

CLAIMS

WHAT IS CLAIMED IS:

- ~~1.~~ 1. An anti-transferrin receptor-2 antibody comprising a variable heavy chain (VH) region and a variable light chain (VL) region, wherein the VH region comprises HCDR1 sequence comprising SEQ ID NO: 1; HCDR2 sequence comprising EINPIX₁GRSNYAX₂KFQG₇ (SEQ ID NO: 88), wherein X₁ is selected from N or Q and X₂ is selected from Q or E; and HCDR3 sequence comprising SEQ ID NO: 3~~7~~, and wherein the VL region comprises LCDR1 sequence comprising RTSENIYX₃NLA (SEQ ID NO: 89), LCDR2 sequence comprising AX₄TNLAX₅ (SEQ ID NO: 90), and LCDR3 sequence comprising QHFWGTPLTX₆ (SEQ ID NO: 91), wherein X₃ is selected from N or S, X₄ is selected from A or G, X₅ is selected from D or E, and X₆ is present or absent, and if present, is F.
- ~~2.~~ 2. The anti-transferrin receptor-2 antibody of ~~claim 1~~, wherein the VH region comprises HCDR1 sequence comprising SEQ ID NO: 1, HCDR2 sequence comprising SEQ ID NO: 2, and HCDR3 sequence comprising SEQ ID NO: 3.
- ~~3.~~ The anti-transferrin receptor antibody of claim 1, wherein the VH region comprises HCDR1 sequence comprising SEQ ID NO: 1, HCDR2 sequence comprising SEQ ID NO: 4, and HCDR3 sequence comprising SEQ ID NO: 3.
- ~~4.~~ 3. The anti-transferrin receptor-2 antibody of ~~claim 1~~, wherein the VH region comprises HCDR1 sequence comprising SEQ ID NO: 1, HCDR2 sequence comprising SEQ ID NO: 5, and HCDR3 sequence comprising SEQ ID NO: 3.
- ~~5.~~ The anti-transferrin receptor antibody of any one of the claims ~~1-4~~, wherein the claim 1, wherein the VL region comprises LCDR1 sequence RTSENIYX₃NLA comprising SEQ ID NO: 6, LCDR2 sequence ~~AX₄TNLAX₅~~ comprising AATNLAX₅ (SEQ ID NO: 92), and LCDR3 sequence comprising QHFWGTPLTX₆ (SEQ ID NO: 91), wherein ~~X₃ is selected from N or S, X₄ is selected from A or G,~~ X₅ is selected from D or E, and X₆ is present or ~~absence~~ absent, and if present, is F.
- ~~6.~~ 4. The anti-transferrin receptor-2 antibody of ~~any one of the claims claim~~ 1-5, wherein the VL region comprises LCDR1 sequence comprising SEQ ID NO: 6, LCDR2 sequence AATNLAX₅, and LCDR3 sequence QHFWGTPLTX₆, wherein X₅ is selected from D or E and X₆ is present or absence, and if present, is F.
- ~~7.~~ The anti-transferrin receptor antibody of any one of the claims ~~1-6~~, wherein the VL region comprises LCDR1 sequence comprising SEQ ID NO: 6, LCDR2 sequence comprising SEQ ID NO: 7, and LCDR3 sequence comprising SEQ ID NO: 8.
- ~~8.~~ 5. The anti-transferrin receptor-2 antibody of ~~any one of the claims claim~~ 1-5, wherein the VL region comprises LCDR1 sequence comprising SEQ ID NO: 6, LCDR2 sequence comprising SEQ ID NO: 9, and LCDR3 sequence comprising SEQ ID NO: 10.

- ~~9.~~ The anti-transferrin receptor antibody of any one of the claims ~~1-5~~, wherein the VL region comprises L~~CDR1~~ sequence comprising SEQ ID NO: ~~11~~, L~~CDR2~~ sequence comprising SEQ ID NO: ~~12~~, and L~~CDR3~~ sequence comprising SEQ ID NO: ~~10~~.
- ~~10.~~ The anti-transferrin receptor antibody of any one of the claims ~~1-9~~, wherein the VH region comprises H~~CDR1~~ sequence comprising SEQ ID NO: ~~1~~, H~~CDR2~~ sequence comprising SEQ ID NO: ~~2~~, and H~~CDR3~~ sequence comprising SEQ ID NO: ~~3~~; and the VL region comprises L~~CDR1~~ sequence comprising SEQ ID NO: ~~6~~, L~~CDR2~~ sequence comprising SEQ ID NO: ~~7~~, and L~~CDR3~~ sequence comprising SEQ ID NO: ~~8~~.
- ~~11.~~ The anti-transferrin receptor antibody of any one of the claims ~~1-9~~, wherein the VH region comprises H~~CDR1~~ sequence comprising SEQ ID NO: ~~1~~, H~~CDR2~~ sequence comprising SEQ ID NO: ~~4~~, and H~~CDR3~~ sequence comprising SEQ ID NO: ~~3~~; and the VL region comprises L~~CDR1~~ sequence comprising SEQ ID NO: ~~6~~, L~~CDR2~~ sequence comprising SEQ ID NO: ~~7~~, and L~~CDR3~~ sequence comprising SEQ ID NO: ~~8~~.
- ~~12.~~ 6. The anti-transferrin receptor antibody of ~~any one of the claims~~ claim ~~1-9~~, wherein the VH region comprises ~~HCDR1 sequence comprising SEQ ID NO: 1, HCDR2 sequence comprising SEQ ID NO: 5, and HCDR3 sequence comprising SEQ ID NO: 3; and the VL region comprises L~~CDR1 sequence comprising SEQ ID NO: ~~6~~, L~~CDR2~~ sequence comprising SEQ ID NO: ~~9~~, and L~~CDR3~~ sequence comprising SEQ ID NO: ~~10~~.
- ~~13.~~ The anti-transferrin receptor antibody of any one of the claims ~~1-9~~, wherein the VH region comprises H~~CDR1~~ sequence comprising SEQ ID NO: ~~1~~, H~~CDR2~~ sequence comprising SEQ ID NO: ~~4~~, and H~~CDR3~~ sequence comprising SEQ ID NO: ~~3~~; and the VL region comprises L~~CDR1~~ sequence comprising SEQ ID NO: ~~11~~, L~~CDR2~~ sequence comprising SEQ ID NO: ~~12~~, and L~~CDR3~~ sequence comprising SEQ ID NO: ~~10~~.
- ~~14.~~ The anti-transferrin receptor antibody of any one of the claims ~~1-13~~, wherein the VH region comprises ~~at least 80%, -85%, -90%, -95%, -99%, or -100%~~ sequence identity to a sequence selected from SEQ ID NOs: ~~13-16~~.
- ~~15.~~ ~~The anti-transferrin receptor antibody of any one of the claims 1-14, and~~ wherein the VL region comprises ~~at least 80%, -85%, -90%, -95%, -99%, or -100%~~ sequence identity to a sequence selected from SEQ ID NOs: ~~18-21~~.
- ~~16.~~ 7. The anti-transferrin receptor ~~antibody of any one of the claims~~ claim ~~1-15~~, wherein the anti-transferrin receptor ~~antibody~~ comprises a humanized antibody or binding fragment thereof or a chimeric antibody or binding fragment thereof.
- ~~17.~~ 8. The anti-transferrin receptor ~~antibody of any one of the claims~~ claim ~~1-16~~, wherein the anti-transferrin receptor ~~antibody~~ comprises a multi-specific antibody or a binding fragment thereof.

- ~~18.~~ 9. The anti-transferrin receptor-antibody of ~~any one of the claims claim~~ 1-17, wherein the anti-transferrin receptor-~~antibody comprises a bispecific antibody or binding fragment thereof.~~
- ~~19.~~ The anti-transferrin receptor antibody of any one of the claims 1-18, wherein the anti-transferrin receptor-antibody comprises an IgG-scFv, nanobody, BiTE, diabody, DART, TandAb, scDiabody, scDiabody-CH3, triple body, mini-antibody, minibody, TriBi minibody, scFv-CH3-KIH, Fab-scFv-Fc KIH, Fab-scFv, scFv-CH-CL-scFv, Fab', F(ab')ab'2, F(ab')ab'3, F(ab')2-scFv2, scFv, scFv-KIH, Fab-scFv-Fc, tetravalent HCAb, scDiabody-Fc, diabody-Fc, tandem scFv-Fc, or intrabody.
- ~~20.~~ 10. The anti-transferrin receptor-antibody of ~~any one of the claims claim~~ 1-19, wherein the anti-transferrin receptor-antibody comprises at least one of an IgG1-framework.
- ~~21.~~ The anti-transferrin receptor antibody of any one of the claims 1-19, wherein the anti-transferrin receptor antibody comprises, an IgG2-framework.
- ~~22.~~ The anti-transferrin receptor antibody of claim 21, wherein the IgG2,
an IgG2b framework is IgG2b framework.
- ~~23.~~ The anti-transferrin receptor antibody of any one of the claims 1-19, wherein the anti-transferrin receptor antibody comprises, or an IgG4 framework.
- ~~24.~~ 11. The anti-transferrin receptor-antibody of ~~any one of the claims claim~~ 1-23, wherein the anti-transferrin receptor-antibody further comprises at least one mutation in the Fc region.
- ~~25.~~ The anti-transferrin receptor antibody of claim 24, wherein, and the at least one mutation modulates effector function.
- ~~26.~~ 12. The anti-transferrin receptor-antibody of ~~claim 24 or 25~~ 11, wherein the ~~at least one mutation attenuates~~ effector function comprises attenuation or ~~eliminates~~ elimination of Fc- γ receptor binding.
- ~~27.~~ 13. The anti-transferrin receptor-antibody of ~~any one of the claims 24-26~~ claim 11, wherein the at least one mutation is at residue position D265, N297, K322, L328, or P329, wherein the residue position is in reference to IgG1.
- ~~28.~~ 14. The anti-transferrin receptor-antibody of ~~any one of the claims 24-27, wherein the Fc region comprises two or more, three or more, or four or more mutations.~~
- ~~29.~~ The anti-transferrin receptor antibody of any one of the claims 24-28 claim 11, wherein the Fc region comprises mutations at L233-and L234, wherein the residues correspond to position 233 and 234 of SEQ ID NO: 23.
- ~~30.~~ 15. The anti-transferrin receptor-antibody of ~~any one of the claims 24-28~~ claim 11, wherein the Fc region comprises mutations at D265 and N297.
- ~~31.~~ 16. The anti-transferrin receptor antibody of claim 1, wherein the anti-transferrin receptor-antibody of ~~any one of the claims 1-30, wherein the anti-transferrin receptor-antibody~~

comprises a heavy chain (HC) sequence selected from SEQ ID NOs: 23-46 and a light chain (LC) sequence selected from SEQ ID NOs: 47-50.

~~32.~~ 17. The anti-transferrin receptor-antibody of ~~any one of the claims-claim 1-31~~, wherein the anti-transferrin receptor-antibody specifically binds to human-transferrin receptor-(TfR).

~~33.~~ 18. An anti-transferrin receptor-antibody conjugate, comprising ~~an anti-transferrin receptor antibody of claims 1-32 and a payload~~. Formula (I):

~~34.~~ ~~The anti-transferrin receptor antibody conjugate of claim 33, wherein the payload comprises a small molecule, a peptide, a protein, or a polynucleic acid molecule.~~

~~35.~~ ~~The anti-transferrin receptor antibody conjugate of claim 33, wherein the payload comprises a polynucleic acid molecule.~~

~~36.~~ ~~The anti-transferrin receptor antibody conjugate of claim 35, wherein the polynucleic acid molecule comprises short interfering nucleic acid (siNA), short interfering RNA (siRNA), double-stranded RNA (dsRNA), micro-RNA (miRNA), short hairpin RNA (shRNA), antisense oligonucleotide (ASO), a PMO, or mRNA.~~

~~37.~~ ~~The anti-transferrin receptor antibody conjugate of any one of the claims 34-36, wherein the payload comprises a dsRNA.~~

~~38.~~ ~~The anti-transferrin receptor antibody conjugate of any one of the claims 34-36, wherein the payload comprises an antisense oligonucleotide (ASO).~~

~~39.~~ ~~The anti-transferrin receptor antibody conjugate of claim 33, wherein the payload comprises a small molecule, a peptide, or a protein.~~

~~40.~~ ~~The anti-transferrin receptor antibody conjugate of claim 39, wherein the payload comprises a microtubule disrupting agent, a DNA modifying agent, or an Akt inhibitor.~~

~~41.~~ ~~The anti-transferrin receptor antibody conjugate of claim 39, wherein the payload comprises an auristatin or a derivative thereof, a dolastatin or a derivative or analog thereof, a maytansinoid, or a pyrrolobenzodiazepine or a derivative thereof.~~

~~42.~~ ~~The anti-transferrin receptor antibody conjugate of claim 41, wherein the auristatin or derivative thereof is monomethyl auristatin E (MMAE) or monomethyl auristatin F (MMAF).~~

~~43.~~ ~~The anti-transferrin receptor antibody conjugate of claim 41, wherein the maytansinoid is DM1 or DM4.~~

~~44.~~ ~~The anti-transferrin receptor antibody conjugate of claim 41, wherein pyrrolobenzodiazepine is a pyrrolobenzodiazepine dimer.~~

~~45.~~ ~~The anti-transferrin receptor antibody conjugate of claim 39, wherein the payload comprises an immunomodulatory agent or an immune modulator.~~

~~46.~~ ~~The anti-transferrin receptor antibody conjugate of claim 45, wherein the immune modulator comprises a cytokine.~~

- ~~47. The anti-transferrin receptor antibody conjugate of claim 39, wherein the payload comprises a protein or peptide toxin or fragment thereof.~~
- ~~48. The anti-transferrin receptor antibody conjugate of any one of the claims 33-47, wherein the payload is conjugated to the anti-transferrin receptor antibody through a linker.~~
- ~~49. The anti-transferrin receptor antibody conjugate of any one of the claims 33-48, wherein the anti-transferrin receptor antibody is further conjugated to two or more payloads.~~
- ~~50. The anti-transferrin receptor antibody conjugate of any one of the claims 33-49, wherein a ratio of the payloads to the anti-transferrin receptor antibody is about 1:1, 2:1, 3:1, 4:1, 5:1, 6:1, 7:1, 8:1, 9:1, 10:1, 11:1, or 12:1.~~
- ~~51. The anti-transferrin receptor antibody conjugate of any one of the claims 33-50, wherein the anti-transferrin conjugate comprises~~

$$A-(X^1-B)_n$$

Formula (I)

wherein,

~~A comprises the anti-transferring antibody;~~

A comprises the anti-transferrin receptor antibody, wherein the anti-transferrin receptor antibody comprises a variable heavy chain (VH) region and a variable light chain (VL) region, wherein the VH region comprises HCDR1 sequence comprising SEQ ID NO: 1; HCDR2 sequence comprising EINPIX₁GRSNYAX₂KFQG (SEQ ID NO: 88), wherein X₁ is selected from N or Q and X₂ is selected from Q or E; and HCDR3 sequence comprising SEQ ID NO: 3, and wherein the VL region comprises LCDR1 sequence comprising RTSENIYX₃NLA (SEQ ID NO: 89), LCDR2 sequence comprising AX₄TNLAX₅ (SEQ ID NO: 90), and LCDR3 sequence comprising QHFWGTPLTX₆ (SEQ ID NO: 91), wherein X₃ is selected from N or S, X₄ is selected from A or G, X₅ is selected from D or E, and X₆ is present or absence, and if present, is E;

B comprises ~~the payload;~~ a polynucleic acid molecule;

X¹-consists of a bond or linker; and

n is an averaged value selected from 1-12.

~~52. 19. The anti-transferrin receptor-antibody conjugate of claim 51, wherein the payload is a polynucleic acid molecule.~~

~~53. The anti-transferrin receptor antibody conjugate of claim 52 18, wherein the polynucleic-acid-molecule comprises a passenger strand and a guide strand.~~

~~54. 20. The anti-transferrin receptor-antibody conjugate of claim 53 19, wherein the guide strand comprises at least one modified internucleotide linkage, at least one inverted abasic moiety, at least one 5'-5'-vinylphosphonate-modified non-natural-nucleotide, or a combination thereof.~~

~~55. 21. The anti-transferrin receptor-antibody conjugate of claim 54, wherein the at least one 5'-vinylphosphonate-modified non-natural nucleotide is located about 1, 2, 3, 4, or 5 bases away from the 5'-terminus of the guide strand.~~

~~56. The anti-transferrin receptor antibody conjugate of any one of the claims 51-55~~18, wherein the polynucleic-acid-molecule further comprises a modification of a-sugar-moiety at the 2' position:

~~57. The anti-transferrin receptor antibody conjugate of claim 56, and~~ wherein the modification at the 2'-position is selected from ~~2'-2'-O-methyl, 2'-2'-O-methoxyethyl (2'- (2'-O-MOE), 2'-2'-deoxy, T-2'-deoxy-2'-2'-fluoro, 2'-2'-O-aminopropyl (2'- (2'-O-AP), 2'-2'-O-dimethylaminoethyl (2'- (2'-O-DMAOE), 2'-2'-O-dimethylaminopropyl (2'- (2'-O-DMAP), T-2'-O-dimethylaminoethyloxyethyl (2'- (2'-O-DMAEOE), or 2'-2'-O-N-methylacetamido (2'- (2'-O-NMA) modified-nucleotide.~~

~~58. 22. The anti-transferrin receptor-antibody conjugate of claim 53~~19, wherein the passenger strand comprises at least 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, or more-phosphorodiamidate morpholino oligomer-modified non-natural-nucleotides.

~~59. 23. The anti-transferrin receptor-antibody conjugate of any one of the claims 52-58 claim 19, wherein the A-X¹ is conjugated to the 5' end of the passenger strand is shorter in length than the guide strand, thereby generating a 5' overhang, a 3' overhang, a blunt end at one terminus, or a combination thereof. 3' end of the passenger strand.~~

~~60. 24. The anti-transferrin receptor-antibody conjugate of any one of the claims 52-58 claim 18, wherein the passenger strand is equal in length to the guide strand, thereby generating a blunt end at each terminus of the polynucleic-acid-molecule.~~

~~61. The anti-transferrin receptor antibody conjugate of any one of the claims 52-60, wherein the passenger strand is conjugated to A-X¹:~~

~~62. The anti-transferrin receptor antibody conjugate of claim 61, wherein A-X¹ is conjugated to the 5' end of the passenger strand.~~

~~63. The anti-transferrin receptor antibody conjugate of claim 61, wherein A-X¹ is conjugated to the 3' end of the passenger strand.~~

~~64. The anti-transferrin receptor antibody conjugate of any one of the claims 33-50, wherein the anti-transferrin conjugate comprises:~~



Formula (II)

wherein,

A-comprises the anti-transferrin receptor antibody;

B-comprises the polynucleic acid molecule;

C-consists of a polymer;

X¹-consists a bond or first linker;

X²-consists of a bond or second linker; and

n is an averaged value selected from 1-12.

- ~~65. The anti-transferrin receptor antibody conjugate of claim 64, wherein C is polyethylene glycol.~~
- ~~66. The anti-transferrin receptor antibody conjugate of claim 64, wherein the polynucleic acid molecule comprises a passenger strand and a guide strand.~~
- ~~67. The anti-transferrin receptor antibody conjugate of claim 66, wherein the passenger strand is conjugated to A-X¹ and X²-C.~~
- ~~68. The anti-transferrin receptor antibody conjugate of claim 67, wherein A-X¹ is conjugated to the 5' end of the passenger strand and X²-C is conjugated to the 3' end of the passenger strand.~~
- ~~69. The anti-transferrin receptor antibody conjugate of claim 67, wherein X²-C is conjugated to the 5' end of the passenger strand and A-X¹ is conjugated to the 3' end of the passenger strand.~~
- ~~70. The anti-transferrin receptor antibody conjugate of any one of the claims 51-69, wherein X¹ and X² are each independently a non-polymeric linker.~~
- ~~71. The anti-transferrin receptor antibody conjugate of claim 64, further comprising D.~~
- ~~72. The anti-transferrin receptor antibody conjugate of claim 71, wherein D is an endosomolytic moiety.~~
- ~~73. A nucleic acid polymer encoding an anti-transferrin receptor antibody of claims 1-32.~~
- ~~74. A vector comprising a nucleic acid polymer of claim 73.~~
- ~~75. A pharmaceutical composition comprising:~~
~~an anti-transferrin receptor antibody of claims 1-32 or an anti-transferrin receptor antibody conjugate of claims 33-72; and~~
~~a pharmaceutically acceptable excipient.~~
- ~~76. The pharmaceutical composition of claim 75, wherein the pharmaceutical composition is formulated for systemic administration.~~
- ~~77. The pharmaceutical composition of claim 75 or 76, wherein the pharmaceutical composition is formulated for parenteral administration.~~
- ~~78. A method of delivering a payload to a target site of interest in a subject, comprising:~~
~~administering to the subject an anti-transferrin receptor antibody conjugate of claims 33-72 or a pharmaceutical composition of claims 75-77 to deliver the payload to the target site of interest.~~
- ~~79. The method of claim 78, wherein the target site of interest is a cell comprising an overexpressed causative protein.~~
- ~~80. The method of claim 78, wherein the target site of interest is a tumor site.~~
- ~~81. The method of claim 78, wherein the target site of interest is a site located within the brain.~~

- ~~82. A method of treating a cancer in a subject in need thereof, comprising:~~
~~administering to the subject an anti-transferrin receptor antibody conjugate of~~
~~claims 33-72 or a pharmaceutical composition of claims 75-77 to treat the cancer in the~~
~~subject.~~
- ~~83. The method of claim 82, wherein the cancer is a solid cancer.~~
- ~~84. The method of claim 82, wherein the cancer is a hematologic malignancy.~~
- ~~85. The method of any one of the claims 82-84, wherein the cancer is bladder cancer, lung~~
~~cancer, brain cancer, melanoma, breast cancer, Non-Hodgkin lymphoma, cervical cancer,~~
~~ovarian cancer, colorectal cancer, pancreatic cancer, esophageal cancer, prostate cancer,~~
~~kidney cancer, skin cancer, leukemia, thyroid cancer, liver cancer, or uterine cancer.~~
- ~~86. The method of any one of the claims 82-85, wherein the cancer is a metastatic cancer.~~
- ~~87. The method of any one of the claims 82-85, wherein the cancer is a relapsed or refractory~~
~~cancer.~~
- ~~88. A method of treating a muscle atrophy or myotonic dystrophy in a subject in need~~
~~thereof, comprising:~~
~~administering to the subject an anti-transferrin receptor antibody conjugate of claims 33-72 or a~~
~~pharmaceutical composition of claims 75-77, wherein the polynucleic acid-molecule hybridizes~~
~~to a target sequence of an atrogene~~a gene~~, and wherein the polynucleic acid-molecule~~
~~mediates RNA-interference against the atrogene, thereby treating muscle atrophy in the subject.~~
gene.
- ~~89. 25. The method of claim 88, wherein the muscle atrophy is a diabetes-associated muscle~~
~~atrophy or a cancer cachexia-associated muscle atrophy.~~
- ~~90. The method of claim 88, wherein the muscle atrophy is associated with insulin~~
~~deficiency, chronic renal failure, congestive heart failure, chronic respiratory disease, a~~
~~chronic infection, fasting, denervation, sarcopenia, or myotonic dystrophy type 1 (DM1).~~
- ~~91. The method of claim 88, wherein the myotonic dystrophy is DM1.~~
- ~~92. The method of claim 88, wherein reticulocyte levels in the subject are not reduced~~
~~following the administration of anti-transferrin receptor antibody.~~
- ~~93. The method of claim 88, wherein the administration of anti-transferrin receptor antibody~~
~~conjugate downregulates SSB-siRNA or SSB-mRNA levels in the subject.~~
- ~~94. The method of claim 93, wherein downregulation of SSB-siRNA or SSB-mRNA is in~~
~~muscle.~~
- ~~95. The method of claim 94, wherein the muscle is skeletal muscle.~~
- ~~96. The method of claim 94, wherein the muscle is cardiac muscle.~~
- ~~97. The method of claim 88, wherein the atrogene~~of claim 24, the gene ~~comprises an~~
~~upregulated gene within the IGF1-Akt-FoxO-pathway, the glucocorticoids-GR~~

pathway, the PGC1 α -FoxO pathway, the TNF α -NF κ B pathway, or the myostatin-ActRIIb-Smad2/3 pathway;

~~98. The method of claim 88, wherein the atrogene encodes an E3 ligase;~~

~~99. The method of claim 88, wherein the atrogene encodes a Forkhead box transcription factor;~~

~~100. The method of claim 88, wherein the atrogene comprises atrogin-1 gene (FBXO32), MuRF1 gene (TRIM63), FOXO1, FOXO3, or MSTN;~~

~~101. The method of claim 88, wherein the atrogene comprises DMD, or DMPK.~~

~~102. A method of treating a muscular dystrophy in a subject in need thereof, comprising: administering to the subject an~~

~~26. The anti-transferrin receptor antibody conjugate of claims 33-72 or a pharmaceutical composition of claims 75-77, thereby treating the muscular dystrophy in the subject.~~

~~103. The method of claim 102, wherein the muscular dystrophy is Duchenne muscular dystrophy, Becker muscular dystrophy, facioscapulohumeral muscular dystrophy, congenital muscular dystrophy, or myotonic dystrophy.~~

~~104. The method of claim 102, wherein the muscular dystrophy is Duchenne muscular dystrophy.~~

~~105. The method of any of the preceding claims, wherein the subject is a human.~~

~~106. A kit comprising an anti-transferrin receptor antibody conjugate of claims 33-72, a nucleic acid polymer of claim 73, a vector of claim 74, or a pharmaceutical composition of claims 75-77 antibody conjugate is administered to a subject.~~

27. A pharmaceutical composition comprising:
an anti-transferrin receptor antibody of claim 1; and
a pharmaceutically acceptable excipient.