
ASO-002053	TAtTtCaaattcactTTTA	530	138885	138904	1	47

Figure 5 cont.

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ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	<i>In vivo</i> acute tolerability score	brain tau mRNA % remaining
ASO-002054	TTaTTccaaattcaCtTTT	598	138886	138905		
ASO-002055	TAtTtCcaaattcacTTtTA	527	138885	138904		
ASO-002056	TAttTCcaaattcacTTtTA	539	138885	138904		
ASO-002057	ATTTccaaattcaCttTtAC	481	138884	138903		
ASO-002058	ATTTcCaaattcacTttTAC	480	138884	138903	0.83	39
ASO-002062	ATTtcCaaattcactTTtAC	469	138884	138903		
ASO-002063	TATttCcaaattcacTTtTA	540	138885	138904		
ASO-002064	TTaTtTccaaattcaCtTTT	600	138886	138905		
ASO-002065	ATttCCaaattcactTTtAC	486	138884	138903	0	36
ASO-002066	TTATttccaaattCacTtTT	601	138886	138905		
ASO-002067	TAtTTccaaattcaCtTtTA	531	138885	138904		
ASO-002071	TTaTtTccaaattcacTTTT	588	138886	138905	1	33
ASO-002072	TTAttTccaaattcaCtTTT	586	138886	138905		
ASO-002073	TAtTtCcaaattcacTtTTA	542	138885	138904		
ASO-002074	TTatTTccaaattcaCtTTT	596	138886	138905		
ASO-002075	TATtTccaaattcaCtTtTA	544	138885	138904		
ASO-002076	ATtTCcaaattcacTTtTAC	468	138884	138903	0.33	60
ASO-002077	ActttatttccaaattcactTTTAC	653	138884	138908		
ASO-002080	TTatTTccaaattcacTTTT	591	138886	138905	0	36
ASO-002081	TATttCcaaattcacTtTTA	534	138885	138904		
ASO-002082	ATtTcCaaattcactTtTAC	470	138884	138903	0.13	31
ASO-002083	TAttTCcaaattcacTtTTA	547	138885	138904	0.83	54
ASO-002084	ATTTcCaaattcacTTtTAC	478	138884	138903	0.33	52
ASO-002085	TAtTTccaaattcaCtTtTA	546	138885	138904		
ASO-002086	AcTTatttccaaattcactTTTa C	648	138884	138908		
ASO-002089	TATTtccaaattcaCttTTA	541	138885	138904		
ASO-002090	ATTtcCaaattcactTtTAC	466	138884	138903		
ASO-002091	TTaTtTccaaattcaCtTTT	599	138886	138905		

Figure 5 cont.

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ASO Number	ASO Sequence	SEQ ID NO:	premRNA start NG_007398	premRNA end NG_007398	<i>In vivo</i> acute tolerability score	brain tau mRNA % remaining
ASO-002092	ATttCCaaattcactTtTAC	483	138884	138903	0.48	14
ASO-002093	TTAtTtccaaattcACttTT	597	138886	138905		
ASO-002094	ATtTCcaaattcacTtTtAC	475	138884	138903	0.5	61

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Figure 6.

SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
4	ASO-001167	ASO-001167	AAAgatgaaattgctcTT A	134947	134966	2787	77
5	ASO-001168	ASO-001168	GAAgatgaaattgctCT T	134948	134967	2788	89
6	ASO-001169	ASO-001169	GGAaagatgaaattgctTC T	134949	134968	2789	99
7	ASO-000829	ASO-000829	AAGatgaaattgctCTC	134950	134965	2790	99
8	ASO-001170	ASO-001170	TGGaaagatgaaattgctC C	134950	134969	2790	100
9	ASO-001171	ASO-001171	TTGaaagatgaaattgctGC T	134951	134970	2791	97
10	ASO-001172	ASO-001172	TTTggaagatgaaattgctG C	134952	134971	2792	96
11	ASO-001173	ASO-001173	ATTtggaagatgaaattgctG G	134953	134972	2793	43
12	ASO-001174	ASO-001174	AATtggaagatgaaattgctT T	134954	134973	2794	0
13	ASO-001175	ASO-001175	CAAttggaagatgaaattgctAT T	134955	134974	2795	3
14	ASO-001176	ASO-001176	TCAatttggaagatgaaattgctAA T	134956	134975	2796	36
15	ASO-001177	ASO-001177	ATCaatttggaagatgaaattgctAA A	134957	134976	2797	45
16	ASO-001178	ASO-001178	CATcaatttggaagatgaaattgctGA A	134958	134977	2798	26
17	ASO-001179	ASO-001179	CCATcaatttggaagatgaaattgctTG A	134959	134978	2799	79
18	ASO-001180	ASO-001180	CCCATcaatttggaagatgaaattgctAT G	134960	134979	2800	77
19	ASO-001181	ASO-001181	ACCCatcaatttggaagatgaaattgctGA T	134961	134980	2801	82
20	ASO-001182	ASO-001182	CACccatcaatttggaagatgaaattgctAG A	134962	134981	2802	85

Figure 6 cont.

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SEQ ID NO.	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
21	ASO-001183	ASO-001183	CCAcccatcaatttggaAA G	134963	134982	2803	97
22	ASO-001184	ASO-001184	CCCaccatcaatttgAA A	134964	134983	2804	89
23	ASO-001062	ASO-001062	GCCcaccatcaatttgGA A	134965	134984	2805	79
24	ASO-001063	ASO-001063	TAGccaccatcaattTG G	134967	134986	2807	98
25	ASO-001064	ASO-001064	CTAgccaccatcaatTT G	134968	134987	2808	99
26	ASO-001065	ASO-001065	ACTagccaccatcaaTT T	134969	134988	2809	100
27	ASO-001066	ASO-001066	TACTagccaccatcaAT T	134970	134989	2810	94
28	ASO-000830	ASO-000830	TACTagccaccatcaATC	134974	134989	2814	99
29	ASO-000260	ASO-000260	CCCTcttctacatGGA	135077	135092	2917	99
30	ASO-000305	ASO-000305	TGCctctgtgacaCCC	135171	135186	3011	99
31	ASO-000304	ASO-000304	TTCaatcttcttgTTG	135194	135209	3034	96
32	ASO-000324	ASO-000324	CACacaaggttgCAT	135242	135257	3082	99
33	ASO-000268	ASO-000268	CGTcacactcacaCAA	135251	135266	3091	99
34	ASO-000223	ASO-000223	GCCaccaaggacaGGC	135441	135456	3281	8
35	ASO-000224	ASO-000224	CAGcttgcttctCTT	135533	135548	3373	99
36	ASO-000319	ASO-000319	ATCaaggtcagtcTTT	135585	135600	3425	99
37	ASO-000208	ASO-000208	CCTcagaactcaATA	135690	135705	3530	97
38	ASO-000689	ASO-000689	AAAggtcccaggtcTGC	135737	135752	3577	99
39	ASO-000434	ASO-000434	CTAaaggtcccaggTCT	135739	135754	3579	99
40	ASO-000409	ASO-000409	TAAaggtcccaggTCT	135739	135753	3579	98
41	ASO-000432	ASO-000432	CCTaaaggtcccaggGTC	135740	135755	3580	98
42	ASO-000391	ASO-000391	TAAaggtcccaggGTC	135740	135753	3580	98
43	ASO-001779	ASO-001779	TAGccctaaggtcccaggGT C	135740	135759	3580	100
44	ASO-000899	ASO-000899	CTAaaggtcccaggGTC	135740	135754	3580	6

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
45	ASO-000398	ASO-000398	CCCTaaagtcccaGGT	135741	135756	3581	85
46	ASO-001778	ASO-001778	TTAgccctaaagtcccaGG T	135741	135760	3581	100
47	ASO-000414	ASO-000414	GCCctaaagtcccAGG	135742	135757	3582	58
48	ASO-000403	ASO-000403	CCCTaaagtcccAGG	135742	135756	3582	45
49	ASO-001780	ASO-001780	GTTAgccctaaagtcccAG G	135742	135761	3582	100
50	ASO-000433	ASO-000433	GCCctaaagtccCAG	135743	135757	3583	99
51	ASO-000411	ASO-000411	CCCTaaagtccCAG	135743	135756	3583	99
52	ASO-001781	ASO-001781	GGTtagccctaaagtccCA G	135743	135762	3583	100
53	ASO-000389	ASO-000389	TAGccctaaagtccCA	135744	135759	3584	100
54	ASO-001939	ASO-001939	TAGccctaaagtccCA	135744	135759	3584	100
55	ASO-001932	ASO-001932	TAGccctaaagtccCA	135744	135759	3584	100
56	ASO-001925	ASO-001925	TAGccctaaagtccCA	135744	135759	3584	100
57	ASO-001924	ASO-001924	TAGccctaaagtccCA	135744	135759	3584	100
58	ASO-001952	ASO-001952	TAGccctaaagtccCA	135744	135759	3584	100
59	ASO-001931	ASO-001931	TAGccctaaagtccCA	135744	135759	3584	100
60	ASO-001953	ASO-001953	TAGccctaaagtccCA	135744	135759	3584	100
61	ASO-001945	ASO-001945	TAGccctaaagtccCA	135744	135759	3584	100
62	ASO-001946	ASO-001946	TAGccctaaagtccCA	135744	135759	3584	99
63	ASO-001971	ASO-001971	TAGccctaaagtccCA	135744	135759	3584	100
64	ASO-001938	ASO-001938	TAGccctaaagtccCA	135744	135759	3584	100
65	ASO-001959	ASO-001959	TAGccctaaagtccCA	135744	135759	3584	100
66	ASO-001965	ASO-001965	TAGccctaaagtccCA	135744	135759	3584	99
67	ASO-001782	ASO-001782	TGGttagccctaaagtccCA A	135744	135763	3584	99
68	ASO-000900	ASO-000900	TAGccctaaagtccCA	135744	135759	3584	0
69	ASO-000435	ASO-000435	TTAgccctaaagtCCC	135745	135760	3585	98
70	ASO-000423	ASO-000423	GTTAgccctaaagTCC	135746	135761	3586	99

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
71	ASO-000442	ASO-000442	TAGccctaaagTCC	135746	135759	3586	91
72	ASO-000416	ASO-000416	GGTtagccctaaGTC	135747	135762	3587	100
73	ASO-000438	ASO-000438	GTTtagccctaaAGT	135748	135761	3588	98
74	ASO-000581	ASO-000581	ACTggtagccctAAA	135750	135765	3590	100
75	ASO-000639	ASO-000639	AACtgtagccctTAA	135751	135766	3591	100
76	ASO-000558	ASO-000558	GAActggtagccCTA	135752	135767	3592	100
77	ASO-000597	ASO-000597	GAGaactggtagCCC	135754	135769	3594	100
78	ASO-000245	ASO-000245	TACaaagagaactGGT	135760	135775	3600	100
79	ASO-000897	ASO-000897	CACaagtccctacAAA	135770	135785	3610	4
80	ASO-000185	ASO-000185	GGCacaagtcctACA	135772	135787	3612	99
81	ASO-000426	ASO-000426	AGGcacaagtccTTA	135774	135788	3614	52
82	ASO-000417	ASO-000417	GAGgcacaagtccTTA	135774	135789	3614	39
83	ASO-000393	ASO-000393	AGAggcacaagtCCT	135775	135790	3615	75
84	ASO-000449	ASO-000449	AAGaggcacaagtCCT	135776	135791	3616	95
85	ASO-000406	ASO-000406	AGAggcacaagtCCT	135776	135790	3616	78
86	ASO-000392	ASO-000392	CCAagaggcacaGTC	135778	135793	3618	99
87	ASO-000444	ASO-000444	CAAgaggcacaGTC	135778	135792	3618	99
88	ASO-000443	ASO-000443	CCCaagaggcacaAGT	135779	135794	3619	100
89	ASO-000450	ASO-000450	CAAgaggcacaAGT	135779	135792	3619	99
90	ASO-000258	ASO-000258	CTCcaagaggcaCAA	135781	135796	3621	97
91	ASO-000205	ASO-000205	TGGccgtgggaagGAC	135876	135891	3716	90
92	ASO-000213	ASO-000213	GGTgaggctgggaATT	135984	135999	3823	100
93	ASO-000293	ASO-000293	GTGaggctgggaATT	135984	135998	3823	100
94	ASO-000321	ASO-000321	TGGtgaggctgggAAT	135985	136000	3824	99
95	ASO-000226	ASO-000226	CTCagtatggagtAGG	136040	136055	3879	90
96	ASO-000682	ASO-000682	AATttcacctcaGTA	136049	136064	3888	79
97	ASO-000673	ASO-000673	TTAatttcacctCAG	136051	136066	3890	84
98	ASO-000578	ASO-000578	CTTaatttcacctTCA	136052	136067	3891	99

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRNA end NG_0073 98	mRNA start NM_016 835	Tau/Tubulin % inhibition
99	ASO-000540-21	ASO-002180	CCTTaatttcaccCTCA	136052	136068	3891	98
100	ASO-000540-22	ASO-002192	CCTTaatttcacCctCA	136052	136068	3891	99
101	ASO-000540-23	ASO-002109	CCTTAatttcacCctCA	136052	136068	3891	97
102	ASO-000540-24	ASO-002121	TcCCTaatttcaccCT	136054	136070	3893	98
103	ASO-000540-25	ASO-002133	TcCCTaatttcaccCT	136054	136070	3893	97
104	ASO-000540-26	ASO-002145	TcCCTaatttcAccCT	136054	136070	3893	90
105	ASO-000540-27	ASO-002157	TcCCTTaatttcaccCT	136054	136070	3893	95
106	ASO-000540-28	ASO-002169	TCcCTTaatttcaccCT	136054	136070	3893	91
107	ASO-000540-29	ASO-002181	TCCcttaatttcacCCT	136054	136070	3893	92
108	ASO-000540-3	ASO-002154	CCCTaatttcacCcTC	136053	136069	3892	97
109	ASO-000540-42	ASO-002147	CCCTaatttcacccTCA	136052	136069	3891	99
110	ASO-000540-43	ASO-002159	CCCTaatttcaccCtCA	136052	136069	3891	97
111	ASO-000540-44	ASO-002171	CCCTaatttcaccCTCA	136052	136069	3891	96
112	ASO-000540-45	ASO-002183	CCCTaatttcacCctCA	136052	136069	3891	98
113	ASO-000540-46	ASO-002195	CCCTaatttcacCcTCA	136052	136069	3891	91
114	ASO-000540-47	ASO-002196	CCCTaatttcacCctCA	136052	136069	3891	100
115	ASO-000540-48	ASO-002200	CCCTaatttcacCcTCA	136052	136069	3891	95

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRNA end NG_0073 98	mRNA start NM_016 835	Tau/Tubulin % inhibition
116	ASO-000540-49	ASO-002204	CCCTtaatttcaCcCtCA	136052	136069	3891	82
117	ASO-000540-5	ASO-002178	CCCttaaatttcAcccTC	136053	136069	3892	97
118	ASO-000540-50	ASO-002208	CCCTtaatttcAccCtCA	136052	136069	3891	93
119	ASO-000540-51	ASO-002212	CCCTtaatttcAcCctCA	136052	136069	3891	87
120	ASO-000540-52	ASO-002216	TcCCTtaatttcacCcTC	136053	136070	3892	97
121	ASO-000540-53	ASO-002220	TCcCTtaatttcacccTC	136053	136070	3892	99
122	ASO-000540-54	ASO-002224	TCcCTtaatttcacCcTC	136053	136070	3892	85
123	ASO-000540-55	ASO-002197	TCCcttaatttcaccCTC	136053	136070	3892	99
124	ASO-000540-69	ASO-002222	TCCcTtaatttcacCctCA	136052	136070	3891	97
125	ASO-000540-70	ASO-002226	TCCCttaaatttcaccCTCA	136052	136070	3891	93
126	ASO-000540-71	ASO-002199	TCCCttaaatttcacCcTCA	136052	136070	3891	83
127	ASO-000540-72	ASO-002203	TCCCttaaatttcacCCtCA	136052	136070	3891	78
128	ASO-000540-73	ASO-002207	TCCCttaaatttcaCcCtCA	136052	136070	3891	58
129	ASO-000540-74	ASO-002211	TCCCttaaatttcACcCtCA	136052	136070	3891	26
130	ASO-000540-75	ASO-002215	TCCCTtaatttcaccCTCA	136052	136070	3891	84
131	ASO-000540-76	ASO-002219	TCCCTtaatttcacCCtCA	136052	136070	3891	44
132	ASO-000540-77	ASO-002223	TCCCTtaatttcacCCTCA	136052	136070	3891	30

Figure 6 cont.

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SEQ ID NO.	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRNA end NG_0073 98	mRNA start NM_016 835	Tau/Tubulin % inhibition
133	ASO-000540-8	ASO-002119	CCCTaatttcaccCTC	136053	136069	3892	98
134	ASO-000540-9	ASO-002131	CCCTaatttcacCcTC	136053	136069	3892	96
135	TBD-mm10	ASO-002382	CCttgATttgccctCA	136053	136069	3891	84
136	TBD-mm11	ASO-002299	CCttgATttcacccctCT	136052	136068	3891	98
137	TBD-mm12	ASO-002311	CCttaGTttcacccctCG	136054	136070	3891	98
138	TBD-mm19	ASO-002300	CCCTtgatttcaccctCA	136052	136068	3891	50
139	TBD-mm20	ASO-002312	CCCTtaatttcaccctCG	136054	136070	3891	50
140	TBD-mm21	ASO-002324	CCCTtagtttcaccctCA	136052	136069	3891	50
141	TBD-mm22	ASO-002336	CCCTtgatttcgccctCA	136052	136069	3891	57
142	TBD-mm23	ASO-002348	CCCTtgatttcaccctCG	136053	136070	3891	52
143	TBD-mm24	ASO-002360	CCCTtgatttcaccctCT	136052	136070	3891	52
144	TBD-mm31	ASO-002349	TCcCTtgatttcacCctCA	136053	136070	3891	97
145	TBD-mm32	ASO-002361	TCcCTaatttcacCctCG	136052	136070	3891	98
146	TBD-mm33	ASO-002373	ACcCTaatttcacCctCA	136053	136069	3891	100
147	TBD-mm34	ASO-002385	TCcCTtgatttcgcCctCA	136052	136068	3891	92
148	TBD-mm35	ASO-002302	TCcCTtagtttcacCctCG	136054	136070	3891	50
149	TBD-mm36	ASO-002314	ACcCTtgatttcacCctCA	136054	136070	3891	95
150	TBD-mm7	ASO-002346	CCttgATttcacccctCA	136053	136070	3891	98
151	TBD-mm8	ASO-002358	CCttaGTttcacccctCA	136053	136069	3891	99
152	TBD-mm9	ASO-002370	CCttaATttcacccctCG	136052	136070	3891	100
153	ASO-000540	ASO-000540	CCTaatttcaccCTC	136053	136068	3892	99
154	ASO-000555	ASO-000555	CTTaatttcaccCTC	136053	136067	3892	98

Figure 6 cont.

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SEQ ID NO.	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRNA end NG_0073 98	mRNA start NM_016 835	Tau/Tubulin % inhibition
155	ASO-000579	ASO-000579	TTAatttcaccCTC	136053	136066	3892	94
156	ASO-000540-1	ASO-002130	CCCttaatttcacccTC	136053	136069	3892	97
157	ASO-000540-10	ASO-002143	CCCTtaatttcaccCTC	136053	136069	3892	98
158	ASO-000540-11	ASO-002155	CCCTtaatttcacCcTC	136053	136069	3892	96
159	ASO-000540-12	ASO-002167	CCCTtaatttcacCCTC	136053	136069	3892	88
160	ASO-000540-13	ASO-002179	CCCTtaatttcacCcTC	136053	136069	3892	95
161	ASO-000540-14	ASO-002191	CCttaATttcacctCA	136052	136068	3891	99
162	ASO-000540-15	ASO-002108	CCTtaatttcacccTCA	136052	136068	3891	98
163	ASO-000540-16	ASO-002120	CCTtaaTttcacctCA	136052	136068	3891	98
164	ASO-000540-17	ASO-002132	CCTtaAtttcacctCA	136052	136068	3891	98
165	ASO-000540-18	ASO-002144	CCTtaATttcacctCA	136052	136068	3891	99
166	ASO-000540-19	ASO-002156	CCTtaATttcacccTCA	136052	136068	3891	99
167	ASO-000540-2	ASO-002142	CCCttaatttcaccCTC	136053	136069	3892	98
168	ASO-000540-20	ASO-002168	CCTTaatttcaccCtCA	136052	136068	3891	99
169	ASO-000540-56	ASO-002201	TCCcttaatttcacCcTC	136053	136070	3892	98
170	ASO-000540-57	ASO-002205	TCCcTtaatttcacccTC	136053	136070	3892	98
171	ASO-000540-58	ASO-002209	TCCcTtaatttcacCcTC	136053	136070	3892	93
172	ASO-000540-59	ASO-002213	TCCcTtaatttcacCcTC	136053	136070	3892	84

Figure 6 cont.

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SEQ ID NO.	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
173	ASO-000540-6	ASO-002190	CCCttaaatttcAcCcTC	136053	136069	3892	80
174	ASO-000540-60	ASO-002217	TCCcTtaaatttcAcCcTC	136053	136070	3892	3
175	ASO-000540-61	ASO-002221	TCCCttaaatttcacCCTC	136053	136070	3892	69
176	ASO-000540-62	ASO-002225	TCCCttaaatttcacCcCTC	136053	136070	3892	36
177	ASO-000540-63	ASO-002198	TCCCttaaatttcacCcTC	136053	136070	3892	48
178	ASO-000540-64	ASO-002202	TCCCttaaatttcAccCTC	136053	136070	3892	61
179	ASO-000540-65	ASO-002206	TCCCttaaatttcaccCTC	136053	136070	3892	69
180	ASO-000540-66	ASO-002210	TCcCTtaaatttcacCctCA	136052	136070	3891	99
181	ASO-000540-67	ASO-002214	TCCcttaaatttcacccTCA	136052	136070	3891	99
182	ASO-000540-68	ASO-002218	TCCcTtaaatttcaccCtCA	136052	136070	3891	99
183	ASO-000540-mm1	ASO-002297	CCTtgatttcaccCTC	136053	136068	3892	97
184	ASO-000540-mm2	ASO-002309	CCTtaatttcgcccCTC	136053	136068	3892	87
185	ASO-000540-mm3	ASO-002321	CCTtagtttcaccCTC	136053	136068	3892	91
186	ASO-000540-mm4	ASO-002333	CCTtgatttcgcccCTC	136053	136068	3892	89
187	ASO-000540-mm5	ASO-002345	CCTtgatttcaccCTC	136053	136068	3892	96
188	ASO-000540-mm6	ASO-002357	CCTtagtttcgcccCTC	136053	136068	3892	13
189	TBD-mm1	ASO-002369	CCCttgatttcacccTC	136052	136070	3892	95
190	TBD-mm2	ASO-002381	CCCttgatttcacccTC	136053	136069	3892	98

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRN A end NG_0073 98	mRNA start NM_016 835	Tau/Tubulin % inhibition
191	TBD-mm25	ASO-002372	TcCCTtgatttcacCcTC	136052	136070	3892	51
192	TBD-mm26	ASO-002384	TcCCTtaatttcgcCcTC	136052	136068	3892	61
193	TBD-mm27	ASO-002301	TcCCTtagtttcacCcTC	136052	136068	3892	52
194	TBD-mm28	ASO-002313	TcCCTtgatttcgcCcTC	136054	136070	3892	51
195	TBD-mm29	ASO-002325	TcCCTtagtttcgcCcTC	136052	136069	3892	23
196	TBD-mm3	ASO-002298	CCCtaatttcgcccTC	136053	136069	3892	97
197	TBD-mm30	ASO-002337	AcCCTtgatttcacCcTC	136053	136070	3892	100
198	TBD-mm4	ASO-002310	CCCTtgatttcgcccTC	136054	136070	3892	71
199	TBD-mm5	ASO-002322	CCCTtgatttcaccccTC	136052	136069	3892	91
200	TBD-mm6	ASO-002334	CCCTtagtttcgcccTC	136052	136069	3892	51
201	ASO-000662	ASO-000662	CCCtaatttcacCCT	136054	136069	3893	96
202	ASO-000566	ASO-000566	CCTtaatttcacCCT	136054	136068	3893	94
203	ASO-000540-30	ASO-002193	TCCcTtaatttcaccCT	136054	136070	3893	89
204	ASO-000540-31	ASO-002110	TCCcTtaatttcAccCT	136054	136070	3893	74
205	ASO-000540-32	ASO-002384	TCCcTTaatttcaccCT	136054	136070	3893	84
206	ASO-000540-33	ASO-002301	TCCcTtaatttcacCCT	136054	136070	3893	75
207	ASO-000540-34	ASO-002313	TCCcTtaatttcacCcCT	136054	136070	3893	60
208	ASO-000540-35	ASO-002325	TCCcTtaatttcacCCCT	136054	136070	3893	33
209	ASO-000540-36	ASO-002298	TCCcTtaatttcaccCT	136054	136070	3893	66
210	ASO-000540-37	ASO-002337	CCCTtaatttcaccctCA	136052	136069	3891	98

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRNA end NG_0073 98	mRNA start NM_016 835	Tau/Tubulin % inhibition
211	ASO-000540-38	ASO-002310	CCCttaatttcacccTCA	136052	136069	3891	98
212	ASO-000540-39	ASO-002322	CCCttaatttcacCctCA	136052	136069	3891	98
213	ASO-000540-4	ASO-002334	CCCttaatttcacCcTC	136053	136069	3892	96
214	ASO-000540-40	ASO-000662	CCCttaatttcacCctCA	136052	136069	3891	99
215	ASO-000540-41	ASO-000566	CCCttaatttcacCctCA	136052	136069	3891	96
216	TBD-mm13	ASO-002193	TcCCtTgatttcacccCT	136053	136069	3893	95
217	TBD-mm14	ASO-002110	TcCCtTaatttcacccCA	136052	136069	3893	99
218	TBD-mm15	ASO-002347	TcCCtTaatttcgcccCT	136053	136070	3893	91
219	TBD-mm16	ASO-002359	TcCCtTgatttcacccCA	136053	136070	3893	97
220	TBD-mm17	ASO-002371	TcCCtTgatttcacccCG	136052	136070	3893	95
221	TBD-mm18	ASO-002383	TcCCtTagtttcgcccCT	136052	136068	3893	65
222	ASO-000628	ASO-000628	CCTtaatttcacCCC	136055	136068	3894	98
223	ASO-000642	ASO-000642	CCCttaatttcacCCC	136055	136069	3894	98
224	ASO-000274	ASO-000274	TCCcttaatttcacCCC	136055	136070	3894	99
225	ASO-000339	ASO-000339	CCttaatttcacCCC	136055	136068	3894	100
226	ASO-000536	ASO-000536	TTCccttaatttcacACC	136056	136071	3895	91
227	ASO-000603	ASO-000603	TCCcttaatttcacACC	136056	136070	3895	87
228	ASO-000666	ASO-000666	TCCcttaatttcacCAC	136057	136070	3896	63
229	ASO-000272	ASO-000272	AGAgtagagaggctGGG	136099	136114	3938	100
230	ASO-000255	ASO-000255	TGGatgagtggaaCTG	136115	136130	3954	99
231	ASO-000336	ASO-000336	GGAtgagtggaaACT	136116	136129	3955	98
232	ASO-000206	ASO-000206	GTTggatgagtGAA	136118	136132	3957	99
233	ASO-000271	ASO-000271	AGTggatgagtGGA	136119	136133	3958	100
234	ASO-000340	ASO-000340	GTTggatgagtGGA	136119	136132	3958	100

Figure 6 cont.

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SEQ ID NO.	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
235	ASO-000229	ASO-000229	CAGggaaccgaatCAG	136160	136175	3999	100
236	ASO-000273	ASO-000273	GCCctggctcacaTCT	136193	136208	4032	95
237	ASO-000264	ASO-000264	ACAaggcagaacACC	136229	136244	4068	100
238	ASO-000341	ASO-000341	TGTcaacaaggCAG	136236	136249	4075	56
239	ASO-000198	ASO-000198	TGCcctgggtgccTTG	136355	136370	4194	97
240	ASO-000210	ASO-000210	AGCgggactgtggGCC	136371	136386	4210	92
241	ASO-000342	ASO-000342	GGgacagcgggACT	136378	136391	4217	
242	ASO-000333	ASO-000333	GCGggctgggctgTCT	136427	136442	4266	99
243	ASO-000199	ASO-000199	CAGaacagacagcATG	136541	136556	4380	99
244	ASO-000280	ASO-000280	TCTatgtatatgtTCA	136567	136582	4406	100
245	ASO-000211	ASO-000211	ATCtatgtatatgTTC	136568	136583	4407	99
246	ASO-000347	ASO-000347	CATctatgtataTGT	136570	136584	4409	42
247	ASO-000352	ASO-000352	ACAtctatgtataTGT	136570	136585	4409	4
248	ASO-000232	ASO-000232	CAAcagggtgcagATG	136600	136615	4439	98
249	ASO-000257	ASO-000257	AGCataaacagacAAA	136629	136644	4468	99
250	ASO-000388	ASO-000388	ATAgtcactctggTGA	136650	136665	4489	99
251	ASO-000390	ASO-000390	TAGtcactctggTGA	136650	136664	4489	97
252	ASO-000413	ASO-000413	AGTcactctggTGA	136650	136663	4489	37
253	ASO-000405	ASO-000405	CATagtcactctgGTG	136651	136666	4490	100
254	ASO-000430	ASO-000430	TAGtcactctgGTG	136651	136664	4490	100
255	ASO-000447	ASO-000447	TCAtagtcactctGGT	136652	136667	4491	100
256	ASO-000396	ASO-000396	TACatgcgtccTTT	136693	136706	4532	100
257	ASO-000395	ASO-000395	GATacatgcgtccTTT	136693	136708	4532	99
258	ASO-000394	ASO-000394	AAGatacatgcgtCCT	136695	136710	4534	100
259	ASO-000421	ASO-000421	TTCaagatacatgCGT	136698	136713	4537	100
260	ASO-000400	ASO-000400	ATTtcaagatacaTGC	136700	136715	4539	99
261	ASO-000248	ASO-000248	GCAtttcaagataCAT	136702	136717	4541	100
262	ASO-000451	ASO-000451	AAGcatttcaagaTAC	136704	136719	4543	99
263	ASO-000707	ASO-000707	ACAagcatttcaaGAT	136706	136721	4545	100

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRN A end NG_0073 98	mRNA start NM_016 835	Tau/Tubu lin % inhibition
264	ASO-000619	ASO-000619	TTAcaagcatttcAAG	136708	136723	4547	88
265	ASO-000671	ASO-000671	AACctctttacaaGCA	136715	136730	4554	
266	ASO-000221	ASO-000221	GTTagaaacctctTTA	136721	136736	4560	100
267	ASO-000298	ASO-000298	CCAcacaggccacACG	136776	136791	4615	98
268	ASO-000311	ASO-000311	GTCTctgttggtCCC	136842	136857	4681	97
269	ASO-000290	ASO-000290	TGAacggcctcctTAG	136871	136886	4710	99
270	ASO-000437	ASO-000437	CTGtgcttcaggcCTT	136896	136911	4735	100
271	ASO-000446	ASO-000446	TCCTgtgcttcagGCC	136898	136913	4737	98
272	ASO-000685	ASO-000685	AATcctgtgttcAGG	136900	136915	4739	65
273	ASO-000410	ASO-000410	TCCTgtgttcAGG	136900	136913	4739	23
274	ASO-000604	ASO-000604	AATcctgtgttcCAG	136901	136915	4740	94
275	ASO-000490	ASO-000490	TAAcctgtgttcCAG	136901	136916	4740	89
276	ASO-000529	ASO-000529	AATcctgtgttcTCA	136902	136915	4741	100
277	ASO-000532	ASO-000532	CTAatcctgtgttcTCA	136902	136917	4741	99
278	ASO-000508	ASO-000508	TAAcctgtgttcTCA	136902	136916	4741	95
279	ASO-000219	ASO-000219	CCTaatcctgtgtTTC	136903	136918	4742	100
280	ASO-000656	ASO-000656	TAAcctgtgttcTTC	136903	136916	4742	99
281	ASO-000522	ASO-000522	CTAatcctgtgttcTTC	136903	136917	4742	98
282	ASO-000513	ASO-000513	CCTaatcctgtgtCTT	136904	136918	4743	97
283	ASO-000640	ASO-000640	TCCTaatcctgtgtCTT	136904	136919	4743	93
284	ASO-000661	ASO-000661	CTAatcctgtgtCTT	136904	136917	4743	85
285	ASO-000478	ASO-000478	GTCctaatcctgtGCT	136905	136920	4744	96
286	ASO-000500	ASO-000500	TCCTaatcctgtGCT	136905	136919	4744	94
287	ASO-000601	ASO-000601	CCTaatcctgtGCT	136905	136918	4744	93
288	ASO-000643	ASO-000643	AGTcctaatcctgtGTC	136906	136921	4745	99
289	ASO-000600	ASO-000600	GTCctaatcctgtGTC	136906	136920	4745	98
290	ASO-000525	ASO-000525	TCCTaatcctgtGTC	136906	136919	4745	90
291	ASO-000453	ASO-000453	TCAGtcctaatccTGT	136908	136923	4747	60
292	ASO-000553	ASO-000553	CTTcagtcctaatCCT	136910	136925	4749	95

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
293	ASO-000622	ASO-000622	GCTtcagtcctaATC	136912	136926	4751	100
294	ASO-000325	ASO-000325	CTGacacaggagCCC	136956	136971	4795	99
295	ASO-000215	ASO-000215	GCCagaccagccaCAA	136987	137002	4826	97
296	ASO-000482	ASO-000482	CAGgagttgtaAGC	137065	137078	4904	60
297	ASO-000337	ASO-000337	TGCaggagttgtaAGC	137065	137080	4904	88
298	ASO-000480	ASO-000480	ATGcaggagttgtAAG	137066	137081	4905	57
299	ASO-000644	ASO-000644	GATgcaggagttgTAA	137067	137082	4906	97
300	ASO-000695	ASO-000695	TGCaggagttgTAA	137067	137080	4906	41
301	ASO-000455	ASO-000455	TGATgcaggagttGTA	137068	137083	4907	94
302	ASO-000531	ASO-000531	GTGatgcaggagtTGT	137069	137084	4908	100
303	ASO-000651	ASO-000651	TGTgatgcaggagTTG	137070	137085	4909	96
304	ASO-000007	ASO-000007	TGTgatgcaggagGTT	137071	137085	4910	92
305	ASO-000419	ASO-000419	GTGatgcaggagGTT	137071	137084	4910	100
306	ASO-000730	ASO-000730	TGTgatgcaggagGTT	137071	137085	4910	92
307	ASO-000728	ASO-000728	TGTgatgcaggagGTT	137071	137085	4910	91
308	ASO-000729	ASO-000729	TGTgatgcaggagGTT	137071	137085	4910	12
309	ASO-000727	ASO-000727	TGTgatgcaggagGTT	137071	137085	4910	1
310	ASO-000715	ASO-000715	TGtgatgcaggagTT	137071	137085	4910	2
311	ASO-000716	ASO-000716	GATgcaggagTT	137071	137082	4910	97
312	ASO-000721	ASO-000721	TGTgatgcaggagGTT	137071	137085	4910	99
313	ASO-000722	ASO-000722	TGTgatgcaggagGTT	137071	137085	4910	99
314	ASO-000723	ASO-000723	TGTgatgcaggagGTT	137071	137085	4910	
315	ASO-000724	ASO-000724	TGTgatgcaggagGTT	137071	137085	4910	99
316	ASO-000725	ASO-000725	TGTgatgcaggagGTT	137071	137085	4910	100
317	ASO-000726	ASO-000726	TGTgatgcaggagGTT	137071	137085	4910	12
318	ASO-000731	ASO-000731	TGTgatgcaggagGTT	137071	137085	4910	
319	ASO-000718	ASO-000718	TGatgcaggagGT	137072	137083	4911	100
320	ASO-000445	ASO-000445	TTGtgatgcagGAG	137073	137086	4912	100
321	ASO-000436	ASO-000436	CTTgtgatgcagGAG	137073	137087	4912	98

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRN A end NG_007398	mRNA start NM_016835	Tau/Tubu lin % inhibition
322	ASO-000717	ASO-000717	GTgatgcaggAG	137073	137084	4912	99
323	ASO-000570	ASO-000570	TTcttgatgatgcaGGA	137074	137089	4913	91
324	ASO-000408	ASO-000408	TCTtgatgatgcaGGA	137074	137088	4913	90
325	ASO-000401	ASO-000401	CTTtgatgatgcaGGA	137074	137087	4913	88
326	ASO-000719	ASO-000719	TGtgatgcagGA	137074	137085	4913	100
327	ASO-000313	ASO-000313	CAGagggcgagctTGG	137173	137188	5012	100
328	ASO-000331	ASO-000331	AATccctgctgtgGTC	137223	137238	5062	100
329	ASO-000251	ASO-000251	AGGcaattcatCCC	137239	137252	5078	97
330	ASO-000574	ASO-000574	TGGtcaaggctttGGG	137326	137341	5165	99
331	ASO-000218	ASO-000218	TCTggtaaggctTTG	137328	137343	5167	99
332	ASO-000634	ASO-000634	CTCtggtcaaggcTTT	137329	137344	5168	99
333	ASO-000497	ASO-000497	GGTgctctggtcaAGG	137333	137348	5172	99
334	ASO-000569	ASO-000569	GGTgctctggtCAA	137335	137348	5174	100
335	ASO-000565	ASO-000565	GCTgaggtgctctGGT	137338	137353	5177	99
336	ASO-000296	ASO-000296	AGTttgtgcaaggTCA	137358	137373	5197	98
337	ASO-000663	ASO-000663	GAGtttgtgcaagGTC	137359	137374	5198	100
338	ASO-000670	ASO-000670	AGTttgtgcaagGTC	137359	137373	5198	100
339	ASO-000261	ASO-000261	GGAgtttgtgcaaGGT	137360	137375	5199	100
340	ASO-000262	ASO-000262	GGAgtttgtgcaAGG	137361	137375	5200	99
341	ASO-000275	ASO-000275	TGGagtttgtgcaAGG	137361	137376	5200	7
342	ASO-000247	ASO-000247	ATGgagtttgtgcAAG	137362	137377	5201	98
343	ASO-000303	ASO-000303	TGGagtttgtgcAAG	137362	137376	5201	99
344	ASO-000299	ASO-000299	ATGgagtttgtgCAA	137363	137377	5202	96
345	ASO-000270	ASO-000270	AGAtggagtttgtGCA	137364	137379	5203	100
346	ASO-000297	ASO-000297	AGCagatggagttTGT	137367	137382	5206	96
347	ASO-000259	ASO-000259	TTctttaggcagcAAT	137416	137431	5255	
348	ASO-000220	ASO-000220	TGTacccaaccaGAA	137462	137477	5301	98
349	ASO-000278	ASO-000278	GTTgcctttaacTGT	137475	137489	5314	99
350	ASO-000334	ASO-000334	GCCctggatttctACT	137505	137520	5344	61

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRN A end NG_007398	mRNA start NM_016835	Tau/Tubu lin % inhibition
351	ASO-000241	ASO-000241	TGGtgagaggttcTGG	137583	137598	5422	99
352	ASO-000289	ASO-000289	TTCtcagatccctTCA	137643	137658	5482	99
353	ASO-000233	ASO-000233	CTCtaaccaccacCAA	137682	137697	5521	100
354	ASO-000201	ASO-000201	AGGgcacaagaacTTC	137765	137780	5604	90
355	ASO-000645	ASO-000645	ATCcttaggctggCCC	137851	137865	5689	94
356	ASO-000546	ASO-000546	GATcttaggctggCCC	137851	137866	5689	92
357	ASO-000692	ASO-000692	TGAtcttaggctgGCC	137852	137867	5690	99
358	ASO-000511	ASO-000511	GATcttaggctgGCC	137852	137866	5690	76
359	ASO-000538	ASO-000538	TGAtcttaggctGGC	137853	137867	5691	99
360	ASO-000214	ASO-000214	ATGatcttaggctGGC	137853	137868	5691	99
361	ASO-000653	ASO-000653	GATcttaggctGGC	137853	137866	5691	98
362	ASO-000615	ASO-000615	CATgatcttaggTGG	137854	137869	5692	89
363	ASO-000524	ASO-000524	CCAtgatcttaggCTG	137855	137870	5693	98
364	ASO-000492	ASO-000492	CATgatcttaggCTG	137855	137869	5693	95
365	ASO-000468	ASO-000468	ACCatgatcttagGCT	137856	137871	5694	99
366	ASO-000698	ASO-000698	CCAtgatcttagGCT	137856	137870	5694	100
367	ASO-000593	ASO-000593	CATgatcttagGCT	137856	137869	5694	55
368	ASO-000519	ASO-000519	AAAccatgatcttAGG	137858	137873	5696	96
369	ASO-000582	ASO-000582	CTAaacatgatcTTA	137860	137875	5698	74
370	ASO-000635	ASO-000635	CCCTaaacatgaTCT	137862	137877	5700	98
371	ASO-000471	ASO-000471	CACcctaaacatGAT	137864	137879	5702	96
372	ASO-000701	ASO-000701	ATCaccctaaaccATG	137866	137881	5704	100
373	ASO-000533	ASO-000533	TGAtcacccctaaaCCA	137868	137883	5706	96
374	ASO-000323	ASO-000323	GAGgagtgtcccagCCC	137947	137962	5785	
375	ASO-000329	ASO-000329	TGCaggtgggagaAGT	137973	137988	5811	
376	ASO-000194	ASO-000194	TATctagcccaCCC	138003	138016	5841	100
377	ASO-000192	ASO-000192	CTAtctagcccaCCC	138003	138017	5841	99
378	ASO-000343	ASO-000343	TATcttatctaGCC	138008	138021	5846	
379	ASO-000212	ASO-000212	TTGataaagtgaGTC	138050	138064	5888	

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRN A end NG_0073 98	mRNA start NM_016 835	Tau/Tubu lin % inhibition
380	ASO-000230	ASO-000230	ATTgataaagtAGT	138051	138065	5889	99
381	ASO-000188	ASO-000188	AACtattgataaAGT	138055	138069	5893	4
382	ASO-000415	ASO-000415	GAActattgatAAA	138057	138070	5895	21
383	ASO-000448	ASO-000448	GGAactattgaTAA	138058	138071	5896	100
384	ASO-000190	ASO-000190	AAAtggaactattGAT	138060	138075	5898	
385	ASO-000191	ASO-000191	AATggaactatTGA	138061	138074	5899	97
386	ASO-000348	ASO-000348	TCAAtttaaatGGAA	138068	138082	5906	
387	ASO-000349	ASO-000349	GTcaatttaaaTGGA	138069	138083	5907	
388	ASO-000200	ASO-000200	GGAatacagtctcaCCA	138089	138104	5927	100
389	ASO-000630	ASO-000630	GCAaacaggatacAGT	138096	138111	5934	100
390	ASO-000614	ASO-000614	CAAacaggatacAGT	138096	138110	5934	99
391	ASO-000563	ASO-000563	AAAcaggatacAGT	138096	138109	5934	90
392	ASO-000527	ASO-000527	TAGcaaacaggatACA	138098	138113	5936	99
393	ASO-000617	ASO-000617	ATAgcaaacaggaTAC	138099	138114	5937	99
394	ASO-000539	ASO-000539	AATagcaaacaggATA	138100	138115	5938	99
395	ASO-000691	ASO-000691	CAAtagcaaacagGAT	138101	138116	5939	99
396	ASO-000589	ASO-000589	AATagcaaacagGAT	138101	138115	5939	99
397	ASO-000509	ASO-000509	GCAatagcaaacaGGA	138102	138117	5940	
398	ASO-000674	ASO-000674	CAAtagcaaacaGGA	138102	138116	5940	
399	ASO-000488	ASO-000488	GCAatagcaaacAGG	138103	138117	5941	100
400	ASO-000507	ASO-000507	AGCaatagcaaacAGG	138103	138118	5941	99
401	ASO-000521	ASO-000521	AGCaatagcaaaCAG	138104	138118	5942	99
402	ASO-000288	ASO-000288	AAGcaatagcaaaCAG	138104	138119	5942	
403	ASO-000552	ASO-000552	AAGcaatagcaaACA	138105	138119	5943	98
404	ASO-000250	ASO-000250	CAAatgtggttgAAT	138223	138238	6061	
405	ASO-000294	ASO-000294	GCAaatgtggttgAAA	138224	138239	6062	
406	ASO-000318	ASO-000318	TAGcaaatgtggtTGA	138226	138241	6064	
407	ASO-000308	ASO-000308	CCCaaggcctctAAC	138263	138278	6101	
408	ASO-000254	ASO-000254	AAAgcaaccagatGTC	138361	138376	6199	

Figure 6 cont.

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SEQ ID NO.	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
409	ASO-000545	ASO-000545	AAGagggcagcagGCC	138377	138392	6215	92
410	ASO-000476	ASO-000476	GAAagagggcagcAGG	138379	138394	6217	100
411	ASO-000620	ASO-000620	CTGaaagagggcaGCA	138381	138396	6219	63
412	ASO-000477	ASO-000477	CCCTgaaagagggCAG	138383	138398	6221	39
413	ASO-000562	ASO-000562	TGAttgtgggcttAGG	138401	138416	6239	100
414	ASO-000547	ASO-000547	ATGattgtgggctTAG	138402	138417	6240	100
415	ASO-000696	ASO-000696	TGAttgtgggctTAG	138402	138416	6240	99
416	ASO-000279	ASO-000279	GATgtgtgggctTAG	138402	138415	6240	
417	ASO-000543	ASO-000543	CATgattgtgggcTTA	138403	138418	6241	100
418	ASO-000626	ASO-000626	TGAttgtgggcTTA	138403	138416	6241	100
419	ASO-000650	ASO-000650	ATGattgtgggcTTA	138403	138417	6241	100
420	ASO-000599	ASO-000599	CATgattgtgggCTT	138404	138418	6242	98
421	ASO-000542	ASO-000542	GCAtgattgtgggCTT	138404	138419	6242	96
422	ASO-000463	ASO-000463	GGCatgattgtggGCT	138405	138420	6243	79
423	ASO-000605	ASO-000605	GCAtgattgtggGCT	138405	138419	6243	61
424	ASO-000479	ASO-000479	CATgattgtggGCT	138405	138418	6243	
425	ASO-000474	ASO-000474	GCAtgattgtgGGC	138406	138419	6244	99
426	ASO-000675	ASO-000675	GGCatgattgtgGGC	138406	138420	6244	95
427	ASO-000537	ASO-000537	AGGcatgattgtgGGC	138406	138421	6244	89
428	ASO-000287	ASO-000287	AGGgagggcatgatTGT	138410	138425	6248	
429	ASO-000292	ASO-000292	GGGagggcatgatTGT	138410	138424	6248	
430	ASO-000216	ASO-000216	TTAgggagggcatgATT	138412	138427	6250	96
431	ASO-000266	ASO-000266	TTAgggagggcatGAT	138413	138427	6251	
432	ASO-000256	ASO-000256	TCTtagggaggcaTGA	138414	138429	6252	
433	ASO-000269	ASO-000269	GAGgtggcacagaGGT	138460	138475	6298	
434	ASO-000350	ASO-000350	CAGtgtgagaggtGG	138469	138483	6307	
435	ASO-000353	ASO-000353	CAGtgtgagaggtTG	138470	138483	6308	
436	ASO-000310	ASO-000310	ACAaagatgaggaGGG	138532	138547	6370	
437	ASO-000309	ASO-000309	AACaaagatgaggAGG	138533	138548	6371	

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRN A end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
438	ASO-000263	ASO-000263	GAAgagaaatcagAAG	138631	138646	6469	
439	ASO-000197	ASO-000197	TCTaggccagtgcCCA	138667	138682	6505	99
440	ASO-000239	ASO-000239	AGTctattaggAGG	138689	138702	6527	100
441	ASO-000267	ASO-000267	GCTcaacatggcaAAC	138714	138729	6552	
442	ASO-000306	ASO-000306	TGCaagtgcagAAA	138737	138751	6575	
443	ASO-000345	ASO-000345	GCAagtgcagAAA	138737	138750	6575	
444	ASO-000193	ASO-000193	AATcatgggacttGCA	138748	138763	6586	100
445	ASO-000284	ASO-000284	GATttcatgtcccTCC	138788	138803	6626	
446	ASO-000209	ASO-000209	GCTaagctaagaTGA	138802	138816	6640	99
447	ASO-000207	ASO-000207	CTAagctaagaTGA	138802	138815	6640	97
448	ASO-000301	ASO-000301	TAGacattcacaGAC	138822	138836	6660	
449	ASO-000234	ASO-000234	TATagacattcaCAG	138824	138838	6662	100
450	ASO-000332	ASO-000332	AAAcacacaatacACT	138840	138855	6678	
451	SPC-15693-01	ASO-002268	CAGcaacagtcagtGT	138869	138884	6707	100
452	SPC-15692-01	ASO-002268	ACagcaacagtcagTG	138870	138885	6708	100
453	SPC-15691-01	ASO-002260	TACagcaacagtcagT	138871	138886	6709	99
454	SPC-15690-01	ASO-002252	TTAcagcaacagtcAG	138872	138887	6710	100
455	SPC-15689-01	ASO-002244	TTTAcagcaacagtcA	138873	138888	6711	100
456	SPC-15688-01	ASO-002290	TTTAcagcaacaGTC	138874	138889	6712	100
457	SPC-15687-01	ASO-002274	CTTttacagcaacaGT	138875	138890	6713	86
458	SPC-15686-01	ASO-002275	ACttttacagcaaCAG	138876	138891	6714	100
459	SPC-15685-01	ASO-002267	CActttttacagcaaCA	138877	138892	6715	93
460	SPC-15684-01	ASO-002259	TCActttttacagAAC	138878	138893	6716	99
461	SPC-15683-01	ASO-002251	TTCactttttacagCAA	138879	138894	6717	100
462	SPC-15682-01	ASO-002243	ATTcactttttacagCA	138880	138895	6718	98
463	SPC-15681-01	ASO-002234	AATtcactttttacaGC	138881	138896	6719	77

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRNA end NG_0073 98	mRNA start NM_016 835	Tau/Tubulin % inhibition
464	SPC-15680-01	ASO-002289	AAATtcacttttACAG	138882	138897	6720	96
465	SPC-15679-01	ASO-002281	CAAattcactttTACA	138883	138898	6721	99
466	ASO-002090	ASO-002090	ATTtcCaaattcactTtTAC	138884	138903	6722	99
467	ASO-002043	ASO-002043	ATtTCcaaattcactTTAC	138884	138903	6722	99
468	ASO-002076	ASO-002076	ATtTCcaaattcacTTtTAC	138884	138903	6722	99
469	ASO-002062	ASO-002062	ATTtcCaaattcactTTtTAC	138884	138903	6722	100
470	ASO-002082	ASO-002082	ATtTCcaaattcactTtTAC	138884	138903	6722	100
471	ASO-000753	ASO-000753	ATTTcCaaattcactTTTA C	138884	138903	6722	96
472	ASO-001940	ASO-001940	ATtTCcaaattcactTTtTAC	138884	138903	6722	99
473	ASO-001933	ASO-001933	AtTTCcaaattcactTTtTAC	138884	138903	6722	99
474	ASO-001919	ASO-001919	ATTTcCaaattcactTTTA C	138884	138903	6722	99
475	ASO-002094	ASO-002094	ATtTCcaaattcacTtTtTAC	138884	138903	6722	98
476	ASO-002034	ASO-002034	ATtTCcaaattcactTtTAC	138884	138903	6722	100
477	ASO-002036	ASO-002036	ATtTCcAaattcactTTAC	138884	138903	6722	100
478	ASO-002084	ASO-002084	ATTtcCaaattcacTTtTAC	138884	138903	6722	99
479	ASO-002037	ASO-002037	ATTTcCaaattcaCtTtTAC	138884	138903	6722	99
480	ASO-002058	ASO-002058	ATTtcCaaattcacTtTtTAC	138884	138903	6722	99
481	ASO-002057	ASO-002057	ATTTcCaaattcaCtTtTAC	138884	138903	6722	99
482	ASO-001926	ASO-001926	ATTTcCaaattcactTTTA C	138884	138903	6722	99
483	ASO-002092	ASO-002092	ATtTCcAaattcactTtTAC	138884	138903	6722	99
484	ASO-002023	ASO-002023	ATTTcCaaattcacTTtTAC	138884	138903	6722	100
485	ASO-000758	ASO-000758	ATTTcCaaattcactttTAC	138884	138903	6722	97
486	ASO-002065	ASO-002065	ATtTCcAaattcactTTtTAC	138884	138903	6722	99
487	ASO-002038	ASO-002038	ATTtcCaaattcacTtTtTAC	138884	138903	6722	99
488	ASO-002039	ASO-002039	ATtTCcAaattcacTtTtTAC	138884	138903	6722	98
489	ASO-000763	ASO-000763	ATtTCcAaattcactttTAC	138884	138903	6722	14
490	ASO-000768	ASO-000768	AtttcCaaattcactttTAC	138884	138903	6722	0

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
491	ASO-001933-mm1	ASO-002291	GtTTCcaaattcactTTtAC	138884	138903	6722	50
492	ASO-001933-mm2	ASO-002303	AtTTCcagattcactTTtAC	138884	138903	6722	50
493	ASO-001933-mm3	ASO-002315	TtTTCcaaattcactTTtAC	138884	138903	6722	50
494	ASO-001933-mm4	ASO-002327	GtTTCcagattcactTTtAC	138884	138903	6722	83
495	ASO-001933-mm5	ASO-002339	AtTTCcaagttcactTTtGC	138884	138903	6722	69
496	ASO-001933-mm6	ASO-002351	AtTTCcagattcactTTtAC	138884	138903	6722	75
497	SPC-15678-01	ASO-002274	CCaaattcactttTAC	138884	138899	6722	79
498	SPC-15857-01	ASO-002326	ATtTcCaaattcacttTTAC	138884	138903	6722	99
499	SPC-15858-01	ASO-002338	ATTtcCaaattcacttTTAC	138884	138903	6722	99
500	SPC-15860-01	ASO-002362	ATTtCaaattcacttTTAC	138884	138903	6722	99
501	SPC-15864-01	ASO-002236	ATTTcaaattcacTttTAC	138884	138903	6722	100
502	SPC-15868-01	ASO-002269	ATtTCaaattcactTtTAC	138884	138903	6722	100
503	SPC-15872-01	ASO-002237	ATtTCaaattcacttTTAC	138884	138903	6722	100
504	SPC-15873-01	ASO-002246	ATTtCaaattcactTTtAC	138884	138903	6722	99
505	SPC-15874-01	ASO-002254	ATTTcaaattcacTtTtAC	138884	138903	6722	11
506	SPC-15878-01	ASO-002284	ATtTccAaattcacttTTAC	138884	138903	6722	100
507	SPC-15879-01	ASO-002229	ATTTcaaattcacttTTAC	138884	138903	6722	99
508	SPC-15880-01	ASO-002238	ATTTcaaattcactTtTAC	138884	138903	6722	100
509	SPC-15883-01	ASO-002263	ATtTcCaaattcactTTtAC	138884	138903	6722	
510	SPC-15888-01	ASO-002239	ATTTcaaattcactTTtAC	138884	138903	6722	100

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
511	ASO-000754	ASO-000754	TATTTccaaattcacTTTT A	138885	138904	6723	100
512	ASO-002055	ASO-002055	TAtTtCcaaattcacTTtTA	138885	138904	6723	99
513	ASO-002035	ASO-002035	TAtTtCcaaattcacTTTA	138885	138904	6723	100
514	ASO-002048	ASO-002048	TATtTcaaattcaCttTTA	138885	138904	6723	100
515	ASO-002053	ASO-002053	TAtTtCcaaattcacTTTA	138885	138904	6723	100
516	ASO-002067	ASO-002067	TAtTtCcaaattcaCTtTA	138885	138904	6723	99
517	ASO-001954	ASO-001954	TATTTccaaattcactTTT A	138885	138904	6723	99
518	ASO-001947	ASO-001947	TATTtcaaattcacTTTT A	138885	138904	6723	99
519	ASO-002081	ASO-002081	TATtTcaaattcacTtTTA	138885	138904	6723	100
520	ASO-001966	ASO-001966	TAtTTcaaattcacTTtTA	138885	138904	6723	99
521	ASO-002025	ASO-002025	TAttTcCaaattcacTTTA	138885	138904	6723	100
522	ASO-002033	ASO-002033	TATtTcaaattcacTtTTA	138885	138904	6723	99
523	ASO-001960	ASO-001960	TaTTTcaaattcacTTtTA	138885	138904	6723	99
524	ASO-002056	ASO-002056	TAttTCcaaattcacTTtTA	138885	138904	6723	100
525	ASO-002063	ASO-002063	TATtTcaaattcacTTtTA	138885	138904	6723	99
526	ASO-002089	ASO-002089	TATTtcaaattcaCttTTA	138885	138904	6723	100
527	ASO-002073	ASO-002073	TAtTtCcaaattcacTtTTA	138885	138904	6723	99
528	ASO-002027	ASO-002027	TATtTcaaattcaCtTtTA	138885	138904	6723	99
529	ASO-002075	ASO-002075	TATtTcaaattcaCTtTA	138885	138904	6723	99
530	ASO-002028	ASO-002028	TAtTTcaaattcaCttTTA	138885	138904	6723	99
531	ASO-002085	ASO-002085	TAtTTcaaattcaCtTtTA	138885	138904	6723	99
532	ASO-002083	ASO-002083	TAttTCcaaattcacTtTTA	138885	138904	6723	99
533	ASO-000759	ASO-000759	TATTtcaaattcacttTTA	138885	138904	6723	93
534	ASO-000769	ASO-000769	TatttcaaattcactttTA	138885	138904	6723	0
535	ASO-000764	ASO-000764	TAtttcaaattcactttTA	138885	138904	6723	0
536	ASO-001954-mm1	ASO-002340	TATTTcgaattcactTTT A	138885	138904	6723	98

Figure 6 cont.

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SEQ ID NO.	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
537	ASO-001954-mm2	ASO-002352	TATTTcgaattcactTTT A	138885	138904	6723	99
538	ASO-001954-mm3	ASO-002364	GATTTccaaattcactTTT A	138885	138904	6723	97
539	ASO-001954-mm4	ASO-002376	GGTTTccaaattcactTTT A	138885	138904	6723	38
540	ASO-001954-mm5	ASO-002293	AATTTccagattcactTTT A	138885	138904	6723	96
541	ASO-001954-mm6	ASO-002305	TATTTccaaattcactTTT A	138885	138904	6723	52
542	SPC-15677-01	ASO-002266	TCCaaattcactttTA	138885	138900	6723	99
543	SPC-15859-01	ASO-002350	TATTTccaaattcactTTTA	138885	138904	6723	99
544	SPC-15861-01	ASO-002374	TATTTccaaattcacTtTTA	138885	138904	6723	100
545	SPC-15862-01	ASO-002386	TATTTccaaattcaCTtTA	138885	138904	6723	99
546	SPC-15863-01	ASO-002227	TATtTccaaattcactTTTA	138885	138904	6723	99
547	SPC-15865-01	ASO-002245	TAttTCcaaattcactTTTA	138885	138904	6723	100
548	SPC-15867-01	ASO-002261	TATtTccaaattcacTTtTA	138885	138904	6723	99
549	SPC-15869-01	ASO-002276	TATtTCcaaattcactTTTA	138885	138904	6723	100
550	SPC-15871-01	ASO-002228	TATTTccaaattcaCtTtTA	138885	138904	6723	97
551	SPC-15882-01	ASO-002255	TATTTccaaattcactTTTA	138885	138904	6723	98
552	SPC-15886-01	ASO-002285	TATTTccaaattcacTTtTA	138885	138904	6723	83
553	SPC-15887-01	ASO-002230	TATTTccaaattcacTtTTA	138885	138904	6723	100
554	SPC-15890-01	ASO-002256	TATTTccaaattcAcTtTA	138885	138904	6723	99
555	SPC-15893-01	ASO-002279	TATTTccaaattcActTtTA	138885	138904	6723	100
556	ASO-002072	ASO-002072	TTAttTccaaattcaCTtTT	138886	138905	6724	99
557	ASO-000755	ASO-000755	TTATTtccaaattcaCTTT T	138886	138905	6724	99

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRN A end NG_0073 98	mRNA start NM_016 835	Tau/Tubu lin % inhibition
558	ASO-002071	ASO-002071	TTaTtTccaaattcacTTTT	138886	138905	6724	100
559	ASO-000760	ASO-000760	TTAttccaaattcactTTT	138886	138905	6724	96
560	ASO-001920	ASO-001920	TTATttccaaattcaCTTTT	138886	138905	6724	99
561	ASO-002080	ASO-002080	TTatTTccaaattcacTTTT	138886	138905	6724	100
562	ASO-001927	ASO-001927	TTATTccaaattcacTTTT	138886	138905	6724	99
563	ASO-001941	ASO-001941	TTaTTccaaattcaCTtTT	138886	138905	6724	99
564	ASO-002045	ASO-002045	TTaTtTccaaattcacTTTT	138886	138905	6724	100
565	ASO-001934	ASO-001934	TtATTccaaattcaCTtTT	138886	138905	6724	98
566	ASO-002074	ASO-002074	TTaTtTccaaattcacTtTT	138886	138905	6724	100
567	ASO-002093	ASO-002093	TTAtTccaaattcACtTT	138886	138905	6724	100
568	ASO-002054	ASO-002054	TTaTTccaaattcaCtTTT	138886	138905	6724	100
569	ASO-002091	ASO-002091	TTaTtTccaaattcaCtTTT	138886	138905	6724	99
570	ASO-002064	ASO-002064	TTaTtTccaaattcaCTtTT	138886	138905	6724	99
571	ASO-002066	ASO-002066	TTATttccaaattCacTtTT	138886	138905	6724	99
572	ASO-002044	ASO-002044	TTAtTccaaattcaCtTTT	138886	138905	6724	99
573	ASO-002047	ASO-002047	TTATttccaaattCaCtTT	138886	138905	6724	99
574	ASO-002046	ASO-002046	TTatTtCcaaattcacTTTT	138886	138905	6724	96
575	ASO-000765	ASO-000765	TTatttccaaattcacttTT	138886	138905	6724	39
576	ASO-000770	ASO-000770	TtatttccaaattcacttTT	138886	138905	6724	0
577	ASO-001941-mm1	ASO-002317	A T aTTtccaaattcaCTtTT	138886	138905	6724	50
578	ASO-001941-mm2	ASO-002329	TTaTTtccaaattcaCTtT A	138886	138905	6724	99
579	ASO-001941-mm3	ASO-002341	TTaTTtccaaattcaCTtT G	138886	138905	6724	99
580	ASO-001941-mm4	ASO-002353	A T aTTtcca g attcaCTtTT	138886	138905	6724	76
581	ASO-001941-mm5	ASO-002365	TTaTTtcca g ttcaCTtT C	138886	138905	6724	87
582	ASO-001941-mm6	ASO-002377	TTaTTtcca g attc g CTtTT	138886	138905	6724	79

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
583	SPC-15676-01	ASO-002258	TTCcaaattcactTTT	138886	138901	6724	100
584	SPC-15866-01	ASO-002253	TTAtTtccaaattcaCTtTT	138886	138905	6724	97
585	SPC-15870-01	ASO-002283	TTAttTccaaattcacTTTT	138886	138905	6724	99
586	SPC-15875-01	ASO-002262	TTATttccaaattcacTTTT	138886	138905	6724	100
587	SPC-15876-01	ASO-002270	TTATttccaaattcaCtTTT	138886	138905	6724	100
588	SPC-15877-01	ASO-002277	TTATttccaaattcACtTT	138886	138905	6724	100
589	SPC-15881-01	ASO-002247	TTaTTtccaaattcacTTTT	138886	138905	6724	100
590	SPC-15884-01	ASO-002271	TTAtTtccaaattcacTTTT	138886	138905	6724	100
591	SPC-15885-01	ASO-002278	TTaTTtccaaattcACtTT	138886	138905	6724	100
592	SPC-15889-01	ASO-002248	TTaTTtccaaattcActTTT	138886	138905	6724	100
593	SPC-15891-01	ASO-002264	TTAtTtccaaattcActTTT	138886	138905	6724	100
594	SPC-15892-01	ASO-002272	TTaTTtccaaattcAcTtTT	138886	138905	6724	100
595	SPC-15894-01	ASO-002286	TTAtTtccaaattcAcTtTT	138886	138905	6724	99
596	SPC-15895-01	ASO-002231	TTATttccaaattcActTTT	138886	138905	6724	100
597	SPC-15896-01	ASO-002240	TTATttccaaattcAcTtTT	138886	138905	6724	100
598	ASO-002020	ASO-002020	ACtTatttccaaattcactT TTaC	138884	138909	6722	99
599	ASO-000756	ASO-000756	TTTATttccaaattcACTT T	138887	138906	6725	100
600	ASO-001967	ASO-001967	TTtATttccaaattcActTT	138887	138906	6725	99
601	ASO-001955	ASO-001955	TTTATttccaaattcaCTTT	138887	138906	6725	99
602	ASO-001948	ASO-001948	TTTAttccaaattcACTTT	138887	138906	6725	100
603	ASO-002086	ASO-002086	AcTTatttccaaattcactT TTaC	138884	138908	6722	98
604	ASO-002029	ASO-002029	ACtTatttccaaattcactt TTaC	138884	138908	6722	98

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRN A end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
605	ASO-001961	ASO-001961	TtTATttccaaattcACtTT	138887	138906	6725	99
606	ASO-002095	ASO-002095	ACTttatttccaaattcactTtTaC	138884	138908	6722	94
607	ASO-002059	ASO-002059	ACTttatttccaaattcacttTTAC	138884	138908	6722	93
608	ASO-002077	ASO-002077	ActttatttccaaattcactTTTAC	138884	138908	6722	91
609	ASO-002021	ASO-002021	AcTTtatttccaaattcactttTAC	138884	138908	6722	91
610	ASO-000761	ASO-000761	TTTatttccaaattcacTTT	138887	138906	6725	93
611	ASO-002068	ASO-002068	ACTtatttccaaattcactTtTAC	138884	138908	6722	86
612	ASO-000766	ASO-000766	TTtatttccaaattcactTT	138887	138906	6725	3
613	ASO-000771	ASO-000771	TttatttccaaattcactTT	138887	138906	6725	0
614	17-18-19mer-19	ASO-002416	TATttccaaattcaCTTT	138887	138904	6725	100
615	ASO-001967-mm2	ASO-002306	TTtATttccaagttcACtTT	138887	138906	6725	50
616	ASO-001967-mm3	ASO-002318	G TtATttccaaattcACtTT	138887	138906	6725	99
617	ASO-001967-mm4	ASO-002330	A TtATttccaagttcACtTT	138887	138906	6725	83
618	ASO-001967-mm5	ASO-002342	TTtATttccaaggttcACtTT	138887	138906	6725	48
619	ASO-001967-mm6	ASO-002354	C TtATttccaagttcACtTT	138887	138906	6725	87
620	SPC-15675-01	ASO-002250	TTTCcaaattcacTTT	138887	138902	6725	99
621	ASO-002006	ASO-002006	CTtTAttttccaaattcACTT	138888	138907	6726	99
622	ASO-000757	ASO-000757	CTTTAttttccaaattCACTT	138888	138907	6726	100
623	ASO-002017	ASO-002017	CTtTAttttccaaattcaCTT	138888	138907	6726	99
624	ASO-001928	ASO-001928	CTTTAttttccaaattcACTT	138888	138907	6726	100

Figure 6 cont.

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SEQ ID NO.	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
625	ASO-001968	ASO-001968	ACTTTatttccaaattCAC TT	138888	138908	6726	100
626	ASO-001921	ASO-001921	CTTTatttccaaattCACTT	138888	138907	6726	100
627	ASO-001989	ASO-001989	CTTTatttccaaattcACTT	138888	138907	6726	100
628	ASO-001942	ASO-001942	CTtTatttccaaattCAcTT	138888	138907	6726	99
629	ASO-000128	ASO-000128	TTTccaaattcaCTT	138888	138902	6726	100
630	ASO-001935	ASO-001935	CtTTAttccaaattCAcTT	138888	138907	6726	100
631	ASO-000013	ASO-000013	ATTtccaaattcaCTT	138888	138903	6726	95
632	ASO-002002	ASO-002002	CTTtAttccaaattcACTT	138888	138907	6726	100
633	ASO-000762	ASO-000762	CTTtatttccaaattcaCTT	138888	138907	6726	97
634	ASO-002010	ASO-002010	CTTtatttccaaatTcaCTT	138888	138907	6726	98
635	ASO-002005	ASO-002005	CTtTatttccaaattcaCTT	138888	138907	6726	98
636	ASO-001998	ASO-001998	CTtTatttccaaattcACTT	138888	138907	6726	99
637	ASO-002001	ASO-002001	CTTTatttccaaattcaCTT	138888	138907	6726	97
638	ASO-001994	ASO-001994	CTtTatttccaaattcACTT	138888	138907	6726	95
639	ASO-002013	ASO-002013	CTTtAttccaaattcaCTT	138888	138907	6726	98
640	ASO-002009	ASO-002009	CTtTatttccaaattcaCTT	138888	138907	6726	94
641	ASO-000767	ASO-000767	CTtatttccaaattcacTT	138888	138907	6726	32
642	ASO-000772	ASO-000772	CttatttccaaattcacTT	138888	138907	6726	0
643	BMT-214296	ASO-214296	CTTTActtccaaattCACT T	138888	138907	6726	
644	ASO-000013-mm1	ASO-002366	GTTtccaaattcaCTT	138888	138903	6726	97
645	ASO-000013-mm2	ASO-002378	ATTtccaaattcaCTT	138888	138903	6726	55
646	ASO-000013-mm3	ASO-002295	ATTtccgaattcaCTT	138888	138903	6726	60
647	ASO-000013-mm4	ASO-002307	GTTtccagattcaCTT	138888	138903	6726	52
648	ASO-000013-mm5	ASO-002319	GTTtccaaattcaCTA	138888	138903	6726	98

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
649	ASO-000013-mm6	ASO-002331	ATTtccagattcaCTC	138888	138903	6726	46
650	ASO-000898	ASO-000898	ATTtccaaattcaCTT	138888	138903	6726	
651	ASO-001942-mm1	ASO-002363	CTtTAttccagattCAcTT	138888	138907	6726	98
652	ASO-001942-mm2	ASO-002375	CTtTAttccaaattCAcTG	138888	138907	6726	99
653	ASO-001942-mm3	ASO-002292	CTtTAttccaaattCAcTT	138888	138907	6726	50
654	ASO-001942-mm4	ASO-002304	CTtTAttccagattCAcTA	138888	138907	6726	50
655	ASO-001942-mm5	ASO-002316	CTtTAttccagattCAcTT	138888	138907	6726	52
656	ASO-001942-mm6	ASO-002328	CTtTAttccagattCAcTT	138888	138907	6726	96
657	SPC-15674-01	ASO-002242	ATTtccaaattcACTT	138888	138903	6726	100
658	ASO-002004	ASO-002366	CTTTatttccaaatTcaCT	138889	138907	6727	98
659	ASO-002012	ASO-002378	CTTTatttccaaatTcACT	138889	138907	6727	100
660	ASO-001962	ASO-002295	ACTTTatttccaaattCAC T	138889	138908	6727	100
661	ASO-001956	ASO-002307	ACTTtatttccaaatTCAC T	138889	138908	6727	99
662	ASO-001949	ASO-002319	ACTTTatttccaaatTCAC T	138889	138908	6727	100
663	ASO-001987	ASO-002331	CTTTAttccaaatTcACT	138889	138907	6727	99
664	ASO-001991	ASO-000898	CTTTatttccaaatTcACT	138889	138907	6727	100
665	ASO-001995	ASO-002363	CTTtatttccaaatTcACT	138889	138907	6727	99
666	ASO-001992	ASO-002375	CTTTAttccaaatTcaCT	138889	138907	6727	100
667	ASO-002000	ASO-002292	CTTTatttccaaatTcACT	138889	138907	6727	100
668	ASO-001996	ASO-001996	CTTTatttccaaatTcaCT	138889	138907	6727	99

Figure 6 cont.

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SEQ ID NO.	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_0073 98	premRNA end NG_0073 98	mRNA start NM_016 835	Tau/Tubulin % inhibition
669	ASO-002008	ASO-002008	CTTtatttccaaatTCaCT	138889	138907	6727	99
670	ASO-002015	ASO-002015	CTTTAttccaaatTCaCT	138889	138907	6727	98
671	ASO-002016	ASO-002016	CTTtatttccaaatTcaCT	138889	138907	6727	98
672	ASO-001986	ASO-001986	CTTTAttccaaatTCACT	138889	138907	6727	95
673	ASO-001995-mm1	ASO-002343	CTTtatttccaaatTCaCT	138889	138907	6727	97
674	ASO-001995-mm2	ASO-002355	CTTtatttccaaatTCaCT	138889	138907	6727	98
675	ASO-001995-mm3	ASO-002367	CTTtatttccaaatTCACG	138889	138907	6727	100
676	ASO-001995-mm4	ASO-002379	CTTtatttccaaatTCaCT	138889	138907	6727	86
677	ASO-001995-mm5	ASO-002296	CTTtatttccaaatTCaCT	138889	138907	6727	52
678	ASO-001995-mm6	ASO-002308	CTTtatttccaaatTCaCT	138889	138907	6727	51
679	SPC-15673-01	ASO-002233	TATtccaaattcACT	138889	138904	6727	99
680	ASO-002003	ASO-002003	CTTTatttccaaatTCAC	138890	138907	6728	99
681	ASO-002007	ASO-002007	CTTtatttccaaatTCAC	138890	138907	6728	99
682	ASO-002011	ASO-002011	CTtAttccaaatTcAC	138890	138907	6728	100
683	ASO-001988	ASO-001988	CTTTAttccaaatTcAC	138890	138907	6728	99
684	ASO-001999	ASO-001999	CTTTAttccaaatTCAC	138890	138907	6728	100
685	ASO-001993	ASO-001993	CTTTatttccaaatTcAC	138890	138907	6728	99
686	ASO-001997	ASO-001997	CTTtatttccaaatTcAC	138890	138907	6728	99
687	ASO-001997-mm1	ASO-002320	CTTtatttccaaatTcAC	138890	138907	6728	83
688	ASO-001997-mm2	ASO-002332	CTTtatttccaaatTcAC	138890	138907	6728	85
689	ASO-001997-mm3	ASO-002344	CTTtatttccaaatTcAC	138890	138907	6728	83
690	ASO-001997-mm4	ASO-002356	CTTtatttccaaatTcAC	138890	138907	6728	33

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRN A end NG_007398	mRNA start NM_016835	Tau/Tubu lin % inhibition
691	ASO-001997-mm5	ASO-002368	CTTtatttcca gg TcAC	138890	138907	6728	6
692	ASO-001997-mm6	ASO-002380	CTT gt tatttcca gt TcAC	138890	138907	6728	50
693	SPC-15672-01	ASO-002288	TTAttccaaattCAC	138890	138905	6728	93
694	SPC-15671-01	ASO-002280	TTTatttccaaatTCA	138891	138906	6729	100
695	SPC-15670-01	ASO-002273	CTTtatttccaaATTC	138892	138907	6730	99
696	SPC-15669-01	ASO-002265	ACTTtatttccaAATT	138893	138908	6731	84
697	ASO-000139	ASO-000139	AACtttatttccaAAT	138894	138909	6732	23
698	SPC-15668-01	ASO-002257	AACTttatttccAAAT	138894	138909	6732	93
699	SPC-15667-01	ASO-002249	TAACTttatttccAAA	138895	138910	6733	97
700	SPC-15666-01	ASO-002241	ATAActttatttccAA	138896	138911	6734	97
701	ASO-000118	ASO-000118	AATaactttatttCCA	138897	138912	6735	92
702	SPC-15665-01	ASO-002232	AATaactttattTCCA	138897	138912	6735	99
703	ASO-000101	ASO-000101	TAAaactttattTCC	138898	138913	6736	60
704	SPC-15664-01	ASO-002287	TAAaactttatTCC	138898	138913	6736	76
705	ASO-000148	ASO-000148	GTAaactttatTTC	138899	138914	6737	41
706	ASO-000184	ASO-000184	TAAaactttatTTC	138899	138913	6737	7
707	ASO-000112	ASO-000112	GTAaactttaTTT	138900	138914	6738	1
708	ASO-000170	ASO-000170	AGTaataactttaTTT	138900	138915	6738	1
709	ASO-000154	ASO-000154	GAGTaataactttATT	138901	138916	6739	0
710	ASO-000125	ASO-000125	AGTaataactttATT	138901	138915	6739	1
711	ASO-000167	ASO-000167	GAGTaataacttTAT	138902	138916	6740	5
712	ASO-000134	ASO-000134	AGAgtaataactTAT	138902	138917	6740	12
713	ASO-000175	ASO-000175	CAGagtaataactTTA	138903	138918	6741	43
714	ASO-000178	ASO-000178	AGAgtaataactTTA	138903	138917	6741	2
715	ASO-000138	ASO-000138	CAGagtaataacTTT	138904	138918	6742	43

Figure 6 cont.

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SEQ ID NO:	Oligomer Name	ASO Number	ASO Sequence	premRNA start NG_007398	premRNA end NG_007398	mRNA start NM_016835	Tau/Tubulin % inhibition
716	ASO-000171	ASO-000171	TCAgagtaataacTTT	138904	138919	6742	39
717	ASO-000236	ASO-000236	ATCagagtaataaCTT	138905	138920	6743	65
718	ASO-000127	ASO-000127	TCAgagtaataaCTT	138905	138919	6743	29
719	ASO-000177	ASO-000177	CAGagtaataaCTT	138905	138918	6743	28
720	ASO-000238	ASO-000238	AATcagagtaataACT	138906	138921	6744	21
721	ASO-000222	ASO-000222	TAAcagagtaataAAC	138907	138922	6745	15
722	ASO-000307	ASO-000307	AATcagagtaataAAC	138907	138921	6745	3
723	ASO-000204	ASO-000204	TTAatcagagtaaTAA	138908	138923	6746	1
724	ASO-000330	ASO-000330	TAAcagagtaaTAA	138908	138922	6746	2
725	ASO-000326	ASO-000326	TTTaatcagagtaATA	138909	138924	6747	9
726	ASO-000249	ASO-000249	TTTaatcagagtAAT	138910	138924	6748	0
727	ASO-002022	ASO-002022	TTATttccaaattcaCtTT	138886	138905	6724	99
728	ASO-002026	ASO-002026	TTatTTccaaattcaCtTTT	138886	138905	6724	100
729	ASO-002024	ASO-002024	TTAttTccaaattcaCtTTT	138886	138905	6724	99
730	ASO-002049	ASO-002049	ACTTtatttccaaattcactT TtAC	138884	138908	6722	99
731	ASO-002019	ASO-002019	ACtTatttccaaattcactT TtAC	138884	138908	6722	98

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2016/016652

A. CLASSIFICATION OF SUBJECT MATTER

INV. G01N33/50

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, BIOSIS, EMBASE, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Z. CAO ET AL: "Tetramethylenedisulfotetramine Alters Ca ²⁺ Dynamics in Cultured Hippocampal Neurons: Mitigation by NMDA Receptor Blockade and GABAA Receptor-Positive Modulation", TOXICOLOGICAL SCIENCES, vol. 130, no. 2, 13 August 2012 (2012-08-13), pages 362-372, XP055267009, ISSN: 1096-6080, DOI: 10.1093/toxsci/kfs244	1-5,7
Y	abstract; figures 1,2 page 363, column 2, paragraph 2 ----- -/--	1,6



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

21 April 2016

Date of mailing of the international search report

11/07/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Gundlach, Björn

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/016652

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Th Murphy ET AL: "Spontaneous synchronous synaptic calcium transients in cultured cortical neurons", Journal of Neuroscience, 1 December 1992 (1992-12-01), page 4834, XP055267084, UNITED STATES Retrieved from the Internet: URL: http://www.jneurosci.org/content/12/12/4834.full.pdf [retrieved on 2016-04-20] cited in the application figure 3	1,2
X	----- W. BOEHMERLE ET AL: "Paclitaxel induces calcium oscillations via an inositol 1,4,5-trisphosphate receptor and neuronal calcium sensor 1-dependent mechanism", PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, vol. 103, no. 48, 28 November 2006 (2006-11-28), pages 18356-18361, XP055267208, US ISSN: 0027-8424, DOI: 10.1073/pnas.0607240103 figure 1	1-4
Y	----- HE S-J ET AL: "Caffeine-dependent stimulus-triggered oscillations in the CA3 region of hippocampal slices from rats chronically exposed to lead", EXPERIMENTAL NEUROLOGY, ACADEMIC PRESS, NEW YORK, NY, US, vol. 190, no. 2, 1 December 2004 (2004-12-01), pages 525-534, XP004626745, ISSN: 0014-4886, DOI: 10.1016/J.EXPNEUROL.2004.08.016 abstract	1,8
Y	----- WO 00/40614 A2 (BETH ISRAEL HOSPITAL [US]; SCHARENBERG ANDREW M [US]) 13 July 2000 (2000-07-13) abstract page 17 -----	1,6
Y	----- WO 00/40614 A2 (BETH ISRAEL HOSPITAL [US]; SCHARENBERG ANDREW M [US]) 13 July 2000 (2000-07-13) abstract page 17 -----	1,8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/016652

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-8

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8

A method of testing or determining in vivo acute neurotoxicity of a molecule comprising measuring calcium oscillations in vitro in neuronal cells which are in contact with the molecule.

2. claims: 9-18

A method of determining in vivo acute neurotoxicity of a molecule comprising a polynucleotide, the method comprising calculating a sequence score, wherein the sequence score is calculated by formula (I): (number of C nucleotides or analogs thereof in the polynucleotide - number of G nucleotides or analogs thereof in the polynucleotide) / total nucleotide length (number) of the polynucleotide (I).

3. claims: 19, 20

A molecule selected to have a certain neurotoxicity or having tolerable in vivo acute neurotoxicity.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/016652

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0040614	A2	13-07-2000	AT 407949 T 15-09-2008
		AU 776672 B2	16-09-2004
		AU 2055600 A	24-07-2000
		CA 2360396 A1	13-07-2000
		EP 1141017 A2	10-10-2001
		EP 2006300 A2	24-12-2008
		HK 1041009 A1	08-05-2009
		JP 2002536966 A	05-11-2002
		WO 0040614 A2	13-07-2000
