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(54) Title: COMPOSITIONS AND METHODS FOR MUSCLE DISORDERS

(57) Abstract: The invention discloses approaches to reduce expression of a gene in a cell.



## COMPOSITIONS AND METHODS FOR MUSCLE DISORDERS

### Sequence Listing

This application contains a sequence listing in electronic form as an eXtensible Markup  
5 Language (XML) form filed via the Patent Center and is hereby incorporated by reference in its  
entirety. The XML-formatted sequence listing, created on April 6, 2023, is named KATF-013-  
02WO-Seq.xml, and is 1.13 MB in size.

### Field of the Invention

10 The invention relates to the medical treatment of muscle weakening disorders, including  
facioscapulohumeral muscular dystrophy.

### Background

Genetic disorders are a major source of disease burden, and many of them have few or no  
15 medical or curative treatments. Along with other genetically linked muscle wasting disorders,  
Facioscapulohumeral Muscular Dystrophy (“FSHD”) is a genetic disorder that causes progressively  
increasing weakness and atrophy of the muscles. FSHD is so named because the muscles in the face,  
shoulder, and upper arm are the most affected, but it also affects other muscles in the body,  
including the legs, eyes, heart, hip, or abdominal muscles. FSHD causes progressively worsening  
20 symptoms that may result in asymmetric weakness

FSHD is a genetic disorder caused by a genetic mutation that leads to inappropriate  
expression of the DUX4 gene on chromosome 4. DUX4 is the double homeobox protein 4 gene.  
FSHD can be inherited by just one parent because it is an autosomal dominant genetic disorder.  
FSHD often affects patients before the age of 20 and has an estimated prevalence in the United  
25 States of 4 cases per 100,000 individuals. There is currently no medical treatment to arrest or reverse  
the muscular effects of FSHD.

### Summary

Aspects of the invention provide a method of inhibiting expression of a gene in a cell, the  
30 method comprising administering to a subject the adeno-associated virus (AAV) vector comprising a  
promoter sequence, a miRNA strand that binds to DUX4-FL, and a capsid protein comprising at  
least one modification that is an insertion between any two contiguous amino acids between amino

acids 262-269, 327-332, 382-386, 452-460, 488-505, 527-539, 545-558, 581-593, 704-714, or any combination thereof in an AAV9 capsid polypeptide or in an analogous position in an AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV rh.74, AAV rh.10 capsid polypeptide. Methods of inhibiting that gene expression may include providing the AAV vector with any of the indicated permutations of the embodiment of the invention.

For example, the promoter sequence is a promoter sequence transcribed by RNA polymerase II or III, U6 promoter sequence, MHCK7 promoter sequence, CK6 promoter sequence, tMCK promoter sequence, CK5 promoter sequence, MCK promoter sequence, HAS promoter sequence, MPZ promoter sequence, desmin promoter sequence, APOA2 promoter sequence, hAAT promoter sequence, INS promoter sequence, IRS2 promoter sequence, MYH6 promoter sequence, MYL2 promoter sequence, TNNI3 promoter sequence, SYN1 promoter sequence, GFAP promoter sequence, NES promoter sequence, MBP promoter sequence, or TH promoter sequence.

The miRNA strand or miRNA scaffold may be selected from the group of miDUX4, miRN92, miRNA-17, miRNA-18a, miRNA-19a, miRNA-20a, miRNA-19b-1, miRNA-26a, miRNA-126, miRNA-335, let-7a and let-7b, miRNA-34, miR-34a, miRNA-10b, miRNA-208, miRNA-499, miRNA-195, miRNA-29a, miRNA-29b, or miRNA-29c.

The miRNA strand may be selected from the group of SEQ ID NOs. 1250-1305.

The miRNA strand may further comprise 5-6 thymidines at the 5' end.

Advantageously, the capsid protein comprises at least one modification that results in reduced liver-tropism of the AAV vector. The capsid protein may comprise at least one modification that results in preferential targeting of the AAV vector to muscle tissue.

The capsid protein may be selected from the sequences in Tables 1 - 4.

The vector may further comprise a nuclear export sequence enabling nuclear spreading.

Aspects of the invention also provide a methods of inhibiting expression of a gene in a cell by administering AAV vectors of the invention. Methods may comprise administering to a subject an adeno-associated virus (AAV) vector comprising a promoter sequence, a miRNA strand that binds to DUX4-FL, and a capsid protein comprising at least one modification that is an insertion between any two contiguous amino acids between amino acids 262-269, 327-332, 382-386, 452-460, 488-505, 527-539, 545-558, 581-593, 704-714, or any combination thereof in an AAV9 capsid polypeptide or in an analogous position in an AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV rh.74, AAV rh.10 capsid polypeptide.

Table 1:

MyoAAV (eMyoAAV) Capsid Variants				
RANK	N-MER MOTIF	SEQ ID NO.:	ENCODING SEQUENCE	SEQ ID NO.:
1	AEGRGDQYTR	177	GCTGAGGGTAGAGGAGACCAGTATACTCGT	181
2	GPGRGDQTTL	178	GGGCCGGGTAGAGGAGACCAGACTACGTTG	182
3	AEGRGDQYTR	177	GCGGAAGGCAGAGGAGACCAATACACAAGG	183
4	ATGRGDLGQA	179	GCGACTGGTAGAGGAGACCTGGGTCAGGCT	184
5	AVARGDQGLI	180	GCGGTGGCGAGAGGAGACCAGGGTCTTATT	185
6	NISRGDQGYQ	6	AACATCTCCAGAGGAGACCAAGTTACCAA	186
7	APARGDQGSQ	7	GCGCCGGCTAGAGGAGACCAGGGGAGTCAG	187
8	AVSRGDRMEF	8	GCCGTTAGCAGAGGAGACCGGATGGAATTC	188
9	QMGRGDMGIK	10	CAGATGGGTAGAGGAGACATGGGGATTAAG	189
10	EYRRGDKADI	11	GAGTATCGGAGAGGAGACAAGGCCGATATT	190
11	ESRRGDKEPL	12	GAGAGTCGGAGAGGAGACAAGGAGCCGCTG	191
12	AHMRGDLGGT	13	GCACACATGAGAGGAGACCTAGGCCGGCACG	192
13	VWQRGDKMDM	14	GTGTGGCAAAGAGGAGACAAAATGGACATG	193
14	SIGRGDTGHM	15	TCTATTGGGAGAGGAGACACGGGTCATATG	194
15	NIARGDAGQY	16	AATATTGCTAGAGGAGACGCTGGTCAGTAT	195
16	AVARGDQGLI	180	GCAGTAGCAAGAGGAGACCAAGGCTTAATC	196
17	SVSRGDQGLH	17	TCGGTCTCGAGAGGAGACCAAGGATTGCAC	197
18	EYRRGDKADI	11	GAATACAGGAGAGGAGACAAAGCAGACATC	198
19	AHMRGDLGGT	13	GCGCATATGAGAGGAGACTTGGGGGGGACT	199
20	QIGRGDITHG	18	CAGATTGGTAGAGGAGACATTACTCATGGG	200
21	EVRRGDLIGT	19	GAAGTCAGAAGAGGAGACTTGCACGGGACA	201
22	SVSRGDVHTM	20	AGTGTCTCAAGAGGAGACGTGCACACGATG	202
23	MVTRGDLGTR	21	ATGGTGACTAGAGGAGACCTTGGTACGCGG	203
24	NGGRGDTTHF	22	AACGGCGGGAGAGGAGACACGACGCACTTC	204
25	TMGRGDMNSL	23	ACGATGGGGAGAGGAGACATGAATTCGCTT	205
26	AISRGDQGLS	24	GCGATTAGTAGAGGAGACCAGGGTCTTTCT	206
27	NDARGDKSTY	25	AACGACGCAAGAGGAGACAAATCCACATAC	207
28	VGLRGDLTGS	26	GTGGGGCTGAGAGGAGACTTGACGGGTTTCG	208
29	EMRRGDLGTS	27	GAGATGAGGAGAGGAGACCTGGGGACGAGT	209
30	AMSRGDMGMA	28	GCGATGAGTAGAGGAGACATGGGGATGGCG	210
31	ATGRGDLGQA	179	GCAACGGGCAGAGGAGACTTAGGCCAAGCA	211
32	NVARGDQVNY	29	AACGTAGCAAGAGGAGACCAAGTTAACTAC	212
33	SIGRGDTGHM	15	AGCATCGGAAGAGGAGACACCGGCCACATG	213

34	ASVRGDLSGS	30	GCATCCGTAAGAGGAGACCTATCAGGCTCA	214
35	SAARGDTERL	31	AGCGCCGCGAGAGGAGACACTGAACGGCTA	215
36	AMSRGDMGMA	28	GCCATGTCAAGAGGAGACATGGGTATGGCT	216
37	SPSRGDQGR	9	AGTCCATCGAGAGGAGACCAAGGACGCACT	217
38	VPGRGDLNTM	32	GTGCCTGGGAGAGGAGACCTTAATACTATG	218
39	GPGRGDQTTL	178	GGTCCTGGGAGAGGAGACCAAACGACCCTT	219
40	TSVRGDHGT	33	ACATCGGTCAGAGGAGACCACGGAACATTG	220
41	TPSRGDLGQT	34	ACGCCTTCGAGAGGAGACCTTGGGCAGACT	221
42	AGHRGDTGVI	35	GCTGGACACAGAGGAGACACAGGAGTCATC	222
43	APARGDQGSM	36	GCGCCGGCGAGAGGAGACCAGGGTAGTATG	223
44	MSLRGDLNGS	37	ATGTCGTTGAGAGGAGACTTGAATGGGTCG	224
45	EAKRGDVHSI	38	GAGGCTAAGAGAGGAGACGTGCATTCTATT	225
46	SAQRGDVQAV	39	AGTGCTCAGAGAGGAGACGTGCAGGCGGTG	226
47	STARGDQGDR	40	AGTACGGCGAGAGGAGACCAGGGGGATAGG	227
48	QISRGDGIN	41	CAGATTAGTAGAGGAGACCTGGGGATTAAT	228
49	TFTRGDMTMN	42	ACGTTCAACAAGAGGAGACATGACGATGAAC	229
50	QEGRGDLNMR	43	CAAGAAGGAAGAGGAGACCTGAACATGAGG	230
51	AHARGDTSSL	44	GCACACGCAAGAGGAGACACCAGCTCCCTG	231
52	TNGRGDAGTL	45	ACGAATGGGAGAGGAGACGCTGGGACTCTG	232
53	AFGRGDQQL	46	GCTTTCGGCAGAGGAGACCAAGGGCAACTA	233
54	ADGRGDRSSL	47	GCTGATGGGAGAGGAGACCGTTCGTCTCTG	234
55	DGRRGDGHSL	48	GACGGACGCAGAGGAGACGGACACAGCCTT	235
56	EKLRGDLHST	49	GAGAAAGTTGAGAGGAGACCTTCATTGCACT	236
57	FARRGDASAM	50	GAGGCGCGTAGAGGAGACGCTTCGGCGATG	237
58	MGTRGDKMDF	51	ATGGGAACGAGAGGAGACAAAATGGACTTC	238
59	SISRGDRESY	52	TGACTTCGAGAGGAGACCGGGAGTCGTAI	239
60	CQPRGDTTRC	53	TGTCAGCCGAGAGGAGACACGACTCGGTGT	240
61	MHTRGDKMDF	54	ATGCACACGAGAGGAGACAAAATGGACTTC	241
62	YSARGDTSGL	55	TACAGTGCCAGAGGAGACACAAGTGGCCTG	242
63	STMGRDHEKL	56	TCGACGATGAGAGGAGACCATGAGAAGTTG	243
64	TQMRGDGVTL	57	ACCCAAATGAGAGGAGACGGGGTCACACTA	244
65	TTRRGDMGDN	58	ACTACTCGTAGAGGAGACATGGGGGATAAT	245
66	ANRGDRLEL	59	GCGAATGGTAGAGGAGACAGGCTGGAGTTG	246
67	AVSRGDRMEF	8	GCTGTGTCTAGAGGAGACAGGATGGAGTTT	247
68	ENQRGDLSSR	60	GAGAAITCAGAGAGGAGACITGTCGGGTCGG	248
69	STGRGDLGQA	61	TCGACTGGTAGAGGAGACCTGGGGCAGGCT	249
70	MHTRGDKMDF	54	ATGCATACTAGAGGAGACAAGATGGATTTT	250
71	SSARGDYSEV	62	AGTAGTCCGAGAGGAGACTATAGTGAGGTG	251

72	AFGRGDQGQL	46	GCGTTTGGGAGAGGAGACCAGGGTCAGCTT	252
73	STARGLAATY	63	AGTACGGCGAGAGGAGACGCGGCGACTTAT	253
74	VNTRGDTQKL	64	GTCAACACAAGAGGAGACACTCAAAAACCTT	254
75	AMSRGDHASL	65	GCGATGAGTAGAGGAGACCATGCGTCGCTT	255
76	QAARGDVNKL	66	CAGGCTGCTAGAGGAGACGTTAATAAGCTG	256
77	RGTRGDTVEL	67	AGGGGTACGAGAGGAGACACGGTTGAGTTG	257
78	TTRRGDMGDN	58	ACCACCCGGAGAGGAGACATGGGAGACAAC	258
79	ASTRGDYAGV	68	GCTAGTACGAGAGGAGACTATGCGGGTGT	259
80	DDRRGDKLPL	69	GACGACAGGAGAGGAGACAAAACCTGCCCTT	260
81	SGSRGDLNAV	70	TCGGGGTCGAGAGGAGACCTGAATGCGGTG	261
82	EYRRGDQQIQ	71	GAGTATAGGAGAGGAGACCAGCAGATTCAG	262
83	TYVRGDRAEV	72	ACGTACGTCAGAGGAGACAGAGCAGAAGTG	263
84	QSLRGDLNGS	73	CAATCACTAAGAGGAGACTTGAACGGATCC	264
85	EGRRGDTTSL	74	GAGGGTCCGAGAGGAGACACGACGTCGTTG	265
86	AENRGDRSSL	75	GCGGAGAATAGAGGAGACCGGTCGAGTTTG	266
87	VAGRGDRSEL	76	GTGGCTGGGAGAGGAGACCGTAGTGAGCTG	267
88	DPARGDIGAR	77	GATCCGGCGAGAGGAGACATTGGTGCGCGT	268
89	EMRRGDLGTS	27	GAAATGCGCAGAGGAGACTTGGGAACCTCA	269
90	VWQRGDKMDM	14	GTTTGGCAGAGAGGAGACAAGATGGATATG	270
91	VIGRGDKALQ	78	GTGATTGGGAGAGGAGACAAGGCGCTTCAG	271
92	SFERGDKNSL	79	AGCTTCGAAAGAGGAGACAAAACCTCTCTT	272
93	QIARGDIASV	80	CAGATTGCTAGAGGAGACATTGCTAGTGTG	273
94	TISRGLDGGGA	81	ACGATTAGTAGAGGAGACCTGGGTGGGGCT	274
95	AMIRGDMTHS	82	GCGATGATTAGAGGAGACATGACGCATAGT	275
96	TSVRGDHGT	33	ACGAGTGTGAGAGGAGACCATGGGACGCTG	276
97	TMRRGDLNDS	83	ACGATGCGGAGAGGAGACCTGAATGATAGT	277
98	AYSRLDLGNH	84	GCCTACTCCAGAGGAGACCTAGGCAACCAC	278
99	EERRGDTHRL	85	GAGGAGCGGAGAGGAGACACTCATCGGCTG	279
100	SQLRGDAGTI	86	TCACAACCTAAGAGGAGACGCGGGGACAATC	280
101	AMVRGDAHQL	87	GCGATGGTGAGAGGAGACGCGCATCAGCTG	281
102	TTSRGLDNSV	88	ACGACTAGTAGAGGAGACTTGAATTCGGTT	282
103	WEQRGDMIGK	89	TGGGAGCAGAGAGGAGACATGATTGGGAAG	283
104	YTTRGDLQSN	90	TACACCACCAGAGGAGACCTCCAATCAAAC	284
105	MSQRGDLSHQ	91	ATGTCGCAGAGAGGAGACCTTTCGCATCAG	285
106	ASIRGDTTHM	92	GCGAGTACTAGAGGAGACACGACGCAIATG	286
107	SDTRGDTHRL	93	TCAGACACCAGAGGAGACACCCACAGACTG	287
108	TLGRGDQYTS	94	ACGCTGGGTAGAGGAGACCAGTATACGAGT	288
109	SYARGDVREV	95	TCGTATGCGAGAGGAGACGTTAGGGAGGTT	289

110	ETRRGDLSQN	96	GAGACTCGTAGAGGAGACCTGAGTCAGAAT	290
111	TIGRGDLMKD	97	ACAATCGGGAGAGGAGACCTGATGGACAAA	291
112	SYTRGDLSQN	98	AGTTACACCAGAGGAGACCTTAGCCAAAAC	292
113	SKLRGDASEI	99	TCGAAGCTGAGAGGAGACGCTAGTGAGATT	293
114	SMARGDKAEI	100	TCGATGGCGAGAGGAGACAAGGCCGAGATT	294
115	GAVRGDHSSL	101	GGAGCCGTCAGAGGAGACCACTCATCGTTA	295
116	METRGDMSNR	102	ATGGAGACGAGAGGAGACATGAGTAATCGT	296
117	AYTRGDKDAL	103	GCGTACACAAGAGGAGACAAAGACGCACTA	297
118	ENRRGDITQS	104	GAGAATCGGAGAGGAGACATTACGCAGTCG	298
119	STGRGDLGQA	61	TCCACGGGCAGAGGAGACCTTGGACAAGCA	299
120	GAVRGDHSSL	101	GGTGCTGTTAGAGGAGACCATAGTAGTCTT	300
121	SQLRGDAGTI	86	TCTCAGCTTAGAGGAGACGCTGGTACGATT	301
122	MLLRGDKNDF	105	ATGCTCCTAAGAGGAGACAAAAACGACTTC	302
123	KVQRGDASDW	106	AAGGTGCAGAGAGGAGACGCGAGTGATTGG	303
124	AFTRGDMQTA	107	GCGTTTACGAGAGGAGACATGCAGACTGCT	304
125	QPKRGDVQAQ	108	CAGCCTAAGAGAGGAGACGTTGAGGCTCAG	305
126	ASLRGDMGVS	109	GCTAGTCTGAGAGGAGACATGGGGGTGAGT	306
127	AYSRGDKESF	110	GCCTACTCCAGAGGAGACAAAGAATCGTTC	307
128	RFQRGDLTDA	111	CGGTTCCAAAGAGGAGACTTGACCGACGCT	308
129	SDARGDTMKL	112	TCTGATGCTAGAGGAGACACGATGAAGCTG	309
130	SGARGDTVSL	113	AGCGGGGCCAGAGGAGACACAGTAAGTCTC	310
131	DEKRGDQKHL	114	GATGAGAAGAGAGGAGACCAGAAGCATCTT	311
132	NGVRGDVQNF	115	AACGGAGTAAGAGGAGACGTCCAAAACCTC	312
133	MTLRGDI.GGS	116	ATGACGTTGAGAGGAGACCTGGGTGGGTGCG	313
134	EARRGDASAM	50	GAGGCTAGGAGAGGAGACGCTAGTGCGATG	314
135	GQERGDLDGTR	117	GGGCAGGAGAGAGGAGACC'GGGGAC'CGG	315
136	RGARGDLVDA	118	AGAGGCGCCAGAGGAGACCTAGTCGACGCT	316
137	QYSRGDHTDL	119	CAATACTCCAGAGGAGACCACACCGACCTT	317
138	MNTRGDVHAM	120	ATGAACACCAGAGGAGACGTGCACGCTATG	318
139	TVRRGDLATE	121	ACGGTACGGAGAGGAGACCTAGCAACCGAA	319
140	NIARGDAGQY	16	AATATTGCGAGAGGAGACGCTGGTCAGTAT	320
141	SVGRGDKADI	122	TCTGTTGGGAGAGGAGACAAGGCTGATAIT	321
142	SHNRGDTGTM	123	TCACACAACAGAGGAGACACCGGAACCATG	322
143	TNTRGDKESV	124	ACGAACACCAGAGGAGACAAAGAATCAGTA	323
144	SIGRGDQYTI	125	T'CGA'ITGGTAGAGGAGACCAGT'A'ACGA'IT	324
145	QTSRGDAGSW	126	CAGACGAGTAGAGGAGACGCGGGGTCTTGG	325
146	AENRGDRSSL	75	GCTGAAAACAGAGGAGACCGAAGCAGCCTA	326
147	AISRGDVQSL	127	GCGATTTGAGAGGAGACGTTGAGTCGTTG	327

148	NAQRGDHGL	128	AACGCACAAAGAGGAGACCACGGGCAACTG	328
149	LNSRGDQASV	129	CTCAACTCGAGAGGAGACCAAGCCTCCGTC	329
150	SGNRGDIGTF	130	TCGGGAAACAGAGGAGACATAGGTACATTC	330
151	NVGRGDQATM	131	AACGTGGGAAGAGGAGACCAAGCCACAATG	331
152	SYSRGDTGRL	132	TCGTATTCTAGAGGAGACACTGGTCGGCTT	332
153	SHLRGDQALA	133	AGCCACTTAAGAGGAGACCAAGCGTTGGCC	333
154	YFARGDMTMN	134	TACTTCGCCAGAGGAGACATGACTATGAAC	334
155	QSQRGDLNPM	135	CAGTCGCAGAGAGGAGACCTTAATCCTATG	335
156	EQRRGDKTEL	136	GAGCAGAGGAGAGGAGACAAGACGGAGCTG	336
157	VSARGDAGQL	137	GTGTCTGCGAGAGGAGACGCGGGTCAGTTG	337
158	SPSRGDQGR	9	TCTCCGTCTAGAGGAGACCAGGGGCGGACG	338
159	EASRGDKGTH	138	GAGGCTAGTAGAGGAGACAAGGGTACGCAT	339
160	LSTRGDMGMQ	139	CTGTCTACTAGAGGAGACATGGGTATGCAG	340
161	ANMRGDQLHT	140	GCGAATATGAGAGGAGACCAGCTGCATACT	341
162	ENTRGDLTHA	141	GAGAATACGAGAGGAGACCTTACTCATGCG	342
163	IERRGDSAGL	142	ATTGAGCGTAGAGGAGACTCGGCGGGGCTG	343
164	SAMRGDGVSL	143	AGTGCGATGAGAGGAGACGGAGTGAGCTTG	344
165	TVSRGDQGLS	144	ACGGTTTCGAGAGGAGACCAGGGGTTGTCT	345
166	SIVRGDLNST	145	TCGATCGTCAGAGGAGACCTGAACTCCACG	346
167	DVARGDKTNF	146	GACGTAGCGAGAGGAGACAAAACAACTTC	347
168	WSQRGDLST	147	TGGAGCCAAAGAGGAGACCTGAGTGGAACC	348
169	LNQRGDVSNM	148	CTGAACCAAAGAGGAGACGTTTCCAACATG	349
170	AALRGDLSGS	149	GCCGCCCTAAGAGGAGACCTATCCGGCTCA	350
171	RVARGDITDI	150	AGGGTTGCGAGAGGAGACATTACGGATATT	351
172	STNRGDLNQV	151	TCGACGAACAGAGGAGACCTCAACCAAGTT	352
173	DSRRGDSVSL	152	GA'1'CGCGGAGAGGAGAC'1'G'1'GAG'1'CT'1'	353
174	SVGRGDQSQM	153	AGTGTTGGGAGAGGAGACCAGTCTCAGATG	354
175	SNTRGDTNSL	154	TCCAACACGAGAGGAGACACAAACTCCCTA	355
176	DNRRGDGTTM	155	GATAATCGGAGAGGAGACGGTACGACTATG	356
177	TPSRGDQGR	156	ACGCCTTCGAGAGGAGACCAAGGAAGACTA	357
178	NYSRGDSMTL	157	AACTACAGCAGAGGAGACTCAATGACGCTT	358
179	MQARGDAGTL	158	ATGCAGGCTAGAGGAGACGCTGGGACTCTG	359
180	TQSRGDLSGA	159	ACGCAGTCGAGAGGAGACTTGTCTGGTTCG	360
181	FAQRGDLTGV	160	TTTGCGCAGAGAGGAGACTTGACTGGGGTT	361
182	APVRGDLIGT	161	GCGCCGGT'GAGAGGAGACCT'GAI'TGGT'ACG	362
183	SNTRGDTNSL	154	TCGAATACTAGAGGAGACACGAATAGTTTG	363
184	EPKRGDLSNT	162	GAGCCGAAGAGAGGAGACTTGAGTAATACG	364
185	SVGRGDTYPL	163	TCGGTTGGGAGAGGAGACACTTATCCTCTG	365

186	QTARGDMTGH	164	CAAACAGCCAGAGGAGACATGACTGGCCAC	366
187	AGARGDLENR	165	GCTGGTGCAGAGGAGACTTGGAGAATCGG	367
188	MSTRGDLNV	166	ATGAGCACTAGAGGAGACCTAAACAACGTC	368
189	EKQRGDLNSM	167	GAAAAACAAAGAGGAGACCTCAACAGCATG	369
190	IKTRGDLGHE	168	ATTAAGACGAGAGGAGACCTTGGTCATGAG	370
191	IGRRGDMELS	169	ATTGGGAGGAGAGGAGACATGGAGTTGTCT	371
192	TTGRGDLKEV	170	ACTACGGGTAGAGGAGACTTGAAGGAGGTT	372
193	TDKRGDQNTV	171	ACGGATAAGAGAGGAGACCAGAATACTGTG	373
194	SNVRGDREAV	172	TCGAATGTTAGAGGAGACCGGGAGGCGGTT	374
195	SVGRGDQSQM	153	TCAGTCGGCAGAGGAGACCAAAGTCAAATG	375
196	YANRGDLSHQ	173	TACGCCAACAGAGGAGACCTGAGTCACCAA	376
197	QISRGDGIN	41	CAAATATCGAGAGGAGACCTAGGTATCAAC	377
198	SMMRGDAGQL	174	TCGATGATGAGAGGAGACGCTGGGCAGTTG	378
199	EARRGDSQGL	175	GAGGCGCGGAGAGGAGACAGTCAGGGGCTG	379
200	MPTRGDQTKF	176	ATGCCACAAGAGGAGACCAAACCAAATTC	380

Table 2:

Enhanced MyoAAV (eMyoAAV) Capsid Variants				
RANK	N-MER INSERT	SEQ ID NO.:	ENCODING SEQUENCE	SEQ ID NO.:
1	SNSRGDYNSL	381	TCAAACCTCCAGAGGAGACTACAACCTCCTTG	557
2	SSARGDRDYL	397	TCGTCCGGCTAGAGGAGACCGTGATTATCTG	558
3	STVRGDYTSV	398	AGCACGGTCAGAGGAGACTACACGTCCGTG	559
4	QERRGDYISM	382	CAGGAGCGGAGAGGAGACTATACGAGTATG	560
5	NGGRGDITHF	386	AACGGCGGGAGAGGAGACACGACGCACTTC	561
6	ASTRGDHSV	383	GCGAGTACTAGAGGAGACCATGGTGTGTTG	562
7	SYQRGDQHNH	399	TCGTACCAAAGAGGAGACCAACACAACATG	563
8	NDTRGDRSYM	400	AACGACACAAGAGGAGACCGATCTTACATG	564
9	ENRRGDFNNT	384	GAAAACAGGAGAGGAGACTTCAACAACACT	565
10	SGSRGDLSSH	401	TCCGGCTCGAGAGGAGACTTGTGAGGACAC	566
11	ENRRGDITQS	393	GAGAATCGGAGAGGAGACATTACGCAGTCG	567
12	DKPRGDRQLL	402	GATAAGCCGAGAGGAGACCGGCAGTTGTTG	568
13	EERRGDTHRL	392	GAGGAGCGGAGAGGAGACACTCATCGGCTG	569
14	AMIRGDMTHS	391	GCGATGATTAGAGGAGACATGACGCATAGT	570
15	SNNRGDYTTM	403	TCAAACAACAGAGGAGACTACACGACAATG	571
16	QGGRGDLSTL	404	CAGGGTGGGAGAGGAGACTTGTGACGTTG	572

17	SKDRGDYQTL	405	TCGAAGGATAGAGGAGACTATCAGACTCTT	573
18	ATARGDQMKL	406	GCTACGGCGAGAGGAGACCAGATGAAGCTG	574
19	QIIMRGDLTGA	407	CAGCATATGAGAGGAGACTTGACTGGTGCG	575
20	DGTRGDLGRY	408	GACGGCACGAGAGGAGACCTTGAAGGTAC	576
21	DSRRGDYANL	409	GACTCTCGGAGAGGAGACTACGCAAACCTC	577
22	SAMRGDYTST	410	TCGGCGATGAGAGGAGACTATACTAGTACT	578
23	ENRRGDAQLL	411	GAGAATCGGAGAGGAGACGCGCAGCTGCTG	579
24	TTLRGDHSQL	412	ACGACGCTGAGAGGAGACCATAGTCAGCTT	580
25	DAGRGMHRM	413	GACGCAGGGAGAGGAGACATGCACCGTATG	581
26	QHTRGDLST	414	CAGCATACGAGAGGAGACTTGAGTTCTACT	582
27	QVYRGDRESV	415	CAAGTTTACAGAGGAGACAGGGAAATCCGTG	583
28	SSQRGDLACT	416	TCGAGTCAGAGAGGAGACTTGGCTGGTACT	584
29	TDVRGDRGTF	417	ACGGATGTTAGAGGAGACAGGGGGACGTTT	585
30	SSVRGDREVT	418	TCGTCTGTGAGAGGAGACCGGGAGGTGACG	586
31	ENRRGDLTNA	419	GAGAATAGGAGAGGAGACCTGACTAATGCG	587
32	SYARGDVHSI	420	TCGTATGCGAGAGGAGACGTTTATTCTATT	588
33	DSSRGDLNLR	421	GACAGCTCAAGAGGAGACCTCAACCTCCGG	589
34	SNARGDYSNM	422	TCGAACGCGAGAGGAGACTACTCAAACATG	590
35	SSVRGDHSVL	423	TCGTCTGTGAGAGGAGACCATTCGGTGCTT	591
36	SAFRGDLHAT	424	TCGGCTTTTAGAGGAGACCTGCATGCTACT	592
37	SAMRGDYTST	410	TCCGCCATGAGAGGAGACTACACAAGCACC	593
38	NAQRGDHGQL	394	AACGCACAAAGAGGAGACCACGGGCAACTG	594
39	SDRRGDQLLY	425	TCGGATCGGAGAGGAGACCAGCTGTTGTAT	595
40	SGVRGDRIAV	426	AGCGGCGTAAGAGGAGACCGCCTAGCCGTA	596
41	ASLRGDLST	427	GCCAGCCTAAGAGGAGACCTCAGCTCAACG	597
42	TNGRGDLHGM	428	ACGAACGGAAGAGGAGACCTTACGGAAITG	598
43	TNTRGDHGML	429	ACGAATACGAGAGGAGACCATGGGATGCTG	599
44	SSARGDRDYL	397	AGTTCGCCAGAGGAGACCGGGACTACCTC	600
45	EDRRGDLLRT	430	GAGGATCGGAGAGGAGACCTTTTGAGGACT	601
46	SSLRGDLLHS	431	TCGTCTGTGAGAGGAGACCTGTTGCATTCT	602
47	ENRRGDLTNA	419	GAAAACCGTAGAGGAGACCTCACGAACGCT	603
48	DGRRGDRESI	432	GACGGCAGGAGAGGAGACCGGGAAATCGATC	604
49	TGTRGDTMTW	433	ACTGGAACCAGAGGAGACACAATGACATGG	605
50	STVRGDYTSV	398	TCGACTGTTAGAGGAGACTATACTTCTGTT	606
51	SATRGDHNVL	434	TCGGCAACGAGAGGAGACCACAACGTACTIG	607
52	TDRRGDSGTL	435	ACGGATCGGAGAGGAGACAGTGGTACTCTG	608
53	TSARGDLIHT	436	ACGAGTGCTAGAGGAGACCTGATTCATACG	609
54	SGVRGDRLAV	426	AGTGGGGTGAGAGGAGACCGGCTGGCGGTG	610

55	AVERGDRLML	437	GCGGTTGAGAGAGGAGACCGTCTTATGCTG	611
56	DRSRGDTHVL	438	GACAGGTCGAGAGGAGACACGCACGTA	612
57	ESTRGDLRVV	439	GAGTCGACGAGAGGAGACCTTCGTGTTGTG	613
58	TTIRGDYREL	440	ACGACGATTAGAGGAGACTATCGTGAGTTG	614
59	TFIRGDLAGA	441	ACGTTTCATCAGAGGAGACCTGGCAGGTGCG	615
60	MTSRGDLTTY	442	ATGACGAGCAGAGGAGACTTGACAACATAC	616
61	ADRRGDQLYS	443	GCGGATCGTAGAGGAGACCAGCTTTATTCG	617
62	AHMRGDLGGT	385	GCACACATGAGAGGAGACCTAGGCGGCACG	618
63	GYVRGDLGQH	444	GGGTACGTCAGAGGAGACCTGGGGCAACAC	619
64	DASRGDRDSL	445	GATGCGAGTAGAGGAGACAGGACTAGTTTG	620
65	TEVRGDRSQV	446	ACGGAGGTGAGAGGAGACAGGTCGCAGGTT	621
66	SHLRGDQALA	395	TCGCATCTGAGAGGAGACCAGGCTCTTGCG	622
67	SEVRGDRLSI	447	TCGGAGGTGAGAGGAGACCGGTTGAGTATT	623
68	SAARGDTERL	387	AGCGCCGCGAGAGGAGACACTGAACGGCTA	624
69	SDRRGDLSGA	448	TCAGACCGTAGAGGAGACCTGTCGGGCGCT	625
70	SVTRGDRVVI	449	AGCGTCACAAGAGGAGACAGAGTAGTCATC	626
71	SEGRGDRMAL	450	TCGGAGGGGAGAGGAGACAGGATGGCTCTT	627
72	SSTRGDHLSL	451	TCGTCTACTAGAGGAGACCATCTTTTCGCTG	628
73	AMIRGDMTHS	391	GCTATGATCAGAGGAGACATGACCCACTCC	629
74	SSTRGDQIYV	452	TCGTGACGAGAGGAGACCAGATTTATGTG	630
75	EERRGDTHRL	392	GAGGAGCGGAGAGGAGACACTCATCGGTTG	631
76	SNSRGDYNLSL	381	TCGAATTCGAGAGGAGACTATAAATAGTCTT	632
77	SAQRDRMGSP	453	TCCGCACAAAGGGATCGTATGGGTTCTCCG	633
78	TGTRGDIATF	454	ACGGGTACGAGAGGAGACATTGCGACTTTT	634
79	SMQRGDLLST	455	TCGATGCAGAGAGGAGACCTGCTTTCTACT	635
80	EDVRGDRSKL	456	GAGGA'GT'GAGAGGAGACAGGAG'AAAGC'IT	636
81	AHMRGDLGGT	385	GCGCATATGAGAGGAGACTTGGGGGGGACT	637
82	TSVRGDQSQY	457	ACGAGTGTGAGAGGAGACCAGAGTCAGTAT	638
83	ADRRGDTGLF	458	GCGGATCGGAGAGGAGACACGGGGTTGTTT	639
84	NTYRGDRDSL	459	AACACTTACAGAGGAGACCGAGACAGCCTG	640
85	TDVRGDRGTF	417	ACGGATGTTAGAGGAGACCGGGGGACGTTT	641
86	SRGRGDLNDL	460	TCTCGTGGGAGAGGAGACCTGAATGATTTG	642
87	SNVRGDREAV	396	AGCAACGTAAGAGGAGACAGGGAAGCCGTC	643
88	MDRRGDASIL	461	ATGGACAGGAGAGGAGACGCCTCCATACTG	644
89	SIWRGDRI'EV	462	'TCGATATGGAGAGGAGACCGT'ACAGAAG'IC	645
90	NSQRGDYSGM	463	AACTCACAAAGAGGAGACTACAGTGGAATG	646
91	SSVRGDIGGI	464	TCTAGCGTAAGAGGAGACATCGGGGGGATC	647
92	ENQRGDLSGR	390	GAGAATCAGAGAGGAGACTTGTCGGGTTCGG	648

93	EIRRGDLLAQ	465	GAGATTCGGAGAGGAGACCTTCTGGCTCAG	649
94	SNIRGDHAVM	466	TCGAACATCAGAGGAGACCACGCAGTCATG	650
95	LDTRGDRSQV	467	CTGGATACGAGAGGAGACCGGAGTCAGGTT	651
96	ANTRGDHQNF	468	GCGAATACGAGAGGAGACCATCAGAATTTT	652
97	QVYRGDRESV	415	CAGGTGTATAGAGGAGACCGTGAGTCTGTT	653
98	TSVRGDLSMN	469	ACGTCGGTGAGAGGAGACCTTTTCGATGAAT	654
99	ASTRGDHSV	383	GCCTCAACGAGAGGAGACCACGGAGTTCTC	655
100	TTTRGDYLN	470	ACGACGACGAGAGGAGACTATCTTAATACG	656
101	AERRGDIKEY	471	GCGGAGAGGAGAGGAGACATTAAGGAGTAT	657
102	SHARGDLGST	472	TCGCATGCTAGAGGAGACTTGGGTTCGACT	658
103	TSQRGDYVSL	473	ACGTCTCAGAGAGGAGACTATGTTTCTCTT	659
104	GPGRGDQTTL	556	GGGCCGGGTAGAGGAGACCAGACTACGTTG	660
105	VNVRGDRGEV	474	GTGAATGTGAGAGGAGACCGTGGTGAGGTG	661
106	SYRRGDHDQL	475	TCGTATCGTAGAGGAGACCATGATCAGCTT	662
107	SGTRGDRVDL	476	AGCGGCACAAGAGGAGACAGGGTAGACCTC	663
108	SHFRGDLHTS	477	TCCCACTTCAGAGGAGACTTGCACACGTCC	664
109	SDRRGDLSVP	478	TCGGATCGTAGAGGAGACCTTTTCGGTGCTT	665
110	SGTRGDTLIL	479	AGCGGCACCAGAGGAGACACCCTTATACTC	666
111	ENTRGDLHGK	480	GAAAACACCAGAGGAGACCTCCACGGCAA	667
112	DRARGDTHVL	481	GATCGGGCGAGAGGAGACACGCATGTGCTG	668
113	ASGRGDIAGL	482	GCGTCTGGTAGAGGAGACATTGCGGGGCTT	669
114	EGRRGDLFQA	483	GAGGGTTCGTAGAGGAGACCTGTTTCAGGCG	670
115	RSERGDRLEI	484	AGATCCGAAAGAGGAGACAGGCTAGAAATC	671
116	AAYRGDAHVI	485	GCGGCCTACAGAGGAGACGCACACGTGCTC	672
117	NDSRGDQHRL	486	AACGACTCGAGAGGAGACCAACACCGATTG	673
118	SSARGDHSQL	487	TCA'CGGCAAGAGGAGACCAC'CI'CAAC'IG	674
119	TNERGDRLSI	488	ACGAATGAGAGAGGAGACCGTCTTTTCGATT	675
120	SNSRGDYTSV	489	AGCAACTCCAGAGGAGACTACACCAGTGTC	676
121	NVTRGDHTVM	490	AACGTCACAAGAGGAGACCACACCGTTATG	677
122	TMVRGDVKGL	491	ACGATGGTGAGAGGAGACGTTAAGGGGCTT	678
123	TGTRGDIATF	454	ACCGGGACAAGAGGAGACATAGCCACGTTT	679
124	VQLRGDLAST	492	GTGCAGCTGAGAGGAGACTTGGCTTCTACT	680
125	MNRRGDYSEQ	493	ATGAACCGGAGAGGAGACTACTCGGAACAA	681
126	ANTRGDLSPV	494	GCGAATACTAGAGGAGACCTGAGTCCGGTT	682
127	TGMRGDAGSL	495	ACGGG'I'AT'GAGAGGAGACGC'IGGGAG'I'CI'I'	683
128	LDRRGDFSSA	496	CTAGACCGCAGAGGAGACTTTCAGCTCCGCG	684
129	MYHRGDMT'SV	497	ATGTACCACAGAGGAGACATGACTTCCGGTG	685
130	GSMRGDLHST	498	GGGTCGATGAGAGGAGACTTGCATTTCGACG	686

131	SSSRGDFSSV	499	TCGTCTCCAGAGGAGACTTCAGCTCTGTT	687
132	TGTRGDLHTY	500	ACGGGTACGAGAGGAGACTTGCATACTTAT	688
133	YTQRGDLATV	501	TACACCCAAAGAGGAGACCTTGCCACCGTC	689
134	TDVRGDRMYV	502	ACGGATGTTAGAGGAGACCGGATGTATGTG	690
135	TSVRGDHGTL	388	ACATCGGTCAGAGGAGACCACGGAACATTG	691
136	SNSRGDLSVN	503	TCGAACCTCCAGAGGAGACCTATCGGTAAAC	692
137	QSGRGDQMTL	504	CAGTCTGGGAGAGGAGACCAGATGACGTTG	693
138	MNTRGDLQQS	505	ATGAACACCAGAGGAGACTTGCAACAATCG	694
139	AGSRGDLQTV	506	GCGGGATCAAGAGGAGACCTACAAACGGTG	695
140	SNMRGDQTYV	507	TCGAACATGAGAGGAGACCAAACCTTACGTC	696
141	TPSRGDMSNV	508	ACGCCAAGTAGAGGAGACATGTCCAACGTC	697
142	NSTRGDLHMA	509	AACAGCACAAGAGGAGACCTACACATGGCA	698
143	ANTRGDLSVS	510	GCTAACACCAGAGGAGACCTCTCAGTCAGT	699
144	TDRRGDTGLL	511	ACCGACCGAAGAGGAGACACCGGCTTACTG	700
145	DGVRGDRATW	512	GACGGCGTAAGAGGAGACCGTGCAACATGG	701
146	ENRRGDFNNT	384	GAGAATCGTAGAGGAGACTTTAATAATACG	702
147	EPSRGDRMVL	513	GAGCCTAGTAGAGGAGACAGGATGGTGTTG	703
148	SGVRGDRIII	514	AGCGGCGTTAGAGGAGACCGGATCATAATC	704
149	TSMRGDYTHV	515	ACGTCTGATGAGAGGAGACTATACGCATGTT	705
150	ASSRGDLTVI	516	GCGTCGAGTAGAGGAGACTTGACTGTTATT	706
151	ETRRGDLSLQ	517	GAGACGCGTAGAGGAGACCTGTCGCTTCAG	707
152	NNARGDQSMH	518	AACAACGCAAGAGGAGACCAATCAATGCAC	708
153	TDRRGDSSAL	519	ACGGATAGGAGAGGAGACTCTAGTGCGCTT	709
154	SSQRGDLTGV	520	TCAAGCCAAAGAGGAGACTTGACAGGTGTG	710
155	QTARGDVMVH	521	CAGACGGCTAGAGGAGACGTTATGGTTCAT	711
156	VSQRGDLNAV	522	G'G'G'CGCAGAGAGGAGACCT'GAAT'GC'G'G'	712
157	TMTRGDLAAN	523	ACGATGACCAGAGGAGACCTCGCTGCTAAC	713
158	NASRGDHSSL	524	AATGCTTCGAGAGGAGACCATTCGTCGTTG	714
159	SNTRGDMGLT	525	TCAAACACCAGAGGAGACATGGGCCTCACG	715
160	MYSRGDTHSL	526	ATGTATTTCGAGAGGAGACACTCATAGTCTG	716
161	ADQRGDRAPL	527	GCGGATCAGAGAGGAGACAGGGCTCCGCTT	717
162	QERRGDYISM	382	CAAGAAAGGAGAGGAGACTACACCTCTATG	718
163	SQNRGDLANT	528	TCCCAAACAGAGGAGACCTAGCCAACACG	719
164	EKLRGDLHST	389	GAGAAGTTGAGAGGAGACCTTCATTCGACT	720
165	QGGRGDLSTL	404	CAAGGCGGAAGAGGAGACCT'GAGT'ACAC'G	721
166	SNRRGDTEMQ	529	TCGAATAGGAGAGGAGACACTGAGATGCAG	722
167	SGSRGDVSAL	530	TCGGGTAGTAGAGGAGACGTGAGTGCTTTG	723
168	ESTRGDRGTL	531	GAGTCGACGAGAGGAGACCGTGGTACGCTG	724

169	SAVRGDAALH	532	TCGGCGGTGAGAGGAGACGCGGCGCTTCAT	725
170	LSSRGDVNRL	533	CTGAGCAGCAGAGGAGACGTTAACCGCCTT	726
171	EQRRGDIQTI	534	GAGCAGAGGAGAGGAGACATTCAGACTATT	727
172	AAVRGDAHVL	485	GCTGCGTATAGAGGAGACGCGCATGTTCTT	728
173	SPVRGDHGAL	535	TCGCCGGTGAGAGGAGACCATGGGGCTTTG	729
174	DSRRGDYANL	409	GATTCGAGGAGAGGAGACTATGCGAATCTG	730
175	LSRRGDYQEL	536	TTGAGTCGGAGAGGAGACTATCAGGAGTTG	731
176	SYARGDVHSI	420	TCCTACGCAAGAGGAGACGTCCACTCCATC	732
177	DSRRGDASYH	537	GACTCACGCAGAGGAGACGCGTCGTACCAC	733
178	NHQRGDLSSS	538	AACCACCAAAGAGGAGACCTGAGCTCGAGT	734
179	SSTRGDHLSL	451	TCCTCAACGAGAGGAGACCACCTGTCTTTG	735
180	SWNRGDISGL	539	TCGTGGAACAGAGGAGACATATCTGGCCTT	736
181	TGTRGDLGTM	540	ACGGGTACTAGAGGAGACCTGGGGACGATG	737
182	QQLRGDTHIL	541	CAGCAGCTTAGAGGAGACACGCATACTCTT	738
183	AGLRGDRDSL	542	GCGGGGTTGAGAGGAGACCGTGATTCGCTT	739
184	QVYRGDRDQL	543	CAGGTTTATAGAGGAGACCGGGATCAGTTG	740
185	AGVRGDRVTI	544	GCAGGAGTAAGAGGAGACAGAGTGACCATC	741
186	NSARGDLLHS	545	AACTCAGCCAGAGGAGACCTTCTGCACTCC	742
187	NHSRGDLTGV	546	AACCACAGTAGAGGAGACCTGACAGGCGTT	743
188	NAYRGDTSAF	547	AACGCTTACAGAGGAGACACATCCGCGTTC	744
189	SANRGDIMHT	548	TCGGCTAACAGAGGAGACATAATGCACACG	745
190	QSARGDLVSY	549	CAATCCGCCAGAGGAGACCTCGTCAGTTAC	746
191	DSRRGDASYH	537	GATAGTAGGAGAGGAGACGCTAGTTATCAT	747
192	SFVRGDVRTI	550	TCGTTTGTGAGAGGAGACGTTTCGTACGCTG	748
193	SDMRGDRSVY	551	AGCGACATGAGAGGAGACCGATCTGTGTAC	749
194	SGIRGDRYPI	552	TCCGGAATCAGAGGAGACCGCTACCCAATA	750
195	SNVRGDMAHS	553	TCCAACGTCAGAGGAGACATGGCTCACAGC	751
196	TEVRGDRSQV	446	ACTGAGGTTAGAGGAGACCGTTCGCAGGTT	752
197	ASSRGDLQQT	554	GCGAGCAGCAGAGGAGACCTGCAACAAACG	753
198	QSARGDLVSY	549	CAGTCTGCTAGAGGAGACCTTGTGTCTTAT	754
199	DASRGDRDSL	445	GACGCATCTAGAGGAGACCGAACATCCCTC	755
200	NSVRGDLNQT	555	AACAGTGTGAGAGGAGACCTCAACCAAAC	756

Table 3:

Top Ranking Skeletal Muscle Specific n-mer inserts and/or RGD Motifs			
Variant	SEQ ID NO.:		
TTGRGDQARL	757	SQTRGDTSLM	797
TTLRGDHSQL	758	DATRGDTRML	798
TNLRGDYQLT	759	SMQRGDLTHA	799
STSRGDYVTH	760	SGTRGDTLIL	800
MPARGDLVQT	761	ANTRGDHQNF	801
SGVRGDR LAV	762	TSQRGDHTQL	802
SNERGDQHRL	763	SHWRGDTSSL	803
STLRGDYAVS	764	ISGRGDRQEL	804
SNARGDIMTT	765	SVLRGDIGTI	805
EASRGDLQMR	766	QDSRGDLSGK	806
TYARGDLSGII	767	KPIRGDGAEL	807
DSSRGDRSSV	768	TYMRGDLQHT	808
SQSRGDLVPL	769	TELRGDL SST	809
SATRGDYSIL	770	SAMRGDHA VL	810
QATRGDLQHT	771	SWVRGDASTL	811
HDDRGD RRML	772	QYARGDPHAL	812
SSHRGDJLAT	773	STNRGDIVVH	813
SYQRGDQHNM	774	VNIRGDLHQT	814
SHQRGDYNTL	775	REYRGDSSIL	815
MDQRGDM SVV	776	STLRGDGSMM	816
QIARGDLIIVP	777	SSQRGDITAH	817
TYTRGDQHMM	778	TEFRGDRSTV	818
DASRGDR TSL	779	TSTRGDYVTV	819
SDRRGDLHPQ	780	NHLRGDVSAI	820
SATRGDHSTL	781	LERRGDLVST	821
AYQRGDFTSV	782	NEYRGDHSHP	822
TGNRGDLQSV	783	NWQRGDTSTL	823
AWRRGDLENA	784	TDSRGDRTVL	824
NAARGDHGLL	785	YAVRGDQH TI	825
SYSRGD HQAL	786	FGVRGDTRDL	826
DGVRGDRTVV	787	SSARGDTGML	827
SSERGD KMST	788	SAMRGDQMGQ	828
TSMRGDYTHV	789	SHTRGDLVTT	829
SGVRGDRII	790	VITRGDTAIL	830
ENRRGDAQLL	791	EPTRGDRHSI	831
TVYRGDREQH	792	GSQRGDRLVL	832
LDRRGDLLNS	793	QH YRGDI STT	833
ESVRGDLRST	794	METRGDRQQL	834
DKYRGDQRGL	795	EALRGDKVVL	835
TDRRGDAHIL	796	NAVRGDQSYV	836
		SPLRGDNRAL	837
		FNRRGDTHAL	838
		NSQRGDLTGT	839

QYAPSQGTV	840	QIGRGDVTPL	885
DNSRGDHSRL	841	MQARGDLLGV	886
NTHRGDYASI	842	NTQRGDYASV	887
HTTRGDQQPL	843	SDTRGDRLTQ	888
EWRRGDQTAL	844	SAIRGDYRDV	889
TAVRGDQTTV	845	VGVRGDVHPL	890
EYLRGDRISQ	846	TVLRGDAERL	891
SRYRGDQETI	847	ASTRGDLSGQ	892
ASLRGDTVTL	848	DSRRGDGQNL	893
VGVRGDShVL	849	IDKRGDIQGL	894
TNSRGDHTSL	850	TVTRGDLLVN	895
VDQRGDQRAL	851	DSTRGDRLGL	896
ASVRGDRLDV	852	AANRGDYASL	897
TSYRGDLSSN	853	RDYRGDTSSL	898
TSDRGDSSNR	854	SNIRGDASLH	899
SYMRGDLDMR	855	NLQRGDRTDF	900
TDVRGDRSMI	856	NASRGDHSSM	901
SYVRGDSSTV	857	TSMRGDYTHV	902
QVYRGDRESV	858	TSRRGDLNDV	903
TDRRGDAVSF	859	QSHRGDVQSL	904
TNSRGDLHTT	860	STTRGDYQSV	905
EAIRGDFKTL	861	YSTRGDHAML	906
TGIRGDTAGL	862	TSARGDLIHT	907
TSSRGDVQSL	863	ATARGDRESF	908
SSRRGDTNEL	864	ASTRGDYSTM	909
SNARGDHTPL	865	SNNRGDVQRL	910
SELRGDRSPY	866	ERLRGDQHII	911
VHARGDTSIM	867	SSIRGDHATL	912
SALRGDhGTL	868	NPTRGDIA TV	913
QTGRGDIA GM	869	MSTRGDLSVN	914
TVARGDQIRL	870	MDRRGDITYA	915
TNSRGDSVAL	871	NATRGDLMSA	916
QNARGDSAVI	872	SDHRGDRTYQ	917
HYLRGDTTTL	873	NWVRGDLSTA	918
ANARGDLQNT	874	SSHRGDLSAT	919
QNIRGDIRTV	875	NATRGDYREI	920
AALRGDhGQM	876	DTLRGDLQTA	921
TTDRGDLSAR	877	IAVRGDLTPV	922
LNVRGDLVHT	878	TLLRGDLAHS	923
YSTRGDHTVL	879	MNTRGDHTVL	924
TNARGDLTVS	880	TGHRGDIAVY	925
TNARGDYTAL	881	TSNRGDQMSN	926
AEGRGDTRGS	882	SATRGDHTAI	927
TNIRGDQSSV	883	SSVRGDREHA	928
VDRRGDTMTM	884	TNSRGDLVVH	929

ETRRGDLSSQ	930
TYARGDITLT	931
SASRGDTLHL	932
DNQRGDLSSR	933
TQSRGDLRDA	934
ENRRGDLTNA	935
TSIRGDISSV	936
ISARGDTMTL	937
SRVRGDQDHW	938
SGNRGDIASY	939
NEQRGDRYNH	940
EALRGDVRAL	941
VDRRGDYTQM	942
NNVRGDYTSV	943
QTYRGDASVL	944
SNYRGDGHSL	945
TSSRGDLREV	946
QYTRGDVSNL	947
SDLRGDVRER	948
QNARGD'TTAL	949
NSLRGDRDTM	950
SNSRGDQAQV	951
EATRGRDRSTL	952
VPQRGDITNL	953
DKIRGDLRSI	954
SAARGDYSIV	955
VGLRGDLIGQ	956
QAGRGDLTVI	957
SKTRGDFQEA	958
GTARGDY SML	959
ISTRGDLVTI	960
TGTRGDREYM	961
MTTRGDLSIT	962
STSRGDMTSV	963
GPARGDFTSS	964
VDRRGDLGHV	965
NSGRGDMSQL	966
SQGRGDLERY	967
VFGRGDQYTL	968
IVGRGDLHLQ	969
SYSRGD'TSRL	970
MSSRGDRATI	971
MSSRGDLTRV	972
QHTRGDFGNL	973
ETRRGDLSSQ	974

TGTRGDLRAI	975
QMARGDLSTA	976
LVERGDRIMN	977
GLVRGDLNAR	978
NNPRGDLSSV	979
HEKRGDLSNS	980
SQARGDLHQT	981
FTGRGDLRTA	982
QSIRGDTGHL	983
SAGRGDMSVL	984
SERRGDEHKW	985
TTGRGDLVSL	986
LGLRGDQIGQ	987
VALRGDLTHQ	988
MIGRGDQAPL	989
FQARGDHSTL	990
NSVRGDHSSL	991
WPNRGDLQST	992
SASRGDYQTL	993
TMQRGDLHTI	994
TALRGDLAGT	995
VNARGDFSQT	996
GWIRGDRTSM	997
TT'SRGDHTVL	998
SGARGDLVGV	999
NNVRGDYTSV	1000
QTARGDHSVVL	1001
TLIRGDL'IRS	1002
VTTRGDRLLEL	1003

Table 4:

Top Ranking Skeletal Muscle Specific n-mer inserts and/or RGD Motifs	
Variant	SEQ ID NO.:
EASRGDLQMR	1004
TYARGDLSGH	1005
DSSRGDRSSV	1006
SQSRGDLVPL	1007
MPARGDLVQT	1008
SGVRGDRLAV	1009
SNERGDQHRL	1010
STLRGDYAVS	1011
SNARGDIMTT	1012
TTGRGDQARL	1013
TTLRGDHSQL	1014
TNLRGDYQLT	1015
STSRGDYVTH	1016
SATRGDYSIL	1017
QATRGDLQHT	1018
HDDRGDRRML	1019
SSHRGDLLAT	1020
SYQRGDQHNM	1021
SHQRGDYNTL	1022
MDQRGDMSSV	1023
QIARGDLHVP	1024
TYTRGDQHMM	1025
DASRGDRSTL	1026
SDRRGDLHPQ	1027
SATRGDHSSTL	1028
AYQRGDFTSV	1029
TGNRGDLQSV	1030
AWRRGDLENA	1031
NAARGDHGLL	1032
SYSRGDHQAL	1033
DGVRGDRTVV	1034
SSERGDKMST	1035
TSMRGDYTHV	1036
SGVRGDRIII	1037
ENRRGDAQLI	1038
TVYRGDREQH	1039
LDRRGDLLNS	1040

ESVRGDLRST	1041
DKYRGDQRGL	1042
TDRRGDAHIL	1043
SQTRGDTSLM	1044
DATRGDTRML	1045
SMQRGDLTHA	1046
SGTRGDTLIL	1047
ANTRGDHQNF	1048
TSQRGDHTQL	1049
SHWRGDTSSL	1050
ISGRGDRQEL	1051
SVLRGDIGTI	1052
QDSRGDLSGK	1053
KPIRGDGAEL	1054
TYMRGDLQHT	1055
TELRGDLST	1056
SAMRGDHAFL	1057
SWVRGDASTL	1058
QYARGDPHAL	1059
STNRGDIVVH	1060
VNIRGDLHQT	1061
REYRGDSSIL	1062
STLRGDGSMM	1063
SSQRGDTAH	1064
TEFRGDRSTV	1065
TSTRGDYVTV	1066
NHLRGDVSAI	1067
LERRGDLVST	1068
NEYRGDHSHP	1069
NWQRGDTSTL	1070
TDSRGDRTVL	1071
YAVRGDQHTI	1072
FGVRGDTRDL	1073
SSARGDTGML	1074
SAMRGDQMGQ	1075
SHTRGDLVTT	1076
VTTRGDTAIL	1077
EPTRGDRHSI	1078
GSQRGDRLLV	1079
QHRYGDI SST	1080
METRGDRQQL	1081
EALRGDKVVL	1082
NAVVRGDQSYV	1083

SPLRGDNRAL	1084	TNARGDYTAL	1127
ENRRGDTHAL	1085	AEGRGDTRGS	1128
NSQRGDLTGT	1086	TNIRGDQSSV	1129
DNSRGDHSRL	1087	VDRRGDTMTM	1130
NTHRGDYASI	1088	QIGRGDVTPL	1131
HTTRGDQQPL	1089	MQARGDLLGV	1132
EWRRGDQTAL	1090	NTQRGDYASV	1133
TAVRGDQTTV	1091	SDTRGDRLTQ	1134
EYLRGDRISQ	1092	SAIRGDYRDV	1135
SRYRGDQETI	1093	VGVRGDVHPL	1136
ASLRGDTVTL	1094	TVLRGDAERL	1137
VGVRGDShVL	1095	ASTRGDLSGQ	1138
TNSRGDHTSL	1096	DSRRGDGQNL	1139
VDQRGDQRAL	1097	IDKRGDIQGL	1140
ASVRGDRLDV	1098	TVTRGDLLVN	1141
TSYRGDLSSN	1099	DSTRGDRLGL	1142
TSDRGDSSNR	1100	AANRGDYASL	1143
SYMRGDLDMR	1101	RDYRGDTSSL	1144
TDVRGDRSMI	1102	SNIRGDASLH	1145
SYVRGDSSTV	1103	NLQRGDRITDF	1146
QVYRGDRESV	1104	NASRGDHSSM	1147
TDRRGDAVSF	1105	TSMRGDYTHV	1148
TNSRGDLHTT	1106	TSRRGDLNDV	1149
EAIRGDFKTL	1107	QSHRGDVQSL	1150
TGIRGDTAGL	1108	STTRGDYQSV	1151
TSSRGDVQSL	1109	YSTRGDHAML	1152
SSRRGDTNEL	1110	TSARGDLIHT	1153
SNARGDHTPL	1111	ATARGDRESF	1154
SELRGDRSPY	1112	ASTRGDYSTM	1155
VHARGDTSIM	1113	SNNRGDVQRL	1156
SALRGDHGTL	1114	ERLRGDQHII	1157
QTGRGDLAGM	1115	SSIRGDHATL	1158
TVARGDQIRL	1116	NPTRGDIA TV	1159
TNSRGDSVAL	1117	MSTRGDLSVN	1160
QNARGDSAVI	1118	MDRRGDITYA	1161
HYLRGDTTTL	1119	NATRGDLMSA	1162
ANARGDLQNT	1120	SDHRGDRTYQ	1163
QNIRGDIRTV	1121	NWVRGDLSTA	1164
AALRGDHGQM	1122	SSHRGDLSAT	1165
TTDRGDISAR	1123	NATRGDYREI	1166
LNVRGDLVHT	1124	DTLRGDLQTA	1167
YSTRGDIITVL	1125	IAVRGDLTPV	1168
TNARGDLTVS	1126	TLLRGDLAHS	1169

MNTRGDHTVL	1170
TGHRGDIAVY	1171
TSNRGDQMSN	1172
SATRGDHTAI	1173
SSVRGDREHA	1174
TNSRGDLVVH	1175
ETRRGDLSSQ	1176
TYARGDITLT	1177
SASRGDTLHL	1178
DNQRGDLSSR	1179
TQSRGDLRDA	1180
ENRRGDLTNA	1181
TSIRGDISSV	1182
ISARGDTMTL	1183
SRVRGDQDHW	1184
SGNRGDIASY	1185
NEQRGDRYNH	1186
EALRGDVRAL	1187
VDRRGDYTQM	1188
NNVRGDYTSV	1189
QTYRGDASVL	1190
SNYRGDHHGSL	1191
TSSRGDLREV	1192
QYTRGDVSNL	1193
SDLRGDVREER	1194
QNARGD'TTAL	1195
NSLRGDRDTM	1196
SNSRGDQAQV	1197
EATRGDRSTL	1198
VPQRGDITNL	1199
DKIRGDLRSI	1200
SAARGDYIV	1201
VGLRGDLIGQ	1202
QAGRGDLTVI	1203
SKTRGDFQEA	1204
GTARGDYXML	1205
ISTRGDLVTI	1206
TGTRGDREYM	1207
MTTRGDLSIT	1208
STSRGDMTSV	1209

GPARGDFTSS	1210
VDRRGDLGHV	1211
NSGRGDMSQL	1212
SQGRGDLERY	1213
VFGRGDQYTL	1214
IVGRGDLHLQ	1215
SYSRGDT SRL	1216
MSSRGDRATI	1217
MSSRGDLTRV	1218
QHTRGDFGNL	1219
ETRRGDLSSQ	1220
TGTRGDLRAI	1221
QMARGDLSTA	1222
LVERGDRIMN	1223
GLVRGDLNAR	1224
NNPRGDLSSV	1225
HEKRGDLSNS	1226
SQARGDLHQT	1227
FTGRGDLRTA	1228
QSIRGDTGHL	1229
SAGRGDMSVL	1230
SERRGDEHKW	1231
TTGRGDLVSL	1232
LGLRGDQIGQ	1233
VALRGDLTHQ	1234
MIGRGDQAPL	1235
FQARGDHSTL	1236
NSVRGDHSSL	1237
WPNRGDLQST	1238
SASRGDYQTL	1239
TMQRGDLHTI	1240
TALRGDLAGT	1241
VNARGDFSQT	1242
GWIRGDRTSM	1243
TFSRGDHTVL	1244
SGARGDLVGV	1245
NNVRGDYTSV	1246
QTARGDHVVL	1247
TLIRGDLTRS	1248
VTTRGDRI.FI.	1249

**Table 5**

Exemplary nucleic acids comprising the mature guide strand of miDUX4, mi405 or mi1155 and the miR-122 binding site or the miR-208 binding site are provided below .

5

SEQ ID NO:	miDUX4	miR binding site	Location of binding site	Nucleotide Sequence (lowercase letter spacers to facilitate proper folding of the per-miRNA stem)
1250	mi405	miR-122	Loop	CTCGAGTGAGCGATCCAGGATTCAGATC TGGTTTCTAATTTAGTGTGATAATGGTGTT TAAACCAGATCTGAATCCTGGACTGCCTA CTAGT
1251	mi1155	miR-122	Loop	CTCGAGTGAGCGACAGGCGCAACCTCTC CTAGAATATTTAGTGTGATAATGGTGTTT CTAGGAGAGGTTGCGCCTGCTGCCTACT AGT
1252	mi405	miR-122	5'end	CTCGAGTATTTAGTGTGATAATGGTGTTT ctcgggTGAGCGATCCAGGATTCAGATCTGG TTTCTGAAAGCCACAGATGGGAAACCAG ATCTGAATCCTGGACTGCCTACTAGT
1253	mi1155	miR-122	5'end	CTCGAGTATTTAGTGTGATAATGGTGTTT ctcgggTGAGCGACAGGCGCAACCTCTCCTA GAACTGTAAAGCCACAGATGGGTTCTAG GAGAGGTTGCGCCTGCTGCCTACTAGT
1254	mi405	miR-122	3' end	CTCGAGTGAGCGATCCAGGATTCAGATC TGGTTTCTGAAAGCCACAGATGGGAAAC CAGATCTGAATCCTGGACTGCcTactagaTAT TTAGTGTGATAATGGTGTTTACTAGT
1255	mi1155	miR-122	3' end	CTCGAGTGAGCGACAGGCGCAACCTCTC CTAGAACTGTAAAGCCACAGATGGGTTT TAGGAGAGGTTGCGCCTGCTGCCTactagaT ATTTAGTGTGATAATGGTGTTTACTAGT
1256	mi405	miR-208	Loop	CTCGAGTGAGCGATCCAGGATTCAGATC TGGTTTCTACGAGCCTTTTGCTCGTCTTA TGGAAACCAGATCTGAATCCTGGACTGCC TACTAGT
1257	mi1155	miR-208	Loop	CTCGAGTGAGCGACAGGCGCAACCTCTC CTAGAACTACGAGCCTTTTGCTCGTCTTA TGGTTCTAGGAGAGGTTGCGCCTGCTGC CTACTAGT

SEQ ID NO:	miDUX4	miR binding site	Location of binding site	Nucleotide Sequence (lowercase letter spacers to facilitate proper folding of the per-miRNA stem)
1258	mi405	miR-208	5'end	CTCGAGACGAGCCTTTTGCICGTCTTATctc gggTGAGCGATCCAGGATTCAGATCTGGT TTCTGTAAAGCCACAGATGGGAAACCAG ATCTGAATCCTGGACTGCCTACTAGT
1259	mi115 5	miR-208	5'end	CTCGAGTGAGCGATCCAGGATTCAGATC TGGTTTTCTGTAAAGCCACAGATGGGAAA CCAGATCTGAATCCTGGACTGCCTactagaA CGAGCCTTTTCGTCGTCTTATACTAGT
1260	mi405	miR-208	3' end	CTCGAGTGAGCGATCCAGGATTCAGATC TGGTTTTCTGTAAAGCCACAGATGGGAAA CCAGATCTGAATCCTGGACTGCCTACTAG T
1261	mi115 5	miR-208	3' end	CTCGAGTGAGCGACAGGCGCAACCTCTC CTAGAAGTGTAAAGCCACAGATGGGTTC TAGGAGAGGTTGCGCCTGCTGCCTactagaA CGAGCCTTTTCGTCGTCTTATACTAGT
1262	mi405	5' miR- 122	3' miR- 208	CTCGAGTATTTAGTGTGATAATGGTGTTT ctcggqTGAGCGATCCAGGATTCAGATCTG GTTTTCTGTAAAGCCACAGATGGGAAACC AGATCTGAATCCTGGACTGCCTactagaACG AGCCTTTTTCGTCGTCTTATACTAGT
1263	mi115 5	5' miR- 122,	3' miR- 208	CTCGAGTATTTAGTGTGATAATGGTGTTT ctcggqAGCGACAGGCGCAACCTCTCCTAGA ACTGTAAAGCCACAGATGGGTCTAGGA GAGGTTCGCGCCCGCCCGCCactagaACGAGC CTTTTCGTCGTCTTATACTAGT
1264	mi405	miR-122, miR-208	5' (both)	CTCGAGTATTTAGTGTGATAAIGGTGTTT ACGAGCCTTTTTCGTCGTCTTATctcgggTGA GCGATCCAGGATTCAGATCTGGTTTTCTGT AAAGCCACAGATGGGAAACCAGATCTGA ATCCTGGACTGCCTACTAGT
1265	mi115 5	miR-122, miR-208	5' (both)	CTCGAGTATTTAGTGTGATAATGGTGTTT ACGAGCCTTTTTCGTCGTCTTATctcGOTGA GCGACAGGCGCAACCTCTCCTAGAACTGT AAAGCCACAGATGGGTCTAGGAGAGGT TGCGCCTGCTGCCTACTAGT

SEQ ID NO:	miDU X4	miR binding site	Location of binding site	Nucleotide Sequence (lowercase letter spacers to facilitate proper folding of the per-miRNA stem)
1266	mi405	miR-122, miR208	3' (both)	CTCGAGTGAGCGATCCAGGATTCAGATC TGGTTTCTGTAAAGCCACAGATGGGAAA CCAGATCTGAATCCTGGACTGCCTactagaT ATTTAGTGTGATAATGGTGTTTACGAGCC TTTTGCTCGTCTTAT ACTAGT
1267	mi115 5	miR-122, miR208	3' (both)	CTCGAGTGAGCGACAGGCGCAACCTCTC CTAGAACTGTAAAGCCACAGATGGGTTT TAGGAGAGGTGTGCGCCGTGCTGCTactagaT ATTTAGTGTGATAATGGTGTTTACGAGCC TTTTGCTCGTCTTAT ACTAGT
1268	mi405	miR-122 loop, 5' miR-208		CTCGAGACGAGCCTTTTGCTCGTCTTATct cgggTGAGCGATCCAGGATTCAGATCTGGT TTCTTATTTAGTGTGATAATGGTGTTTGG AAACCAGATCTGAATCCTGGACTGCCTAC TAGT
1269	mi115 5	miR-122 loop,		CTCGAGACGAGCCTTTTCTCGTCTTATctc gggTGAGCGACAGGCGCAACCTCTCCTAG AACITATTTAGTGTGATAATGGTGTTTGG TTCTAGGAGAGGTTGCGCCTGCTGCCTA CTAGT
1270	mi405	miR-122 Loop, 3' miR-208		CTCGAGTGAGCGATCCAGGATTCAGATC TGGTTTCTTATTTAGTGTGATAATGGTGT TTGGAAACCAGATCTGAATCCTGGACTGC CTactagaACGAGCCTTTTGCTCGTCTTATAC TAGT
1271	mi115 5	miR-122 Loop, 3' miR-208		CTCGAGTGAGCGACAGGCGCAACCTCTC CTAGAACTATTTAGTGTGATAATGGTGT TGGTTCTAGGAGAGGTTGCGCCTGCTGC CTactagaACGAGCCTTTTGCTCGTCTTATAC TAGT
1272	mi405	miR-208 loop, 5' miR-122		CTCGAGTATTTAGTGTGATAATGGTGT? ctcgggTGAGCGATCCAGGATTCAGATCTGG TTTCTACGAGCCTTTTGCTCGTCTTAT GGAAACCAGATCTGAATCCTGGACTGCCT ACT AGT
1273	mi115 5	miR-208 loop, 5' miR-122		CTCGAGTATTTAGTGTGATAATGGTGT ctcgggTGAGCGACAGGCGCAACCTCTCCTA GAACTACGAGCCTTTTGCTCGTCTTATGG

SEQ ID NO:	miDUX4	miR binding site	Location of binding site	Nucleotide Sequence (lowercase letter spacers to facilitate proper folding of the per-miRNA stem)
				TTCTAGGAGAGGTTGCGCCTGCTGCCTACTAGT
1274	mi405	miR-208 loop, 3' miR-122		CTCGAGTGAGCGATCCAGGATTCAGATC TGGTTTCTACGAGCCTTTTGCTCGTCTTA TGGAAACCAGATCTGAATCCTGGACTGCC TactagaTATTTAGTGTGATAATGGTGTTTA CTAGT
1275	mi115 5	miR-208 loop, 3' miR-122		CTCGAGTGAGCGATCCAGGATTCAGATC TGGTTTCTTTTAGTGTGATAATGGTGTTT GACGAGCTTTTTGCTCGTCTTATGGAAAC CAGATCTGAATCCTGGACTGCCTACTAGT
1276	mi405	miR-122miR-122	Loop (both)	CTCGAGTGAGCGACAGGCGCAACCTCTC CTAGAACTTTTAGTGTGATAATGGTGTTT GACGAGCTTTTTGCTCGTCTTATGGTTCT AGGAGAGGTTGCGCCTGCTGCCTACTAG T
1277	mi115 5	miR-122 miR-122	Loop (both)	CTCGAGTGAGCGACAGGCGCAACCTCTC CTAGAACTTTTAGTGTGATAATGGTGTTT GACGAGCTTTTTGCTCGTCTTATGGTTCT AGGAGAGGTTGCGCCTGCTGCCTACTAG T
1278	mi405	miR-122	Loop	CUCGAGUGAGCGAUCCAGGAUUCAGAU CUGGUUUQUAUUUAGUGUGAJAAUGGU GUUUAACCAGAUUCUGAAUCCUGGACUG CCUACUAGU
1279	mi115 5	miR-122	Loop	CUCGAGUGAGCGACAGGCGCAACCUCUC CUAGAAUUAUUUAGUGUGAUAAUGGUGU UUCUAGGAGAGGUUGCGCCUGCUGCCU ACUAGU
1280	mi405	miR-122	5' end	CUCGACUAUUUAGUGUGAUAAJGGUGUU UCU <sup>cgggu</sup> GAGCGAUCCAGGAUUCAGAUC UGGUUUCUGAAAGCCACAGAUGGGAAA CCAGAUCUGAAUCCUGGACUGCCUACUA GU
1281	mi115 5	miR-122	5'end	CUCGALAUUUAGUGUGAUAAUGGUGUU UCU <sup>cgggu</sup> GAGCGACAGGCGCAACCUCUCC UAGAACUGUAAAGCCACAGAUGGGUUC

SEQ ID NO:	miDUX4	miR binding site	Location of binding site	Nucleotide Sequence (lowercase letter spacers to facilitate proper folding of the per-miRNA stem)
				UAGGAGAGGUUGCGCCUGCUGCCUACUAGU
1282	mi405	miR-122	3' end	CUCGAGUGAGCGAUCCAGGAUUCAGAU CUGGUUUCUGAAAAGCCACAGAUGGGAA ACCAGAUCUGAAUCCUGGACUGcCuacuaga UAUUUAGUGUGAUAAUGGUGUUUACUA GU
1283	mi115 5	miR-122	3' end	CUCGAGUGAGCGACAGGCGCAACCUCUC CUAGAACUGUAAAAGCCACAGAUGGGUUC UAGGAGAGGUUGCGCCUGCUGcCuacUaga UAUUUAGUG UGAUAAUGGUGUUU ACUAGU
1284	mi405	miR-208	Loop	CUCGAGUGAGCGAUCCAGGAUUCAGAU CUGGUUUCUACGAGCCU'UUGCUCGUCU UAUGGAAACCAGAUCUGAAUCCUGGACU GCCUACUAGU
1285	mi115 5	miR-208	Loop	CUCGAGUGAGCGACAGGCGCAACCUCUC CUAGAACUCGAGCcUUUUGCUCUUAUGG UUCUAGGAGAGGUUGCGCCUGCUGCCU ACUAGU
1286	mi405	miR-208	5' end	CUCGAGACGAGCCU'UUGCUCGUCUUAU CUcggguGAGCGAUCCAGGAUUCAGAU GGUUUCUGUAAAAGCCACAGAUGGGAAA CCAGAUCUGAAUCCUGGACUGCCUAC UAGU
1287	mi115 5	miR-208	5' end	CUCGACACGAGCUUUUUGCUCGUCUUAU CUcggqUGAGCGACAGGCGCAACCUCUCC UAGAACUGUAAAAGCCACAGAUGGGUUC UAGGAGAGGUUGCGCCUGCUGCCUAC UAGU
1288	mi405	miR-208	3' end	CUCGAGUGAGCGAUCCAGGAUUCAGAU CUGGUUUCUGUAAAAGCCACAGAUGGGA AACCAGAUCUGAAUCCUGGACUGCCUacU agaACGAGCCU'UUGCUCGUCUUAUA CUAGU
1289	mi115 5	miR-208	3' end	CUCGAGUGAGCGACAGGCGCAACCUCUC CUAGAACUGUAAAAGCCACAGAUGGGUUC

SEQ ID NO:	miDUX4	miR binding site	Location of binding site	Nucleotide Sequence (lowercase letter spacers to facilitate proper folding of the per-miRNA stem)
				UAGGAGAGGUUGCGCCUGCUGcCuacUaga ACGAGCCUUUUGCUCGUCUUAUAC UAGU
1290	mi405	5' miR-122, 3' miR-208		CUCGAGUAUUUAGUGUGAUAAUGGUGU UUcUcggguGAGCGAUCCAGGAUUCAGAUC UGGUUUCUGUAAAAGCCACAGAUGGGAA ACCAGAUCUGAAUCCUGGACUGCCUacUa gaACGAGCCUUUUGCUCGUCUUAUACUA GU
1291	mi115 5	5' miR-122, miR-208		CUCGAGUAUUUAGUGUGAUAAUGGUGU UUCUcggguGAGCGACAGGCGCAACCUCUC CUAGAACUGUAAAAGCCACAGAUGGGUUC UAGGAGAGGUUGCGCCUGCUGCCUacuag aACGAGCCUUUUGCUCGUCUUAUACUAG U
1292	mi405	miR-122,	5' (both)	CUCGAGUAUUUAGUGUGAUAAUGGUGU UUACGAGCCUUUUGCUCGUCUUAUCUcg UGAGCGAUCCAGGAUUCAGAUCUGGUU UCUGUAAAAGCCACAGAUGGGAAACCAGA UCUGAAUCCUGGACUGCCUACUAGU
1293	mi115 5	miR-122, miR-208	5' (both)	CUCGAGUAUUUAGUGUGAUAAUGGUGU UUACGAGCCUUUUGCUCGUCUUAUCUcO goUGAGCGACAGGCGCAACCUCUCCUAG AACUGUAAAAGCCACAGAUGGGUUCUAG GAGAGGUUGCGCCUGCUGCCUACUAGU
1294	mi405	miR-122, miR-208	3' (both)	CUCGAGUGAGCGAUCCAGGAUUCAGAU CUGGUUUCUGUAAAAGCCACAGAUGGGA AACCAGAUCUGAAUCCUGGACUGCCUacu agalAUUUAGUGUGAUAAUGGUGUUUACG AGCCUUUUGCUCGUCUUAUACUAGU
1295	mi115 5	miR-122, miR-208	3' (both)	CUCGAGUGAGCGACAGGCGCAACCUCUC CUAGAACUGUAAAAGCCACAGAUGGGUUC UAGGAGAGGUUGCGCCUGCUGCCU acUagaUAUUUAGUGUGAUAAUGGUGUUU ACGAGCCUUUUGCUCGUCUUAUACUAGU
1296	mi405	miR-122, 5' miR-208	Loop	CUCGAGACGAGCCUUUUGCUCGUCUUAU CUcOggUGAGCGAUCCAGGAUUCAGAUUC GGUUUCUUAUUUAGUGUGAUAAUGGUG

SEQ ID NO:	miDUX4	miR binding site	Location of binding site	Nucleotide Sequence (lowercase letter spacers to facilitate proper folding of the per-miRNA stem)
				UUUGGAAACCAGAUUCUGAAUCCUGGACU GCCUACUAGU
1297	mi115 5	miR-122, 5' miR- 208	Loop	CUCGAGACGAGCCU <sup>U</sup> UUGCUCGUCUUAU CU <sup>cggq</sup> UGAGCGACAGGCGCAACCUCUCC UAGAACUAUUUAGUGUGAUAAUGGUGU UUGGUUCUAGGAGAGGUUGCGCCUGCU GCCUACUAGU
1298	mi405	miR-122, 3' miR- 208	Loop	CUCGAGUGAGCGAUCCAGGAUUCAGAU CUGGUUUCUUAUUUAGUGUGAUAAUGG UGUUUGGAAACCAGAUUCUGAAUCCUGG ACUGCCU <sup>acUaga</sup> ACGAGCCUUUUGCUCGU CUVAUACUAGU
1299	mi115 5	miR-122, 3' miR- 208	Loop	CUCGAGUGAGCGACAGGCGCAACCUCUC CUAGAACUU AUUUAGUGUGAUAAUGGUGUVUGGUUC UAGGAGA GGUUGCGCCUGCUGCCU <sup>acuaga</sup> ACGAGCC UUUUGCU CGUCUUAUACUAGU
1300	mi405	miR-208, 5' miR- 122	Loop	CUCGAGUAUUUAGUGUGAUAAUGGUGU UUCU <sup>cggg</sup> GAGCGAUCCAGGAUUCAGAU UGGUUUCUACGAGCCUUUUGCUCGUCU UAUGGAAACCAGAUUCUGAAUCCUGGACU GCCUACUAGU
1301	mi115 5	miR-208, 5' miR- 122	Loop	CUCGAGUAUUUAGUGUGAUAAUGGUGU GUUU <sup>c</sup> U <sup>cggg</sup> UGAGCGACAGGCGCAACCU CUCCUAGAACUACGAGCCUUUUGCUCGU CUUAUGGUUCUAGGAGAGGUUGCGCC UGCUGCCUACUAGU
1302	mi405	miR-208, 3' miR- 122	Loop	CUCGAGUGAGCGAUCCAGGAUUCAGAU CUGGUUUCUACGAGCCU <sup>U</sup> UUGCUCGUCU UAUGGAAACCAGAUUCUGAAUCCUGGACU GCCU <sup>acUaga</sup> UAUUUAGUGUGAUAAUGGU GUUUACUAGU
1303	mi115 5	miR-208 loop, 3' miR-122	Loop	CUCGAGUGAGCGACAGGCGCAACCUCUC CUAGAACUACGAGCCUUUUGCUCGUCU AUGGUUCUAGGAGAGGUUGCGCCUGCU

SEQ ID NO:	miDU X4	miR binding site	Location of binding site	Nucleotide Sequence (lowercase letter spacers to facilitate proper folding of the per-miRNA stem)
				GCCUacUagaUAUUUAGUGUGAUA AUGGU GUUUACUAGU
1304	mi405	miR-122 miR-122	Loop (both)	CUCGAGUGAGCGAUCCAGGAUUCAGAU CUGGUUUCUUUAGUGUGAUA AUGGUG UUUGACGAGCUUUUUGCUCGUCUUAUG GAAACCAGAUCUGAAUCCUGGACUGCCU ACUAGU
1305	mi115 5	miR-122 miR-122	Loop (both)	CUCGAGUGAGCGACAGGCGCAACCUCUC CUAGAACUUUAGUGUGAUA AUGGUGU UUGACGAGCUUUUUGCUCGUCUUAUGG UUCUAGGAGAGGUUGC GCCUGCUGCCU ACUAGU

**Table 6**

Additional exemplary miRNA.

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-99b	MI0000746	1742	chr19	51692612	51692681	+	✓
hsa-mir-99a	MI0000101	26393	chr21	16539089	16539169	+	✓
hsa-mir-9986	MI0032316	—	chr2	132433711	132433820	+	—
hsa-mir-9985	MI0032313	1873	chrY	4606120	4606228	+	✓
hsa-mir-9983	MI0033670	3	chr6	39074314	39074381	+	—
hsa-mir-9903	MI0031831	1	chr8	98393645	98393738	-	✓
hsa-mir-9902-2	MI0041071	406	chr12	122709332	122709424	-	—
hsa-mir-9902-1	MI0031830	406	chr12	122695907	122695999	-	—
hsa-mir-9901	MI0031829	13	chr16	34163578	34163673	+	—
hsa-mir-9900	MI0031828	—	chr3	112737089	112737181	+	—
hsa-mir-9899	MI0031827	—	chr2	149330278	149330373	-	—
hsa-mir-9898	MI0031826	3	chr12	52898889	52898984	-	—
hsa-mir-9851	MI0039502	—	chr10	116827488	116827568	-	—
hsa-mir-98	MI0000100	45139	chrX	53556223	53556341	-	✓
hsa-mir-9718	MI0030983	—	chr14	60648648	60648711	+	—
hsa-mir-96	MI0000098	483	chr7	129774692	129774769	-	✓
hsa-mir-9500	MI0029185	—	chr2	218823090	218823154	+	—
hsa-mir-95	MI0000097	164	chr4	8005301	8005381	-	—
hsa-mir-944	MI0005769	80	chr3	189829922	189830009	+	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-943	MI0005768	—	chr4	1986384	1986477	—	—
sa-mir-942	MI0005767	2	chr1	117094643	117094728	+	✓
hsa-mir-941-5	MI0031520	57	chr20	63919868	63919939	+	✓
hsa-mir-941-4	MI0005766	57	chr20	63919756	63919827	+	✓
hsa-mir-941-3	MI0005765	57	chr20	63919561	63919632	+	✓
hsa-mir-941-2	MI0005764	57	chr20	63919505	63919576	+	✓
hsa-mir-941-1	MI0005763	57	chr20	63919449	63919520	+	✓
hsa-mir-940	MI0005762	—	chr16	2271747	2271840	+	—
hsa-mir-939	MI0005761	—	chr8	144394149	144394230	—	—
hsa-mir-938	MI0005760	53	chr10	29602264	29602346	—	—
hsa-mir-937	MI0005759	18	chr8	143812957	143813042	—	—
hsa-mir-936	MI0005758	—	chr10	104048089	104048186	—	—
hsa-mir-935	MI0005757	11	chr19	53982307	53982397	+	—
hsa-mir-934	MI0005756	5	chrX	136550878	136550960	+	—
hsa-mir-933	MI0005755	—	chr2	175167633	175167709	—	—
hsa-mir-93	MI0000095	2001	chr7	100093768	100093847	—	✓
hsa-mir-92b	MI0003560	4600	chr1	155195177	155195272	+	✓
hsa-mir-92a-2	MI0000094	7185	chrX	134169538	134169612	—	✓
hsa-mir-92a-1	MI0000093	8600	chr13	91351314	91351391	+	✓
hsa-mir-924	MI0005716	100	chr18	39622123	39622175	—	—
hsa-mir-922	MI0005714	17	chr3	197674496	197674576	—	—
hsa-mir-921	MI0005713	—	chr1	166154743	166154798	—	—
hsa-mir-920	MI0005712	—	chr12	24212421	24212495	+	—
hsa-mir-9-3	MI0000468	1073	chr15	89368017	89368106	+	✓
hsa-mir-9-2	MI0000467	1073	chr5	88666853	88666939	—	✓
hsa-mir-9-1	MI0000466	1073	chr1	156420341	156420429	—	✓
hsa-mir-892c	MI0022560	2	chrX	145992750	145992826	—	—
hsa-mir-892b	MI0005538	—	chrX	145997198	145997274	—	—
hsa-mir-892a	MI0005528	—	chrX	145996669	145996743	—	—
hsa-mir-891b	MI0005534	—	chrX	146001053	146001131	—	—
hsa-mir-891a	MI0005524	—	chrX	146027794	146027872	—	—
hsa-mir-890	MI0005533	2	chrX	145994275	145994351	—	—
hsa-mir-889	MI0005540	26	chr14	101047901	101047979	+	✓
hsa-mir-888	MI0005537	784	chrX	145994784	145994860	—	✓
hsa-mir-887	MI0005562	6	chr5	15935182	15935260	+	✓
hsa-mir-885	MI0005560	4	chr3	10394489	10394562	—	✓
hsa-mir-877	MI0005561	70	chr6	30584332	30584417	+	—
hsa-mir-876	MI0005542	28	chr9	28863626	28863706	—	✓
hsa-mir-875	MI0005541	—	chr8	99536786	99536861	—	—
hsa-mir-874	MI0005532	23	chr5	137647572	137647649	—	✓
hsa-mir-873	MI0005564	8	chr9	28888879	28888955	—	✓
hsa-mir-8485	MI0027288	1000	chr2	50696172	50696262	—	—
hsa-mir-8089	MI0025925	28	chr5	181043403	181043484	—	—
hsa-mir-8088	MI0025924	—	chrX	52336557	52336642	—	—
hsa-mir-8087	MI0025923	65	chr11	27514970	27515047	—	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-8086	MI0025922	209	chr10	28289258	28289350	-	—
hsa-mir-8085	MI0025921	—	chr19	44758657	44758721	+	—
hsa-mir-8084	MI0025920	—	chr8	93029751	93029839	+	—
hsa-mir-8083	MI0025919	—	chr1	153689705	153689793	-	—
hsa-mir-8082	MI0025918	—	chr4	113152282	113152362	+	—
hsa-mir-8081	MI0025917	472	chr9	106600928	106601022	+	—
hsa-mir-8080	MI0025916	15	chr2	79866495	79866583	-	—
hsa-mir-8079	MI0025915	—	chr13	44196129	44196200	-	—
hsa-mir-8078	MI0025914	—	chr18	112256	112339	-	—
hsa-mir-8077	MI0025913	—	chr19	42351131	42351205	+	—
hsa-mir-8076	MI0025912	—	chr3	113432118	113432200	-	—
hsa-mir-8075	MI0025911	—	chr13	113262920	113262999	+	—
hsa-mir-8074	MI0025910	—	chr19	51206929	51207009	-	—
hsa-mir-8073	MI0025909	—	chr13	110340958	110341029	+	—
hsa-mir-8072	MI0025908	5	chr12	123364764	123364843	-	—
hsa-mir-8071-2	MI0026417	—	chr14	105640168	105640232	+	—
hsa-mir-8071-1	MI0025907	—	chr14	105621116	105621180	+	—
hsa-mir-8070	MI0025906	—	chr11	11783135	11783222	-	—
hsa-mir-8069-2	MI0031519	12	chr21	13724189	13724274	+	—
hsa-mir-8069-1	MI0025905	12	chr21	6859171	6859256	+	—
hsa-mir-8068	MI0025904	—	chr11	28477481	28477548	-	—
hsa-mir-8067	MI0025903	—	chr15	62304658	62304734	-	—
hsa-mir-8066	MI0025902	—	chr4	101240795	101240872	-	—
hsa-mir-8065	MI0025901	180	chr16	5632467	5632566	+	—
hsa-mir-8064	MI0025900	3	chr3	52846463	52846552	-	—
hsa-mir-8063	MI0025899	—	chr15	36972821	36972901	-	—
hsa-mir-8062	MI0025898	—	chr20	7371608	7371692	+	—
hsa-mir-8061	MI0025897	—	chr19	54645309	54645383	+	—
hsa-mir-8060	MI0025896	—	chr3	96359964	96360039	+	—
hsa-mir-8059	MI0025895	—	chr17	50768650	50768730	+	—
hsa-mir-8058	MI0025894	8	chr16	82688931	82689019	+	—
hsa-mir-8057	MI0025893	5	chr18	26591467	26591535	-	—
hsa-mir-8056	MI0025892	—	chr5	173347455	173347536	+	—
hsa-mir-8055	MI0025891	—	chr8	6622124	6622220	-	—
hsa-mir-8054	MI0025890	—	chr11	23419105	23419190	-	—
hsa-mir-8053	MI0025889	—	chr4	47652669	47652743	+	—
hsa-mir-8052	MI0025888	—	chr11	130666735	130666803	+	—
hsa-mir-802	MI0003906	266	chr21	35720715	35720808	+	—
hsa-mir-7978	MI0025754	—	chr4	21464700	21464758	-	—
hsa-mir-7977	MI0025753	58	chr3	176515103	176515151	+	—
hsa-mir-7976	MI0025752	—	chr3	127587111	127587176	-	✓
hsa-mir-7975	MI0025751	121	chr19	55123225	55123292	-	—
hsa-mir-7974	MI0025750	21	chr19	11495544	11495622	-	—

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hsa-mir-7973-2	MI0025749	—	chr15	51314032	51314107	-	—
hsa-mir-7973-1	MI0025748	—	chr15	51314034	51314109	+	—
hsa-mir-7856	MI0025526	—	chr1	86357632	86357687	-	—
hsa-mir-7855	MI0025525	35	chr14	64785626	64785686	-	—
hsa-mir-7854	MI0025524	—	chr16	81533902	81533966	+	—
hsa-mir-7853	MI0025523	11	chr6	6169304	6169435	-	—
hsa-mir-7852	MI0025522	—	chr1	107897223	107897304	+	—
hsa-mir-7851	MI0025521	837	chr12	42323700	42323859	-	—
hsa-mir-7850	MI0025520	64	chr19	2630715	2630793	+	—
hsa-mir-7849	MI0025519	—	chr4	146408583	146408688	+	—
hsa-mir-7848	MI0025518	—	chr8	133046481	133046581	-	—
hsa-mir-7847	MI0025517	24	chr11	1880045	1880147	+	—
hsa-mir-7846	MI0025516	4	chr1	12166943	12167038	+	—
hsa-mir-7845	MI0025515	4	chr2	207166400	207166498	+	—
hsa-mir-7844	MI0025514	—	chr12	94571231	94571352	-	—
hsa-mir-7843	MI0025510	—	chr14	72516820	72516898	+	—
hsa-mir-7706	MI0025242	1	chr15	85380596	85380662	+	—
hsa-mir-7705	MI0025241	—	chr8	100702968	100703024	-	—
hsa-mir-7704	MI0025240	29	chr2	176188843	176188901	+	—
hsa-mir-7703	MI0025239	4	chr14	24143489	24143565	-	—
hsa-mir-7702	MI0025238	—	chr9	111271156	111271214	-	—
hsa-mir-770	MI0005118	—	chr14	100852390	100852487	+	✓
hsa-mir-769	MI0003834	120	chr19	46018932	46019049	+	✓
hsa-mir-767	MI0003763	30	chrX	152393421	152393529	-	✓
hsa-mir-766	MI0003836	10	chrX	119646738	119646848	-	✓
hsa-mir-765	MI0005116	8	chr1	156936131	156936244	-	—
hsa-mir-764	MI0003944	—	chrX	114639435	114639519	+	—
hsa-mir-762	MI0003892	—	chr16	30893903	30893985	+	—
hsa-mir-761	MI0003941	40	chr1	51836344	51836402	-	—
hsa-mir-760	MI0005567	9	chr1	93846832	93846911	+	—
hsa-mir-759	MI0004065	—	chr13	52810050	52810140	+	—
hsa-mir-758	MI0003757	2	chr14	101026020	101026107	+	✓
hsa-mir-7515	MI0024354	20	chr2	6650373	6650439	+	—
hsa-mir-744	MI0005559	324	chr17	12081899	12081996	+	✓
hsa-mir-718	MI0012489	2	chrX	154019920	154019989	-	—
hsa-mir-7162	MI0023623	—	chr10	30368597	30368665	-	—
hsa-mir-7161	MI0023619	107	chr6	158609707	158609790	+	—
hsa-mir-7160	MI0023621	—	chr8	2076589	2076640	+	—
hsa-mir-7159	MI0023620	50	chr6	33899135	33899200	+	—
hsa-mir-7158	MI0023618	—	chr2	5974662	5974732	+	—
hsa-mir-7157	MI0023617	—	chr2	140586626	140586685	-	—
hsa-mir-7156	MI0023616	—	chr1	77060143	77060202	+	—
hsa-mir-7155	MI0023615	—	chr11	64341849	64341904	-	—
hsa-mir-7154	MI0023614	—	chr11	45691704	45691776	-	✓
hsa-mir-7153	MI0023613	—	chr18	11654885	11654941	-	—

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hsa-mir-7152	MI0023612	—	chr10	71790747	71790800	+	—
hsa-mir-7151	MI0023611	—	chr10	67403351	67403410	-	—
hsa-mir-7150	MI0023610	—	chr9	123485529	123485622	-	—
hsa-mir-7114	MI0022965	—	chr9	137450026	137450086	-	—
hsa-mir-7113	MI0022964	—	chr11	68032864	68032922	+	—
hsa-mir-7112	MI0022963	—	chr8	144262673	144262737	-	—
hsa-mir-7111	MI0022962	—	chr6	35470508	35470579	+	—
hsa-mir-7110	MI0022961	578	chr3	123161794	123161879	+	—
hsa-mir-711	MI0012488	—	chr3	48578902	48578977	-	—
hsa-mir-7109	MI0022960	2	chr22	31621467	31621531	-	—
hsa-mir-7108	MI0022959	100	chr19	2434914	2435000	-	—
hsa-mir-7107	MI0022958	13	chr12	121444273	121444352	-	—
hsa-mir-7106	MI0022957	—	chr12	113159113	113159177	-	—
hsa-mir-708	MI0005543	184	chr11	79402022	79402109	-	✓
hsa-mir-7-3	MI0000265	3279	chr19	4770670	4770779	+	—
hsa-mir-7-2	MI0000264	3265	chr15	88611825	88611934	+	✓
hsa-mir-7-1	MI0000263	3664	chr9	83969748	83969857	-	✓
hsa-mir-6895	MI0022742	4	chrX	53195411	53195488	-	—
hsa-mir-6894	MI0022741	1	chrX	53198889	53198945	-	—
hsa-mir-6893	MI0022740	—	chr8	144435551	144435619	-	—
hsa-mir-6892	MI0022739	35	chr7	143382686	143382800	+	—
hsa-mir-6891	MI0022738	12	chr6	31355224	31355316	-	—
hsa-mir-6890	MI0022737	—	chr3	49099854	49099914	-	—
hsa-mir-6889	MI0022736	—	chr22	41252992	41253050	-	—
hsa-mir-6888	MI0022735	2	chr2	159186835	159186901	+	—
hsa-mir-6887	MI0022734	—	chr19	35122700	35122764	+	—
hsa-mir-6886	MI0022733	—	chr19	11113474	11113534	+	—
hsa-mir-6885	MI0022732	—	chr19	6389638	6389703	-	—
hsa-mir-6884	MI0022731	—	chr17	40026332	40026409	-	—
hsa-mir-6883	MI0022730	—	chr17	8144994	8145071	-	—
hsa-mir-6882	MI0022729	29	chr15	74840642	74840707	-	—
hsa-mir-6881	MI0022728	—	chr15	74411357	74411432	-	—
hsa-mir-6880	MI0022727	2	chr12	124337181	124337242	-	—
hsa-mir-6879	MI0022726	162	chr11	65018505	65018570	+	—
hsa-mir-6878	MI0022725	69	chr1	150492345	150492410	+	—
hsa-mir-6877	MI0022724	—	chr9	133051996	133052059	+	—
hsa-mir-6876	MI0022723	12	chr8	25345402	25345474	+	—
hsa-mir-6875	MI0022722	49	chr7	100868036	100868107	+	—
hsa-mir-6874	MI0022721	18	chr7	5711840	5711910	-	—
hsa-mir-6873	MI0022720	72	chr6	33287227	33287289	-	—
hsa-mir-6872	MI0022719	—	chr3	50273236	50273297	+	—
hsa-mir-6871	MI0022718	—	chr20	41169023	41169078	+	—
hsa-mir-6870	MI0022717	2	chr20	10649636	10649695	-	—
hsa-mir-6869	MI0022716	—	chr20	1392900	1392961	-	—
hsa-mir-6868	MI0022715	—	chr17	76098019	76098076	-	—
hsa-mir-6867	MI0022714	4	chr17	40193597	40193663	+	—
hsa-mir-6866	MI0022713	—	chr17	40161933	40162001	+	—
hsa-mir-6865	MI0022712	—	chr17	4970086	4970150	-	—

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hsa-mir-6864	MI0022711	—	chr17	4969702	4969771	-	—
hsa-mir-6863	MI0022710	—	chr16	56904264	56904353	+	—
hsa-mir-6862-2	MI0026415	—	chr16	28724252	28724321	+	—
hsa-mir-6862-1	MI0022709	—	chr16	28390982	28391051	-	—
hsa-mir-6861	MI0022708	6	chr12	112163258	112163321	-	—
hsa-mir-6860	MI0022707	—	chr11	67045643	67045708	+	—
hsa-mir-6859-4	MI0031521	—	chr16	17052	17119	-	—
hsa-mir-6859-3	MI0026421	—	chr15	101973524	101973591	+	—
hsa-mir-6859-2	MI0026420	—	chr1	187891	187958	-	—
hsa-mir-6859-1	MI0022705	—	chr1	17369	17436	-	—
hsa-mir-6858	MI0022704	19	chrX	154450320	154450386	+	—
hsa-mir-6857	MI0022703	—	chrX	53405673	53405765	-	—
hsa-mir-6856	MI0022702	47	chr9	130626297	130626363	+	—
hsa-mir-6855	MI0022701	—	chr9	129869605	129869671	+	✓
hsa-mir-6854	MI0022700	—	chr9	98229149	98229217	-	—
hsa-mir-6853	MI0022699	—	chr9	35732922	35732995	+	—
hsa-mir-6852	MI0022698	—	chr9	35710676	35710741	-	—
hsa-mir-6851	MI0022697	2	chr9	33467869	33467935	-	—
hsa-mir-6850	MI0022696	—	chr8	144791931	144791991	-	—
hsa-mir-6849	MI0022695	—	chr8	144400277	144400345	-	—
hsa-mir-6848	MI0022694	—	chr8	144317246	144317315	-	—
hsa-mir-6847	MI0022693	—	chr8	144079874	144079942	+	—
hsa-mir-6846	MI0022692	20	chr8	144057321	144057380	-	—
hsa-mir-6845	MI0022691	—	chr8	143837756	143837816	-	—
hsa-mir-6844	MI0022690	—	chr8	124508515	124508576	-	—
hsa-mir-6843	MI0022689	—	chr8	27610601	27610751	-	—
hsa-mir-6842	MI0022688	34	chr8	27433370	27433434	+	—
hsa-mir-6841	MI0022687	—	chr8	24953796	24953867	-	—
hsa-mir-6840	MI0022686	—	chr7	100356651	100356721	+	—
hsa-mir-6839	MI0022685	—	chr7	64679064	64679176	+	—
hsa-mir-6838	MI0022684	—	chr7	44073378	44073433	-	—
hsa-mir-6837	MI0022683	—	chr7	44051766	44051829	+	—
hsa-mir-6836	MI0022682	10	chr7	2257515	2257577	-	—
hsa-mir-6835	MI0022680	—	chr6	34240673	34240736	+	—
hsa-mir-6834	MI0022679	—	chr6	33290245	33290325	+	—
hsa-mir-6833	MI0022678	1	chr6	32179816	32179876	+	—
hsa-mir-6832	MI0022677	12	chr6	31633787	31633858	+	—
hsa-mir-6831	MI0022676	—	chr5	140563671	140563751	-	—
hsa-mir-6830	MI0022675	—	chr5	132217849	132217918	-	—
hsa-mir-6829	MI0022674	—	chr3	195882329	195882395	-	—
hsa-mir-6828	MI0022673	—	chr3	170423103	170423162	+	—
hsa-mir-6827	MI0022672	—	chr3	134367804	134367862	-	—

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hsa-mir-6826	MI0022671	3	chr3	129272146	129272243	+	—
hsa-mir-6825	MI0022670	—	chr3	127575266	127575331	-	—
hsa-mir-6824	MI0022669	—	chr3	48633636	48633698	-	—
hsa-mir-6823	MI0022668	—	chr3	48549961	48550021	-	—
hsa-mir-6822	MI0022667	3	chr3	39138206	39138266	+	—
hsa-mir-6821	MI0022666	5	chr22	49962866	49962939	+	—
hsa-mir-6820	MI0022665	—	chr22	37967563	37967624	+	✓
hsa-mir-6819	MI0022664	—	chr22	36286847	36286907	-	—
hsa-mir-6818	MI0022663	5	chr22	30007049	30007113	+	—
hsa-mir-6817	MI0022662	—	chr22	25455646	25455711	+	—
hsa-mir-6816	MI0022661	—	chr22	20114686	20114751	-	—
hsa-mir-6815	MI0022660	—	chr21	45478266	45478326	+	—
hsa-mir-6814	MI0022659	—	chr21	41746772	41746841	-	—
hsa-mir-6813	MI0022658	—	chr20	64076955	64077010	-	—
hsa-mir-6812	MI0022657	90	chr20	45425510	45425573	+	—
hsa-mir-6811	MI0022656	—	chr2	237510931	237510988	+	—
hsa-mir-6810	MI0022655	—	chr2	218341911	218341980	+	—
hsa-mir-6809	MI0022654	2	chr2	217900513	217900628	-	—
hsa-mir-6808	MI0022653	—	chr1	1339650	1339708	-	—
hsa-mir-6807	MI0022652	8	chr19	58550285	58550376	+	—
hsa-mir-6806	MI0022651	—	chr19	58334688	58334751	+	—
hsa-mir-6805	MI0022650	28	chr19	55388181	55388242	+	—
hsa-mir-6804	MI0022649	—	chr19	55230885	55230952	-	—
hsa-mir-6803	MI0022648	9	chr19	55245186	55245250	-	—
hsa-mir-6802	MI0022647	—	chr19	55239912	55239976	-	—
hsa-mir-6801	MI0022646	—	chr19	52222020	52222098	+	—
hsa-mir-6800	MI0022645	1	chr19	49832018	49832099	+	—
hsa-mir-6799	MI0022644	—	chr19	49791866	49791934	+	—
hsa-mir-6798	MI0022643	—	chr19	49009906	49009972	+	—
hsa-mir-6797	MI0022642	6	chr19	41869627	41869698	+	—
hsa-mir-6796	MI0022641	2	chr19	40369846	40369907	+	—
hsa-mir-6795	MI0022640	3	chr19	15179283	15179350	-	—
hsa-mir-6794	MI0022639	26	chr19	12852260	12852327	+	—
hsa-mir-6793	MI0022638	—	chr19	10828973	10829035	+	—
hsa-mir-6792	MI0022637	7	chr19	7617439	7617505	+	—
hsa-mir-6791	MI0022636	5	chr19	6736712	6736778	-	—
hsa-mir-6790	MI0022635	—	chr19	6392921	6392983	-	—
hsa-mir-6789	MI0022634	51	chr19	2235829	2235926	-	—
hsa-mir-6788	MI0022633	65	chr18	10759584	10759649	-	—
hsa-mir-6787	MI0022632	—	chr17	82236668	82236728	+	—
hsa-mir-6786	MI0022631	13	chr17	81693757	81693869	+	—
hsa-mir-6785	MI0022630	2	chr17	75498548	75498628	+	—
hsa-mir-6784	MI0022629	—	chr17	45114367	45114433	-	—
hsa-mir-6783	MI0022628	—	chr17	44934618	44934681	-	—
hsa-mir-6782	MI0022627	—	chr17	44207771	44207839	-	—
hsa-mir-6781	MI0022626	—	chr17	42823880	42823943	-	—
hsa-mir-6780b	MI0022681	—	chr6	43434542	43434620	+	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-6780a	MI0022625	—	chr17	42708084	42708151	-	—
hsa-mir-6779	MI0022624	6	chr17	38914979	38915042	+	—
hsa-mir-6778	MI0022623	5	chr17	18340814	18340886	-	—
hsa-mir-6777	MI0022622	—	chr17	17813480	17813545	-	—
hsa-mir-6776	MI0022621	—	chr17	2692861	2692919	-	—
hsa-mir-6775	MI0022620	—	chr16	87834592	87834660	-	—
hsa-mir-6774	MI0022619	—	chr16	85918347	85918416	+	—
hsa-mir-6773	MI0022618	—	chr16	68233426	68233499	-	—
hsa-mir-6772	MI0022617	—	chr16	57772289	57772352	-	—
hsa-mir-6771	MI0022616	5	chr16	50292616	50292675	+	—
hsa-mir-6770-3	MI0026419	—	chr16	18379351	18379410	-	✓
hsa-mir-6770-2	MI0026418	—	chr16	16329305	16329364	+	✓
hsa-mir-6770-1	MI0022615	—	chr16	14930820	14930879	+	✓
hsa-mir-6769b	MI0022706	—	chr1	206474803	206474864	+	—
hsa-mir-6769a	MI0022614	—	chr16	4671318	4671390	+	—
hsa-mir-6768	MI0022613	—	chr16	2463967	2464038	+	—
hsa-mir-6767	MI0022612	—	chr16	2445392	2445457	+	—
hsa-mir-6766	MI0022611	—	chr15	89326739	89326810	-	—
hsa-mir-6765	MI0022610	9	chr14	105150778	105150864	-	—
hsa-mir-6764	MI0022609	2	chr14	100277357	100277417	+	—
hsa-mir-6763	MI0022608	5	chr12	132581997	132582061	+	—
hsa-mir-6762	MI0022607	—	chr12	113291523	113291608	+	—
hsa-mir-6761	MI0022606	1	chr12	111799834	111799905	+	—
hsa-mir-6760	MI0022605	—	chr12	111304142	111304209	+	—
hsa-mir-676	MI0016436	—	chrX	70022857	70022923	+	✓
hsa-mir-6759	MI0022604	—	chr12	57748618	57748682	-	—
hsa-mir-6758	MI0022603	—	chr12	57512688	57512750	+	✓
hsa-mir-6757	MI0022602	3	chr12	53056944	53057012	+	—
hsa-mir-6756	MI0022601	21	chr11	119312950	119313012	-	—
hsa-mir-6755	MI0022600	—	chr11	86278333	86278398	+	—
hsa-mir-6754	MI0022599	—	chr11	71473503	71473568	+	—
hsa-mir-6753	MI0022598	13	chr11	68044794	68044957	+	—
hsa-mir-6752	MI0022597	17	chr11	67490245	67490315	+	—
hsa-mir-6751	MI0022596	41	chr11	65129916	65129978	-	—
hsa-mir-6750	MI0022595	2	chr11	64898363	64898437	-	—
hsa-mir-675	MI0005416	20	chr11	1996759	1996831	-	✓
hsa-mir-6749	MI0022594	7	chr11	64902387	64902455	-	—
hsa-mir-6748	MI0022593	—	chr11	62789815	62789885	+	—
hsa-mir-6747	MI0022592	5	chr11	62567011	62567071	-	—
hsa-mir-6746	MI0022591	2	chr11	61878216	61878278	-	—
hsa-mir-6745	MI0022590	—	chr11	47179611	47179737	-	—
hsa-mir-6744	MI0022589	—	chr11	1256605	1256670	+	—
hsa-mir-6743	MI0022588	—	chr11	209336	209406	+	—
hsa-mir-6742	MI0022587	—	chr1	228397048	228397109	-	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-6741	MI0022586	—	chr1	225922080	225922142	-	—
hsa-mir-6740	MI0022585	4	chr1	202003124	202003236	+	—
hsa-mir-6739	MI0022584	—	chr1	201863373	201863447	+	—
hsa-mir-6738	MI0022583	—	chr1	155951273	155951336	-	—
hsa-mir-6737	MI0022582	—	chr1	153962351	153962420	-	—
hsa-mir-6736	MI0022581	6	chr1	145850587	145850645	-	—
hsa-mir-6735	MI0022580	1	chr1	43448539	43448611	+	—
hsa-mir-6734	MI0022579	1	chr1	43364648	43364715	-	—
hsa-mir-6733	MI0022578	—	chr1	43171652	43171712	-	—
hsa-mir-6732	MI0022577	2	chr1	37480230	37480289	+	—
hsa-mir-6731	MI0022576	2	chr1	24919345	24919416	-	—
hsa-mir-6730	MI0022575	51	chr1	12578957	12579023	-	—
hsa-mir-6729	MI0022574	—	chr1	12029158	12029222	+	—
hsa-mir-6728	MI0022573	84	chr1	8866502	8866590	-	—
hsa-mir-6727	MI0022572	5	chr1	1312502	1312566	-	—
hsa-mir-6726	MI0022571	—	chr1	1296110	1296170	-	—
hsa-mir-6724-4	MI0031518	1	chr21	8432530	8432621	+	—
hsa-mir-6724-3	MI0031517	1	chr21	8388362	8388453	+	—
hsa-mir-6724-2	MI0031516	1	chr21	8249505	8249596	+	—
hsa-mir-6724-1	MI0022559	1	chr21	8205315	8205406	+	—
hsa-mir-6722	MI0022557	—	chr9	136746893	136746970	-	—
hsa-mir-6721	MI0022556	2	chr6	32170030	32170116	-	—
hsa-mir-6720	MI0022555	1	chr6	1390314	1390411	-	✓
hsa-mir-6719	MI0022554	33	chr19	39829716	39829802	-	—
hsa-mir-6718	MI0022553	—	chr18	3885353	3885432	+	—
hsa-mir-6717	MI0022551	—	chr14	21023314	21023386	-	—
hsa-mir-6716	MI0022550	13	chr11	118644000	118644079	+	—
hsa-mir-6715b	MI0022549	—	chr10	112299612	112299688	-	—
hsa-mir-6715a	MI0022548	24	chr10	112299612	112299690	+	—
hsa-mir-671	MI0003760	77	chr7	151238421	151238538	+	✓
hsa-mir-670	MI0003933	—	chr11	43559656	43559753	+	—
hsa-mir-668	MI0003761	7	chr14	101055258	101055323	+	—
hsa-mir-665	MI0005563	14	chr14	100875033	100875104	+	—
hsa-mir-664b	MI0019134	2	chrX	154768596	154768656	+	✓
hsa-mir-664a	MI0006442	64	chr1	220200538	220200619	-	✓
hsa-mir-663b	MI0006336	9	chr2	132256966	132257080	-	—
hsa-mir-663a	MI0003672	10	chr20	26208186	26208278	-	—
hsa-mir-662	MI0003670	—	chr16	770183	770277	+	—
hsa-mir-661	MI0003669	130	chr8	143945191	143945279	-	—
hsa-mir-660	MI0003684	510	chrX	50013241	50013337	+	✓
hsa-mir-659	MI0003683	1	chr22	37847678	37847774	-	—
hsa-mir-658	MI0003682	1	chr22	37844272	37844371	-	—
hsa-mir-657	MI0003681	7	chr17	81125276	81125373	-	—

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hsa-mir-656	MI0003678	—	chr14	101066724	101066801	+	—
hsa-mir-655	MI0003677	6	chr14	101049550	101049646	+	—
hsa-mir-654	MI0003676	5	chr14	101040219	101040299	+	✓
hsa-mir-653	MI0003674	—	chr7	93482760	93482855	-	✓
hsa-mir-6529	MI0039501	—	chr3	120084564	120084648	-	—
hsa-mir-652	MI0003667	189	chrX	110055329	110055426	+	✓
hsa-mir-6516	MI0025513	2	chr17	77089417	77089497	+	—
hsa-mir-6515	MI0022227	4	chr19	12940484	12940540	+	—
hsa-mir-6514	MI0022226	—	chr11	62792702	62792771	-	—
hsa-mir-6513	MI0022225	2	chr2	218280125	218280188	-	—
hsa-mir-6512	MI0022224	2	chr2	177313806	177313882	-	—
hsa-mir-6511b-2	MI0023431	6	chr16	15134075	15134145	-	—
hsa-mir-6511b-1	MI0022552	5	chr16	2106669	2106753	-	—
hsa-mir-6511a-4	MI0023566	3	chr16	18344013	18344079	-	✓
hsa-mir-6511a-3	MI0023565	3	chr16	16368876	16368942	+	✓
hsa-mir-6511a-2	MI0023564	3	chr16	16324588	16324654	+	✓
hsa-mir-6511a-1	MI0022223	3	chr16	14925937	14926003	+	✓
hsa-mir-6510	MI0022222	5	chr17	41517164	41517217	-	—
hsa-mir-651	MI0003666	7	chrX	8126965	8127061	+	✓
hsa-mir-6509	MI0022221	—	chr7	135206994	135207078	-	—
hsa-mir-6508	MI0022220	—	chr21	39447010	39447069	+	—
hsa-mir-6507	MI0022219	2	chr10	98924499	98924568	-	—
hsa-mir-6506	MI0022218	—	chr16	15611030	15611095	-	—
hsa-mir-6505	MI0022217	1	chr12	48132797	48132867	+	—
hsa-mir-6504	MI0022216	—	chr16	81611348	81611408	+	—
hsa-mir-6503	MI0022215	—	chr11	60209071	60209156	-	—
hsa-mir-6502	MI0022214	—	chr12	66251082	66251157	+	—
hsa-mir-6501	MI0022213	—	chr21	33550662	33550728	+	—
hsa-mir-6500	MI0022211	58	chr1	51060018	51060103	+	—
hsa-mir-650	MI0003665	—	chr22	22822776	22822871	+	—
hsa-mir-6499	MI0022209	7	chr5	151522087	151522148	-	—
hsa-mir-649	MI0003664	—	chr22	21034176	21034272	-	—
hsa-mir-648	MI0003663	31	chr22	17980868	17980961	-	—
hsa-mir-647	MI0003662	42	chr20	63942631	63942726	-	—
hsa-mir-646	MI0003661	—	chr20	60308474	60308567	+	—
hsa-mir-645	MI0003660	21	chr20	50585786	50585879	+	—
hsa-mir-644a	MI0003659	—	chr20	34466325	34466418	+	—
hsa-mir-643	MI0003658	216	chr19	52281797	52281893	+	✓
hsa-mir-642b	MI0016685	—	chr19	45674932	45675008	-	✓
hsa-mir-642a	MI0003657	—	chr19	45674928	45675024	+	✓
hsa-mir-641	MI0003656	4	chr19	40282543	40282641	-	—

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hsa-mir-640	MI0003655	36	chr19	19435063	19435158	+	—
hsa-mir-639	MI0003654	78	chr19	14529543	14529640	+	—
hsa-mir-638	MI0003653	9	chr19	10718404	10718503	+	—
hsa-mir-637	MI0003652	37	chr19	3961414	3961512	-	—
hsa-mir-636	MI0003651	37	chr17	76736450	76736548	-	—
hsa-mir-635	MI0003650	—	chr17	68424451	68424548	-	—
hsa-mir-634	MI0003649	—	chr17	66787072	66787168	+	—
hsa-mir-633	MI0003648	—	chr17	62944215	62944312	+	—
hsa-mir-632	MI0003647	10	chr17	32350109	32350202	+	—
hsa-mir-631	MI0003645	—	chr15	75353611	75353685	-	—
hsa-mir-630	MI0003644	3442	chr15	72587217	72587313	+	—
hsa-mir-629	MI0003643	99	chr15	70079372	70079468	-	✓
hsa-mir-628	MI0003642	4	chr15	55372940	55373034	-	—
hsa-mir-627	MI0003641	3	chr15	42199570	42199666	-	✓
hsa-mir-626	MI0003640	—	chr15	41691585	41691678	+	—
hsa-mir-625	MI0003639	24	chr14	65471102	65471186	+	✓
hsa-mir-624	MI0003638	—	chr14	31014646	31014742	-	—
hsa-mir-623	MI0003637	—	chr13	99356131	99356228	+	—
hsa-mir-622	MI0003636	5	chr13	90231182	90231277	+	—
hsa-mir-621	MI0003635	11	chr13	40810766	40810861	+	—
hsa-mir-620	MI0003634	20	chr12	116148560	116148654	-	—
hsa-mir-619	MI0003633	201	chr12	108836908	108837006	-	—
hsa-mir-618	MI0003632	13	chr12	80935736	80935833	-	—
hsa-mir-617	MI0003631	38	chr12	80832533	80832629	-	—
hsa-mir-6165	MI0021472	39	chr17	49510817	49510900	+	—
hsa-mir-616	MI0003629	1	chr12	57519163	57519259	-	✓
hsa-mir-615	MI0003628	117	chr12	54033950	54034045	+	✓
hsa-mir-614	MI0003627	—	chr12	12915829	12915918	+	—
hsa-mir-6134	MI0021279	38	chrX	28495555	28495663	-	—
hsa-mir-6133	MI0021278	1	chr7	133290881	133290988	+	—
hsa-mir-6132	MI0021277	—	chr7	117020211	117020319	+	—
hsa-mir-6131	MI0021276	—	chr5	10478037	10478145	+	—
hsa-mir-6130	MI0021275	335	chr21	23079284	23079392	+	—
hsa-mir-613	MI0003626	24	chr12	12764649	12764743	+	—
hsa-mir-6129	MI0021274	8	chr17	49288346	49288454	-	—
hsa-mir-6128	MI0021272	20	chr11	56743873	56743981	+	—
hsa-mir-6127	MI0021271	87	chr1	22633258	22633366	-	—
hsa-mir-6126	MI0021260	68	chr16	3485381	3485469	-	—
hsa-mir-6125	MI0021259	4	chr12	62260359	62260454	+	—
hsa-mir-6124	MI0021258	214	chr11	12163683	12163767	+	—
hsa-mir-612	MI0003625	45	chr11	65444458	65444557	+	—
hsa-mir-611	MI0003624	4	chr11	61792495	61792561	-	—
hsa-mir-610	MI0003623	13	chr11	28056815	28056910	+	—
hsa-mir-6090	MI0020367	—	chr11	128522390	128522449	+	—
hsa-mir-609	MI0003622	—	chr10	104218789	104218883	-	—
hsa-mir-6089-2	MI0023563	2	chrY	2609191	2609254	+	—

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hsa-mir-6089-1	MI0020366	2	chrX	2609191	2609254	+	—
hsa-mir-6088	MI0020365	24	chr19	45436654	45436704	+	—
hsa-mir-6086	MI0020363	83	chrX	13590292	13590346	+	—
hsa-mir-6085	MI0020362	—	chr15	62343029	62343138	+	—
hsa-mir-6084	MI0020361	—	chr1	20633679	20633788	+	—
hsa-mir-6083	MI0020360	6	chr3	124374332	124374437	+	—
hsa-mir-6082	MI0020359	22	chr4	171186184	171186292	+	—
hsa-mir-6081	MI0020358	—	chr9	95065350	95065446	+	—
hsa-mir-6080	MI0020357	—	chr17	64780759	64780824	+	—
hsa-mir-608	MI0003621	—	chr10	100974985	100975084	+	—
hsa-mir-6079	MI0020356	—	chr1	43838622	43838683	+	—
hsa-mir-6078	MI0020355	—	chr10	3991160	3991259	+	—
hsa-mir-6077	MI0020354	—	chr1	148388282	148388363	+	—
hsa-mir-6076	MI0020353	21	chr14	49966399	49966511	+	—
hsa-mir-6075	MI0020352	24	chr5	1510762	1510856	-	—
hsa-mir-6074	MI0020351	49	chr12	66023620	66023726	-	—
hsa-mir-6073	MI0020350	4	chr11	15969533	15969621	-	—
hsa-mir-6072	MI0020349	—	chr10	2076019	2076089	-	—
hsa-mir-6071	MI0020348	—	chr2	85783600	85783677	-	—
hsa-mir-6070	MI0020347	—	chr21	43609887	43609989	-	—
hsa-mir-607	MI0003620	—	chr10	96828669	96828764	-	—
hsa-mir-6069	MI0020346	244	chr22	35336721	35336799	-	—
hsa-mir-6068	MI0020345	—	chr1	63326925	63326984	-	—
hsa-mir-606	MI0003619	—	chr10	75552458	75552553	+	—
hsa-mir-605	MI0003618	20	chr10	51299573	51299655	+	✓
hsa-mir-604	MI0003617	—	chr10	29545004	29545097	-	—
hsa-mir-603	MI0003616	1	chr10	24275685	24275781	+	—
hsa-mir-602	MI0003615	4	chr9	137838419	137838516	+	—
hsa-mir-601	MI0003614	—	chr9	123402525	123402603	-	—
hsa-mir-600	MI0003613	—	chr9	123111546	123111643	-	—
hsa-mir-599	MI0003611	3	chr8	99536636	99536730	-	—
hsa-mir-598	MI0003610	138	chr8	11035206	11035302	-	✓
hsa-mir-597	MI0003609	—	chr8	9741672	9741768	+	✓
hsa-mir-596	MI0003608	—	chr8	1817231	1817307	+	—
hsa-mir-595	MI0003607	—	chr7	158532718	158532813	-	—
hsa-mir-593	MI0003605	—	chr7	128081861	128081960	+	—
hsa-mir-592	MI0003604	—	chr7	127058088	127058184	-	—
hsa-mir-591	MI0003603	—	chr7	96219662	96219756	-	—
hsa-mir-590	MI0003602	270	chr7	74191198	74191294	+	✓
hsa-mir-589	MI0003599	8	chr7	5495819	5495917	-	✓
hsa-mir-588	MI0003597	4	chr6	126484631	126484713	+	—
hsa-mir-587	MI0003595	—	chr6	106784125	106784220	+	—
hsa-mir-586	MI0003594	—	chr6	45197674	45197770	-	—
hsa-mir-585	MI0003592	5	chr5	169263601	169263694	-	✓
hsa-mir-584	MI0003591	97	chr5	149062313	149062409	-	✓
hsa-mir-583	MI0003590	—	chr5	96079138	96079212	+	—

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hsa-mir-582	MI0003589	151	chr5	59703606	59703703	-	✓
hsa-mir-581	MI0003588	3	chr5	53951504	53951599	-	—
hsa-mir-580	MI0003587	—	chr5	36147892	36147988	-	—
hsa-mir-579	MI0003586	4	chr5	32394378	32394475	-	✓
hsa-mir-5787	MI0019797	—	chr3	50227436	50227490	+	—
hsa-mir-578	MI0003585	—	chr4	165386242	165386337	+	—
hsa-mir-577	MI0003584	13	chr4	114656759	114656854	+	✓
hsa-mir-576	MI0003583	15	chr4	109488698	109488795	+	✓
hsa-mir-575	MI0003582	81	chr4	82753337	82753430	-	—
hsa-mir-574	MI0003581	780	chr4	38868032	38868127	+	✓
hsa-mir-5739	MI0019412	50	chr22	28459869	28459948	+	—
hsa-mir-573	MI0003580	—	chr4	24520192	24520290	-	—
hsa-mir-572	MI0003579	6	chr4	11368827	11368921	+	—
hsa-mir-571	MI0003578	—	chr4	350157	350252	+	—
hsa-mir-5708	MI0019316	55	chr8	80241389	80241473	+	—
hsa-mir-5707	MI0019315	—	chr7	158591616	158591696	+	—
hsa-mir-5706	MI0019314	—	chr5	119154637	119154716	+	—
hsa-mir-5705	MI0019313	—	chr4	87300495	87300583	-	—
hsa-mir-5704	MI0019312	—	chr3	131985855	131985931	-	—
hsa-mir-5703	MI0019310	6	chr2	227472132	227472187	+	—
hsa-mir-5702	MI0019309	—	chr2	226658710	226658793	-	—
hsa-mir-5701-3	MI0031522	—	chr15	21951242	21951323	+	—
hsa-mir-5701-2	MI0019593	—	chr15	21513959	21514040	+	—
hsa-mir-5701-1	MI0019308	—	chr15	20940252	20940333	+	—
hsa-mir-5700	MI0019307	—	chr12	94561789	94561859	+	—
hsa-mir-570	MI0003577	4	chr3	195699401	195699497	+	—
hsa-mir-5699	MI0019306	6	chr10	641689	641778	-	—
hsa-mir-5698	MI0019305	—	chr1	154104521	154104592	-	—
hsa-mir-5697	MI0019304	—	chr1	9967381	9967458	+	—
hsa-mir-5696	MI0019303	—	chr2	101309450	101309534	+	—
hsa-mir-5695	MI0019302	1	chr19	12920320	12920404	+	—
hsa-mir-5694	MI0019301	2	chr14	67441855	67441930	-	—
hsa-mir-5693	MI0019300	4	chr13	51348567	51348639	-	—
hsa-mir-5692c-2	MI0019289	3	chr7	97964405	97964481	-	—
hsa-mir-5692c-1	MI0019288	—	chr5	135802985	135803075	-	—
hsa-mir-5692b	MI0019311	—	chr21	42950928	42951014	-	—
hsa-mir-5692a-2	MI0019298	—	chr8	12719132	12719190	+	—
hsa-mir-5692a-1	MI0019297	—	chr7	97963658	97963726	+	—
hsa-mir-5691	MI0019296	—	chr11	9090312	9090379	-	—
hsa-mir-5690	MI0019295	—	chr6	35664717	35664789	-	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-569	MI0003576	—	chr3	171106664	171106759	—	—
hsa-mir-5689	MI0019294	9	chr6	10439717	10439794	+	—
hsa-mir-5688	MI0019292	—	chr3	85385710	85385792	+	—
hsa-mir-5687	MI0019291	—	chr5	55508850	55508926	—	—
hsa-mir-5685	MI0019287	21	chr6	53276993	53277071	+	—
hsa-mir-5684	MI0019285	46	chr19	12787128	12787192	+	—
hsa-mir-5683	MI0019284	—	chr6	6169334	6169409	+	—
hsa-mir-5682	MI0019282	—	chr3	121049640	121049715	+	✓
hsa-mir-5681b	MI0019293	—	chr8	74548550	74548609	—	—
hsa-mir-5681a	MI0019281	—	chr8	74548543	74548617	+	—
hsa-mir-5680	MI0019280	—	chr8	102125432	102125515	+	—
hsa-mir-568	MI0003574	—	chr3	114316475	114316569	—	—
hsa-mir-567	MI0003573	70	chr3	112112801	112112898	+	—
hsa-mir-564	MI0003570	—	chr3	44861888	44861981	+	—
hsa-mir-563	MI0003569	—	chr3	15873771	15873849	+	—
hsa-mir-562	MI0003568	—	chr2	232172653	232172747	+	—
hsa-mir-561	MI0003567	32	chr2	188297492	188297588	+	✓
hsa-mir-5591	MI0019151	—	chr4	39411910	39411974	+	—
hsa-mir-5590	MI0019150	—	chr2	134857820	134857873	+	—
hsa-mir-559	MI0003565	9	chr2	47377675	47377770	+	—
hsa-mir-5589	MI0019148	—	chr19	10038354	10038413	+	—
hsa-mir-5588	MI0019147	97	chr3	185253210	185253272	—	—
hsa-mir-5587	MI0019144	3	chr16	535316	535368	+	—
hsa-mir-5586	MI0019143	—	chr14	59646962	59647020	—	—
hsa-mir-5585	MI0019142	320	chr1	32086949	32087007	+	—
hsa-mir-5584	MI0019141	—	chr1	44545493	44545552	+	—
hsa-mir-5583-2	MI0019140	—	chr18	39676719	39676777	—	✓
hsa-mir-5583-1	MI0019139	—	chr18	39676721	39676779	+	✓
hsa-mir-5582	MI0019138	—	chr11	46753125	46753192	—	—
hsa-mir-5581	MI0019136	—	chr1	37500935	37500994	—	—
hsa-mir-5580	MI0019135	—	chr14	53948427	53948484	—	—
hsa-mir-558	MI0003564	134	chr2	32532153	32532246	+	—
hsa-mir-5579	MI0019133	—	chr11	79422169	79422226	—	—
hsa-mir-5572	MI0019117	94	chr15	80581103	80581239	+	—
hsa-mir-5571	MI0019115	22	chr22	22886267	22886379	+	—
hsa-mir-557	MI0003563	—	chr1	168375524	168375621	+	—
hsa-mir-556	MI0003562	3	chr1	162342546	162342640	+	✓
hsa-mir-555	MI0003561	—	chr1	155346350	155346445	—	—
hsa-mir-554	MI0003559	—	chr1	151545796	151545891	+	—
hsa-mir-553	MI0003558	—	chr1	100281241	100281308	+	—
hsa-mir-552	MI0003557	—	chr1	34669599	34669694	—	✓
hsa-mir-551b	MI0003575	70	chr3	168551854	168551949	+	✓
hsa-mir-551a	MI0003556	7	chr1	3560695	3560790	—	—
hsa-mir-550b-2	MI0016687	2	chr7	32732981	32733077	—	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-550b-1	MI0016686	2	chr7	30289794	30289890	-	—
hsa-mir-550a-3	MI0003762	16	chr7	29680734	29680828	-	✓
hsa-mir-550a-2	MI0003601	16	chr7	32732981	32733077	+	✓
hsa-mir-550a-1	MI0003600	16	chr7	30289794	30289890	+	✓
hsa-mir-549a	MI0003679	—	chr15	80841978	80842073	-	—
hsa-mir-548z	MI0016688	3	chr12	64622509	64622605	-	—
hsa-mir-548y	MI0016595	1	chr14	47760995	47761104	-	✓
hsa-mir-548x-2	MI0016833	8	chr13	65966330	65966429	-	—
hsa-mir-548x	MI0014244	3	chr21	18686090	18686164	-	✓
hsa-mir-548w	MI0014222	3	chr16	26025237	26025310	+	—
hsa-mir-548v	MI0014174	9	chr8	17681578	17681657	-	✓
hsa-mir-548u	MI0014168	17	chr6	57390132	57390212	+	—
hsa-mir-548t	MI0014164	2	chr4	173268160	173268233	+	—
hsa-mir-548s	MI0014141	5	chr2	11767444	11767525	+	—
hsa-mir-548q	MI0010637	5	chr10	12725254	12725353	-	—
hsa-mir-548p	MI0006420	7	chr5	100816482	100816565	-	—
hsa-mir-548o-2	MI0016746	15	chr20	38516563	38516632	+	✓
hsa-mir-548o	MI0006402	5	chr7	102405742	102405855	-	—
hsa-mir-548n	MI0006399	7	chr7	34940760	34940834	-	—
hsa-mir-548m	MI0006400	—	chrX	95063141	95063226	-	—
hsa-mir-548l	MI0006361	8	chr11	94466495	94466580	-	—
hsa-mir-548k	MI0006354	15	chr11	70283955	70284070	+	✓
hsa-mir-548j	MI0006345	1	chr22	26555212	26555323	-	✓
hsa-mir-548i-4	MI0006424	16	chrX	84225752	84225828	-	—
hsa-mir-548i-3	MI0006423	17	chr8	8088941	8089089	-	—
hsa-mir-548i-2	MI0006422	17	chr4	9556168	9556316	-	—
hsa-mir-548i-1	MI0006421	17	chr3	125790404	125790552	-	—
hsa-mir-548h-5	MI0016751	2	chr6	131792172	131792231	+	—
hsa-mir-548h-4	MI0006414	4	chr8	27048853	27048963	-	✓
hsa-mir-548h-3	MI0006413	6	chr17	13543529	13543646	-	✓
hsa-mir-548h-2	MI0006412	3	chr16	11306440	11306527	-	✓
hsa-mir-548h-1	MI0006411	2	chr14	64095024	64095125	-	—
hsa-mir-548g	MI0006395	—	chr4	147344629	147344717	-	—

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hsa-mir-548f-5	MI0006378	—	chrX	32641474	32641559	-	—
hsa-mir-548f-4	MI0006377	8	chr7	147378017	147378121	-	—
hsa-mir-548f-3	MI0006376	3	chr5	110513829	110513915	-	—
hsa-mir-548f-2	MI0006375	2	chr2	212426263	212426360	-	—
hsa-mir-548f-1	MI0006374	3	chr10	54607874	54607957	-	—
hsa-mir-548c	MI0006344	14	chr10	110988926	110989013	+	✓
hsa-mir-548d-2	MI0003671	15	chr17	67471489	67471585	-	✓
hsa-mir-548d-1	MI0003668	12	chr8	123348034	123348130	-	✓
hsa-mir-548c	MI0003630	13	chr12	64622509	64622605	+	—
hsa-mir-548bc	MI0032315	1	chr17	39297400	39297509	+	—
hsa-mir-548bb	MI0029321	—	chr3	60617805	60617870	-	—
hsa-mir-548ba	MI0025747	8	chr2	49059603	49059658	+	—
hsa-mir-548b	MI0003596	35	chr6	119069047	119069143	-	✓
hsa-mir-548az	MI0022212	8	chr8	119325171	119325265	+	—
hsa-mir-548ay	MI0022210	8	chr3	32506283	32506389	-	✓
hsa-mir-548ax	MI0019286	1	chrX	11318614	11318686	-	—
hsa-mir-548aw	MI0019283	—	chr9	132945707	132945771	+	—
hsa-mir-548av	MI0019152	25	chr18	72853321	72853382	-	—
hsa-mir-548au	MI0019145	8	chr9	93594841	93594894	+	—
hsa-mir-548at	MI0019137	—	chr17	42494773	42494830	+	✓
hsa-mir-548as	MI0019132	1	chr13	92490163	92490220	+	—
hsa-mir-548ar	MI0019131	—	chr13	114244505	114244561	+	✓
hsa-mir-548aq	MI0019130	3	chr3	185767847	185767904	-	✓
hsa-mir-548ap	MI0017875	2	chr15	85825635	85825730	+	✓
hsa-mir-548ao	MI0017871	—	chr8	41271048	41271143	-	—
hsa-mir-548an	MI0016907	—	chrX	106639814	106639896	+	✓
hsa-mir-548am	MI0016904	16	chrX	16627012	16627085	-	✓
hsa-mir-548a1	MI0016851	1	chr11	74399237	74399333	+	—
hsa-mir-548ak	MI0016840	3	chr10	12130760	12130816	-	—
hsa-mir-548aj-2	MI0016815	2	chrX	38023895	38023986	-	—
hsa-mir-548aj-1	MI0016814	2	chr6	132115192	132115263	-	—
hsa-mir-548a1	MI0016813	—	chr6	99124609	99124696	+	—
hsa-mir-548ah	MI0016796	7	chr4	76575551	76575626	+	—
hsa-mir-548ag-2	MI0016794	4	chr20	60564562	60564625	+	✓

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hsa-mir-548ag-1	MI0016793	3	chr4	60922619	60922684	+	—
hsa-mir-548ae-2	MI0016780	10	chr5	58530043	58530109	-	✓
hsa-mir-548ae-1	MI0016779	15	chr2	184378975	184379044	+	—
hsa-mir-548ad	MI0016770	8	chr2	35471405	35471486	+	—
hsa-mir-548ac	MI0016762	6	chr1	116560024	116560111	-	—
hsa-mir-548ab	MI0016752	7	chr3	103524033	103524116	-	—
hsa-mir-548aa-2	MI0016690	1	chr17	67471489	67471585	+	—
hsa-mir-548aa-1	MI0016689	1	chr8	123348034	123348130	+	—
hsa-mir-548a-3	MI0003612	18	chr8	104484369	104484465	-	✓
hsa-mir-548a-2	MI0003598	25	chr6	135239160	135239256	+	—
hsa-mir-548a-1	MI0003593	21	chr6	18571784	18571880	+	—
hsa-mir-545	MI0003516	11	chrX	74287104	74287209	-	✓
hsa-mir-544b	MI0014159	1	chr3	124732439	124732516	+	—
hsa-mir-544a	MI0003515	2	chr14	101048658	101048748	+	—
hsa-mir-543	MI0005565	6	chr14	101031987	101032064	+	—
hsa-mir-542	MI0003686	174	chrX	134541341	134541437	-	✓
hsa-mir-541	MI0005539	28	chr14	101064495	101064578	+	✓
hsa-mir-539	MI0003514	4	chr14	101047321	101047398	+	✓
hsa-mir-532	MI0003205	322	chrX	50003148	50003238	+	✓
hsa-mir-527	MI0003179	27	chr19	53754018	53754102	+	—
hsa-mir-526b	MI0003150	1	chr19	53694393	53694475	+	—
hsa-mir-526a-2	MI0003168	—	chr19	53726922	53726986	+	—
hsa-mir-526a-1	MI0003157	23	chr19	53706252	53706336	+	—
hsa-mir-525	MI0003152	8	chr19	53697533	53697617	+	—
hsa-mir-524	MI0003160	2	chr19	53711002	53711088	+	—
hsa-mir-523	MI0003153	3	chr19	53698385	53698471	+	—
hsa-mir-522	MI0003177	8	chr19	53751211	53751297	+	✓
hsa-mir-521-2	MI0003163	13	chr19	53716594	53716680	+	—
hsa-mir-521-1	MI0003176	—	chr19	53748636	53748722	+	—
hsa-mir-520h	MI0003175	18	chr19	53742512	53742599	+	—
hsa-mir-520g	MI0003166	17	chr19	53722166	53722255	+	—
hsa-mir-520f	MI0003146	4	chr19	53682159	53682245	+	—
hsa-mir-520e	MI0003143	33	chr19	53675711	53675797	+	—
hsa-mir-520d	MI0003164	—	chr19	53720096	53720182	+	—
hsa-mir-520c	MI0003158	6	chr19	53707453	53707539	+	✓
hsa-mir-520b	MI0003155	9	chr19	53701227	53701287	+	—
hsa-mir-520a	MI0003149	4	chr19	53690881	53690965	+	✓

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hsa-mir-519e	MI0003145	10	chr19	53679940	53680023	+	—
hsa-mir-519d	MI0003162	3	chr19	53713347	53713434	+	—
hsa-mir-519c	MI0003148	14	chr19	53686469	53686555	+	—
hsa-mir-519b	MI0003151	8	chr19	53695213	53695293	+	✓
hsa-mir-519a-2	MI0003182	8	chr19	53762344	53762430	+	✓
hsa-mir-519a-1	MI0003178	11	chr19	53752397	53752481	+	✓
hsa-mir-5197	MI0018176	—	chr5	143679860	143679971	+	—
hsa-mir-5196	MI0018175	20	chr19	35345513	35345627	+	—
hsa-mir-5195	MI0018174	—	chr14	106850885	106850999	-	—
hsa-mir-5194	MI0018173	—	chr8	130008334	130008453	-	—
hsa-mir-5193	MI0018172	2	chr3	49806137	49806245	-	—
hsa-mir-5192	MI0018171	4	chr2	62205826	62205917	+	—
hsa-mir-5191	MI0018170	64	chr1	201719508	201719627	+	—
hsa-mir-5190	MI0018169	—	chr18	13459947	13460026	+	—
hsa-mir-518f	MI0003154	6	chr19	53700015	53700101	+	—
hsa-mir-518e	MI0003169	3	chr19	53729838	53729925	+	—
hsa-mir-518d	MI0003171	—	chr19	53734877	53734963	+	—
hsa-mir-518c	MI0003159	5	chr19	53708735	53708835	+	—
hsa-mir-518b	MI0003156	6	chr19	53702737	53702819	+	—
hsa-mir-518a-2	MI0003173	—	chr19	53739333	53739419	+	—
hsa-mir-518a-1	MI0003170	—	chr19	53731006	53731090	+	—
hsa-mir-5189	MI0018168	—	chr16	88468918	88469031	+	—
hsa-mir-5188	MI0018167	—	chr12	124915547	124915659	+	—
hsa-mir-5187	MI0018166	1	chr1	161227186	161227261	+	—
hsa-mir-5186	MI0018165	13	chr3	151565876	151565995	-	—
hsa-mir-517c	MI0003174	1	chr19	53741313	53741407	+	—
hsa-mir-517b	MI0003165	1	chr19	53721076	53721142	+	—
hsa-mir-517a	MI0003161	1	chr19	53712268	53712354	+	—
hsa-mir-516b-2	MI0003167	—	chr19	53725442	53725526	+	—
hsa-mir-516b-1	MI0003172	—	chr19	53736845	53736934	+	—
hsa-mir-516a-2	MI0003181	32	chr19	53761133	53761222	+	—
hsa-mir-516a-1	MI0003180	31	chr19	53756741	53756830	+	—
hsa-mir-515-2	MI0003147	7	chr19	53685009	53685091	+	—
hsa-mir-515-1	MI0003144	7	chr19	53679003	53679085	+	—
hsa-mir-514b	MI0014251	573	chrX	147250151	147250230	-	✓
hsa-mir-514a-3	MI0003200	434	chrX	147284641	147284728	-	✓
hsa-mir-514a-2	MI0003199	434	chrX	147281943	147282030	-	✓
hsa-mir-514a-1	MI0003198	431	chrX	147279247	147279344	-	✓

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hsa-mir-513c	MI0006649	23	chrX	147189704	147189787	-	✓
hsa-mir-513b	MI0006648	24	chrX	147199044	147199127	-	—
hsa-mir-513a-2	MI0003192	20	chrX	147225826	147225952	-	✓
hsa-mir-513a-1	MI0003191	23	chrX	147213463	147213591	-	✓
hsa-mir-512-2	MI0003141	—	chr19	53669157	53669254	+	✓
hsa-mir-512-1	MI0003140	—	chr19	53666679	53666762	+	✓
hsa-mir-511	MI0003127	—	chr10	17845107	17845193	+	✓
hsa-mir-5100	MI0019116	107	chr10	42997563	42997681	+	—
hsa-mir-510	MI0003197	20	chrX	147272335	147272408	-	✓
hsa-mir-5094	MI0017983	—	chr15	89850637	89850721	-	—
hsa-mir-5093	MI0017982	38	chr16	85306226	85306325	-	—
hsa-mir-5092	MI0017981	—	chr3	125151465	125151552	-	—
hsa-mir-5091	MI0017980	6	chr4	13627865	13627957	+	—
hsa-mir-5090	MI0017979	2	chr7	102465742	102465826	+	—
hsa-mir-509-3	MI0005717	352	chrX	147259652	147259726	-	✓
hsa-mir-509-2	MI0005530	259	chrX	147258760	147258850	-	✓
hsa-mir-509-1	MI0003196	259	chrX	147260532	147260625	-	✓
hsa-mir-5089	MI0017978	34	chr17	46973017	46973100	+	—
hsa-mir-5088	MI0017977	—	chr19	49682117	49682195	+	—
hsa-mir-5087	MI0017976	—	chr1	148334479	148334554	-	—
hsa-mir-508	MI0003195	347	chrX	147236913	147237027	-	✓
hsa-mir-507	MI0003194	20	chrX	147230984	147231077	-	—
hsa-mir-506	MI0003193	55	chrX	147230720	147230843	-	✓
hsa-mir-505	MI0003190	86	chrX	139924148	139924231	-	—
hsa-mir-5047	MI0017932	—	chr17	64501214	64501313	-	—
hsa-mir-504	MI0003189	4	chrX	138667711	138667793	-	✓
hsa-mir-503	MI0003188	132	chrX	134546328	134546398	-	✓
hsa-mir-502	MI0003186	58	chrX	50014598	50014683	+	✓
hsa-mir-5011	MI0017879	—	chr18	67081584	67081686	+	—
hsa-mir-5010	MI0017878	1	chr17	42514188	42514307	+	✓
hsa-mir-501	MI0003185	53	chrX	50009722	50009805	+	✓
hsa-mir-500b	MI0015903	13	chrX	50010672	50010750	+	—
hsa-mir-500a	MI0003184	63	chrX	50008431	50008514	+	✓
hsa-mir-5009	MI0017877	—	chr15	89883931	89884030	-	—
hsa-mir-5008	MI0017876	1	chr1	227941590	227941683	-	—
hsa-mir-5007	MI0017874	—	chr13	55174454	55174548	+	—
hsa-mir-5006	MI0017873	8	chr13	41568286	41568395	-	—
hsa-mir-5004	MI0017870	7	chr6	33438331	33438437	+	—
hsa-mir-5003	MI0017869	12	chr5	172662165	172662263	+	—
hsa-mir-5002	MI0017868	9	chr3	124132929	124133025	+	—
hsa-mir-5001	MI0017867	—	chr2	232550474	232550573	-	✓
hsa-mir-5000	MI0017866	11	chr2	75090812	75090914	+	✓
hsa-mir-499b	MI0017396	6	chr20	34990400	34990472	-	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-499a	MI0003183	382	chr20	34990376	34990497	+	✓
hsa-mir-4999	MI0017865	13	chr19	8389290	8389380	-	—
hsa-mir-498	MI0003142	54	chr19	53674197	53674320	+	—
hsa-mir-497	MI0003138	267	chr17	7017911	7018022	-	—
hsa-mir-496	MI0003136	—	chr14	101060573	101060674	+	—
hsa-mir-495	MI0003135	91	chr14	101033755	101033836	+	✓
hsa-mir-494	MI0003134	10	chr14	101029634	101029714	+	—
hsa-mir-493	MI0003132	10	chr14	100869060	100869148	+	✓
hsa-mir-492	MI0003131	—	chr12	94834398	94834513	+	—
hsa-mir-491	MI0003126	4	chr9	20716105	20716188	+	✓
hsa-mir-490	MI0003125	13	chr7	136903167	136903294	+	✓
hsa-mir-489	MI0003124	—	chr7	93483936	93484019	-	—
hsa-mir-488	MI0003123	16	chr1	177029363	177029445	-	✓
hsa-mir-487b	MI0003530	23	chr14	101046455	101046538	+	—
hsa-mir-487a	MI0002471	—	chr14	101052446	101052525	+	✓
hsa-mir-486-2	MI0023622	645	chr8	41660444	41660507	+	✓
hsa-mir-486-1	MI0002470	650	chr8	41660441	41660508	-	✓
hsa-mir-485	MI0002469	9	chr14	101055419	101055491	+	✓
hsa-mir-484	MI0002468	435	chr16	15643294	15643372	+	—
hsa-mir-483	MI0002467	83	chr11	2134134	2134209	-	✓
hsa-mir-4804	MI0017452	3	chr5	72878591	72878663	+	—
hsa-mir-4803	MI0017451	—	chr5	72169467	72169540	+	—
hsa-mir-4802	MI0017450	—	chr4	40502040	40502119	-	✓
hsa-mir-4801	MI0017449	—	chr4	37241910	37241991	-	—
hsa-mir-4800	MI0017448	4	chr4	2250077	2250156	-	—
hsa-mir-4799	MI0017446	—	chr4	147782595	147782668	+	—
hsa-mir-4798	MI0017445	—	chr4	7310450	7310524	+	—
hsa-mir-4797	MI0017444	—	chr3	197293878	197293948	-	—
hsa-mir-4796	MI0017443	—	chr3	114743445	114743525	-	—
hsa-mir-4795	MI0017442	—	chr3	87226189	87226277	-	—
hsa-mir-4794	MI0017441	—	chr1	64579847	64579923	+	—
hsa-mir-4793	MI0017440	8	chr3	48644194	48644280	-	—
hsa-mir-4791	MI0017438	3	chr3	19314848	19314931	-	—
hsa-mir-4790	MI0017437	52	chr3	5250177	5250255	-	—
hsa-mir-4789	MI0017436	—	chr3	175369540	175369621	+	—
hsa-mir-4788	MI0017435	4	chr3	134437827	134437906	+	—
hsa-mir-4787	MI0017434	4	chr3	50675080	50675163	+	—
hsa-mir-4786	MI0017433	—	chr2	239943015	239943094	-	✓
hsa-mir-4785	MI0017430	—	chr2	160407810	160407882	-	—
hsa-mir-4784	MI0017429	—	chr2	131491160	131491236	-	—
hsa-mir-4783	MI0017428	—	chr2	127423537	127423618	-	—
hsa-mir-4782	MI0017427	—	chr2	113721290	113721368	-	—
hsa-mir-4781	MI0017426	—	chr1	54054079	54054154	+	—
hsa-mir-4780	MI0017424	—	chr2	88082519	88082599	-	—
hsa-mir-4779	MI0017423	11	chr2	86193026	86193108	-	—
hsa-mir-4778	MI0017422	2	chr2	66358249	66358328	-	✓

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hsa-mir-4777	MI0017421	—	chr2	231362708	231362793	+	—
hsa-mir-4776-2	MI0017420	114	chr2	212926257	212926336	-	—
hsa-mir-4776-1	MI0017419	8	chr2	212926257	212926336	+	—
hsa-mir-4775	MI0017418	—	chr2	207754807	207754881	+	—
hsa-mir-4774	MI0017417	—	chr2	168582943	168583018	+	—
hsa-mir-4773-2	MI0017416	18	chr2	151368334	151368411	-	—
hsa-mir-4773-1	MI0017415	17	chr2	151368334	151368411	+	—
hsa-mir-4772	MI0017414	1	chr2	102432289	102432366	+	—
hsa-mir-4771-2	MI0017413	—	chr2	111771061	111771134	-	—
hsa-mir-4771-1	MI0017412	—	chr2	87194786	87194859	+	—
hsa-mir-4770	MI0017411	—	chrX	6383906	6383963	-	—
hsa-mir-4769	MI0017410	—	chrX	47587429	47587505	+	—
hsa-mir-4768	MI0017409	—	chrX	17425881	17425954	+	—
hsa-mir-4767	MI0017408	2	chrX	7147860	7147937	+	—
hsa-mir-4766	MI0017407	1	chr22	40813883	40813958	-	—
hsa-mir-4765	MI0017406	—	chr2	32635255	32635331	+	—
hsa-mir-4764	MI0017405	—	chr22	33436582	33436669	-	—
hsa-mir-4763	MI0017404	5	chr22	46113566	46113657	+	—
hsa-mir-4762	MI0017403	—	chr22	45760524	45760598	+	—
hsa-mir-4761	MI0017402	8	chr22	19963753	19963834	+	✓
hsa-mir-4760	MI0017401	—	chr21	40212352	40212431	-	—
hsa-mir-4759	MI0017400	—	chr21	26953961	26954043	+	—
hsa-mir-4758	MI0017399	—	chr20	62332487	62332557	-	—
hsa-mir-4757	MI0017398	—	chr2	19348429	19348505	+	—
hsa-mir-4756	MI0017397	11	chr20	54068408	54068485	-	—
hsa-mir-4755	MI0017395	—	chr20	34049119	34049190	+	✓
hsa-mir-4754	MI0017394	—	chr19	58386770	58386858	-	—
hsa-mir-4753	MI0017392	1	chr1	235190034	235190116	-	—
hsa-mir-4752	MI0017391	—	chr19	54282109	54282180	+	—
hsa-mir-4751	MI0017390	—	chr19	49933064	49933137	+	—
hsa-mir-4750	MI0017389	—	chr19	49888175	49888230	+	—
hsa-mir-4749	MI0017388	9	chr19	49854591	49854651	+	—
hsa-mir-4748	MI0017387	—	chr19	10780254	10780335	+	—
hsa-mir-4747	MI0017386	—	chr19	4932687	4932740	+	—
hsa-mir-4746	MI0017385	—	chr19	4445978	4446048	+	—
hsa-mir-4745	MI0017384	—	chr19	804940	805001	+	—
hsa-mir-4744	MI0017382	—	chr18	49049687	49049768	-	—
hsa-mir-4743	MI0017381	—	chr18	48670600	48670668	+	—
hsa-mir-4742	MI0017380	—	chr1	224398227	224398311	-	—
hsa-mir-4741	MI0017379	—	chr18	22933349	22933438	+	—
hsa-mir-4740	MI0017378	26	chr17	81400716	81400778	-	—
hsa-mir-4739	MI0017377	166	chr17	79707176	79707249	-	—

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hsa-mir-4738	MI0017376	3	chr17	75784521	75784607	-	—
hsa-mir-4737	MI0017374	—	chr17	60043025	60043105	-	—
hsa-mir-4736	MI0017373	282	chr17	58335976	58336022	-	—
hsa-mir-4735	MI0017372	75	chr1	196582413	196582481	-	—
hsa-mir-4734	MI0017371	2	chr17	38702262	38702331	-	—
hsa-mir-4733	MI0017370	—	chr17	31094350	31094425	-	—
hsa-mir-4732	MI0017369	1	chr17	28861655	28861730	-	—
hsa-mir-4731	MI0017368	—	chr17	15251627	15251696	-	—
hsa-mir-4730	MI0017367	8	chr17	80419418	80419493	+	—
hsa-mir-4729	MI0017366	—	chr17	59366083	59366154	+	—
hsa-mir-4728	MI0017365	—	chr17	39726495	39726561	+	—
hsa-mir-4727	MI0017364	—	chr17	38825838	38825892	+	—
hsa-mir-4726	MI0017363	—	chr17	38719691	38719748	+	—
hsa-mir-4725	MI0017362	24	chr17	31575269	31575358	+	—
hsa-mir-4724	MI0017361	2	chr17	31534883	31534971	+	—
hsa-mir-4723	MI0017359	1	chr17	28360654	28360734	+	—
hsa-mir-4722	MI0017357	11	chr16	88716278	88716337	-	—
hsa-mir-4721	MI0017356	—	chr16	28843919	28844007	-	—
hsa-mir-4720	MI0017355	—	chr16	81385018	81385093	+	—
hsa-mir-4719	MI0017354	41	chr16	76868936	76869019	+	—
hsa-mir-4718	MI0017353	—	chr16	12720321	12720371	+	—
hsa-mir-4717	MI0017352	—	chr16	2274620	2274691	+	—
hsa-mir-4716	MI0017350	5	chr15	49169070	49169153	-	—
hsa-mir-4715	MI0017349	—	chr15	25848747	25848825	-	—
hsa-mir-4714	MI0017348	—	chr15	98784426	98784502	+	—
hsa-mir-4713	MI0017347	4	chr15	51242190	51242264	+	—
hsa-mir-4712	MI0017346	—	chr15	50360329	50360410	+	—
hsa-mir-4711	MI0017345	—	chr1	59733227	59733296	-	—
hsa-mir-4710	MI0017344	2	chr14	104677694	104677749	-	—
hsa-mir-4709	MI0017342	4	chr14	74480133	74480204	-	—
hsa-mir-4708	MI0017341	8	chr14	65335117	65335183	-	—
hsa-mir-4707	MI0017340	—	chr14	22956950	22957029	-	—
hsa-mir-4706	MI0017339	8	chr14	65044688	65044769	+	—
hsa-mir-4705	MI0017338	—	chr13	102045934	102046004	-	—
hsa-mir-4704	MI0017337	—	chr13	66218250	66218324	+	—
hsa-mir-4703	MI0017336	—	chr13	51552589	51552667	+	—
hsa-mir-4701	MI0017334	—	chr12	48771975	48772037	-	—
hsa-mir-4700	MI0017333	—	chr12	120723193	120723266	+	—
hsa-mir-4699	MI0017332	29	chr12	81158388	81158461	+	—
hsa-mir-4698	MI0017331	—	chr12	47187812	47187891	+	—
hsa-mir-4697	MI0017330	—	chr11	133898504	133898581	-	—
hsa-mir-4696	MI0017329	—	chr11	74720268	74720337	-	—
hsa-mir-4695	MI0017328	2	chr1	18883202	18883275	-	—
hsa-mir-4694	MI0017327	75	chr11	19760004	19760083	-	—
hsa-mir-4693	MI0017326	5	chr11	103849906	103849980	+	—
hsa-mir-4692	MI0017325	—	chr11	72783530	72783592	+	—
hsa-mir-4691	MI0017324	9	chr11	68033897	68033981	+	—
hsa-mir-4690	MI0017323	—	chr11	65636310	65636369	+	—

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hsa-mir-4689	MI0017322	30	chr1	5862672	5862741	-	—
hsa-mir-4688	MI0017321	50	chr11	46376402	46376484	+	—
hsa-mir-4687	MI0017319	5	chr11	3856062	3856141	+	—
hsa-mir-4686	MI0017318	18	chr11	2173063	2173138	+	—
hsa-mir-4685	MI0017317	26	chr10	98431292	98431360	-	—
hsa-mir-4684	MI0017316	2	chr1	22719517	22719598	+	—
hsa-mir-4683	MI0017315	1	chr10	35641172	35641252	-	—
hsa-mir-4682	MI0017314	—	chr10	119958513	119958592	+	—
hsa-mir-4681	MI0017313	19	chr10	119377972	119378043	+	—
hsa-mir-4680	MI0017312	—	chr10	110898090	110898155	+	—
hsa-mir-4679-2	MI0017311	4	chr10	89063335	89063411	-	—
hsa-mir-4679-1	MI0017310	4	chr10	89063336	89063410	+	—
hsa-mir-4678	MI0017309	—	chr10	87503881	87503954	+	—
hsa-mir-4677	MI0017308	1	chr1	243346176	243346255	+	✓
hsa-mir-4676	MI0017307	—	chr10	72721029	72721100	+	—
hsa-mir-4675	MI0017306	—	chr10	20551970	20552046	+	—
hsa-mir-4674	MI0017305	8	chr9	136546173	136546259	-	—
hsa-mir-4673	MI0017304	—	chr9	136519568	136519626	-	—
hsa-mir-4672	MI0017303	46	chr9	127869415	127869495	-	—
hsa-mir-4671	MI0017302	—	chr1	234306467	234306539	+	—
hsa-mir-4670	MI0017301	—	chr9	92527984	92528058	-	—
hsa-mir-4669	MI0017300	2	chr9	134379411	134379472	+	—
hsa-mir-4668	MI0017298	—	chr9	111932100	111932169	+	—
hsa-mir-4667	MI0017297	3	chr9	35608094	35608159	+	—
hsa-mir-4666b	MI0019299	—	chrX	29574278	29574358	+	—
hsa-mir-4666a	MI0017296	—	chr1	228462074	228462152	+	—
hsa-mir-4665	MI0017295	—	chr9	6007826	6007904	+	—
hsa-mir-4664	MI0017294	—	chr8	143733083	143733153	-	—
hsa-mir-4663	MI0017292	110	chr8	123215788	123215863	-	—
hsa-mir-4662b	MI0017293	1	chr8	124821978	124822058	-	—
hsa-mir-4662a	MI0017290	2	chr8	124821985	124822051	+	—
hsa-mir-4661	MI0017289	—	chr8	91205485	91205559	+	—
hsa-mir-4660	MI0017288	22	chr8	9048445	9048518	+	—
hsa-mir-466	MI0014157	13	chr3	31161704	31161787	-	—
hsa-mir-4659b	MI0017291	—	chr8	6745168	6745240	-	—
hsa-mir-4659a	MI0017287	2	chr8	6745164	6745244	+	—
hsa-mir-4658	MI0017286	—	chr7	100156605	100156669	-	—
hsa-mir-4657	MI0017285	—	chr7	44881748	44881800	-	—
hsa-mir-4656	MI0017284	11	chr7	4788565	4788639	-	—
hsa-mir-4655	MI0017283	2	chr7	1844180	1844253	-	—
hsa-mir-4654	MI0017282	—	chr1	162157107	162157182	+	—
hsa-mir-4653	MI0017281	—	chr7	101159473	101159555	+	—
hsa-mir-4652	MI0017280	—	chr7	93716928	93717005	+	—

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hsa-mir-4651	MI0017279	5	chr7	75915197	75915269	+	—
hsa-mir-4650-2	MI0017278	—	chr7	72697903	72697978	+	—
hsa-mir-4650-1	MI0017277	—	chr7	67114322	67114397	-	—
hsa-mir-4649	MI0017276	—	chr7	44110849	44110912	+	—
hsa-mir-4648	MI0017275	—	chr7	2527074	2527145	+	—
hsa-mir-4647	MI0017274	5	chr6	44254206	44254285	-	—
hsa-mir-4646	MI0017273	—	chr6	31701029	31701091	-	—
hsa-mir-4645	MI0017272	—	chr6	2854031	2854107	-	—
hsa-mir-4644	MI0017271	5	chr6	170330761	170330844	+	—
hsa-mir-4643	MI0017270	—	chr6	91521660	91521737	+	—
hsa-mir-4642	MI0017269	—	chr6	44435641	44435722	+	—
hsa-mir-4641	MI0017268	33	chr6	41598723	41598788	+	—
hsa-mir-4640	MI0017267	3	chr6	30890883	30890972	+	—
hsa-mir-4639	MI0017266	—	chr6	16141556	16141624	+	—
hsa-mir-4638	MI0017265	1	chr5	181222566	181222633	-	—
hsa-mir-4637	MI0017264	—	chr5	14825929	14826012	-	—
hsa-mir-4636	MI0017263	—	chr5	9053816	9053895	-	—
hsa-mir-4635	MI0017262	2	chr5	1062896	1062974	-	—
hsa-mir-4634	MI0017261	—	chr5	174751734	174751787	+	—
hsa-mir-4633	MI0017260	—	chr5	129097688	129097766	+	—
hsa-mir-4632	MI0017259	—	chr1	12191713	12191773	+	—
hsa-mir-455	MI0003513	353	chr9	114209434	114209529	+	—
hsa-mir-4540	MI0016911	—	chr9	36864254	36864308	-	—
hsa-mir-454	MI0003820	207	chr17	59137758	59137872	-	✓
hsa-mir-4539	MI0016910	8	chr14	105857513	105857572	-	—
hsa-mir-4538	MI0016909	2	chr14	105858165	105858242	-	—
hsa-mir-4537	MI0016908	2	chr14	105859484	105859553	-	—
hsa-mir-4536-2	MI0019149	70	chrX	55451495	55451582	+	—
hsa-mir-4536-1	MI0016906	—	chrX	55451495	55451582	-	—
hsa-mir-4535	MI0016903	—	chr22	48780295	48780353	+	—
hsa-mir-4534	MI0016901	—	chr22	37988794	37988853	+	—
hsa-mir-4533	MI0016900	22	chr20	60478111	60478181	+	—
hsa-mir-4531	MI0016898	42	chr19	44653686	44653732	-	—
hsa-mir-4530	MI0016897	—	chr19	39409623	39409678	-	—
hsa-mir-4529	MI0016896	—	chr18	55479221	55479298	+	—
hsa-mir-4528	MI0016895	—	chr18	53237101	53237190	+	—
hsa-mir-4527	MI0016894	—	chr18	47380496	47380565	+	—
hsa-mir-4526	MI0016893	—	chr18	13611114	13611200	+	—
hsa-mir-4525	MI0016892	4	chr17	82668233	82668307	-	—
hsa-mir-4524b	MI0019114	45	chr17	69099542	69099656	+	—
hsa-mir-4524a	MI0016891	—	chr17	69099564	69099632	-	✓
hsa-mir-4523	MI0016890	—	chr17	29390662	29390730	+	—
hsa-mir-4522	MI0016889	—	chr17	27293910	27293996	-	—

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hsa-mir-4521	MI0016887	654	chr17	8186945	8187004	+	—
hsa-mir-4520-2	MI0017358	—	chr17	6655449	6655502	+	—
hsa-mir-4520-1	MI0016886	—	chr17	6655440	6655509	-	—
hsa-mir-452	MI0001733	123	chrX	151959628	151959712	-	✓
hsa-mir-451b	MI0017360	—	chr17	28861371	28861438	+	—
hsa-mir-451a	MI0001729	3855	chr17	28861369	28861440	-	—
hsa-mir-4519	MI0016885	—	chr16	30875266	30875323	-	—
hsa-mir-4518	MI0016884	2	chr16	30503919	30504001	+	—
hsa-mir-4517	MI0016883	10	chr16	28958583	28958661	+	—
hsa-mir-4516	MI0016882	229	chr16	2133119	2133204	+	—
hsa-mir-4515	MI0016881	4	chr15	83067335	83067415	+	—
hsa-mir-4514	MI0016880	—	chr15	80997417	80997473	-	—
hsa-mir-4513	MI0016879	16	chr15	74788672	74788757	-	—
hsa-mir-4512	MI0016878	11	chr15	66496958	66497034	-	—
hsa-mir-4511	MI0016877	6	chr15	65719246	65719332	-	—
hsa-mir-4510	MI0016876	237	chr15	35926856	35926923	+	—
hsa-mir-450b	MI0005531	27	chrX	134540185	134540262	-	✓
hsa-mir-450a-2	MI0003187	275	chrX	134540508	134540607	-	✓
hsa-mir-450a-1	MI0001652	275	chrX	134540341	134540431	-	✓
hsa-mir-4509-3	MI0016875	—	chr15	28490752	28490845	-	—
hsa-mir-4509-2	MI0016874	—	chr15	28426491	28426584	+	—
hsa-mir-4509-1	MI0016873	—	chr15	23197827	23197920	+	—
hsa-mir-4508	MI0016872	31	chr15	23562062	23562131	-	—
hsa-mir-4507	MI0016871	—	chr14	105858124	105858175	-	—
hsa-mir-4506	MI0016869	—	chr14	93948226	93948302	-	—
hsa-mir-4505	MI0016868	—	chr14	73758747	73758819	+	—
hsa-mir-4504	MI0016867	—	chr14	50299855	50299946	-	—
hsa-mir-4503	MI0016866	119	chr14	36952309	36952391	-	—
hsa-mir-4502	MI0016865	—	chr13	114273828	114273908	+	—
hsa-mir-4501	MI0016864	—	chr13	96427229	96427292	+	—
hsa-mir-4500	MI0016863	106	chr13	87618665	87618740	-	—
hsa-mir-449c	MI0003823	9	chr5	55172262	55172353	-	—
hsa-mir-449b	MI0003673	120	chr5	55170646	55170742	-	—
hsa-mir-449a	MI0001648	102	chr5	55170532	55170622	-	—
hsa-mir-4499	MI0016862	—	chr13	20433778	20433846	-	—
hsa-mir-4498	MI0016860	46	chr12	120155434	120155499	-	—
hsa-mir-4497	MI0016859	96	chr12	109833348	109833436	+	—
hsa-mir-4496	MI0016858	—	chr12	108635810	108635870	+	—
hsa-mir-4495	MI0016857	—	chr12	97939056	97939121	-	—
hsa-mir-4494	MI0016856	—	chr12	47364186	47364269	-	—
hsa-mir-4493	MI0016855	23	chr11	123381440	123381512	-	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-4492	MI0016854	12	chr11	118910708	118910787	+	—
hsa-mir-4491	MI0016853	—	chr11	111347757	111347824	+	—
hsa-mir-4490	MI0016852	—	chr11	90555774	90555857	-	—
hsa-mir-4489	MI0016850	—	chr11	65649192	65649253	+	—
hsa-mir-4488	MI0016849	67	chr11	61508596	61508657	+	—
hsa-mir-4487	MI0016848	—	chr11	47400970	47401042	+	✓
hsa-mir-4486	MI0016847	—	chr11	19575310	19575372	+	—
hsa-mir-4485	MI0016846	20	chr11	10508270	10508326	-	—
hsa-mir-4484	MI0016845	24	chr10	125819740	125819822	+	—
hsa-mir-4483	MI0016844	—	chr10	113777993	113778054	-	—
hsa-mir-4482	MI0016843	—	chr10	104268336	104268405	-	—
hsa-mir-4481	MI0016842	—	chr10	12653138	12653197	-	—
hsa-mir-4480	MI0016841	100	chr10	12578753	12578823	+	—
hsa-mir-448	MI0001637	—	chrX	114823454	114823564	+	—
hsa-mir-4479	MI0016838	—	chr9	136886733	136886803	+	—
hsa-mir-4478	MI0016831	—	chr9	122120082	122120167	-	—
hsa-mir-4477b	MI0016830	11	chr9	41233755	41233835	-	—
hsa-mir-4477a	MI0016829	3	chr9	41233755	41233835	+	—
hsa-mir-4476	MI0016828	—	chr9	36893462	36893531	-	—
hsa-mir-4475	MI0016827	—	chr9	36823539	36823599	-	—
hsa-mir-4474	MI0016826	—	chr9	20502265	20502342	-	—
hsa-mir-4473	MI0016825	—	chr9	20411148	20411238	-	—
hsa-mir-4472-2	MI0016824	65	chr12	116428252	116428318	-	—
hsa-mir-4472-1	MI0016823	24	chr8	142176339	142176418	+	—
hsa-mir-4471	MI0016822	—	chr8	100382763	100382845	+	—
hsa-mir-4470	MI0016821	—	chr8	61714788	61714859	+	—
hsa-mir-4469	MI0016820	—	chr8	42896197	42896275	-	—
hsa-mir-4468	MI0016819	—	chr7	138123758	138123821	+	—
hsa-mir-4467	MI0016818	—	chr7	102471469	102471531	+	—
hsa-mir-4466	MI0016817	1	chr6	156779678	156779731	-	—
hsa-mir-4465	MI0016816	—	chr6	140683814	140683883	+	—
hsa-mir-4464	MI0016812	—	chr6	90312742	90312833	+	—
hsa-mir-4463	MI0016811	—	chr6	75428407	75428473	+	—
hsa-mir-4462	MI0016810	—	chr6	37555365	37555422	-	—
hsa-mir-4460	MI0016806	—	chr5	129397062	129397147	-	—
hsa-mir-4458	MI0016804	—	chr5	8460925	8460999	+	—
hsa-mir-4457	MI0016803	—	chr5	1309310	1309377	-	—
hsa-mir-4456	MI0016802	—	—				
hsa-mir-4455	MI0016801	30	chr4	184938383	184938440	-	—
hsa-mir-4454	MI0016800	457	chr4	163093574	163093628	-	—
hsa-mir-4453	MI0016799	—	chr4	152536428	152536516	+	—
hsa-mir-4452	MI0016798	7	chr4	86542482	86542552	-	—
hsa-mir-4451	MI0016797	13	chr4	85722468	85722533	+	—
hsa-mir-4450	MI0016795	—	chr4	76573568	76573632	+	—
hsa-mir-4449	MI0016792	943	chr4	52712682	52712747	+	—

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hsa-mir-4448	MI0016791	59	chr3	183886800	183886885	+	—
hsa-mir-4447	MI0016790	—	chr3	116850277	116850367	-	—
hsa-mir-4446	MI0016789	1	chr3	113594876	113594942	+	—
hsa-mir-4445	MI0016788	100	chr3	109602828	109602897	+	—
hsa-mir-4444-2	MI0019111	9	chr3	75214476	75214549	+	—
hsa-mir-4444-1	MI0016787	9	chr2	177212726	177212799	+	—
hsa-mir-4443	MI0016786	872	chr3	48196564	48196616	+	—
hsa-mir-4442	MI0016785	6	chr3	25664873	25664939	-	—
hsa-mir-4441	MI0016784	—	chr2	239085827	239085926	-	—
hsa-mir-4440	MI0016783	—	chr2	239068817	239068914	-	—
hsa-mir-4439	MI0016782	—	chr2	225010461	225010540	-	—
hsa-mir-4438	MI0016781	138	chr2	213758067	213758159	+	—
hsa-mir-4437	MI0016778	—	chr2	181305593	181305652	-	—
hsa-mir-4436b-2	MI0019110	7	chr2	110284853	110284943	+	—
hsa-mir-4436b-1	MI0017425	7	chr2	110086433	110086523	-	—
hsa-mir-4436a	MI0016776	—	chr2	88812370	88812454	+	—
hsa-mir-4435-2	MI0016777	—	chr2	111321013	111321086	-	—
hsa-mir-4435-1	MI0016775	—	chr2	87629755	87629834	+	—
hsa-mir-4434	MI0016774	—	chr2	64525513	64525565	+	—
hsa-mir-4433b	MI0025511	—	chr2	64340747	64340848	-	—
hsa-mir-4433a	MI0016773	5	chr2	64340759	64340839	+	—
hsa-mir-4432	MI0016772	16	chr2	60387362	60387445	-	—
hsa-mir-4431	MI0016771	5	chr2	52702522	52702615	-	—
hsa-mir-4430	MI0016769	12	chr2	33418516	33418564	+	—
hsa-mir-4429	MI0016768	1989	chr2	11540605	11540677	-	—
hsa-mir-4428	MI0016767	—	chr1	237471119	237471191	+	—
hsa-mir-4427	MI0016766	—	chr1	233624152	233624219	+	—
hsa-mir-4426	MI0016765	—	chr1	192716328	192716390	+	—
hsa-mir-4425	MI0016764	14	chr1	25023503	25023586	+	—
hsa-mir-4424	MI0016763	—	chr1	178677749	178677834	+	—
hsa-mir-4423	MI0016760	10	chr1	85133794	85133873	+	✓
hsa-mir-4422	MI0016759	—	chr1	55225641	55225723	+	—
hsa-mir-4421	MI0016758	—	chr1	51059837	51059905	+	—
hsa-mir-4420	MI0016757	—	chr1	30739156	30739232	-	—
hsa-mir-4418	MI0016754	44	chr1	22266239	22266300	+	—
hsa-mir-4330	MI0015902	11	chrX	151168222	151168326	+	—
hsa-mir-433	MI0001723	2	chr14	100881886	100881978	+	✓
hsa-mir-4329	MI0015901	4	chrX	112780718	112780788	-	—
hsa-mir-4328	MI0015904	80	chrX	78901194	78901249	-	—
hsa-mir-4327	MI0015867	57	chr21	30375294	30375378	-	—
hsa-mir-4326	MI0015866	—	chr20	63286808	63286866	+	—

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hsa-mir-4325	MI0015865	—	chr20	57321502	57321591	-	—
hsa-mir-4324	MI0015854	56	chr19	49308797	49308868	-	—
hsa-mir-4323	MI0015853	—	chr19	42133445	42133513	-	—
hsa-mir-4322	MI0015851	9	chr19	10230413	10230485	+	—
hsa-mir-4321	MI0015852	—	chr19	2250639	2250718	+	—
hsa-mir-4320	MI0015849	—	chr18	50126499	50126563	-	—
hsa-mir-432	MI0003133	55	chr14	100884483	100884576	+	—
hsa-mir-4319	MI0015848	—	chr18	44970082	44970166	-	—
hsa-mir-4318	MI0015847	62	chr18	37657135	37657215	+	—
hsa-mir-4317	MI0015850	1	chr18	6374361	6374425	-	—
hsa-mir-4316	MI0015845	209	chr17	77396984	77397054	-	—
hsa-mir-4315-2	MI0015983	—	chr17	64822030	64822102	-	—
hsa-mir-4315-1	MI0015844	—	chr17	45475363	45475435	-	—
hsa-mir-4314	MI0015846	150	chr17	8088056	8088147	+	—
hsa-mir-4313	MI0015843	28	chr15	75762215	75762315	-	—
hsa-mir-4312	MI0015842	57	chr15	68801850	68801925	-	—
hsa-mir-4311	MI0015841	56	chr15	66040233	66040332	+	—
hsa-mir-4310	MI0015840	77	chr15	41866495	41866551	-	—
hsa-mir-431	MI0001721	—	chr14	100881007	100881120	+	—
hsa-mir-4309	MI0015837	—	chr14	102539644	102539726	+	—
hsa-mir-4308	MI0015839	6	chr14	54878113	54878193	-	—
hsa-mir-4307	MI0015838	—	chr14	26908642	26908725	+	—
hsa-mir-4306	MI0015836	135	chr13	99643059	99643149	+	—
hsa-mir-4305	MI0015835	214	chr13	39664034	39664135	-	—
hsa-mir-4304	MI0015832	13	chr12	123010667	123010728	-	—
hsa-mir-4303	MI0015834	—	chr12	97995383	97995448	-	—
hsa-mir-4302	MI0015833	—	chr12	25874020	25874079	-	—
hsa-mir-4301	MI0015828	8	chr11	113450023	113450088	-	—
hsa-mir-4300	MI0015831	—	chr11	81890741	81890836	-	—
hsa-mir-4299	MI0015829	—	chr11	11656651	11656722	-	—
hsa-mir-4298	MI0015830	9	chr11	1859464	1859536	-	—
hsa-mir-4297	MI0015824	—	chr10	129843299	129843374	-	—
hsa-mir-4296	MI0015823	6	chr10	125032783	125032870	-	—
hsa-mir-4295	MI0015822	—	chr10	112634170	112634254	+	—
hsa-mir-4294	MI0015827	171	chr10	48985512	48985587	-	—
hsa-mir-4293	MI0015826	—	chr10	14383200	14383277	-	—
hsa-mir-4292	MI0015897	—	chr9	136830957	136831023	+	—
hsa-mir-4291	MI0015900	—	chr9	93819357	93819421	+	—
hsa-mir-4290	MI0015899	145	chr9	90023441	90023535	-	—
hsa-mir-429	MI0001641	381	chr1	1169005	1169087	+	—
hsa-mir-4289	MI0015898	852	chr9	88745836	88745905	-	—
hsa-mir-4288	MI0015896	8	chr8	28505116	28505182	-	—
hsa-mir-4287	MI0015895	—	chr8	27886039	27886116	-	—
hsa-mir-4286	MI0015894	310	chr8	10666978	10667070	+	—
hsa-mir-4285	MI0015891	7	chr7	102293103	102293187	+	—
hsa-mir-4284	MI0015893	22	chr7	73711317	73711397	+	—

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hsa-mir-4283-2	MI0015982	—	chr7	63621090	63621169	+	—
hsa-mir-4283-1	MI0015892	—	chr7	56955785	56955864	-	—
hsa-mir-4282	MI0015890	—	chr6	72967687	72967753	-	—
hsa-mir-4281	MI0015885	11	chr5	176629439	176629500	-	—
hsa-mir-4280	MI0015889	—	chr5	87114879	87114954	-	—
hsa-mir-4279	MI0015887	13	chr5	31936102	31936159	-	—
hsa-mir-4278	MI0015888	—	chr5	6827853	6827921	-	—
hsa-mir-4277	MI0015886	—	chr5	1708785	1708868	-	—
hsa-mir-4276	MI0015882	—	chr4	174423795	174423864	+	—
hsa-mir-4275	MI0015883	266	chr4	28819582	28819668	+	—
hsa-mir-4274	MI0015884	33	chr4	7460028	7460118	+	—
hsa-mir-4273	MI0015881	—	chr3	75738280	75738363	+	—
hsa-mir-4272	MI0015880	—	chr3	67225464	67225527	+	—
hsa-mir-4271	MI0015879	24	chr3	49274120	49274186	+	—
hsa-mir-4270	MI0015878	14	chr3	15496239	15496308	-	—
hsa-mir-4269	MI0015875	—	chr2	239305462	239305545	+	—
hsa-mir-4268	MI0015874	—	chr2	219906502	219906565	-	—
hsa-mir-4267	MI0015871	—	chr2	110069961	110070042	-	—
hsa-mir-4266	MI0015870	—	chr2	109313571	109313625	-	—
hsa-mir-4265	MI0015869	5	chr2	109141490	109141588	-	—
hsa-mir-4264	MI0015877	877	chr2	79649294	79649359	-	—
hsa-mir-4263	MI0015876	—	chr2	27996367	27996449	+	—
hsa-mir-4262	MI0015872	—	chr2	11836933	11836986	-	—
hsa-mir-4261	MI0015868	—	chr2	10192614	10192671	-	—
hsa-mir-4260	MI0015859	350	chr1	209623444	209623510	-	—
hsa-mir-4259	MI0015858	10	chr1	159899979	159900079	-	—
hsa-mir-4258	MI0015857	9	chr1	154975693	154975783	+	—
hsa-mir-4257	MI0015856	12	chr1	150551929	150552014	+	—
hsa-mir-4256	MI0015855	—	chr1	112461770	112461833	-	—
hsa-mir-4255	MI0015863	—	chr1	37161563	37161634	+	—
hsa-mir-4254	MI0015862	—	chr1	31758660	31758735	-	—
hsa-mir-4253	MI0015860	—	chr1	22863159	22863226	-	—
hsa-mir-4252	MI0015864	—	chr1	6429834	6429896	-	—
hsa-mir-4251	MI0015861	—	chr1	3127975	3128035	+	—
hsa-mir-425	MI0001448	1131	chr3	49020148	49020234	-	✓
hsa-mir-424	MI0001446	3666	chrX	134546614	134546711	-	✓
hsa-mir-423	MI0001445	3706	chr17	30117079	30117172	+	✓
hsa-mir-422a	MI0001444	7	chr15	63870930	63871019	-	—
hsa-mir-421	MI0003685	120	chrX	74218377	74218461	-	✓
hsa-mir-412	MI0002464	—	chr14	101065447	101065537	+	—
hsa-mir-411	MI0003675	86	chr14	101023325	101023420	+	✓
hsa-mir-410	MI0002465	12	chr14	101065912	101065991	+	✓
hsa-mir-409	MI0001735	3	chr14	101065300	101065378	+	✓
hsa-mir-3978	MI0016996	—	chrX	110082118	110082218	+	—
hsa-mir-3977	MI0016995	—	chr5	82840155	82840224	+	—

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hsa-mir-3976	MI0016994	—	chr18	5840695	5840833	+	—
hsa-mir-3975	MI0016993	100	chr18	35591737	35591806	+	—
hsa-mir-3974	MI0016992	—	chr12	17673299	17673394	+	—
hsa-mir-3973	MI0016991	200	chr11	36010098	36010204	+	—
hsa-mir-3972	MI0016990	122	chr1	17277889	17277975	+	—
hsa-mir-3960	MI0016964	95	chr9	127785833	127785923	+	—
hsa-mir-3945	MI0016602	—	chr4	184851013	184851110	-	—
hsa-mir-3944	MI0016601	10	chr10	133371556	133371663	-	✓
hsa-mir-3943	MI0016600	—	chr7	43150895	43150994	+	—
hsa-mir-3942	MI0016599	—	chr15	35372256	35372364	-	✓
hsa-mir-3941	MI0016598	—	chr10	122416965	122417067	+	—
hsa-mir-3940	MI0016597	—	chr19	6416410	6416511	-	—
hsa-mir-3939	MI0016596	—	chr6	166997807	166997912	-	—
hsa-mir-3938	MI0016594	—	chr3	55852492	55852594	-	—
hsa-mir-3937	MI0016593	—	chrX	39661216	39661321	+	—
hsa-mir-3936	MI0016592	—	chr5	132365490	132365599	-	—
hsa-mir-3935	MI0016591	3	chr16	56245520	56245623	+	—
hsa-mir-3934	MI0016590	1	chr6	33698128	33698234	+	—
hsa-mir-3929	MI0016439	238	chr18	35934088	35934142	-	—
hsa-mir-3928	MI0016438	1	chr22	31160062	31160119	-	—
hsa-mir-3927	MI0016435	—	chr9	109511475	109511545	-	—
hsa-mir-3926-2	MI0016437	6	chr8	12727237	12727299	+	—
hsa-mir-3926-1	MI0016434	5	chr8	12727232	12727304	-	—
hsa-mir-3925	MI0016433	—	chr6	36622436	36622512	-	—
hsa-mir-3924	MI0016432	100	chr10	57304479	57304559	-	—
hsa-mir-3923	MI0016430	—	chr3	79507887	79507969	+	—
hsa-mir-3922	MI0016429	—	chr12	104591633	104591716	+	—
hsa-mir-3921	MI0016428	4	chr3	99964314	99964398	-	—
hsa-mir-3920	MI0016427	—	chr11	101519820	101519905	-	—
hsa-mir-3919	MI0016425	—	chr3	159282646	159282734	+	—
hsa-mir-3918	MI0016424	—	chr6	158764661	158764753	-	—
hsa-mir-3917	MI0016423	3	chr1	25906362	25906454	-	—
hsa-mir-3916	MI0016422	14	chr1	247201967	247202060	-	—
hsa-mir-3915	MI0016420	—	chrX	32583656	32583752	-	—
hsa-mir-3914-2	MI0016421	—	chr7	71307674	71307768	+	—
hsa-mir-3914-1	MI0016419	—	chr7	71307672	71307770	-	—
hsa-mir-3913-2	MI0016418	4	chr12	69584723	69584822	+	—
hsa-mir-3913-1	MI0016417	2	chr12	69584722	69584823	-	—
hsa-mir-3912	MI0016416	—	chr5	171386656	171386760	-	—
hsa-mir-3911	MI0016415	1	chr9	127690687	127690795	-	—
hsa-mir-3910-2	MI0016431	2	chr9	91636264	91636345	-	—

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hsa-mir-3910-1	MI0016414	2	chr9	91636251	91636361	+	—
hsa-mir-3909	MI0016413	—	chr22	35335640	35335758	+	✓
hsa-mir-3908	MI0016412	72	chr12	123536409	123536534	+	—
hsa-mir-3907	MI0016410	36	chr7	151433489	151433639	-	—
hsa-mir-384	MI0001145	—	chrX	76919273	76919360	-	—
hsa-mir-383	MI0000791	8	chr8	14853438	14853510	-	—
hsa-mir-382	MI0000790	23	chr14	101054306	101054381	+	✓
hsa-mir-381	MI0000789	22	chr14	101045920	101045994	+	✓
hsa-mir-380	MI0000788	1	chr14	101025017	101025077	+	✓
hsa-mir-379	MI0000787	263	chr14	101022066	101022132	+	✓
hsa-mir-378j	MI0021273	7	chr17	37614931	37615039	-	—
hsa-mir-378i	MI0016902	5084	chr22	41923222	41923297	-	—
hsa-mir-378h	MI0016808	3791	chr5	154829458	154829540	+	—
hsa-mir-378g	MI0016761	4642	—				
hsa-mir-378f	MI0016756	4762	chr1	23929070	23929147	+	—
hsa-mir-378e	MI0016750	3130	chr5	170028488	170028566	+	—
hsa-mir-378d-2	MI0003840	4789	chr8	93916022	93916119	-	—
hsa-mir-378d-1	MI0016749	3415	chr4	5923275	5923328	-	—
hsa-mir-378c	MI0015825	4978	chr10	130962588	130962668	-	—
hsa-mir-378b	MI0014154	3955	chr3	10330229	10330285	+	—
hsa-mir-378a	MI0000786	6009	chr5	149732825	149732890	+	✓
hsa-mir-377	MI0000785	15	chr14	101062050	101062118	+	✓
hsa-mir-376c	MI0000776	214	chr14	101039690	101039755	+	✓
hsa-mir-376b	MI0002466	115	chr14	101040436	101040535	+	✓
hsa-mir-376a-2	MI0003529	119	chr14	101040069	101040148	+	✓
hsa-mir-376a-1	MI0000784	120	chr14	101040782	101040849	+	✓
hsa-mir-375	MI0000783	3418	chr2	219001645	219001708	-	✓
hsa-mir-374c	MI0016684	8	chrX	74218549	74218618	+	—
hsa-mir-374b	MI0005566	1108	chrX	74218547	74218618	-	✓
hsa-mir-374a	MI0000782	1271	chrX	74287286	74287357	-	✓
hsa-mir-373	MI0000781	2	chr19	53788705	53788773	+	—
hsa-mir-372	MI0000780	91	chr19	53787890	53787956	+	—
hsa-mir-371b	MI0017393	23	chr19	53787677	53787742	-	—
hsa-mir-371a	MI0000779	—	chr19	53787675	53787741	+	—
hsa-mir-3714	MI0016135	5	chr3	16933196	16933260	+	—
hsa-mir-3713	MI0016134	—	—				
hsa-mir-370	MI0000778	9	chr14	100911139	100911213	+	✓
hsa-mir-3692	MI0016093	—	chr6	157529132	157529200	+	—
hsa-mir-3691	MI0016092	—	chr6	5148233	5148322	-	—
hsa-mir-3690-2	MI0023561	—	chrY	1293918	1293992	+	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-3690-1	MI0016091	—	chrX	1293918	1293992	+	—
hsa-mir-369	MI0000777	53	chr14	101065598	101065667	+	✓
hsa-mir-3689f	MI0016837	25	chr9	134850742	134850807	-	—
hsa-mir-3689e	MI0016836	—	chr9	134850570	134850641	-	—
hsa-mir-3689d-2	MI0016835	—	chr9	134850277	134850356	-	—
hsa-mir-3689d-1	MI0016834	—	chr9	134849609	134849682	-	—
hsa-mir-3689c	MI0016832	—	chr9	134849298	134849369	-	—
hsa-mir-3689b	MI0016411	—	chr9	134850125	134850272	-	—
hsa-mir-3689a	MI0016090	—	chr9	134849487	134849564	-	—
hsa-mir-3688-2	MI0017447	3	chr4	159128805	159128891	+	—
hsa-mir-3688-1	MI0016089	73	chr4	159128802	159128894	-	—
hsa-mir-3686	MI0016087	—	chr8	129484057	129484142	-	—
hsa-mir-3685	MI0016086	—	chr12	95309923	95309984	+	—
hsa-mir-3684	MI0016085	—	chr4	98997387	98997460	+	—
hsa-mir-3683	MI0016084	—	chr7	7066964	7067045	-	—
hsa-mir-3682	MI0016083	4	chr2	53849122	53849205	-	—
hsa-mir-3681	MI0016082	—	chr2	12199130	12199201	+	—
hsa-mir-3680-2	MI0019113	3	chr16	29599179	29599265	-	—
hsa-mir-3680-1	MI0016081	3	chr16	21506049	21506135	-	—
hsa-mir-3679	MI0016080	—	chr2	134127125	134127192	+	—
hsa-mir-3678	MI0016079	10	chr17	75406069	75406162	+	—
hsa-mir-3677	MI0016078	8	chr16	2270713	2270772	+	✓
hsa-mir-3675	MI0016076	—	chr1	16858949	16859021	-	—
hsa-mir-3674	MI0016075	—	chr8	1801125	1801192	+	—
hsa-mir-3672	MI0016073	—	chrX	121370972	121371053	+	—
hsa-mir-3671	MI0016072	—	chr1	65057755	65057842	-	—
hsa-mir-3670-4	MI0031514	—	chr16	18488301	18488365	-	—
hsa-mir-3670-3	MI0031513	—	chr16	18405698	18405762	-	—
hsa-mir-3670-2	MI0019112	—	chr16	16306370	16306434	+	—
hsa-mir-3670-1	MI0016071	—	chr16	14907717	14907781	+	—
hsa-mir-367	MI0000775	9	chr4	112647874	112647941	-	—
hsa-mir-3668	MI0016069	—	chr6	140205252	140205326	+	—
hsa-mir-3667	MI0016068	—	chr22	49543393	49543466	-	—
hsa-mir-3666	MI0016067	—	chr7	114653345	114653455	+	—
hsa-mir-3665	MI0016066	63	chr13	77698012	77698116	-	—
hsa-mir-3664	MI0016065	—	chr11	70872270	70872368	-	—
hsa-mir-3663	MI0016064	38	chr10	117167678	117167774	-	—

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hsa-mir-3662	MI0016063	—	chr6	134979338	134979432	—	—
hsa-mir-3661	MI0016062	5	chr5	134225757	134225852	+	—
hsa-mir-3660	MI0016061	29	chr5	90016621	90016720	—	—
hsa-mir-365b	MI0000769	1025	chr17	31575411	31575521	+	✓
hsa-mir-365a	MI0000767	1023	chr16	14309285	14309371	+	✓
hsa-mir-3659	MI0016060	—	chr1	38089231	38089329	+	—
hsa-mir-3658	MI0016058	3	chr1	165907921	165907976	+	—
hsa-mir-3657	MI0016057	—	chr12	112037599	112037715	—	✓
hsa-mir-3655	MI0016055	—	chr5	140647844	140647926	+	—
hsa-mir-3654	MI0016054	—	chr7	133034860	133034915	—	—
hsa-mir-3652	MI0016052	5	chr12	103930425	103930555	+	—
hsa-mir-3651	MI0016051	3	chr9	92292458	92292547	—	—
hsa-mir-3650	MI0016050	—	chr5	38557502	38557561	—	—
hsa-mir-3649	MI0016049	28	chr12	1660315	1660380	—	—
hsa-mir-3648-2	MI0031512	8	chr21	8986999	8987178	+	—
hsa-mir-3648-1	MI0016048	8	chr21	8208473	8208652	+	—
hsa-mir-3646	MI0016046	18	chr20	44408120	44408203	+	—
hsa-mir-363	MI0000764	757	chrX	134169378	134169452	—	✓
hsa-mir-3622b	MI0016014	6	chr8	27701673	27701767	—	—
hsa-mir-3622a	MI0016013	5	chr8	27701677	27701759	+	—
hsa-mir-3621	MI0016012	—	chr9	137169186	137169270	—	—
hsa-mir-3620	MI0016011	—	chr1	228097263	228097341	+	—
hsa-mir-362	MI0000762	61	chrX	50008964	50009028	+	✓
hsa-mir-3619	MI0016009	2	chr22	46091044	46091126	+	—
hsa-mir-3618	MI0016008	8	chr22	20085746	20085833	+	—
hsa-mir-3617	MI0016007	—	chr20	45705102	45705180	—	—
hsa-mir-3616	MI0016006	2	chr20	47166967	47167058	+	✓
hsa-mir-3615	MI0016005	11	chr17	74748613	74748699	+	—
hsa-mir-3614	MI0016004	19	chr17	56891270	56891355	—	✓
hsa-mir-3613	MI0016003	321	chr13	49996415	49996501	—	✓
hsa-mir-3612	MI0016002	—	chr12	128294092	128294178	+	—
hsa-mir-3611	MI0016001	4	chr10	35079598	35079680	—	✓
hsa-mir-3610	MI0016000	13	chr8	116874728	116874800	—	—
hsa-mir-361	MI0000760	866	chrX	85903636	85903707	—	✓
hsa-mir-3609	MI0015999	73	chr7	98881650	98881729	+	—
hsa-mir-3606	MI0015996	9	chr2	188995630	188995692	+	—
hsa-mir-3605	MI0015995	1	chr1	33332393	33332492	—	—
hsa-mir-3529	MI0017351	—	chr15	88611847	88611924	—	—
hsa-mir-34c	MI0000743	379	chr11	111513439	111513515	+	✓
hsa-mir-34b	MI0000742	43	chr11	111512938	111513021	+	✓
hsa-mir-34a	MI0000268	269	chr1	9151668	9151777	—	✓
hsa-mir-346	MI0000826	3	chr10	86264694	86264788	—	—
hsa-mir-345	MI0000825	123	chr14	100307859	100307956	+	✓

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hsa-mir-342	MI0000805	776	chr14	100109655	100109753	+	✓
hsa-mir-340	MI0000802	913	chr5	180015303	180015397	-	✓
hsa-mir-33b	MI0003646	27	chr17	17813836	17813931	-	✓
hsa-mir-33a	MI0000091	256	chr22	41900944	41901012	+	✓
hsa-mir-339	MI0000815	238	chr7	1022933	1023026	-	✓
hsa-mir-338	MI0000814	97	chr17	81125883	81125949	-	✓
hsa-mir-337	MI0000806	21	chr14	100874493	100874585	+	✓
hsa-mir-335	MI0000816	3777	chr7	130496111	130496204	+	✓
hsa-mir-331	MI0000812	226	chr12	95308420	95308513	+	—
hsa-mir-330	MI0000803	70	chr19	45638994	45639087	-	✓
hsa-mir-329-2	MI0001726	—	chr14	101027100	101027183	+	✓
hsa-mir-329-1	MI0001725	—	chr14	101026785	101026864	+	✓
hsa-mir-328	MI0000804	31	chr16	67202321	67202395	-	—
hsa-mir-326	MI0000808	14	chr11	75335092	75335186	-	—
hsa-mir-325	MI0000824	—	chrX	77005404	77005501	-	—
hsa-mir-324	MI0000813	210	chr17	7223297	7223379	-	✓
hsa-mir-323b	MI0014206	—	chr14	101056219	101056300	+	—
hsa-mir-323a	MI0000807	1	chr14	101025732	101025817	+	✓
hsa-mir-320e	MI0014234	4717	chr19	46709282	46709354	-	—
hsa-mir-320d-2	MI0008192	2985	chrX	140926160	140926231	-	—
hsa-mir-320d-1	MI0008190	4526	chr13	40727816	40727887	-	—
hsa-mir-320c-2	MI0008191	4285	chr18	24321675	24321746	+	—
hsa-mir-320c-1	MI0003778	3570	chr18	21683518	21683589	+	—
hsa-mir-320b-2	MI0003839	5249	chr1	224257040	224257110	-	—
hsa-mir-320b-1	MI0003776	5177	chr1	116671746	116671817	+	—
hsa-mir-320a	MI0000542	5331	chr8	22244966	22245037	-	✓
hsa-mir-3202-2	MI0014253	3	chrX	153981098	153981176	-	—
hsa-mir-3202-1	MI0014252	1	chrX	153981097	153981177	+	—
hsa-mir-3201	MI0014250	—	chr22	48274364	48274415	+	—
hsa-mir-3200	MI0014249	3	chr22	30731557	30731641	+	✓
hsa-mir-32	MI0000090	222	chr9	109046229	109046298	-	✓
hsa-mir-3199-2	MI0014248	—	chr22	27920526	27920611	+	—
hsa-mir-3199-1	MI0014247	—	chr22	27920525	27920612	-	—
hsa-mir-3198-2	MI0017335	—	chr12	54231397	54231476	-	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-3198-1	MI0014246	—	chr22	17764180	17764259	-	—
hsa-mir-3197	MI0014245	—	chr21	41167557	41167629	+	—
hsa-mir-3196	MI0014241	12	chr20	63238779	63238842	+	—
hsa-mir-3195	MI0014240	27	chr20	62064802	62064885	+	—
hsa-mir-3194	MI0014239	—	chr20	51452905	51452977	-	—
hsa-mir-3193	MI0014238	—	chr20	31607186	31607240	+	—
hsa-mir-3192	MI0014237	457	chr20	18470615	18470691	+	—
hsa-mir-3191	MI0014236	—	chr19	47226944	47227019	-	—
hsa-mir-3190	MI0014235	12	chr19	47226942	47227021	+	—
hsa-mir-3189	MI0014233	2	chr19	18386562	18386634	+	—
hsa-mir-3188	MI0014232	1	chr19	18282077	18282161	+	—
hsa-mir-3187	MI0014231	2	chr19	813584	813653	+	—
hsa-mir-3186	MI0014229	—	chr17	81451104	81451188	-	—
hsa-mir-3185	MI0014227	6	chr17	48724408	48724475	-	—
hsa-mir-3184	MI0014226	—	chr17	30117086	30117160	-	—
hsa-mir-3183	MI0014225	—	chr17	1022476	1022559	-	—
hsa-mir-3182	MI0014224	37	chr16	83508346	83508408	+	—
hsa-mir-3181	MI0014223	10	chr16	50742305	50742377	+	—
hsa-mir-3180-5	MI0016409	15	chr16	2135977	2136129	-	—
hsa-mir-3180-4	MI0016408	14	chr16	15154850	15155002	-	—
hsa-mir-3180-3	MI0014217	13	chr16	18402178	18402271	-	✓
hsa-mir-3180-2	MI0014215	13	chr16	16309879	16309966	+	✓
hsa-mir-3180-1	MI0014214	13	chr16	14911220	14911313	+	✓
hsa-mir-3179-4	MI0031510	—	chr16	18494493	18494576	-	—
hsa-mir-3179-3	MI0014221	—	chr16	18411894	18411977	-	—
hsa-mir-3179-2	MI0014216	—	chr16	16300159	16300242	+	—
hsa-mir-3179-1	MI0014213	—	chr16	14901508	14901591	+	—
hsa-mir-3178	MI0014212	37	chr16	2531922	2532005	-	—
hsa-mir-3177	MI0014211	—	chr16	1734985	1735066	+	—
hsa-mir-3176	MI0014210	51	chr16	543277	543366	+	—
hsa-mir-3175	MI0014209	1	chr15	92904399	92904475	+	—
hsa-mir-3174	MI0014208	—	chr15	90006755	90006841	+	—
hsa-mir-3173	MI0014204	7	chr14	95137919	95137986	-	✓
hsa-mir-3171	MI0014202	—	chr14	27633205	27633278	-	✓
hsa-mir-3170	MI0014201	—	chr13	98208524	98208600	+	—
hsa-mir-3169	MI0014200	—	chr13	61199798	61199880	-	—
hsa-mir-3168	MI0014199	98	chr13	41101019	41101100	-	—
hsa-mir-3167	MI0014198	—	chr11	126988458	126988542	-	—

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hsa-mir-3166	MI0014196	—	chr11	88176502	88176593	+	—
hsa-mir-3165	MI0014195	1	chr11	72072228	72072302	-	—
hsa-mir-3164	MI0014194	—	chr11	69083176	69083258	+	—
hsa-mir-3163	MI0014193	4	chr11	66934434	66934506	-	—
hsa-mir-3162	MI0014192	1	chr11	59595077	59595158	-	—
hsa-mir-3161	MI0014191	—	chr11	48096782	48096858	+	—
hsa-mir-3160-2	MI0014190	1	chr11	46451807	46451887	+	—
hsa-mir-3160-1	MI0014189	—	chr11	46451805	46451889	-	—
hsa-mir-3159	MI0014188	638	chr11	18387787	18387860	+	—
hsa-mir-3158-2	MI0014187	2	chr10	101601417	101601497	-	✓
hsa-mir-3158-1	MI0014186	2	chr10	101601417	101601497	+	✓
hsa-mir-3157	MI0014185	—	chr10	96064315	96064399	-	✓
hsa-mir-3156-3	MI0014242	—	chr21	13406384	13406460	-	—
hsa-mir-3156-2	MI0014230	—	chr18	14830166	14830242	+	—
hsa-mir-3156-1	MI0014184	—	chr10	45164014	45164088	+	—
hsa-mir-3155b	MI0016839	22	chr10	6152207	6152262	-	—
hsa-mir-3155a	MI0014183	2	chr10	6152196	6152277	+	✓
hsa-mir-3154	MI0014182	1	chr9	128244947	128245030	-	—
hsa-mir-3153	MI0014180	—	chr9	89312225	89312306	+	—
hsa-mir-3152	MI0014179	19	chr9	18573306	18573379	+	—
hsa-mir-3151	MI0014178	—	chr8	103154614	103154689	+	—
hsa-mir-3150b	MI0016426	5	chr8	95072911	95072996	-	—
hsa-mir-3150a	MI0014177	24	chr8	95072914	95072993	+	—
hsa-mir-3149	MI0014176	130	chr8	76966768	76966850	-	—
hsa-mir-3148	MI0014175	—	chr8	29957272	29957348	-	—
hsa-mir-3147	MI0014173	—	chr7	57405025	57405090	+	—
hsa-mir-3146	MI0014172	—	chr7	19705358	19705436	-	—
hsa-mir-3145	MI0014170	—	chr6	138435213	138435294	-	—
hsa-mir-3144	MI0014169	3	chr6	120015179	120015257	+	✓
hsa-mir-3143	MI0014167	172	chr6	27147626	27147688	+	—
hsa-mir-3142	MI0014166	—	chr5	160474402	160474483	+	—
hsa-mir-3141	MI0014165	1	chr5	154596012	154596072	-	—
hsa-mir-3140	MI0014163	—	chr4	152489327	152489416	-	✓
hsa-mir-3139	MI0014162	48	chr4	143343460	143343535	+	—
hsa-mir-3138	MI0014161	1	chr4	10078611	10078692	-	—
hsa-mir-3137	MI0014160	28	chr3	195134506	195134580	-	—
hsa-mir-3136	MI0014158	—	chr3	69048958	69049035	-	—
hsa-mir-3135b	MI0016809	71	chr6	32749912	32749979	-	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-3135a	MI0014156	367	chr3	20137565	20137641	+	—
hsa-mir-3134	MI0014155	14	chr3	15697298	15697371	-	—
hsa-mir-3133	MI0014153	—	chr2	241477905	241477982	+	—
hsa-mir-3132	MI0014152	—	chr2	219549073	219549147	-	—
hsa-mir-3131	MI0014151	—	chr2	219058688	219058750	-	—
hsa-mir-3130-2	MI0014148	3	chr2	206783234	206783308	+	✓
hsa-mir-3130-1	MI0014147	3	chr2	206783234	206783308	-	✓
hsa-mir-3129	MI0014146	—	chr2	189133036	189133111	-	—
hsa-mir-3128	MI0014145	—	chr2	177255945	177256010	-	—
hsa-mir-3127	MI0014144	—	chr2	96798278	96798353	+	—
hsa-mir-3126	MI0014143	—	chr2	69103682	69103755	+	✓
hsa-mir-3125	MI0014142	9	chr2	12737367	12737444	+	—
hsa-mir-3124	MI0014140	—	chr1	248826377	248826443	+	—
hsa-mir-3123	MI0014139	46	chr1	241132272	241132346	+	—
hsa-mir-3122	MI0014138	—	chr1	212077613	212077685	+	—
hsa-mir-3121	MI0014137	—	chr1	180438314	180438390	-	—
hsa-mir-3120	MI0014136	—	chr1	172138808	172138888	+	—
hsa-mir-3119-2	MI0014135	—	chr1	170151378	170151462	+	—
hsa-mir-3119-1	MI0014134	—	chr1	170151378	170151462	-	—
hsa-mir-3118-4	MI0014207	—	chr15	21843750	21843824	+	—
hsa-mir-3118-3	MI0014133	—	chr15	21406385	21406459	+	—
hsa-mir-3118-2	MI0014132	—	chr15	20832795	20832869	+	—
hsa-mir-3118-1	MI0014131	—	chr21	13644775	13644850	-	—
hsa-mir-3117	MI0014130	—	chr1	66628440	66628517	+	—
hsa-mir-3116-2	MI0014129	—	chr1	62078789	62078856	-	—
hsa-mir-3116-1	MI0014128	—	chr1	62078786	62078859	+	—
hsa-mir-3115	MI0014127	29	chr1	23044305	23044372	+	—
hsa-mir-31	MI0000089	1263	chr9	21512115	21512185	-	✓
hsa-mir-30e	MI0000749	10738	chr1	40754355	40754446	+	✓
hsa-mir-30d	MI0000255	11691	chr8	134804876	134804945	-	✓
hsa-mir-30c-2	MI0000254	3223	chr6	71376960	71377031	-	✓
hsa-mir-30c-1	MI0000736	3205	chr1	40757284	40757372	+	✓
hsa-mir-30b	MI0000441	2245	chr8	134800520	134800607	-	✓
hsa-mir-30a	MI0000088	15057	chr6	71403551	71403621	-	✓
hsa-mir-3085	MI0039500	—	chr10	97875813	97875897	-	—
hsa-mir-3074	MI0014181	4	chr9	95086014	95086094	-	—
hsa-mir-3065	MI0014228	39	chr17	81125877	81125955	+	✓

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-3064	MI0017375	—	chr17	64500774	64500839	-	—
hsa-mir-3059	MI0039499	8	chr12	86745068	86745149	-	✓
hsa-mir-302f	MI0006418	—	chr18	30298910	30298960	+	—
hsa-mir-302e	MI0006417	—	chr11	7234766	7234837	+	—
hsa-mir-302d	MI0000774	10	chr4	112648004	112648071	-	—
hsa-mir-302c	MI0000773	—	chr4	112648363	112648430	-	—
hsa-mir-302b	MI0000772	—	chr4	112648485	112648557	-	—
hsa-mir-302a	MI0000738	42	chr4	112648183	112648251	-	✓
hsa-mir-301b	MI0005568	140	chr22	21652981	21653058	+	✓
hsa-mir-301a	MI0000745	227	chr17	59151136	59151221	-	✓
hsa-mir-300	MI0005525	—	chr14	101041363	101041445	+	—
hsa-mir-29c	MI0000735	11179	chr1	207801852	207801939	-	✓
hsa-mir-29b-2	MI0000107	8561	chr1	207802443	207802523	-	✓
hsa-mir-29b-1	MI0000105	8558	chr7	130877459	130877539	-	✓
hsa-mir-29a	MI0000087	11796	chr7	130876747	130876810	-	✓
hsa-mir-299	MI0000744	14	chr14	101023794	101023856	+	✓
hsa-mir-298	MI0005523	—	chr20	58818226	58818313	-	—
hsa-mir-297	MI0005775	3	chr4	110860582	110860647	-	—
hsa-mir-296	MI0000747	12	chr20	58817615	58817694	-	✓
hsa-mir-2909	MI0013083	—	chr17	37033745	37033813	+	—
hsa-mir-2861	MI0013006	9	chr9	127785918	127786007	+	—
hsa-mir-28	MI0000086	3607	chr3	188688781	188688866	+	✓
hsa-mir-27b	MI0000440	14864	chr9	95085445	95085541	+	✓
hsa-mir-27a	MI0000085	8588	chr19	13836440	13836517	-	✓
hsa-mir-26b	MI0000084	17403	chr2	218402646	218402722	+	✓
hsa-mir-26a-2	MI0000750	36460	chr12	57824609	57824692	-	✓
hsa-mir-26a-1	MI0000083	26870	chr3	37969404	37969480	+	✓
hsa-mir-2682	MI0012063	—	chr1	98045242	98045351	-	—
hsa-mir-2681	MI0012062	—	chr13	101967642	101967746	-	—
hsa-mir-25	MI0000082	3122	chr7	100093560	100093643	-	✓
hsa-mir-2467	MI0017432	—	chr2	239351724	239351804	-	✓
hsa-mir-24-2	MI0000081	3749	chr19	13836287	13836359	-	✓
hsa-mir-24-1	MI0000080	3719	chr9	95086021	95086088	+	✓
hsa-mir-23c	MI0016010	5962	chrX	20017088	20017187	-	—
hsa-mir-23b	MI0000439	11091	chr9	95085208	95085304	+	—
hsa-mir-23a	MI0000079	10137	chr19	13836587	13836659	-	✓
hsa-mir-2392	MI0016870	—	chr14	100814491	100814574	+	—
hsa-mir-2355	MI0015873	10	chr2	207109987	207110073	-	—
hsa-mir-2278	MI0011285	3	chr9	94809962	94810057	+	—
hsa-mir-2277	MI0011284	—	chr5	93620696	93620788	-	✓
hsa-mir-2276	MI0011282	—	chr13	24162416	24162504	+	✓
hsa-mir-224	MI0000301	237	chrX	151958578	151958658	-	✓
hsa-mir-223	MI0000300	1044	chrX	66018870	66018979	+	✓
hsa-mir-222	MI0000299	3517	chrX	45747015	45747124	-	✓

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-221	MI0000298	4317	chrX	45746157	45746266	-	✓
hsa-mir-22	MI0000078	3830	chr17	1713903	1713987	-	✓
hsa-mir-219b	MI0017299	—	chr9	128392621	128392708	+	✓
hsa-mir-219a-2	MI0000740	141	chr9	128392618	128392714	-	✓
hsa-mir-219a-1	MI0000296	—	chr6	33207835	33207944	+	✓
hsa-mir-218-2	MI0000295	1077	chr5	168768146	168768255	-	✓
hsa-mir-218-1	MI0000294	1151	chr4	20528275	20528384	+	✓
hsa-mir-217	MI0000293	120	chr2	55982967	55983076	-	—
hsa-mir-216b	MI0005569	5	chr2	56000714	56000795	-	—
hsa-mir-216a	MI0000292	413	chr2	55988950	55989059	-	✓
hsa-mir-215	MI0000291	686	chr1	220117853	220117962	-	—
hsa-mir-214	MI0000290	459	chr1	172138798	172138907	-	✓
hsa-mir-212	MI0000288	28	chr17	2050271	2050380	-	✓
hsa-mir-2117	MI0010636	—	chr17	43444806	43444885	+	—
hsa-mir-2116	MI0010635	—	chr15	59171183	59171262	-	✓
hsa-mir-2115	MI0010634	1	chr3	48316360	48316459	-	✓
hsa-mir-2114	MI0010633	—	chrX	150228004	150228083	+	✓
hsa-mir-2113	MI0003939	8	chr6	98024531	98024621	+	—
hsa-mir-2110	MI0010629	11	chr10	114174105	114174179	-	✓
hsa-mir-211	MI0000287	500	chr15	31065032	31065141	-	✓
hsa-mir-210	MI0000286	160	chr11	568089	568198	-	✓
hsa-mir-21	MI0000077	99440	chr17	59841266	59841337	+	✓
hsa-mir-20b	MI0001519	544	chrX	134169809	134169877	-	✓
hsa-mir-20a	MI0000076	7477	chr13	91351065	91351135	+	✓
hsa-mir-208b	MI0005570	49	chr14	23417987	23418063	-	✓
hsa-mir-208a	MI0000251	90	chr14	23388596	23388666	-	✓
hsa-mir-206	MI0000490	375	chr6	52144349	52144434	+	—
hsa-mir-2054	MI0010488	—	chr4	125507259	125507307	+	—
hsa-mir-2053	MI0010487	—	chr8	112643493	112643583	+	—
hsa-mir-2052	MI0010486	—	chr8	74705693	74705747	+	—
hsa-mir-205	MI0000285	6213	chr1	209432133	209432242	+	✓
hsa-mir-204	MI0000284	400	chr9	70809975	70810084	-	✓
hsa-mir-203b	MI0017343	—	chr14	104117418	104117503	-	—
hsa-mir-203a	MI0000283	524	chr14	104117405	104117514	+	✓
hsa-mir-202	MI0003130	190	chr10	133247511	133247620	-	✓
hsa-mir-200c	MI0000650	4878	chr12	6963699	6963766	+	✓
hsa-mir-200b	MI0000342	3832	chr1	1167104	1167198	+	✓
hsa-mir-200a	MI0000737	2312	chr1	1167863	1167952	+	✓
hsa-mir-19b-2	MI0000075	11771	chrX	134169671	134169766	-	✓
hsa-mir-19b-1	MI0000074	11311	chr13	91351192	91351278	+	✓
hsa-mir-19a	MI0000073	10618	chr13	91350891	91350972	+	✓

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hsa-mir-199b	MI0000282	9394	chr9	128244721	128244830	-	✓
hsa-mir-199a-2	MI0000281	10237	chr1	172144535	172144644	-	✓
hsa-mir-199a-1	MI0000242	10013	chr19	10817426	10817496	-	✓
hsa-mir-198	MI0000240	7	chr3	120395668	120395729	-	—
hsa-mir-1976	MI0009986	1	chr1	26554542	26554593	+	—
hsa-mir-1973	MI0009983	5	—				
hsa-mir-1972-2	MI0015977	94	chr16	70030346	70030422	+	—
hsa-mir-1972-1	MI0009982	94	chr16	15010321	15010397	-	—
hsa-mir-197	MI0000239	195	chr1	109598893	109598967	+	✓
hsa-mir-196b	MI0001150	1662	chr7	27169480	27169563	-	✓
hsa-mir-196a-2	MI0000279	1231	chr12	53991738	53991847	+	✓
hsa-mir-196a-1	MI0000238	1430	chr17	48632490	48632559	-	✓
hsa-mir-195	MI0000489	2034	chr17	7017615	7017701	-	✓
hsa-mir-194-2	MI0000732	155	chr11	64891355	64891439	-	✓
hsa-mir-194-1	MI0000488	167	chr1	220118157	220118241	-	—
hsa-mir-193b	MI0003137	657	chr16	14303967	14304049	+	✓
hsa-mir-193a	MI0000487	540	chr17	31559996	31560083	+	✓
hsa-mir-192	MI0000234	781	chr11	64891137	64891246	-	✓
hsa-mir-1915	MI0008336	3	chr10	21496562	21496641	-	—
hsa-mir-1914	MI0008335	—	chr20	63941465	63941544	-	—
hsa-mir-1913	MI0008334	2	chr6	166509354	166509433	-	—
hsa-mir-1912	MI0008333	8	chrX	114651544	114651623	+	✓
hsa-mir-1911	MI0008332	—	chrX	114763184	114763263	+	—
hsa-mir-1910	MI0008331	5	chr16	85741621	85741700	-	—
hsa-mir-191	MI0000465	8868	chr3	49020618	49020709	-	✓
hsa-mir-190b	MI0005545	8	chr1	154193665	154193743	-	—
hsa-mir-190a	MI0000486	15	chr15	62823957	62824041	+	✓
hsa-mir-1909	MI0008330	2	chr19	1816159	1816238	-	—
hsa-mir-1908	MI0008329	20	chr11	61815161	61815240	-	—
hsa-mir-18b	MI0001518	2965	chrX	134170041	134170111	-	✓
hsa-mir-18a	MI0000072	3057	chr13	91350751	91350821	+	✓
hsa-mir-188	MI0000484	28	chrX	50003503	50003588	+	✓
hsa-mir-187	MI0000274	111	chr18	35904818	35904926	-	✓
hsa-mir-186	MI0000483	4207	chr1	71067631	71067716	-	✓
hsa-mir-185	MI0000482	1871	chr22	20033139	20033220	+	✓
hsa-mir-1843	MI0032314	7	chr1	175968370	175968479	-	—
hsa-mir-184	MI0000481	127	chr15	79209788	79209871	+	✓
hsa-mir-183	MI0000273	490	chr7	129774905	129775014	-	✓
hsa-mir-1827	MI0008195	29	chr12	100189884	100189949	+	—

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hsa-mir-1825	MI0008193	—	chr20	32237795	32237847	+	—
hsa-mir-182	MI0000272	1322	chr7	129770383	129770492	-	✓
hsa-mir-181d	MI0003139	896	chr19	13874875	13875011	+	✓
hsa-mir-181c	MI0000271	180	chr19	13874699	13874808	+	✓
hsa-mir-181b-2	MI0000683	894	chr9	124693710	124693798	+	✓
hsa-mir-181b-1	MI0000270	893	chr1	198858873	198858982	-	✓
hsa-mir-181a-2	MI0000269	3589	chr9	124692442	124692551	+	✓
hsa-mir-181a-1	MI0000289	3606	chr1	198859044	198859153	-	✓
hsa-mir-17	MI0000071	9521	chr13	91350605	91350688	+	✓
hsa-mir-16-2	MI0000115	10438	chr3	160404745	160404825	+	✓
hsa-mir-16-1	MI0000070	10589	chr13	50048973	50049061	-	✓
hsa-mir-15b	MI0000438	6198	chr3	160404588	160404685	+	✓
hsa-mir-15a	MI0000069	4045	chr13	50049119	50049201	-	✓
hsa-mir-1587	MI0016905	—	chrX	39837561	39837613	+	—
hsa-mir-155	MI0000681	355	chr21	25573980	25574044	+	✓
hsa-mir-154	MI0000480	2	chr14	101059755	101059838	+	✓
hsa-mir-1539	MI0007260	—	chr18	49487373	49487422	+	—
hsa-mir-1538	MI0007259	—	chr16	69565808	69565868	-	—
hsa-mir-1537	MI0007258	2	chr1	235853000	235853060	-	—
hsa-mir-153-2	MI0000464	75	chr7	157574336	157574422	-	✓
hsa-mir-153-1	MI0000463	69	chr2	219294111	219294200	-	✓
hsa-mir-152	MI0000462	2307	chr17	48037161	48037247	-	✓
hsa-mir-151b	MI0003772	2711	chr14	100109419	100109514	-	—
hsa-mir-151a	MI0000809	4889	chr8	140732564	140732653	-	—
hsa-mir-150	MI0000479	699	chr19	49500785	49500868	-	✓
hsa-mir-149	MI0000478	130	chr2	240456001	240456089	+	✓
hsa-mir-148b	MI0000811	2746	chr12	54337216	54337314	+	✓
hsa-mir-148a	MI0000253	15136	chr7	25949919	25949986	-	✓
hsa-mir-147b	MI0005544	32	chr15	45433050	45433129	+	✓
hsa-mir-147a	MI0000262	44	chr9	120244979	120245050	-	—
hsa-mir-1471	MI0007076	—	chr2	231892242	231892298	-	—
hsa-mir-1470	MI0007075	—	chr19	15449548	15449608	+	—
hsa-mir-146b	MI0003129	2237	chr10	102436512	102436584	+	✓
hsa-mir-146a	MI0000477	2369	chr5	160485352	160485450	+	✓
hsa-mir-1469	MI0007074	10	chr15	96333261	96333307	+	—
hsa-mir-1468	MI0003782	—	chrX	63786002	63786087	-	—
hsa-mir-145	MI0000461	29896	chr5	149430646	149430733	+	✓
hsa-mir-144	MI0000460	640	chr17	28861533	28861618	-	✓
hsa-mir-143	MI0000459	104879	chr5	149428918	149429023	+	✓
hsa-mir-142	MI0000458	3620	chr17	58331232	58331318	-	✓

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hsa-mir-141	MI0000457	1700	chr12	6964097	6964191	+	✓
hsa-mir-140	MI0000456	5403	chr16	69933081	69933180	+	✓
hsa-mir-139	MI0000261	195	chr11	72615063	72615130	-	✓
hsa-mir-138-2	MI0000455	159	chr16	56858518	56858601	+	✓
hsa-mir-138-1	MI0000476	180	chr3	44114212	44114310	+	✓
hsa-mir-137	MI0000454	246	chr1	98046070	98046171	-	✓
hsa-mir-136	MI0000475	77	chr14	100884702	100884783	+	✓
hsa-mir-135b	MI0000810	189	chr1	205448302	205448398	-	✓
hsa-mir-135a-2	MI0000453	444	chr12	97563812	97563911	+	✓
hsa-mir-135a-1	MI0000452	590	chr3	52294219	52294308	-	✓
hsa-mir-1343	MI0017320	—	chr11	34941837	34941920	+	✓
hsa-mir-134	MI0000474	118	chr14	101054687	101054759	+	✓
hsa-mir-133b	MI0000822	224	chr6	52148923	52149041	+	✓
hsa-mir-133a-2	MI0000451	543	chr20	62564912	62565013	+	✓
hsa-mir-133a-1	MI0000450	543	chr18	21825698	21825785	-	✓
hsa-mir-1324	MI0006657	—	chr3	75630763	75630858	+	—
hsa-mir-1323	MI0003786	7	chr19	53671968	53672040	+	—
hsa-mir-1322	MI0006653	—	chr8	10825373	10825443	-	—
hsa-mir-1321	MI0006652	—	chrX	85835780	85835858	+	—
hsa-mir-132	MI0000449	751	chr17	2049908	2050008	-	✓
hsa-mir-130b	MI0000748	869	chr22	21653304	21653385	+	✓
hsa-mir-130a	MI0000448	1813	chr11	57641198	57641286	+	✓
hsa-mir-1307	MI0006444	249	chr10	103394253	103394401	-	✓
hsa-mir-1306	MI0006443	6	chr22	20086058	20086142	+	✓
hsa-mir-1305	MI0006372	—	chr4	182169293	182169378	+	—
hsa-mir-1304	MI0006371	51	chr11	93733674	93733764	-	✓
hsa-mir-1303	MI0006370	48	chr5	154685776	154685861	+	—
hsa-mir-1302-9	MI0015978	2	chr9	30144	30281	+	—
hsa-mir-1302-8	MI0006369	—	chr9	97363554	97363681	-	—
hsa-mir-1302-7	MI0006368	29	chr8	141786242	141786313	-	—
hsa-mir-1302-6	MI0006367	—	chr7	18127220	18127309	-	—
hsa-mir-1302-5	MI0006366	—	chr20	50614636	50614785	-	—
hsa-mir-1302-4	MI0006365	1	chr2	207269275	207269424	-	—
hsa-mir-1302-3	MI0006364	2	chr2	113582959	113583096	-	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-1302-2	MI0006363	2	chr1	30366	30503	+	—
hsa-mir-1302-11	MI0015980	2	chr19	71973	72110	+	—
hsa-mir-1302-10	MI0015979	2	chr15	101960459	101960596	-	—
hsa-mir-1302-1	MI0006362	—	chr12	112695034	112695176	-	—
hsa-mir-1301	MI0003815	50	chr2	25328640	25328721	-	✓
hsa-mir-1299	MI0006359	6	chr9	40929010	40929092	-	—
hsa-mir-1298	MI0003938	2	chrX	114715233	114715344	+	✓
hsa-mir-1297	MI0006358	—	chr13	54311972	54312048	-	—
hsa-mir-1296	MI0003780	27	chr10	63372957	63373048	-	✓
hsa-mir-1295b	MI0019146	—	chr1	171101739	171101798	+	—
hsa-mir-1295a	MI0006357	1	chr1	171101728	171101806	-	—
hsa-mir-1294	MI0006356	6	chr5	154347106	154347247	+	✓
hsa-mir-1293	MI0006355	4	chr12	50234142	50234212	-	—
hsa-mir-1292	MI0006433	—	chr20	2652777	2652842	+	—
hsa-mir-1291	MI0006353	8	chr12	48654444	48654530	-	—
hsa-mir-1290	MI0006352	798	chr1	18897071	18897148	-	—
hsa-mir-129-2	MI0000473	68	chr11	43581394	43581483	+	✓
hsa-mir-129-1	MI0000252	69	chr7	128207872	128207943	+	✓
hsa-mir-1289-2	MI0006351	41	chr5	133427596	133427706	-	—
hsa-mir-1289-1	MI0006350	146	chr20	35453954	35454097	-	—
hsa-mir-1288	MI0006432	—	chr17	16282014	16282088	+	—
hsa-mir-1287	MI0006349	7	chr10	98395218	98395307	-	✓
hsa-mir-1286	MI0006348	—	chr22	20249134	20249211	-	—
hsa-mir-1285-2	MI0006347	17	chr2	70252918	70253005	-	—
hsa-mir-1285-1	MI0006346	392	chr7	92204015	92204098	-	✓
hsa-mir-1284	MI0006431	—	chr3	71541970	71542089	-	✓
hsa-mir-1283-2	MI0006430	102	chr19	53758232	53758318	+	—
hsa-mir-1283-1	MI0003832	114	chr19	53688481	53688567	+	—
hsa-mir-1282	MI0006429	115	chr15	43793659	43793759	-	—
hsa-mir-1281	MI0006428	—	chr22	41092513	41092566	+	—
hsa-mir-128-2	MI0000727	690	chr3	35744476	35744559	+	✓
hsa-mir-128-1	MI0000447	693	chr2	135665397	135665478	+	✓
hsa-mir-1279	MI0006426	—	chr12	69273157	69273218	-	—
hsa-mir-1278	MI0006425	—	chr1	193136503	193136583	+	✓
hsa-mir-1277	MI0006419	41	chrX	118386394	118386471	+	✓
hsa-mir-1276	MI0006416	—	chr15	85770496	85770578	-	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-1275	MI0006415	241	chr6	33999972	34000051	-	—
hsa-mir-1273h	MI0025512	23	chr16	24203116	24203231	+	—
hsa-mir-1273c	MI0014171	12	chr6	154853360	154853436	+	✓
hsa-mir-1272	MI0006408	67	chr15	64762387	64762515	-	—
hsa-mir-1271	MI0003814	36	chr5	176367946	176368031	+	✓
hsa-mir-1270	MI0006407	—	chr19	20399272	20399354	-	—
hsa-mir-127	MI0000472	395	chr14	100882979	100883075	+	✓
hsa-mir-1269b	MI0016888	77	chr17	12917268	12917342	-	—
hsa-mir-1269a	MI0006406	82	chr4	66276824	66276928	+	✓
hsa-mir-1268b	MI0016748	53	chr17	80098828	80098877	+	—
hsa-mir-1268a	MI0006405	95	chr15	22225278	22225329	-	—
hsa-mir-1267	MI0006404	3	chr13	107531171	107531248	-	—
hsa-mir-1266	MI0006403	—	chr15	52277117	52277200	-	—
hsa-mir-1265	MI0006401	—	chr10	14436576	14436661	+	—
hsa-mir-1264	MI0003758	1	chrX	114652655	114652723	+	—
hsa-mir-1263	MI0006398	—	chr3	164171471	164171556	-	—
hsa-mir-1262	MI0006397	—	chr1	68183518	68183610	-	—
hsa-mir-1261	MI0006396	64	chr11	90869121	90869202	-	—
hsa-mir-1260b	MI0014197	913	chr11	96341438	96341526	+	—
hsa-mir-1260a	MI0006394	898	chr14	77266218	77266290	+	—
hsa-mir-126	MI0000471	4481	chr9	136670602	136670686	+	✓
hsa-mir-125b-2	MI0000470	11409	chr21	16590237	16590325	+	✓
hsa-mir-125b-1	MI0000446	13830	chr11	122099757	122099844	-	✓
hsa-mir-125a	MI0000469	3993	chr19	51693254	51693339	+	✓
hsa-mir-1258	MI0006392	—	chr2	179860836	179860908	-	—
hsa-mir-1257	MI0006391	8	chr20	61953546	61953662	-	—
hsa-mir-1256	MI0006390	—	chr1	20988314	20988432	-	✓
hsa-mir-1255b-2	MI0006436	4	chr1	167998660	167998726	+	—
hsa-mir-1255b-1	MI0006435	4	chr4	36426366	36426428	-	—
hsa-mir-1255a	MI0006389	6	chr4	101330302	101330414	-	✓
hsa-mir-1253	MI0006387	—	chr17	2748078	2748182	-	—
hsa-mir-1252	MI0006434	—	chr12	79419257	79419321	+	—
hsa-mir-1251	MI0006386	—	chr12	97491909	97491978	+	—
hsa-mir-1250	MI0006385	41	chr17	81133196	81133308	-	—
hsa-mir-1249	MI0006384	9	chr22	45200954	45201019	-	✓
hsa-mir-1248	MI0006383	7	chr3	186786672	186786777	+	—
hsa-mir-1247	MI0006382	25	chr14	101560287	101560422	-	✓
hsa-mir-1246	MI0006381	7472	chr2	176600980	176601052	-	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-1245b	MI0017431	—	chr2	188978093	188978161	-	—
hsa-mir-1245a	MI0006380	—	chr2	188978092	188978161	+	—
hsa-mir-1244-4	MI0031511	—	chr12	12111952	12112036	+	—
hsa-mir-1244-3	MI0015975	—	chr12	9239467	9239551	-	—
hsa-mir-1244-2	MI0015974	—	chr5	118974586	118974670	+	—
hsa-mir-1244-1	MI0006379	—	chr2	231713314	231713398	+	—
hsa-mir-1243	MI0006373	—	chr4	113106863	113106955	+	—
hsa-mir-124-3	MI0000445	256	chr20	63178500	63178586	+	✓
hsa-mir-124-2	MI0000444	247	chr8	64379149	64379257	+	✓
hsa-mir-124-1	MI0000443	254	chr8	9903388	9903472	-	✓
hsa-mir-1238	MI0006328	—	chr19	10552122	10552204	+	—
hsa-mir-1237	MI0006327	—	chr11	64368602	64368703	+	—
hsa-mir-1236	MI0006326	—	chr6	31956839	31956940	-	—
hsa-mir-1234	MI0006324	1236	chr8	144400086	144400165	-	—
hsa-mir-1233-2	MI0015973	2	chr15	34528290	34528371	-	—
hsa-mir-1233-1	MI0006323	2	chr15	34382069	34382150	-	—
hsa-mir-1231	MI0006321	—	chr1	201808611	201808702	+	—
hsa-mir-122b	MI0017383	136	chr18	58451080	58451152	-	✓
hsa-mir-1229	MI0006319	3	chr5	179798278	179798346	-	—
hsa-mir-1228	MI0006318	4	chr12	57194504	57194576	+	—
hsa-mir-1227	MI0006316	—	chr19	2234062	2234149	-	—
hsa-mir-1226	MI0006313	5	chr3	47849555	47849629	+	—
hsa-mir-1225	MI0006311	—	chr16	2090195	2090284	-	—
hsa-mir-1224	MI0003764	18	chr3	184241405	184241489	+	—
hsa-mir-122	MI0000442	1201	chr18	58451074	58451158	+	✓
hsa-mir-12136	MI0039740	457	chr1	632615	632685	-	—
hsa-mir-12135	MI0039739	225	chr15	73299910	73299979	+	—
hsa-mir-12133	MI0039735	—	chr1	94543702	94543779	+	—
hsa-mir-12132	MI0039734	—	chr1	61846075	61846176	+	—
hsa-mir-12131	MI0039733	—	chr6	151102675	151102776	+	—
hsa-mir-12130	MI0039732	—	chr5	116255743	116255834	+	—
hsa-mir-12129	MI0039731	—	chrX	153335462	153335537	+	—
hsa-mir-12128	MI0039730	55	chr16	85207796	85207895	+	—
hsa-mir-12127	MI0039729	—	chr3	10280351	10280452	+	—
hsa-mir-12126	MI0039728	18	chr9	130241387	130241488	+	—
hsa-mir-12125	MI0039727	—	chr5	168165845	168165929	+	—
hsa-mir-12124	MI0039726	6	chr3	128846808	128846908	+	—
hsa-mir-12123	MI0039725	—	chr8	79332188	79332274	+	—
hsa-mir-12122	MI0039724	—	chr20	49863859	49863953	+	—
hsa-mir-12121	MI0039723	35	chr14	104865314	104865411	+	—
hsa-mir-12120	MI0039722	—	chrY	13479177	13479266	+	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-12119	MI0039721	—	chr7	99409172	99409264	+	—
hsa-mir-12118	MI0039720	—	chr5	173303730	173303817	+	—
hsa-mir-12117	MI0039719	12	chr9	33108692	33108765	+	—
hsa-mir-12116	MI0039718	59	chr1	179803924	179804025	+	—
hsa-mir-12115	MI0039717	100	chr4	22515312	22515385	+	—
hsa-mir-12114	MI0039716	13	chr22	50407442	50407524	+	—
hsa-mir-12113	MI0039715	—	chr4	11783178	11783248	+	—
hsa-mir-1208	MI0006341	—	chr8	128150116	128150188	+	—
hsa-mir-1207	MI0006340	—	chr8	128049152	128049238	+	—
hsa-mir-1206	MI0006339	—	chr8	128008898	128008956	+	—
hsa-mir-1205	MI0006338	—	chr8	127960633	127960695	+	—
hsa-mir-1204	MI0006337	—	chr8	127795962	127796028	+	—
hsa-mir-1203	MI0006335	—	chr17	48156427	48156511	-	—
hsa-mir-1202	MI0006334	28	chr6	155946797	155946879	+	—
hsa-mir-1200	MI0006332	—	chr7	36919357	36919432	-	—
hsa-mir-1199	MI0020340	—	chr19	14073361	14073479	+	—
hsa-mir-1197	MI0006656	—	chr14	101025564	101025651	+	—
hsa-mir-1193	MI0014205	52	chr14	101030052	101030129	+	—
hsa-mir-1185-2	MI0003821	2	chr14	101044198	101044283	+	✓
hsa-mir-1185-1	MI0003844	2	chr14	101042977	101043062	+	✓
hsa-mir-1184-3	MI0015972	180	chrX	155457517	155457615	+	—
hsa-mir-1184-2	MI0015971	180	chrX	155383100	155383198	-	—
hsa-mir-1184-1	MI0006277	180	chrX	154887360	154887458	-	—
hsa-mir-1183	MI0006276	—	chr7	21471058	21471146	+	—
hsa-mir-1182	MI0006275	—	chr1	231019828	231019924	-	—
hsa-mir-1181	MI0006274	3	chr19	10403458	10403538	-	—
hsa-mir-1180	MI0006273	103	chr17	19344506	19344574	-	✓
hsa-mir-1179	MI0006272	—	chr15	88608107	88608197	+	—
hsa-mir-1178	MI0006271	—	chr12	119713634	119713724	-	—
hsa-mir-11401	MI0036560	8	chr16	87853896	87853964	+	—
hsa-mir-11400	MI0036559	12	chr7	142474527	142474603	+	—
hsa-mir-11399	MI0036558	—	chr1	112882050	112882129	+	—
hsa-mir-11181	MI0035972	—	chr15	87946206	87946268	-	—
hsa-mir-10b	MI0000267	7790	chr2	176150303	176150412	+	—
hsa-mir-10a	MI0000266	5181	chr17	48579838	48579947	-	✓
hsa-mir-107	MI0000114	11858	chr10	89592747	89592827	-	✓
hsa-mir-106b	MI0000734	1841	chr7	100093993	100094074	-	✓
hsa-mir-106a	MI0000113	7942	chrX	134170198	134170278	-	✓
hsa-mir-10527	MI0033674	2	chr12	63823663	63823727	+	—
hsa-mir-10526	MI0033673	—	chr11	122152103	122152156	-	—
hsa-mir-10525	MI0033672	—	chr7	74595968	74596026	+	—
hsa-mir-10524	MI0033671	12	chr6	78539263	78539309	-	—
hsa-mir-10523	MI0033669	36	chr5	172915083	172915158	+	—

miRNA ID	Accession	RPM	Chromosome	Start	End	Strand	Confidence
hsa-mir-10522	MI0033668	—	chr5	17155930	17155992	—	—
hsa-mir-105-2	MI0000112	15	chrX	152394412	152394492	—	✓
hsa-mir-105-1	MI0000111	15	chrX	152392219	152392299	—	✓
hsa-mir-10401	MI0033425	156	chr21	8206563	8206618	+	—
hsa-mir-10400	MI0033424	16	chr8	144462485	144462539	—	—
hsa-mir-103b-2	MI0007262	—	chr20	3917502	3917563	—	—
hsa-mir-103b-1	MI0007261	233	chr5	168560904	168560965	+	—
hsa-mir-103a-2	MI0000108	12432	chr20	3917494	3917571	+	✓
hsa-mir-103a-1	MI0000109	12432	chr5	168560896	168560973	—	✓
hsa-mir-10399	MI0033423	19	chr7	139044100	139044157	—	—
hsa-mir-10398	MI0033422	8	chr6	41733554	41733610	—	—
hsa-mir-10397	MI0033421	—	chr5	10402364	10402431	+	—
hsa-mir-10396b	MI0033426	—	chr21	8436324	8436374	+	✓
hsa-mir-10396a	MI0033420	—	chr21	8987617	8987665	+	—
hsa-mir-10395	MI0033419	—	chr19	12703601	12703664	—	—
hsa-mir-10394	MI0033418	—	chr19	58393364	58393446	+	—
hsa-mir-10393	MI0033417	—	chr15	44717844	44717893	+	—
hsa-mir-10392	MI0033416	8	chr11	64878523	64878609	—	—
hsa-mir-10226	MI0033056	169	chr17	48032882	48032951	+	—
hsa-mir-101-2	MI0000739	6084	chr9	4850297	4850375	+	✓
hsa-mir-101-1	MI0000103	6056	chr1	65058434	65058508	—	✓
hsa-mir-100	MI0000102	10013	chr11	122152229	122152308	—	✓
hsa-mir-1-2	MI0000437	13316	chr18	21829004	21829088	—	—
hsa-mir-1-1	MI0000651	6511	chr20	62554306	62554376	+	✓
hsa-let-7i	MI0000434	17040	chr12	62603686	62603769	+	✓
hsa-let-7g	MI0000433	102832	chr3	52268278	52268361	—	✓
hsa-let-7f-2	MI0000068	118700	chrX	53557192	53557274	—	✓
hsa-let-7f-1	MI0000067	109279	chr9	94176347	94176433	+	✓
hsa-let-7e	MI0000066	50938	chr19	51692786	51692864	+	✓
hsa-let-7d	MI0000065	4649	chr9	94178834	94178920	+	✓
hsa-let-7c	MI0000064	135622	chr21	16539828	16539911	+	✓
hsa-let-7b	MI0000063	83403	chr22	46113686	46113768	+	✓
hsa-let-7a-3	MI0000062	142757	chr22	46112749	46112822	+	✓
hsa-let-7a-2	MI0000061	142652	chr11	122146522	122146593	—	✓
hsa-let-7a-1	MI0000060	145261	chr9	94175957	94176036	+	✓

### Detailed Description

The invention discloses the combination of a truncated portion of the full-length DUX4 protein, a promoter that increases translation of the truncated DUX4 protein in muscle cells specifically, and a capsid protein that helps to deliver the genome to the appropriate cells.

5           There are multiple methods for truncating the DUX4-FL protein to make the protein less pathogenic, wherein a single or possibly combinations of mutations, deletions, and fusions of the genome yield possible therapeutic sequences. The invention utilizes a recombinant AAV virus; recombinant viruses can be used to express therapeutic proteins in a subject as a form of genetic therapy. The therapy seeking to deliver that protein may utilize a recombinant viral genome that has  
10           the region of interest that will code the desired protein along with untranslated regions at the 5' and 3' ends of the genome. It may also include a promoter that will drive the gene of interest and it may include uninteresting that enhances stability and exportation out of the nucleus. The promoter may be used to identify preferential cellular transcription sites, so whether the gene is translated more often in skin, blood, bone, muscle, nervous, or other tissue types.

15           For example, and non-exclusively, DUX4-S is the first 159 amino acids of DUX4-FL (SEQ ID NO. 3). This version of the truncated portion of the full-length DUX4-FL sequence may result in reduced pathogenesis of muscle disorders because the full DUX4 amino acid sequence is no longer translated, and thus would not yield harmful effects to the myocytes.

            Furthermore, the invention may be delivered to a subject by any pharmaceutically acceptable  
20           dosage delivery method, which may be preferentially parenteral or another method that accomplishes successful delivery of the genome to a cell that can transcribe and translate a truncated DUX4 sequence.

### ***Adeno Associated Virus Vector***

25           AAVs are particularly appropriate viral vectors for delivery of genetic material into mammalian cells. AAVs are not known to cause disease in mammals and cause a very mild immune response. Additionally, AAVs are able to infect cells in multiple stages whether at rest or in a phase of the cell replication cycle. Advantageously, AAV DNA is not regularly inserted into the host's genome at random sites, reducing the oncogenic properties of this vector.

30           AAVs have been engineered to deliver a variety of treatments, especially for genetic disorders caused by single nucleotide polymorphisms ("SNP"). Genetic diseases that have been studied in conjunction with AAV vectors include Cystic fibrosis, hemophilia, arthritis, macular

degeneration, muscular dystrophy, Parkinson's disease, congestive heart failure, and Alzheimer's disease. The AAV can be used as a vector to deliver engineered nucleic acid to a host and utilize the host's own ribosomes to transcribe that nucleic acid into the desired proteins. See, e.g., West et al., *Virology* 160:38-47 (1987); U.S. Pat. No. 4,797,368; WO 93/24641; Kotin, *Human Gene Therapy* 5:793-801 (1994); and Muzyczka, *J. Clin. Invest.* 94:1351 (1994). AAVs have some deficiency in their replication and/or pathogenicity and thus can be safer than adenoviral vectors. In some embodiments, the AAV can integrate into a specific site on chromosome 19 of a human cell with no observable side effects. In some embodiments, the capacity of the AAV vector, system thereof, and/or AAV particles can be up to about 4.7 kb. The AAV vector or system thereof can include one or more engineered capsid polynucleotides described herein.

AAVs are small, replication-defective, nonenveloped viruses that infect humans and other primate species and have a linear single-stranded DNA genome. Naturally occurring AAV serotypes exhibit liver tropism. As a result, transfection of non-liver tissue with traditional AAV vectors is impeded by the virus's natural liver tropism. Moreover, because the liver acts to break down substances delivered to a subject, transfection of non-liver tissue with unmodified AAV vectors requires higher dosing to provide sufficient viral load to overcome the liver and reach non-liver tissue. More than 30 naturally occurring serotypes of AAV are available. Many natural variants in the AAV capsid exist. AAV serotypes include, but are not limited to, AAV serotypes AAV1, AAV2, AAV3, AAV3B, AAV4, AAV5, AAV6, AAV7, AAV8, AAV9, AAV10, AAV11, AAV 12, AAV13. AAVs may be engineered using conventional molecular biology techniques, making it possible to optimize these particles, for example, for cell specific delivery, for minimizing immunogenicity, for tuning stability and particle lifetime, for efficient degradation, for accurate delivery to the nucleus. AAV vectors can be specifically targeted to one or more types of cells by choosing the appropriate combination of AAV serotype, promoter, and delivery method.

Previous approaches to identify AAV sequences correlated with tropism have relied upon the comparison of highly related extant serotypes with distinct characteristics, random domain swaps between unrelated serotypes, or consideration of higher-order structure, to identify motifs that define liver tropism. For example, mapping determinants of AAV tropism have been carried out by comparing highly related serotypes. One such example is the single-amino acid change (E531K) between AAV1 and AAV6 that improves murine liver transduction in AAV1. See Wu et al. (2006) *J. Virol.*, 80(22):11393-7, incorporated by reference herein. Another example is a reciprocal domain swap between AAV2 and AAV8 that alters tropism, but fails to define any robust specific tissue-

targeting motifs. See Raupp et al. (201) J. Virol., 86(17):9396-408, incorporated by reference herein. Further, global consideration of structure has only highlighted gross differences between better- or worse-liver-transducers that are more observational than useful in practice. Nam et al (2007) J. Virol., 81(22):12260-71.

5 AAVs exhibiting modified tissue tropism that may be used with the present invention are described in U.S. Patent No. 9,695,220, U.S. Patent No. 9,719,070; U.S. Patent No. 10,119,125; U.S. Patent No. 10,526,584; U.S. Patent Application Publication No. 2018-0369414; U.S. Patent Application Publication No. 2020-0123504; U.S. Patent Application Publication No. 2020-0318082; PCT International Patent Application Publication No. WO 2015/054653; PCT International Patent Application Publication No. WO 2016/179496; PCT International Patent Application Publication No. WO 2017/100791; and PCT International Patent Application Publication No. WO 2019/217911, the entirety of the contents of each of which are incorporated by reference herein.

15 The AAV vector or system thereof may include one or more regulatory molecules, such as promoters, enhancers, repressors and the like. In some embodiments, the AAV vector or system thereof can include one or more polynucleotides that can encode one or more regulatory proteins. In some embodiments, the one or more regulatory proteins can be selected from Rep78, Rep68, Rep52, Rep40, variants thereof, and combinations thereof. In some embodiments, the muscle specific promoter can drive expression of an engineered AAV capsid polynucleotide.

20 The AAV vector or system thereof can include one or more polynucleotides that can encode one or more capsid proteins, such as the engineered AAV capsid proteins described elsewhere herein. The engineered capsid proteins can be capable of assembling into a protein shell (an engineered capsid) of the AAV virus particle. The engineered capsid can have a cell-, tissue-, and/or organ-specific tropism.

25 The AAV vector or system thereof can be configured to produce AAV particles having a specific serotype. In some embodiments, the serotype can be AAV-1, AAV-2, AAV-3, AAV-4, AAV-5, AAV-6, AAV-8, AAV-9 or any combinations thereof. In some embodiments, the AAV can be AAV1, AAV-2, AAV-5, AAV-9 or any combination thereof. One can select the AAV of the AAV with regard to the cells to be targeted; e.g., one can select AAV serotypes 1, 2, 5, 9 or a hybrid capsid AAV-1, AAV-2, AAV-5, AAV-9 or any combination thereof for targeting brain and/or neuronal cells; and one can select AAV-4 for targeting cardiac tissue; and one can select AAV-8 for delivery to the liver. Thus, in some embodiments, an AAV vector or system thereof capable of producing AAV particles capable of targeting the brain and/or neuronal cells can be configured to

30

generate AAV particles having serotypes 1, 2, 5 or a hybrid capsid AAV-1, AAV-2, AAV-5 or any combination thereof. In some embodiments, an AAV vector or system thereof capable of producing AAV particles capable of targeting cardiac tissue can be configured to generate an AAV particle having an AAV-4 serotype. In some embodiments, an AAV vector or system thereof capable of producing AAV particles capable of targeting the liver can be configured to generate an AAV having an AAV-8 serotype. See also Srivastava. 2017. *Curr. Opin. Virol.* 21:75-80.

It will be appreciated that while the different serotypes can provide some level of cell, tissue, and/or organ specificity, each serotype still is multi-tropic and thus can result in tissue-toxicity if using that serotype to target a tissue that the serotype is less efficient in transducing. Thus, in addition to achieving some tissue targeting capacity via selecting an AAV of a particular serotype, it will be appreciated that the tropism of the AAV serotype can be modified by an engineered AAV capsid described herein. As described elsewhere herein, variants of wild-type AAV of any serotype can be generated via a method described herein and determined to have a particular cell-specific tropism, which can be the same or different as that of the reference wild-type AAV serotype. In some embodiments, the cell, tissue, and/or specificity of the wild-type serotype can be enhanced (e.g., made more selective or specific for a particular cell type that the serotype is already biased towards). For example, wild-type AAV-9 is biased towards muscle and brain in humans (see e.g., Srivastava. 2017. *Curr. Opin. Virol.* 21:75-80.) By including an engineered AAV capsid and/or capsid protein variant of wild-type AAV-9 as described herein, the tropism for nervous cells might be reduced or eliminated and/or the muscle specificity increased such that the nervous specificity appears reduced in comparison, thus enhancing the specificity for muscle as compared to the wild-type AAV-9. As previously mentioned, inclusion of an engineered capsid and/or capsid protein variant of a wild-type AAV serotype can have a different tropism than the wild-type reference AAV serotype. For example, an engineered AAV capsid and/or capsid protein variant of AAV-9 can have specificity for a tissue other than muscle or brain in humans.

In some embodiments, the AAV vector is a hybrid AAV vector or system thereof. Hybrid AAVs are AAVs that include genomes with elements from one serotype that are packaged into a capsid derived from at least one different serotype. For example, if it is the rAAV2/5 that is to be produced, and if the production method is based on the helper-free, transient transfection method discussed above, the 1st plasmid and the 3rd plasmid (the adeno helper plasmid) will be the same as discussed for rAAV2 production. However, the 2nd plasmid, the pRepCap will be different. In this plasmid, called pRep2/Cap5, the Rep gene is still derived from AAV2, while the Cap gene is derived

from AAV5. The production scheme is the same as the above-mentioned approach for AAV2 production. The resulting rAAV is called rAAV2/5, in which the genome is based on recombinant AAV2, while the capsid is based on AAV5. It is assumed the cell or tissue-tropism displayed by this AAV2/5 hybrid virus should be the same as that of AAV5. It will be appreciated that wild-type hybrid AAV particles suffer the same specificity issues as with the non-hybrid wild-type serotypes previously discussed.

Advantages achieved by the wild-type based hybrid AAV systems can be combined with the increased and customizable cell-specificity that can be achieved with the engineered AAV capsids can be combined by generating a hybrid AAV that can include an engineered AAV capsid described elsewhere herein. It will be appreciated that hybrid AAVs can contain an engineered AAV capsid containing a genome with elements from a different serotype than the reference wild-type serotype that the engineered AAV capsid is a variant of. For example, a hybrid AAV can be produced that includes an engineered AAV capsid that is a variant of an AAV-9 serotype that is used to package a genome that contains components (e.g., rep elements) from an AAV-2 serotype. As with wild-type based hybrid AAVs previously discussed, the tropism of the resulting AAV particle will be that of the engineered AAV capsid.

In some embodiments, the AAV vector or system thereof is configured as a “gutless” vector, similar to that described in connection with a retroviral vector. In some embodiments, the “gutless” AAV vector or system thereof can have the cis-acting viral DNA elements involved in genome amplification and packaging in linkage with the heterologous sequences of interest (e.g., the engineered AAV capsid polynucleotide(s)).

The vectors described herein can be constructed using any suitable process or technique. In some embodiments, one or more suitable recombination and/or cloning methods or techniques can be used to the vector(s) described herein. Suitable recombination and/or cloning techniques and/or methods can include, but not limited to, those described in U.S. Application publication No. US 2004-0171156 A1. Other suitable methods and techniques are described elsewhere herein.

Construction of recombinant AAV vectors are described in a number of publications, including U.S. Pat. No. 5,173,414; Tratschin et al., *Mol. Cell. Biol.* 5:3251-3260 (1985); Tratschin, et al., *Mol. Cell. Biol.* 4:2072-2081 (1984); Hermonat & Muzyczka, *PNAS* 81:6466-6470 (1984); and Samulski et al., *J. Virol.* 63:03822-3828 (1989). Any of the techniques and/or methods can be used and/or adapted for constructing an AAV or other vector described herein. AAV vectors are discussed elsewhere herein.

In some embodiments, the vector can have one or more insertion sites, such as a restriction endonuclease recognition sequence (also referred to as a “cloning site”). In some embodiments, one or more insertion sites (e.g., about or more than about 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or more insertion sites) are located upstream and/or downstream of one or more sequence elements of one or more vectors.

Delivery vehicles, vectors, particles, nanoparticles, formulations and components thereof for expression of one or more elements of a engineered AAV capsid system described herein are as used in the foregoing documents, such as International Patent Application Publications WO WO 2021/050974 and WO 2021/077000 and PCT International Application No. PCT/US2021/042812, the contents of which are incorporated by reference herein.

Additional AAV vectors are described in International Patent Application Publication WO 2019/2071632, the contents of which are incorporated by reference herein.

Further AAV vectors are described in International Patent Application Publications WO 2020/086881 and WO 2020/235543, the contents of each of which are incorporated by reference herein.

Further AAV vectors are described in International Patent Application Publications WO 2005/033321; WO 2006/110689; WO 2007/127264; WO 2008/027084; WO 2009/073103; WO 2009/073104; WO 2009/105084; WO 2009/134681; WO 2009/136977; WO 2010/051367; WO 2010/138675; WO 2001/038187; WO 2012/112832; WO 2015/054653; WO 2016/179496; WO 2017/100791; WO 2017/019994; WO 2018/209154; WO 2019/067982; WO 2019/195701; WO 2019/217911; WO 2020/041498; WO 2020/210839; U.S. Patent No. 7,906,111; U.S. Patent No. 9,737,618; U.S. Patent No. 10,265,417; U.S. Patent No. 10,485,883; U.S. Patent No. 10,695,441; U.S. Patent No. 10,722,598; U.S. Patent No. 8,999,678; U.S. Patent No. 10,301,648; U.S. Patent No. 10,626,415; U.S. Patent No. 9,198,984; U.S. Patent No. 10,155,931; U.S. Patent No. 8,524,219; U.S. Patent No. 9,206,238; U.S. Patent No. 8,685,387; U.S. Patent No. 9,359,618; U.S. Patent No. 8,231,880; U.S. Patent No. 8,470,310; U.S. Patent No. 9,597,363; U.S. Patent No. 8,940,290; U.S. Patent No. 9,593,346; U.S. Patent No. 10,501,757; U.S. Patent No. 10,786,568; U.S. Patent No. 10,973,928; U.S. Patent No. 10,519,198; U.S. Patent No. 8,846,031; U.S. Patent No. 9,617,561; U.S. Patent No. 9,884,071; U.S. Patent No. 10,406,173; U.S. Patent No. 9,596,220; U.S. Patent No. 9,719,010; U.S. Patent No. 10,117,125; U.S. Patent No. 10,526,584; U.S. Patent No. 10,881,548; U.S. Patent No. 10,738,087; U.S. Patent Publication No. 2011-023353; U.S. Patent Publication No. 2019-0015527; U.S. Patent Publication No. 2020-155704; U.S. Patent Publication No 2017-0191079; U.S.

Patent Publication No. 2019-0218574; U.S. Patent Publication No. 2020-0208176; U.S. Patent Publication No. 2020-0325491; U.S. Patent Publication No. 2019-0055523; U.S. Patent Publication No. 2020-0385689; U.S. Patent Publication No. 2009-0317417; U.S. Patent Publication No. 2016-0051603; U.S. Patent Publication No. 2016-00244783; U.S. Patent Publication No. 2017-0183636; U.S. Patent Publication No. 2020-0263201; U.S. Patent Publication No. 2020-0101099; U.S. Patent Publication No. 2020-0318082; U.S. Patent Publication No. 2018-0369414; U.S. Patent Publication No. 2019-0330278; U.S. Patent Publication No. 2020-0231986, the contents of each of which are incorporated by reference herein.

## 10 **Promoter**

The invention may contain a muscle specific promoter or another promoter. The promoter may be linked to the nucleic acid sequence so that the transcription preferably occurs within myocytes. Promoter regions enable the host cells to replicate the AAV delivered nucleic acid only in those cell types and tissues or organs in which the desired protein should be created. Here, the muscle specific promoter is included because it is principally desired that the proteins only be translated in myocytes. Specificity of the cell type into which the nucleic acid is delivered and thus the proteins translated is desired because of the adverse effects that may ensue from delivering the nucleic acid and having it translated in cells in which that nucleic acid and thus protein is not needed.

The myocyte specific promoter may be coupled or otherwise associated with a truncated DUX4 sequence. In some embodiments, the promoter may be directly attached, and in others there may be a linker molecule or another indirect coupling method to attach to the truncated DUX4 sequence. In some embodiments, there may be an associated polypeptide or other particle that is coupled to the truncated DUX4 sequence.

In some embodiments, the muscle specific promoter yields increased muscle cell potency, muscle cell specificity, reduced immunogenicity, or any combination thereof. As used herein the terms “muscle-specific”, “muscle cell specificity”, “muscle cell potency,” “myocyte specific” and the like, refer to the increased specificity, selectivity, or potency, of the muscle-specific targeting moieties and compositions incorporating said muscle-specific targeting moieties of the present invention for myocytes relative to non-muscle cells. In some embodiments, the cell specificity, or selectivity, or potency, or a combination thereof of a muscle-specific targeting moiety or composition

incorporating a muscle-specific targeting moiety described herein is at least 2 to at least 500 times more specific, selective, and/or potent for/in a muscle cell relative to a non-muscle cell.

In some embodiments, the myocyte-selective promoter utilized is MHCK7. MHCK7 is a 770 base pair length promoter that is small enough to be included in an AAV vector. MHCK7 directs  
5 expression in fast and slow skeletal and cardiac muscle, with low expression in the liver, lung, and spleen. It is less active in smooth muscle. The MHCK7 promoter is associated with high levels of expression in skeletal muscles, including the diaphragm, and includes an enhancer to especially drive expression in the heart, whereas expression in off-target tissues is minimal.

In some embodiments, the promoters described herein are inserted into an AAV protein  
10 (e.g., an AAV capsid protein) that has reduced specificity (or no detectable, measurable, or clinically relevant interaction) for one or more non-muscle cell types. Exemplary non-muscle cell types include, but are not limited to, liver, kidney, lung, heart, spleen, central or peripheral nervous system cells, bone, immune, stomach, intestine, eye, skin cells and the like. In some embodiments, the non-muscle cells are liver cells.

15 The term “operably linked” refers to the association of two or more nucleic acid molecules on a single nucleic acid fragment so that the function of one is affected by the other.

Further exemplary tissue specific promoters include U6 promoter sequence, MHCK7 promoter sequence, CK6 promoter sequence, tMCK promoter sequence, CK5 promoter sequence, MCK promoter sequence, HAS promoter sequence, MPZ promoter sequence, desmin promoter  
20 sequence, APOA2 promoter sequence, hAAT promoter sequence, INS promoter sequence, IRS2 promoter sequence, MYH6 promoter sequence, MYL2 promoter sequence, TNNI3 promoter sequence, SYN1 promoter sequence, GFAP promoter sequence, NES promoter sequence, MBP promoter sequence, or TII promoter sequence.

Muscle specific promoters are described in International Patent Application Publications  
25 WO 2020/006458 and WO 2021/126880, the contents of each of which are incorporated by reference herein.

Further muscle specific promoters are described in U.S. Patent No. 9,133,482; U.S. Patent No. 10,105,453; U.S. Patent No. 10,301,367; U.S. Patent Publication No. 2020-0360534; PCT International Patent Publication Nos. WO 2020/006458; WO 2021/035120; WO 2021/053124; and  
30 WO 2021/077000, the contents of each of which are incorporated by reference herein.

It may be convenient to use an RNA polymerase II or III promoter; these are known to the person skilled in the art and reviewed in e.g. Kornberg 1999. However, transcripts from an RNA II

polymerase often have complex transcription terminators and transcripts are polyadenylated; this may hamper with the requirements of the miRNA strand which because both its 5' and 3' ends need to be precisely defined in order to achieve the required secondary structure to produce a functional molecule. These drawbacks can however be circumvented. In case an RNA polymerase II or III promoter is used, the polynucleotide encoding the miRNA strand may also encode self-processing ribozymes and may be operably linked to an RNA polymerase II or III promoter; as such the polynucleotide encodes a pre- miRNA strand comprising the miRNA strand and self-processing ribozymes, wherein, when transcribed, the miRNA strand is released by the self-processing ribozymes from the pre- miRNA strand de transcript.

10 Preferably, in a composition according to the present invention the AAV vector is comprised of an RNA polymerase II promoter or III promoter, and encodes a pre- miRNA strand comprising the miRNA strand and self-processing ribozymes, wherein, when transcribed, the miRNA strand is released by the self-processing ribozymes from the pre- miRNA strand transcript. Conveniently, multiple pre-miRNA strands and multiple self-processing ribozymes may be encoded  
15 by a single polynucleotide, operably linked to one or more RNA polymerase II promoters.

RNA polymerase II or III promoters that are inducible and/or tissue-specific have been previously described. RNA polymerase promoters are known in the art and further described in U.S. Patent Publication 11,149,288, the contents of which is incorporated by reference herein.

## 20 ***Capsid Protein***

The capsid protein is the shell or coating of the virus that enables its delivery into the host. Without the protein, the nucleic acids would be destroyed by the host without entering into the host cells and beginning transcription and translation. The capsid protein may be in the natural conformation of a naturally occurring AAV, or it may be modified.

25 In certain example embodiments, the AAV capsid protein is an engineered AAV capsid protein having reduced or eliminated uptake in a non-muscle cell as compared to a corresponding wild-type AAV capsid polypeptide.

In some embodiments, the engineered AAV capsid encoding polynucleotide can be included in a polynucleotide that is configured to be an AAV genome donor in an AAV vector system that  
30 can be used to generate engineered AAV particles described elsewhere herein. In some embodiments, the engineered AAV capsid encoding polynucleotide can be operably coupled to a poly adenylation tail. In some embodiments, the poly adenylation tail can be an SV40 poly

adenylation tail. In some embodiments, the AAV capsid encoding polynucleotide can be operably coupled to a promoter. In some embodiments, the promoter can be a tissue specific promoter. In some embodiments, the tissue specific promoter is specific for muscle (e.g., cardiac, skeletal, and/or smooth muscle), neurons and supporting cells (e.g., astrocytes, glial cells, Schwann cells, etc.), fat, spleen, liver, kidney, immune cells, spinal fluid cells, synovial fluid cells, skin cells, cartilage, tendons, connective tissue, bone, pancreas, adrenal gland, blood cell, bone marrow cells, placenta, endothelial cells, and combinations thereof. In some embodiments, the promoter can be a constitutive promoter. Suitable tissue specific promoters and constitutive promoters are discussed elsewhere herein and are generally known in the art and can be commercially available. Suitable muscle specific promoters include, but are not limited to CK8, MHCK7, Myoglobin promoter (Mb), Desmin promoter, muscle creatine kinase promoter (MCK) and variants thereof, and SPc5-12 synthetic promoter.

Described herein are various embodiments of engineered viral capsids, such as adeno-associated virus (AAV) capsids, that can be engineered to confer cell-specific tropism, such as muscle specific tropism, to an engineered viral particle. Engineered viral capsids can be lentiviral, retroviral, adenoviral, or AAV capsids. The engineered capsids can be included in an engineered virus particle (e.g., an engineered lentiviral, retroviral, adenoviral, or AAV virus particle), and can confer cell-specific tropism, reduced immunogenicity, or both to the engineered viral particle. The engineered viral capsids described herein can include one or more engineered viral capsid proteins described herein. The engineered viral capsids described herein can include one or more engineered viral capsid proteins described herein that can contain a muscle-specific targeting moiety containing or composed of an n-mer motif described elsewhere herein.

The engineered viral capsid and/or capsid proteins can be encoded by one or more engineered viral capsid polynucleotides. In some embodiments, the engineered viral capsid polynucleotide is an engineered AAV capsid polynucleotide, engineered lentiviral capsid polynucleotide, engineered retroviral capsid polynucleotide, or engineered adenovirus capsid polynucleotide. In some embodiments, an engineered viral capsid polynucleotide (e.g., an engineered AAV capsid polynucleotide, engineered lentiviral capsid polynucleotide, engineered retroviral capsid polynucleotide, or engineered adenovirus capsid polynucleotide) can include a 3' polyadenylation signal. The polyadenylation signal can be an SV40 polyadenylation signal.

The engineered viral capsids can be variants of wild-type viral capsid. For example, in some embodiments, the engineered AAV capsids can be variants of wild-type AAV capsids. In some

embodiments, the wild-type AAV capsids can be composed of VP1, VP2, VP3 capsid proteins or a combination thereof. In other words, the engineered AAV capsids can include one or more variants of a wild-type VP1, wild-type VP2, and/or wild-type VP3 capsid proteins. In some embodiments, the serotype of the reference wild-type  $\Delta\Delta V$  capsid can be  $\Delta\Delta V$ -1,  $\Delta\Delta V$ -2,  $\Delta\Delta V$ -3,  $\Delta\Delta V$ -4,  $\Delta\Delta V$ -5, AAV-6, AAV-8, AAV-9 or any combination thereof. In some embodiments, the serotype of the wild-type AAV capsid can be AAV-9. The engineered AAV capsids can have a different tropism than that of the reference wild-type AAV capsid.

The engineered viral capsid can contain 1-60 engineered capsid proteins. In some embodiments, the engineered viral capsids can contain 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, or 60 engineered capsid proteins. In some embodiments, the engineered viral capsid can contain 0-59 wild-type viral capsid proteins. In some embodiments, the engineered viral capsid can contain 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, or 59 wild-type viral capsid proteins.

In some embodiments, the engineered AAV capsid can contain 1-60 engineered capsid proteins. In some embodiments, the engineered AAV capsids can contain 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, or 60 engineered capsid proteins. In some embodiments, the engineered AAV capsid can contain 0-59 wild-type AAV capsid proteins. In some embodiments, the engineered AAV capsid can contain 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, or 59 wild-type AAV capsid proteins.

In some embodiments, the engineered viral capsid protein can have an n-mer amino acid motif, where n can be at least 3 amino acids. In some embodiments, n can be 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, or 15 amino acids. In some embodiments, an engineered AAV capsid can have a 6-mer or 7-mer amino acid motif. In some embodiments, the n-mer amino acid motif can be inserted between two amino acids in the wild-type viral protein (VP) (or capsid protein). In some embodiments, the n-mer motif can be inserted between two amino acids in a variable amino acid region in a viral capsid protein.

In some embodiments, the *n*-mer motif can be inserted between two amino acids in a variable amino acid region in an AAV capsid protein. The core of each wild-type AAV viral protein contains an eight-stranded beta-barrel motif (betaB to betaI) and an alpha-helix (alphaA) that are conserved in autonomous parvovirus capsids (see e.g., DiMattia et al. 2012. J. Virol. 86(12):6947-6958). Structural variable regions (VRs) occur in the surface loops that connect the beta-strands, which cluster to produce local variations in the capsid surface. AAVs have 12 variable regions (also referred to as hypervariable regions) (see e.g., Weitzman and Linden. 2011. "Adeno-Associated Virus Biology." In Snyder, R.O., Moullier, P. (eds.) Totowa, NJ: Humana Press). In some embodiments, one or more *n*-mer motifs can be inserted between two amino acids in one or more of the 12 variable regions in the wild-type AAV capsid proteins. In some embodiments, the one or more *n*-mer motifs can be each be inserted between two amino acids in VR-I, VR-II, VR-III, VR-IV, VR-V, VR-VI, VR-VII, VR-III, VR-IX, VR-X, VR-XI, VR-XII, or a combination thereof. In some embodiments, the *n*-mer can be inserted between two amino acids in the VR-III of a capsid protein. In some embodiments, the engineered capsid can have an *n*-mer inserted between any two contiguous amino acids between amino acids 262 and 269, between any two contiguous amino acids between amino acids 327 and 332, between any two contiguous amino acids between amino acids 382 and 386, between any two contiguous amino acids between amino acids 452 and 460, between any two contiguous amino acids between amino acids 488 and 505, between any two contiguous amino acids between amino acids 545 and 558, between any two contiguous amino acids between amino acids 581 and 593, between any two contiguous amino acids between amino acids 704 and 714 of an AAV9 viral protein. In some embodiments, the engineered capsid can have an *n*-mer inserted between amino acids 588 and 589 of an AAV9 viral protein. In some embodiments, the engineered capsid can have a 7-mer motif inserted between amino acids 588 and 589 of an AAV9 viral protein. In other embodiments, the motif inserted is a 10-mer motif, with replacement of amino acids 586-88 and an insertion before 589. SEQ ID NO. 2 is a reference AAV9 capsid sequence for at least referencing the insertion sites discussed above. It will be appreciated that *n*-mers can be inserted in analogous positions in AAV viral proteins of other serotypes. In some embodiments as previously discussed, the *n*-mer(s) can be inserted between any two contiguous amino acids within the AAV viral protein and in some embodiments the insertion is made in a variable region.

In some embodiments, the first 1, 2, 3, or 4 amino acids of an *n*-mer motif can replace 1, 2, 3, or 4 amino acids of a polypeptide into which it is inserted and preceding the insertion site. In

some embodiments, the amino acids of the n-mer motif that replace 1 or more amino acids of the polypeptide into which the n-mer motif is inserted come before or immediately before an “RGD” in an n-mer motif. For example, in one or more of the 10-mer inserts shown in e.g., Tables 2-3, the first three amino acids shown can replace 1-3 amino acids into a polypeptide to which they may be inserted. Using an AAV as another non-limiting example, one or more of the n-mer motifs can be inserted into e.g., and AAV9 capsid prolylpeptide between amino acids 588 and 589 and the insert can replace amino acids 586, 587, and 588 such that the amino acid immediately preceding the n-mer motif after insertion is residue 585. It will be appreciated that this principle can apply in any other insertion context and is not necessarily limited to insertion between residues 588 and 589 of an AAV9 capsid or equivalent position in another AAV capsid. It will further be appreciated that in some embodiments, no amino acids in the polypeptide into which the n-mer motif is inserted are replaced by the n-mer motif.

In some embodiments, the AAV capsids or other viral capsids or compositions can be muscle-specific. In some embodiments, muscle-specificity of the engineered AAV or other viral capsid or other composition is conferred by a muscle specific n-mer motif incorporated in the engineered AAV or other viral capsid or other composition described herein. While not intending to be bound by theory, it is believed that the n-mer motif confers a 3D structure to or within a domain or region of the engineered AAV capsid or other viral capsid or other composition such that the interaction of the viral particle or other composition containing the engineered AAV capsid or other viral capsid or other composition described herein has increased or improved interactions (e.g., increased affinity) with a cell surface receptor and/or other molecule on the surface of a muscle cell. In some embodiments, the cell surface receptor is AAV receptor (AAVR). In some embodiments, the cell surface receptor is a muscle cell specific AAV receptor. In some embodiments, the cell surface receptor or other molecule is a cell surface receptor or other molecule selectively expressed on the surface of a muscle cell. In some embodiments, the cell surface receptor or molecule is an integrin or dimer thereof. In some embodiments, the cell surface receptor or molecule is an Vb6 integrin heterodimer.

In some embodiments, a muscle specific engineered viral particle or other composition described herein containing the muscle-specific capsid, n-mer motif, or muscle-specific targeting moiety described herein can have an increased uptake, delivery rate, transduction rate, efficiency, amount, or a combination thereof in a muscle cell as compared to other cells types and/or other

virus particles (including but not limited to AAVs) and other compositions that do not contain the muscle-specific n-mer motif of the present invention.

First- and second-generation muscle specific AAV capsids were developed using a muscle specific promoter and the resulting capsid libraries were screened in mice and non-human primates as described elsewhere herein and/or in e.g., U.S. Provisional Application Serial Nos. 62/899,453, 62/916,207, 63/018,454, and 63/242,008. First and second generation myoAAV capsids were further optimized in mice and non-human primates as previously described to generate enhanced myoAAV capsids.

**Tables 1 and 2** show the top hits of enhanced muscle specific n-mer motifs and their encoding sequence in rank order within each table. Enhanced MyoAAV (eMyoAAV) capsid variants can transduce mouse muscle more effectively as compared to the first generation MyoAAV after systemic delivery. First and second generation myoAAV capsid variants are dependent on the  $\alpha$ V $\beta$ 6 integrin heterodimer for transduction of human primary myotubes.

**Tables 3 and 4** show top-ranking capsid variants produced in rounds of directed evolution of capsid variants for skeletal muscle specificity. As shown in the Tables above with respect to those variant n-mer inserts containing P-motifs, the first three amino acids of the variant sequences shown are amino acids that replaced amino acids corresponding to positions 596, 597, and 598 of an AAV9 capsid polypeptide. Thus, the P-motif, for example, was inserted between amino acids at positions 598 and 599 of an AAV9 vector.

#### ***DUX4-FL and Truncated Versions Thereof***

DUX4 is the double homeobox protein 4, and is expressed in myocytes. DUX4-FL (SEQ ID NO. 1) is the double homeobox protein 4 gene; DUX4-FL is the wild type of the gene that is pathogenic in patients with FSHD. DUX4-FL causes pathogenesis by overproduction of the DUX4 protein. DUX4-FL is located on the D4Z4 region of the chromosome 4.

Together with a linker and a V5 epitope 17 amino acids long, truncated versions of the DUX4 protein include DUX4-S, which is the first 159 amino acids of DUX4-FL (SEQ ID NO. 3), delMid, which is amino acids 1-159, 343-424, delDC2, which is amino acids 1-374, delDC1/2, which is amino acids 1-342, S+DC1, which is amino acids 1-159, 343-374, S+DC2, which is 1-159, 375-424, S+375-397, which is amino acids 1-159, 375-397, S+398-424, which is amino acids 1-159, 398-424, or del405-424, which is amino acids 1-404. The linker is amino acid sequence LEGTRFE, and the V5 epitope is amino acid sequence GKPIP NPLLGLDSTRITG. These truncations are described

in Mitsuhashi et al., (*Biology Open* (2018 Apr. 26; 7(4), bio033977, doi:10.1242/bio.033977), which is incorporated by reference herein as if expressed in its entirety

Advantageously, truncated DUX4 genes may cause reduced expression of the DUX4 protein. Truncated DUX4 genes do not result in the same pathology, wherein the DUX4 protein is not over expressed.

In aspects of the invention, truncated forms of DUX4 are expressed by a nucleic acid molecule. "Nucleic acid molecule" or "polynucleotide" refers to a polymeric compound including covalently linked nucleotides comprising natural subunits (e.g., purine or pyrimidine bases). Purine bases include adenine and guanine, and pyrimidine bases include uracil, thymine, and cytosine. Nucleic acid molecules include polyribonucleic acid (RNA) and polydeoxyribonucleic acid (DNA), which includes cDNA, genomic DNA, and synthetic DNA, either of which may be single or double-stranded. A nucleic acid molecule encoding an amino acid sequence includes all nucleotide sequences that encode the same amino acid sequence.

The term "expression," as used herein, refers to the process by which a polypeptide is produced based on the encoding sequence of a nucleic acid molecule, such as a gene. The process may include transcription, post-transcriptional control, post-transcriptional modification, translation, post-translational control, post-translational modification, or any combination thereof. An expressed nucleic acid molecule is typically operably linked to an expression control sequence (e.g., a promoter).

In aspects of the invention, the truncated form of DUX4 may be a functional variant of the polypeptide. A "functional variant" refers to a polypeptide or polynucleotide that is structurally similar or substantially structurally similar to a parent or reference compound of this disclosure, but differs, in some contexts slightly, in composition (e.g., one base, atom, or functional group is different, added, or removed; or one or more amino acids are substituted, mutated, inserted, or deleted), such that the polypeptide or encoded polypeptide is capable of performing at least one function of the encoded parent polypeptide with at least 50% efficiency of activity of the parent polypeptide.

In aspects of the invention, the functional variant may have at least 70% homology, at least 80% homology, at least 90% homology, at least 95% homology, or at least 99% homology with the reference/parent polypeptide disclosed herein.

As used herein, a "functional portion" or "functional fragment" refers to a polypeptide or polynucleotide that comprises only a domain, motif, portion, or fragment of a parent or reference

compound, and the polypeptide or encoded polypeptide retains at least 50% activity associated with the domain, portion, or fragment of the parent or reference compound. In specific aspects, variants are at least 60% as efficient, at least 70% as efficient, at least 80% efficient, at least 90% as efficient, at least 95% as efficient, or at least 99% as efficient as the reference/parent polypeptides disclosed  
5 herein.

The invention discloses compositions and methods for treating Facioscapulohumeral Muscular Dystrophy (“FSHD”) that comprise a nucleic acid sequence encoding a modified copy of the double homeobox protein 4 (“DUX4”). Without being bound to a mechanism of action, the present invention benefits from the insight that the DUX4 gene presents in FSHD patients as a full-  
10 length form, known as DUX4-FL, and that modifications to the DUX4-FL gene can result in non-pathogenic expression of a truncated DUX4 protein. The invention further benefits from the discovery that adeno-associated virus (“AAV”) vectors may be modified to target muscle tissue and detarget liver tissue *in vivo*, allowing for effective delivery of the gene product to a subject.

Accordingly, aspects of the invention provide an adeno-associated virus (AAV) vector  
15 comprising: a nucleic acid sequence encoding a truncated portion of the full-length DUX4-FL sequence operably linked to a muscle specific promoter, and a capsid protein. The full-length sequence of the DUX4-FL protein (SEQ ID NO. 1) and variants of the protein are discussed in Mitsuhashi et al. (2018) *Biology Open* 7(4):bio033977, the entirety of the contents of which are incorporated by reference herein in their entirety.

For example, the truncated portion of the full-length DUX4-FL sequence may comprise  
20 amino acids 1-159 of the full-length amino acid sequence of DUX4-FL (SEQ ID NO. 3). The truncated portion of the full-length DUX4-FL sequence may comprise amino acids 19-159 of a full-length amino acid sequence of DUX4-FL (SEQ ID NO. 4). The truncated portion of the full-length DUX4-FL sequence may comprise amino acids 1-343 of a full-length amino acid sequence of DUX-  
25 4FL (SEQ ID NO.: 5).

Specific portions of the DUX4-FL sequence may be removed. For example, the truncated portion of the full-length DUX4-FL sequence may comprise a full-length amino acid sequence of DUX4-FL (SEQ ID NO. 1) in which amino acids 344-404 and 405-424 have been removed.

In aspects of the invention, the capsid protein may comprise at least one modification that  
30 results in reduced liver-tropism of the AAV vector. The capsid protein may comprise at least one modification that results in preferential targeting of the AAV vector to muscle tissue. The capsid protein may comprise at least one modification that results in reduced liver-tropism of the AAV

vector, and at least one modification that results in preferential targeting of the AAV vector to muscle tissue.

For example, the capsid protein may comprise at least one modification that is an insertion between any two contiguous amino acids between amino acids 262-269, 327-332, 382-386, 452-460, 488-505, 527-539, 545-558, 581-593, 704-714, or any combination thereof in an AAV9 capsid polypeptide or in an analogous position in an AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV rh.74, AAV rh.10 capsid polypeptide.

The capsid protein may comprise at least one modification that is a replacement of amino acids 586-88 and an insertion between amino acids 588 and 589 in an AAV9 capsid polypeptide or in an analogous position in an AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV rh.74, AAV rh.10 capsid polypeptide. For example, the capsid protein may comprise at least one modification that is a replacement of amino acids 586-88 and an insertion between amino acids 588 and 589 in an AAV9 capsid polypeptide and the insertion may be selected from the sequences in Table 1 or Table 2, hereinbelow.

In aspects of the invention, the muscle specific promoter may be MHCK7. For example, the AAV vector may comprise the truncated DUX-4FL sequence that comprises amino acids 1-159 of a full-length amino acid sequence of DUX-4FL (SEQ ID NO. 1), a capsid protein comprising at least one modification that is a replacement of amino acids 586-88 and an insertion between amino acids 588 and 589 in an AAV9 capsid polypeptide wherein the insertion is selected from the sequences in Tables 1-4, and the muscle specific promoter may be MHCK7.

Aspects of the invention further provide a method of treating a DUX-4 associated disorder in a subject, the method comprising: administering to a subject a composition comprising a nucleic acid sequence encoding a truncated portion of the full-length DUX-4FL sequence or an amino acid sequence expressed by the truncated portion of the full-length DUX-4FL sequence.

The adeno-associated virus (AAV) vector may comprise a nucleic acid sequence encoding the truncated portion of the full-length DUX-4FL sequence operably linked to a muscle specific promoter, and a capsid protein.

For example, the truncated portion of the full-length DUX-4FL sequence may comprise amino acids 1-159 of the full-length amino acid sequence of DUX-4FL (SEQ ID NO. 3). The truncated portion of the full-length DUX-4FL sequence may comprise amino acids 19-159 of a full-length amino acid sequence of DUX-4FL (SEQ ID NO. 4). The truncated portion of the full-length

DUX-4FL sequence may comprise amino acids 1-343 of a full-length amino acid sequence of DUX-4FL (SEQ ID NO. 5).

Specific portions of the DUX-4FL sequence may be removed. For example, the truncated portion of the full-length DUX-4FL sequence may comprise a full-length amino acid sequence of DUX-4FL (SEQ ID NO. 1) in which amino acids 344-404 and 405-424 have been removed.

In aspects of the invention, the capsid protein may comprise at least one modification that results in reduced liver-tropism of the AAV vector. The capsid protein may comprise at least one modification that results in preferential targeting of the AAV vector to muscle tissue. The capsid protein may comprise at least one modification that results in reduced liver-tropism of the AAV vector, and at least one modification that results in preferential targeting of the AAV vector to muscle tissue.

For example, the capsid protein may comprise at least one modification that is an insertion between any two contiguous amino acids between amino acids 262-269, 327-332, 382-386, 452-460, 488-505, 527-539, 545-558, 581-593, 704-714, or any combination thereof in an AAV9 capsid polypeptide or in an analogous position in an AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV rh.74, AAV rh.10 capsid polypeptide.

The capsid protein may comprise at least one modification that is a replacement of amino acids 586-88 and an insertion between amino acids 588 and 589 in an AAV9 capsid polypeptide or in an analogous position in an AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV rh.74, AAV rh.10 capsid polypeptide. For example, the capsid protein may comprise at least one modification that is a replacement of amino acids 586-88 and an insertion between amino acids 588 and 589 in an AAV9 capsid polypeptide and the insertion may be selected from the sequences in Tables 1-4, hereinbelow.

In aspects of the invention, the muscle specific promoter may be MHCK7. For example, the AAV vector may comprise the truncated portion of the full-length DUX-4FL sequence that comprises amino acids 1-159 of a full-length amino acid sequence of DUX-4FL (SEQ ID NO.: 3), a capsid protein comprising at least one modification that is a replacement of amino acids 586-88 and an insertion between amino acids 588 and 589 in an AAV9 capsid polypeptide wherein the insertion is selected from the sequences in Tables 1-4, and the muscle specific promoter may be MHCK7.

In aspects of the method, the DUX4 associated disorder may be facioscapulohumeral muscular dystrophy (FSHD). In aspects of the method, the composition may be administered to the subject intramuscularly.

In aspects of the method, transcription of the nucleic acid results in expression of a truncated DUX4 protein. Expression of the truncated DUX4 protein may inhibit activity and/or expression of the full-length DUX4 protein. The truncated DUX4 protein may inhibit Trim36 and Wfdc3 expression.

5 Further embodiments of the invention comprise an adeno-associated virus (AAV) vector comprising a promoter sequence, a miRNA strand that binds to DUX4-FL, and a capsid protein comprising at least one modification that is an insertion between any two contiguous amino acids between amino acids 262-269, 327-332, 382-386, 452-460, 488-505, 527-539, 545-558, 581-593, 704-714, or any combination thereof in an AAV9 capsid polypeptide or in an analogous position in an AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV rh.74, AAV rh.10 capsid  
10 polypeptide.

In aspects of the invention, the promoter sequence may be a promoter sequence transcribed by RNA polymerase II or III, U6 promoter sequence, MHCK7 promoter sequence, CK6 promoter sequence, tMCK promoter sequence, CK5 promoter sequence, MCK promoter sequence, HAS  
15 promoter sequence, MPZ promoter sequence, desmin promoter sequence, APOA2 promoter sequence, hAAT promoter sequence, INS promoter sequence, IRS2 promoter sequence, MYH6 promoter sequence, MYL2 promoter sequence, TNNT3 promoter sequence, SYN1 promoter sequence, GFAP promoter sequence, NES promoter sequence, MBP promoter sequence, or a TH promoter sequence. The miRNA strand may be selected from the group of miDUX4, miRN92,  
20 miRNA-17, miRNA-18a, miRNA-19a, miRNA-20a, miRNA-19b-1, miRNA-26a, miRNA-126, miRNA-335, let-7a and let-7b, miRNA-34, miRNA-34a, miRNA-10b, miRNA-208, miRNA-499, miRNA-195, miRNA-29a, miRNA-29b, or miRNA-29c.

The miRNA strand may also be selected from the group of SEQ ID NOs. 1250-1305. The miRNA strand may also comprise 5-6 thymidines at the 5' end.

25 In an embodiment of the invention, the capsid protein comprises at least one modification that results in reduced liver-tropism of the AAV vector, or at least one modification that results in preferential targeting of the AAV vector to muscle tissue, or both. The capsid protein may be selected from the sequences in Tables 1 - 4.

In an embodiment of the invention, the vector further comprises a nuclear export sequence  
30 enabling nuclear spreading.

### ***Micro RNA***

5 MiRNA-based therapies, including miRNA inhibition and miRNA replacement, may be used to treat many diseases such as hepatitis C viral infection, muscular dystrophies, neurodegenerative diseases, peripheral neuropathies, chronic heart failure and post-myocardial infarction remodeling and cancers. In addition, miRNA directed regulation of gene expression may improve traditional gene therapy approaches in which the vector payload is a protein coding gene. Systemically delivered AAV vectors preferentially transduce the liver, resulting in high-level transgene expression in that organ if a liver-active promoter is used. As described in detail herein, the insertion of liver-specific miR-122 binding sites reduce transgene expression in the liver when a liver-specific promoter is used.

10 The nucleic acid molecule of the disclosure comprises a mature guide strand of a miRNA to knockdown expression of the DUX4 gene. This system may be used with any tissue specific promoter or gene expression control element and any miRNA sequences. For example, in order to promote expression of miRNA sequence in skeletal muscle and to detarget expression of the miRNA in liver and heart tissue, the nucleic acid molecule comprises the mature guide stand of the miRNA in which the binding sites for liver specific miR-122 and/or the binding site for heart specific miR-208 are inserted within the loop of the mature guide strand or at the 5' or 3' end of the mature guide strand of the miRNA .

20 There are two miR-208 sequences in the human and mouse genome (miR-208a and miR-208b). To avoid a run of 5 U's (pol III promoter termination sequence), in the above exemplary sequences, a single base in the binding site was mutated to a "c" (lower-case bolded "c"). This change was included because it creates a perfect binding site for mir-208b, but will have a mismatch with mir-208a. If detargeting expression of a miRNA in skeletal muscle is desired, binding sites for miR-1, miR-206 or miR-133 are inserted within the loop of the mature guide strand of the miRNA or at the 5' or 3' end of the mature guide strand of the miRNA.

30 There are two miR-208 sequences in the human and mouse genome (miR-208a and miR-208b). To avoid a run of 5 U's (pol III promoter termination sequence), in the following exemplary sequences, a single base in the binding site was mutated to a "c" (lower-case bolded "c"). This change was included because it creates a perfect binding site for mir-208b, but will have a mismatch with mir-208a.

The nucleic acid molecules of the disclosure may comprise the sequence of the mature guide strand of any miRNA transcript sequence desired to have tissue-specific expression. For example, in

one embodiment, skeletal expression of DUX4 miRNA is contemplated. Exemplary DUX4 miRNA sequences are provided in International Patent Application No. PCT/US2012/047999 (WO 2013/016352) and US patent publication no. US 2012-20225034 incorporated by reference herein in their entirety.

5 Two examples of miDUX4 are miDUX4-1: and miDUX4-2. Exemplary nucleotide sequences comprising the DUX4 miRNA and the binding site for either miR-122 or miR-208 are provided in Table 5.

Any human miRNA may be expressed using the nucleic acid molecules of the disclosure, including those set out in the miRBase: the microRNA database websites (miRBase.org), which are  
10 incorporated by reference herein in its entirety. Examples include but not limited to the following: miR-122, miR-124, miR-142, miR-155, miR-21, miR-17-92, miR-17, miR-18a, miR-19a, miR-20a, miR-19b-1, miR-26a, miR-126, miR-335, let-7 family: let-7a and let-7b, miR-34 (miR-34a), miR-10b, miR-208, miR-499, miR-195, miR-29a, miR-29b, and miR-29c. Additional exemplary miRNA are set out below in Table 6 above. Any of these miRNA may be used with different detargeting sequences,  
15 depending of the desired tissue specificity and desired detargeting.

The AAV vector of claim 35, wherein the miRNA strand is selected from the group of in table 5.

The AAV vector of claim 35, wherein the miRNA strand further comprises 5-6 thymidines at the 5' end. The AAV vector of claim 35, wherein the miRNA strand is the binding site for  
20 miRNA-122 or miRNA 208.

Embodiments of the invention further provide methods of decreasing gene expression in a cell. The method may include providing the AAV vector to a subject, the vector comprised as noted within this section.

Further microRNA sequences are described in U.S. Patent Publication Nos. 2020-0248179,  
25 2019-0300903, 2019-0136235, 2019-0024083, 2017-0029849, and 2014-0322169, the contents of each of which are incorporated by reference herein.

### ***Pharmaceutical Composition***

Some embodiments of the invention may include any acceptable form of providing the AAV  
30 vector to a subject. For example, the AAV vector may be provided to the subject in the form of a composition or formulation comprising the AAV vector. The expression vector of this invention can be formulated and administered to treat a variety of disease states by any means that produces

contact of the active ingredient with the agent's site of action in the body of the subject. The compositions, polynucleotides, polypeptides, particles, cells, vector systems and combinations thereof described herein can be contained in a formulation, such as a pharmaceutical formulation. In some embodiments, the formulations can be used to generate polypeptides and other particles that include one or more muscle-specific targeting moieties described herein. In some embodiments, the formulations can be delivered to a subject in need thereof. In some embodiments, component(s) of the engineered AAV capsid system, engineered cells, engineered AAV capsid particles, and/or combinations thereof described herein can be included in a formulation that can be delivered to a subject or a cell. In some embodiments, the formulation is a pharmaceutical formulation. One or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein can be provided to a subject in need thereof or a cell alone or as an active ingredient, such as in a pharmaceutical formulation. As such, also described herein are pharmaceutical formulations containing an amount of one or more of the polypeptides, polynucleotides, vectors, cells, or combinations thereof described herein. In some embodiments, the pharmaceutical formulation can contain an effective amount of the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein. The pharmaceutical formulations described herein can be administered to a subject in need thereof or a cell.

In some embodiments, the amount of the one or more of the polypeptides, polynucleotides, vectors, cells, virus particles, nanoparticles, other delivery particles, and combinations thereof described herein contained in the pharmaceutical formulation can range from about 1 pg/kg to about 10 mg/kg based upon the bodyweight of the subject in need thereof or average bodyweight of the specific patient population to which the pharmaceutical formulation can be administered. The amount of the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein in the pharmaceutical formulation can range from about 1 pg to about 10 g, from about 10 nL to about 10 ml. In embodiments where the pharmaceutical formulation contains one or more cells, the amount can range from about 1 cell to  $1 \times 10^2$ ,  $1 \times 10^3$ ,  $1 \times 10^4$ ,  $1 \times 10^5$ ,  $1 \times 10^6$ ,  $1 \times 10^7$ ,  $1 \times 10^8$ ,  $1 \times 10^9$ ,  $1 \times 10^{10}$  or more cells. In embodiments where the pharmaceutical formulation contains one or more cells, the amount can range from about 1 cell to  $1 \times 10^2$ ,  $1 \times 10^3$ ,  $1 \times 10^4$ ,  $1 \times 10^5$ ,  $1 \times 10^6$ ,  $1 \times 10^7$ ,  $1 \times 10^8$ ,  $1 \times 10^9$ ,  $1 \times 10^{10}$  or more cells per nL,  $\mu$ L, mL, or L.

In embodiments, where engineered AAV capsid particles are included in the formulation, the formulation can contain 1 to  $1 \times 10^2$ ,  $1 \times 10^3$ ,  $1 \times 10^4$ ,  $1 \times 10^5$ ,  $1 \times 10^6$ ,  $1 \times 10^7$ ,  $1 \times 10^8$ ,  $1 \times 10^9$ ,  $1 \times 10^{10}$ ,  $1 \times 10^{11}$ ,  $1 \times 10^{12}$ ,  $1 \times 10^{13}$ ,  $1 \times 10^{14}$ ,  $1 \times 10^{15}$ ,  $1 \times 10^{16}$ ,  $1 \times 10^{17}$ ,  $1 \times 10^{18}$ ,  $1 \times 10^{19}$ , or  $1 \times 10^{20}$

transducing units (TU)/mL of the engineered AAV capsid particles. In some embodiments, the formulation can be 0.1 to 100 mL in volume and can contain 1 to  $1 \times 10^2$ ,  $1 \times 10^3$ ,  $1 \times 10^4$ ,  $1 \times 10^5$ ,  $1 \times 10^6$ ,  $1 \times 10^7$ ,  $1 \times 10^8$ ,  $1 \times 10^9$ ,  $1 \times 10^{10}$ ,  $1 \times 10^{11}$ ,  $1 \times 10^{12}$ ,  $1 \times 10^{13}$ ,  $1 \times 10^{14}$ ,  $1 \times 10^{15}$ ,  $1 \times 10^{16}$ ,  $1 \times 10^{17}$ ,  $1 \times 10^{18}$ ,  $1 \times 10^{19}$ , or  $1 \times 10^{20}$  transducing units (TU)/mL of the engineered AAV capsid particles.

5

### ***Pharmaceutically Acceptable Carriers and Auxiliary Ingredients and Agents***

In embodiments, the pharmaceutical formulation containing an amount of one or more of the polypeptides, polynucleotides, vectors, cells, virus particles, nanoparticles, other delivery particles, and combinations thereof described herein can further include a pharmaceutically acceptable carrier. Suitable pharmaceutically acceptable carriers include, but are not limited to, water, salt solutions, alcohols, gum arabic, vegetable oils, benzyl alcohols, polyethylene glycols, gelatin, carbohydrates such as lactose, amylose or starch, magnesium stearate, talc, silicic acid, viscous paraffin, perfume oil, fatty acid esters, hydroxy methylcellulose, and polyvinyl pyrrolidone, which do not deleteriously react with the active composition.

15 The pharmaceutical formulations can be sterilized, and if desired, mixed with auxiliary agents, such as lubricants, preservatives, stabilizers, wetting agents, emulsifiers, salts for influencing osmotic pressure, buffers, coloring, flavoring and/or aromatic substances, and the like which do not deleteriously react with the active composition.

In some embodiments, the pharmaceutical formulations described herein may be in a dosage form. The dosage forms can be adapted for administration by any appropriate route. Appropriate routes include, but are not limited to, oral (including buccal or sublingual), rectal, epidural, intracranial, intraocular, inhaled, intranasal, topical (including buccal, sublingual, or transdermal), vaginal, intraurethral, parenteral, intracranial, subcutaneous, intramuscular, intravenous, intraperitoneal, intradermal, intraosseous, intracardiac, intraarticular, intracavernous, intrathecal, intravitreal, intracerebral, gingival, subgingival, intracerebroventricular, and intradermal. Such formulations may be prepared by any method known in the art.

Dosage forms adapted for oral administration can be discrete dosage units such as capsules, pellets or tablets, powders or granules, solutions, or suspensions in aqueous or non- aqueous liquids; edible foams or whips, or in oil-in-water liquid emulsions or water-in-oil liquid emulsions. In some embodiments, the pharmaceutical formulations adapted for oral administration also include one or more agents which flavor, preserve, color, or help disperse the pharmaceutical formulation. Dosage forms prepared for oral administration can also be in the form of a liquid solution that can be

30

delivered as foam, spray, or liquid solution. In some embodiments, the oral dosage form can contain about 1 ng to 1000 g of a pharmaceutical formulation containing a therapeutically effective amount or an appropriate fraction thereof of the targeted effector fusion protein and/or complex thereof or composition containing the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein. The oral dosage form can be administered to a subject in need thereof.

Where appropriate, the dosage forms described herein can be microencapsulated.

The dosage form can also be prepared to prolong or sustain the release of any ingredient. In some embodiments, the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein can be the ingredient whose release is delayed. In other embodiments, the release of an optionally included auxiliary ingredient is delayed. Suitable methods for delaying the release of an ingredient include, but are not limited to, coating or embedding the ingredients in material in polymers, wax, gels, and the like. Delayed release dosage formulations can be prepared as described in standard references such as "Pharmaceutical dosage form tablets," eds. Liberman et. al. (New York, Marcel Dekker, Inc., 1989), "Remington - The science and practice of pharmacy", 20th ed., Lippincott Williams & Wilkins, Baltimore, MD, 2000, and "Pharmaceutical dosage forms and drug delivery systems", 6th Edition, Ansel et al., (Media, PA: Williams and Wilkins, 1995). These references provide information on excipients, materials, equipment, and processes for preparing tablets and capsules and delayed release dosage forms of tablets and pellets, capsules, and granules. The delayed release can be anywhere from about an hour to about 3 months or more.

Examples of suitable coating materials include, but are not limited to, cellulose polymers such as cellulose acetate phthalate, hydroxypropyl cellulose, hydroxypropyl methylcellulose, hydroxypropyl methylcellulose phthalate, and hydroxypropyl methylcellulose acetate succinate; polyvinyl acetate phthalate, acrylic acid polymers and copolymers, and methacrylic resins that are commercially available under the trade name EUDRAGIT® (Roth Pharma, Westerstadt, Germany), zein, shellac, and polysaccharides.

Coatings may be formed with a different ratio of water-soluble polymer, water insoluble polymers, and/or pH dependent polymers, with or without water insoluble/water soluble non-polymeric excipient, to produce the desired release profile. The coating is either performed on the dosage form (matrix or simple) which includes, but is not limited to, tablets (compressed with or

without coated beads), capsules (with or without coated beads), beads, particle compositions, "ingredient as is" formulated as, but not limited to, suspension form or as a sprinkle dosage form.

Dosage forms adapted for topical administration can be formulated as ointments, creams, suspensions, lotions, powders, solutions, pastes, gels, sprays, aerosols, or oils. In some embodiments  
5 for treatments of the eye or other external tissues, for example the mouth or the skin, the pharmaceutical formulations are applied as a topical ointment or cream. When formulated in an ointment, the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein can be formulated with a paraffinic or water-miscible ointment base. In some embodiments, the active ingredient can be formulated in a cream with an oil-in-water cream  
10 base or a water-in-oil base. Dosage forms adapted for topical administration in the mouth include lozenges, pastilles, and mouth washes.

Dosage forms adapted for nasal or inhalation administration include aerosols, solutions, suspension drops, gels, or dry powders. In some embodiments, the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein is contained in a dosage  
15 form adapted for inhalation is in a particle-size-reduced form that is obtained or obtainable by micronization. In some embodiments, the particle size of the size reduced (e.g., micronized) compound or salt or solvate thereof, is defined by a D50 value of about 0.5 to about 10 microns as measured by an appropriate method known in the art. Dosage forms adapted for administration by inhalation also include particle dusts or mists. Suitable dosage forms wherein the carrier or excipient  
20 is a liquid for administration as a nasal spray or drops include aqueous or oil solutions/suspensions of an active ingredient (e.g., the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein and/or auxiliary active agent), which may be generated by various types of metered dose pressurized aerosols, nebulizers, or insufflators.

In some embodiments, the dosage forms can be aerosol formulations suitable for  
25 administration by inhalation. In some of these embodiments, the aerosol formulation can contain a solution or fine suspension of the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein and a pharmaceutically acceptable aqueous or non-aqueous solvent. Aerosol formulations can be presented in single or multi-dose quantities in sterile form in a sealed container. For some of these embodiments, the sealed container is a single dose or  
30 multi-dose nasal, or an aerosol dispenser fitted with a metering valve (e.g., metered dose inhaler), which is intended for disposal once the contents of the container have been exhausted.

Where the aerosol dosage form is contained in an aerosol dispenser, the dispenser contains a suitable propellant under pressure, such as compressed air, carbon dioxide, or an organic propellant, including but not limited to a hydrofluorocarbon. The aerosol formulation dosage forms in other embodiments are contained in a pump-atomizer. The pressurized aerosol formulation can also contain a solution or a suspension of one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein. In further embodiments, the aerosol formulation can also contain co-solvents and/or modifiers incorporated to improve, for example, the stability and/or taste and/or fine particle mass characteristics (amount and/or profile) of the formulation. Administration of the aerosol formulation can be once daily or several times daily, for example 2, 3, 4, or 8 times daily, in which 1, 2, or 3 doses are delivered each time.

For some dosage forms suitable and/or adapted for inhaled administration, the pharmaceutical formulation is a dry powder inhalable formulation. In addition to the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein, an auxiliary active ingredient, and/or pharmaceutically acceptable salt thereof, such a dosage form can contain a powder base such as lactose, glucose, trehalose, mannitol, and/or starch. In some of these embodiments, the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein is in a particle-size reduced form. In further embodiments, a performance modifier, such as L-leucine or another amino acid, cellobiose octaacetate, and/or metals salts of stearic acid, such as magnesium or calcium stearate.

In some embodiments, the aerosol dosage forms can be arranged so that each metered dose of aerosol contains a predetermined amount of an active ingredient, such as the one or more of the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein.

Dosage forms adapted for vaginal administration can be presented as pessaries, tampons, creams, gels, pastes, foams, or spray formulations. Dosage forms adapted for rectal administration include suppositories or enemas.

Dosage forms adapted for parenteral administration and/or adapted for any type of injection (e.g. intravenous, intraperitoneal, subcutaneous, intramuscular, intradermal, intraosseous, epidural, intracardiac, intraarticular, intracavernous, gingival, subgingival, intrathecal, intravitreal, intracerebral, and intracerebroventricular) can include aqueous and/or non-aqueous sterile injection solutions, which can contain anti-oxidants, buffers, bacteriostats, solutes that render the composition isotonic with the blood of the subject, and aqueous and non-aqueous sterile suspensions, which can include

suspending agents and thickening agents. The dosage forms adapted for parenteral administration can be presented in a single- unit dose or multi-unit dose containers, including but not limited to sealed ampoules or vials. The doses can be lyophilized and resuspended in a sterile carrier to reconstitute the dose prior to administration. Extemporaneous injection solutions and suspensions  
5 can be prepared in some embodiments, from sterile powders, granules, and tablets.

Dosage forms adapted for ocular administration can include aqueous and/or nonaqueous sterile solutions that can optionally be adapted for injection, and which can optionally contain anti-oxidants, buffers, bacteriostats, solutes that render the composition isotonic with the eye or fluid contained therein or around the eye of the subject, and aqueous and nonaqueous sterile suspensions,  
10 which can include suspending agents and thickening agents.

For some embodiments, the dosage form contains a predetermined amount of the one or more of the polypeptides, polynucleotides, vectors, cells, and combinations thereof described herein per unit dose. In some embodiments, the predetermined amount of the Such unit doses may therefore be administered once or more than once a day. Such pharmaceutical formulations may be  
15 prepared by any of the methods well known in the art.

### ***DUX4 and Facioscapulohumeral Muscular Dystrophy***

Muscular dystrophies (MDs) are a group of genetic diseases. The group is characterized by progressive weakness and degeneration of the skeletal muscles that control movement or breathing.  
20 Some forms of MD develop in infancy or childhood, while others may not appear until middle age or later. The disorders differ in terms of the distribution and extent of muscle weakness (some forms of MD also affect cardiac muscle), the age of onset, the rate of progression, and the pattern of inheritance.

Facioscapulohumeral muscular dystrophy (FSHD) is a complex autosomal dominant  
25 disorder characterized by progressive and asymmetric weakness of facial, shoulder and limb muscles. Symptoms typically arise in adulthood with most patients showing clinical features before age thirty. About five percent of patients develop symptoms as infants or juveniles and these are generally more severely affected. Clinical presentation can vary from mild (some limited muscle weakness) to severe (wheelchair dependence). Historically, FSHD was classified as the third most common MD, affecting one in 20,000 individuals worldwide. However, recent data indicate FSHD is the most  
30 common MD in Europe, suggesting its worldwide incidence could be as high as 1 in 8,333. Typical FSHD cases (FSHD1A, heretofore referred to as FSHD) are linked to heterozygous chromosomal

deletions that decrease the copy number of 3.3 kilobase (kb) D4Z4 repeats on human chromosome 4q35. Simplistically, normal individuals have 11-100 tandemly-repeated D4Z4 copies on both 4q35 alleles, while patients with FSHD have one normal and one contracted allele containing 1-10 repeats. In addition, FSHD-associated D4Z4 contractions must occur on specific disease-permissive chromosome 4q35 backgrounds (called 4qA). Importantly, no genes are completely lost or structurally mutated as a result of FSHD-associated deletions. Instead, genetic changes associated with FSHD give rise to expression of the toxic DUX4 gene, which is damaging to muscle. FSHD2 (also known as FSHD1B) is phenotypically identical to FSHD1, is associated with DUX4 expression, and requires the 4qA chromosomal background. FSHD2 is not associated with D4Z4 repeat contraction, but is instead caused by mutation in the SMCHD1 gene, which is a chromatin regulator normally involved in repressing the DUX4 locus at 4qA. Mutated SMCHD1 proteins fail to participate in adding heterochromatin to the 4qA DUX4 allele, thereby allowing DUX4 gene expression.

In the leading FSHD pathogenesis model, D4Z4 contractions are proposed to cause epigenetic changes that permit expression of the DUX4 gene. As a result, the aberrant over-expression of otherwise silent or near-silent DUX4 gene, and the genes it regulates, may ultimately cause FSHD. This model is consistent with data showing normal 4q35 D4Z4 repeats have heterochromatin characteristics, while FSHD-linked D4Z4 repeats contain marks more indicative of actively transcribed euchromatin. These transcription-permissive epigenetic changes, coupled with the observation that complete monosomic D4Z4 deletions (i.e., zero repeats) do not cause FSHD, support the hypothesis that D4Z4 repeats harbor potentially myopathic open reading frames (ORFs), which are abnormally expressed in FSHD muscles. This notion was initially considered in 1994, when a D4Z4-localized ORF, called DUX4, was first identified. However, the locus had some characteristics of an unexpressed pseudogene and DUX4 was therefore summarily dismissed as an FSHD candidate. For many years thereafter, the search for FSHD-related genes was mainly focused outside the D4Z4 repeats, and although some intriguing candidates emerged from these studies, no single gene had been conclusively linked to FSHD development. This slow progress led to the re-emergence of DUX4 as an FSHD candidate in 2007.

The role of DUX4 in FSHD pathogenesis can be explained as follows. First, D4Z4 repeats contain identical DUX4 coding regions, and D4Z4 repeats also harbor smaller sense and antisense transcripts, including some resembling microRNAs. Over-expressed DUX4 transcripts and a .about.50 kDa full-length DUX4 protein are found in biopsies and cell lines from FSHD patients.

These data are consistent with a transcriptional de-repression model of FSHD pathogenesis. In addition, unlike pseudogenes, D4Z4 repeats and DUX4 likely have functional importance, since tandemly-arrayed D4Z4 repeats are conserved in at least eleven different placental mammalian species (non-placental animals lack D4Z4 repeats), with the greatest sequence conservation occurring within the DUX4 ORF. Second, over-expressed DUX4 is toxic to tissue culture cells and embryonic progenitors of developing lower organisms in vivo. This toxicity occurs at least partly through a pro-apoptotic mechanism, indicated by Caspase-3 activation in DUX4 transfected cells, and presence of TUNEL-positive nuclei in developmentally arrested *Xenopus* embryos injected with DUX4 mRNA at the two-cell stage. These findings are consistent with studies showing some pro-apoptotic proteins, including Caspase-3, are present in FSHD patient muscles. In addition to stimulating apoptosis, DUX4 may negatively regulate myogenesis. Human DUX4 inhibits differentiation of mouse C2C12 myoblasts in vitro, potentially by interfering with PAX3 and/or PAX7, and causes developmental arrest and reduced staining of some muscle markers when delivered to progenitor cells of zebrafish or *Xenopus* embryos. Finally, aberrant DUX4 function is directly associated with potentially important molecular changes seen in FSHD patient muscles. Specifically, full-length human DUX4 encodes an approximately 50 kDa double homeodomain transcription factor, and DUX4 targets can be found at elevated levels in FSHD patient muscles. These data support that DUX4 catalyzes numerous downstream molecular changes that are incompatible with maintaining normal muscle integrity.

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#### ***Application of Nuclear Spreading to Facioscapulohumeral Muscular Dystrophy (FSHD)***

A DUX4 Dominant Negative can compete with full-length DUX4 to prevent DUX4-mediated transcription. One such construct is S+375-397 DUX4, which contains HIOX1 and HIOX2 DNA binding domains, which but only part of the C-terminal domain (FIG. 8A). This construct was identified by Mitsuhashi et al. as a potential inhibitory construct which can bind the DUX4 promoter without being toxic to cells.

Muscle cells include cells including multiple nuclei, thus a DUX4 dominant negative may require efficient spreading to multiple myonuclei. Thus, if delivered by AAV, not all myonuclei will generate DUX4 dominant negative RNA, and if the DUX4 dominant negative has nuclear localization activity, then activity of the dominant negative will be limited to only a few nuclei. Addition of nuclear export sequences may enable the DUX4 dominant negative to spread across the myofiber.

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In an experiment, C2C12 mouse myoblast stable cell lines were created and used: reporter cell line containing Zscan4 promoter driving tdTomato (Zscan4 is a promoter activated by DUX4); cell line that contains tet-inducible DUX4-Halo (Halo is a fluorescent protein that can be visualized upon addition of a small molecule dye); cell line that stably expresses S+375-397 DUX4 dominant negative fused to GFP; and cell line that stably expresses S+375-397 DUX4 dominant negative fused to GFP and an ALYREF nuclear export signal. Cell lines were plated at varying ratios onto a gelatin substrate that facilitates formation of myotubes. The cells were then differentiated into myotubes; each myotube contains a mixture of nuclei from all the different cell lines. Once differentiated (7 days post serum withdrawal), DUX4-Halo is induced with doxycycline-containing media (500 nanograms per milliliter (ng/ml)).

Myotubes were imaged 72 hours following doxycycline induction. S+375- 397 dominant negative prevents binding of DUX4-Halo to the Zscan promoter, limiting expression of tdTomato, with the ALYREF construct performing more efficiently.

The ALYREF dominant negative fusion prevents tdTomato expression more effectively than the dominant negative without the ALYREF sequence providing enhanced nuclear-cytoplasmic trafficking which is beneficial to limit DUX4 transcriptional activation.

Nuclear spreading is further described in the patent application PCT/US2021/033680, the entirety of the contents of which is incorporated by reference herein in its entirety.

## 20 ***Examples***

Adeno-associated viral vectors comprising a nucleic acid sequence encoding Dux4 and adeno-associated viral vectors comprising a nucleic acid sequence encoding truncated forms of Dux4 were administered to mice. Expression of Dux4 regulated genes were analyzed.

FIG. 1 shows the expression rates of protein coding gene Wfdc3 in response to full and truncated forms of Dux4. Wfdc3 is the Whey Acidic Four-Disulfide Core Domain Protein 3; it functions as a protease inhibitor and contains eight cysteines forming four disulfide bonds at the core of the protein. Expression of the gene may be associated with FSHD. Experimental mice were intramuscularly administered an inert control, the full-length DUX4-FL sequence, the truncated DUX4-S sequence, a 1:1 co-administered mixture of DUX4-FL and DUX4-S, and a 1:10 co-administered mixture of DUX4-FL and DUX4-S. Wfdc3 was found to be upregulated in those mice that received only the DUX4-FL full sequence, as well as upregulated to a lesser degree in those mice that received a 1:1 co-administered mixture of DUX4-FL and DUX4-S. Wfdc3 was not

upregulated in mice that received the inert control, DUX4-S alone, or the 1:10 1 mixture of DUX4-FL and DUX4-S.

FIG. 2 shows the expression rates of protein coding gene Trim36 in response to varying forms of the DUX4 sequence. Trim36 is the tripartite motif containing 36 gene; it includes three  
5 zinc-binding domains, a ring, B-box type 1 and B-box type 2, and a coiled-coil region. Expression of the gene is related to the innate immune system pathway, and the gene is involved in chromosome segregation and regulation of the cell cycle. Experimental mice were intramuscularly administered an inert control, the full-length DUX4-FL sequence, the truncated DUX4-S sequence, a 1:1 co-administered mixture of DUX4-FL and DUX4-S, and a 1:10 1 co-administered mixture of DUX4-  
10 FL and DUX4-S. Trim36 was found to be upregulated in those mice that received only the DUX4-FL full sequence, as well as upregulated to a lesser degree in those mice that received a 1:1 co-administered mixture of DUX4-FL and DUX4-S. Trim36 expression matched the inert control in mice receiving DUX4S alone. Trim36 expression was lower than the vehicle in mice that received the 1:10 1 mixture of DUX4-FL and DUX4-S.

15

### ***Conclusion***

Expression of truncated forms of DUX4 inhibit the expression of DUX4 controlled genes, even in the presence of full-length DUX4. Accordingly, DUX4 associated conditions, such as FSHD, may be treated by expression of truncated forms of DUX4.

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### Incorporation by Reference

References and citations to other documents, such as patents, patent applications, patent publications, journals, books, papers, web contents, have been made throughout this disclosure. All such documents are hereby incorporated herein by reference in their entirety for all purposes.

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### Equivalents

Various modifications of the invention and many further embodiments thereof, in addition to those shown and described herein, will become apparent to those skilled in the art from the full contents of this document, including references to the scientific and patent literature cited herein.  
30 The subject matter herein contains important information, exemplification and guidance that can be adapted to the practice of this invention in its various embodiments and equivalents thereof.

Select Sequences

SEQ ID NO. 1: Full-length DUX4-FL amino acid sequence.

MALPTPSDSTLPAEARGRGRRRRLVWTPSQSEALRACFERNPYPGIATRERLAQAIGIPEPR  
 VQIWFQNERSRQLRQHRRESRPWPGRRGPPEGRRKRTAVTGSQTALLLRAFEKDRFPGLA  
 5 AREELARETGLPESRIQIWFQNRRARHPGQGGRAPAQAGGLCSAAPGGGHPAPSWVAFA  
 HTGAWGTGLPAPHVPCAPGALPQGAFVSQAARAAPALQPSQAAPAFEGISQPAPARGDFA  
 YAAPAPPDGAISHPQAPRWPPHPQKSREDRDPQRDGLPGPCAVAQPGPAQAGPQQGGV  
 LAPPTSQGSPPWWGWRGPQVAGAAWEPQAGAAPPPQPAPPDASASARQGMQMGIPAPS  
 QALQEPAPWSALPCGLLLDELLASPEFLQQAQPLLETEAPGELEASEEAAASLEAPLSEEEY  
 10 RALLEEL

SEQ ID NO. 2: AAV9 Capsid Reference Sequence

MAADGYLPDWLEDNLSEGIREWWALKPGAPQPKANQQHQDNARGLVLPGYKYLPGP  
 NGLDKGEPVNAADAAALEHDKAYDQQLKAGDNPYLKYNHADADEFQERLKEDTSFGG  
 15 NLGRAVFQAKKRLLEPLGLVEEAAKTAPGKKRPVEQSPQEPDSSAGIGKSGAQPAKKRL  
 NFGQTDGTEVDPDPQPIGEPPAAPSGVGSMTMASGGGAPVADNNEGADGVGSSSGNWH  
 CDSQWLGDRTVITSTRTWALPTYNNHLYKQISNSTSGSSNDNAYFGYSTPWGYFDFNR  
 FHCHFSPRDWQRLINNNWGFPRKRLNFKLFNIQVKEV'IDNNGVK'I'IANNL'I'S'IVQV'I'  
 DSDYQLPYVLGSAHEGCLPPFPADVFMIPQYGYLTLNDGSQAVGRSSFYCLEYFPSQMLR  
 20 TGNNFQFSYEFENVPFHSSYAHSQLDRLMNPLIDQYLYLSKTINGSGQNQQTLKFSVA  
 GPSNMAVQGRNYIPGPSYRQQRVSTTVTQNNNSEFAWPGASSWALNGRNSLMNPGPAM  
 ASHKEGEDRFFPLSGSLIFGKQGTGRDNVDADKVMITNEEEIKT'N'PVATESYGVATN  
 IIQSAQAQAQTGWVQNQGILPGMVWQDRDVYLQGPWAKIPIITDGNFIIPSPLMGGFG  
 MKHPPPQILIKNTVPVADPPTAFNKDKLNSFITQYSTGQVSVEIEWELQKENSKRWNPEI  
 25 QYTSNYYKSNVFAVNTEGVYSEPRPIGTRYLTRNL

SEQ ID NO. 3: DUX4-FL Truncated

MALPTPSDSTLPAEARGRGRRRRLVWTPSQSEALRACFERNPYPGIATRERLAQAIGIPEPR  
 VQIWFQNERSRQLRQHRRESRPWPGRRGPPEGRRKRTAVTGSQTALLLRAFEKDRFPGLA  
 30 AREELARETGLPESRIQIWFQNRRARHPGQGGRAPAQ

**SEQ ID NO. 4:** DUX4-FL Truncated

GRRRRLVWTPSQSEALRACFERNPYPGIATRERLAQAIGIPEPRVQIWFQNERSRQLRQHR  
RESRPWPGRRGPPEGRRKRTAVTGSQTALLLRAFEKDRFPGIAAREELARETGLPESRIQI  
WFQNRRARHPGQGGRAPAQ

5

**SEQ ID NO. 5:** DUX4-FL Truncated

MALPTPSDSTLPAEARGRRRRRLVWTPSQSEALRACFERNPYPGIATRERLAQAIGIPEPR  
VQIWFQNERSRQLRQHRRESRPWPGRRGPPEGRRKRTAVTGSQTALLLRAFEKDRFPGIA  
AREELARETGLPESRIQIWFQNRRARHPGQGGRAPAQAGGLCSAAPGGGHPAPSWVAFA  
10 HTGAWGTGLPAPHVPCAPGALPQGAFVSQAARAAPALQPSQAAPAEGISQPAPARGDFA  
YAAPAPPD GALSH PQAPRWPPHPQKSREDRDPQRDGLPGPCAVAQPGPAQAGPQQGGV  
LAPPTSQGS PWWGWGRGPQVAGAAWEPQAGAAPPPQPAPPDASAS

Claims

1. An adeno-associated virus (AAV) vector comprising:  
a promoter sequence,  
5 a miRNA strand that binds to DUX4-FL, and  
a capsid protein comprising at least one modification that is an insertion between any  
two contiguous amino acids between amino acids 262-269, 327-332, 382-386, 452-  
460, 488-505, 527-539, 545-558, 581-593, 704-714, or any combination thereof in an  
AAV9 capsid polypeptide or in an analogous position in an AAV1, AAV2, AAV3,  
10 AAV4, AAV5, AAV6, AAV7, AAV8, AAV rh.74, AAV rh.10 capsid polypeptide.
2. The AAV vector of claim 1, wherein the promoter sequence is a promoter sequence  
transcribed by RNA polymerase II or III, U6 promoter sequence, MHCK7 promoter  
sequence, CK6 promoter sequence, tMCK promoter sequence, CK5 promoter sequence,  
15 MCK promoter sequence, HAS promoter sequence, MPZ promoter sequence, desmin  
promoter sequence, APOA2 promoter sequence, hAAT promoter sequence, INS promoter  
sequence, IRS2 promoter sequence, MYH6 promoter sequence, MYL2 promoter sequence,  
TNNI3 promoter sequence, SYN1 promoter sequence, GFAP promoter sequence, NES  
promoter sequence, MBP promoter sequence, or TH promoter sequence.
- 20
3. The AAV vector of claim 1, wherein the miRNA strand is selected from the group of  
miDUX4, miRN92, miRNA-17, miRNA-18a, miRNA-19a, miRNA-20a, miRNA-19b-1, mi-  
RNA-26a, miRNA-126, miRNA-335, let-7a and let-7b, miRNA-34, miR-34a, miRNA-10b,  
miRNA-208, miRNA-499, miRNA-195, miRNA-29a, miRNA-29b, or miRNA-29c.
- 25
4. The AAV vector of claim 1, wherein the miRNA strand is selected from the group of SEQ  
ID NOs. 1250-1305.
5. The AAV vector of claim 1, wherein the miRNA strand further comprises 5-6 thymidines at  
30 the 5' end.

6. The AAV vector of claim 1, wherein the capsid protein comprises at least one modification that results in reduced liver-tropism of the AAV vector.
7. The AAV vector of claim 1, wherein the capsid protein comprises at least one modification that results in preferential targeting of the AAV vector to muscle tissue.
8. The AAV vector of claim 1, wherein the capsid protein may be selected from the sequences in Tables 1 - 4.
9. The AAV vector of claim 1, wherein the vector further comprises a nuclear export sequence enabling nuclear spreading.
10. A method of inhibiting expression of a gene in a cell, the method comprising administering to a subject an adeno-associated virus (AAV) vector comprising a promoter sequence, a miRNA strand that binds to DUX4-FL, and a capsid protein comprising at least one modification that is an insertion between any two contiguous amino acids between amino acids 262-269, 327-332, 382-386, 452-460, 488-505, 527-539, 545-558, 581-593, 704-714, or any combination thereof in an AAV9 capsid polypeptide or in an analogous position in an AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV rh.74, AAV rh.10 capsid polypeptide.
11. The method of claim 8, wherein the promoter sequence is a promoter sequence transcribed by RNA polymerase II or III, U6 promoter sequence, MIICK7 promoter sequence, CK6 promoter sequence, tMCK promoter sequence, CK5 promoter sequence, MCK promoter sequence, HAS promoter sequence, MPZ promoter sequence, desmin promoter sequence, APOA2 promoter sequence, hAAT promoter sequence, INS promoter sequence, IRS2 promoter sequence, MYH6 promoter sequence, MYL2 promoter sequence, TNNI3 promoter sequence, SYN1 promoter sequence, GFAP promoter sequence, NES promoter sequence, MBP promoter sequence, or TH promoter sequence.
12. The method of claim 8, wherein the miRNA strand is selected from the group of miDUX4, miRN92, miRNA-17, miRNA-18a, miRNA-19a, miRNA-20a, miRNA-19b-1, mi-RNA-26a,

miRNA-126, miRNA-335, let-7a and let-7b, miRNA-34, miR-34a, miRNA-10b, miRNA-208, miRNA-499, miRNA-195, miRNA-29a, miRNA-29b, or miRNA-29c.

- 5 13. The method of claim 8, wherein the miRNA strand is selected from the group of SEQ ID NOs 1250-1305.
14. The method of claim 8, wherein the miRNA strand further comprises 5-6 thymidines at the 5' end.
- 10 15. The method of claim 8, wherein the capsid protein comprises at least one modification that results in reduced liver-tropism of the AAV vector.
16. The method of claim 8, wherein the capsid protein comprises at least one modification that results in preferential targeting of the AAV vector to muscle tissue.
- 15 17. The method of claim 8, wherein the capsid protein may be selected from the sequences in Tables 1 - 4.
- 20 18. The method of claim 8, wherein the vector further comprises a nuclear export sequence enabling nuclear spreading.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 23/65520

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC - INV. C12N 15/86, C12N 15/113, C12N 15/11, A61K 31/713 (2023.01)  
 ADD. A61K 35/76, A61K 31/7088, A61P 21/00 (2023.01)

CPC - INV. C12N 15/86, C12N 15/113, C12N 15/11, A61K 35/76

ADD. A61K 31/7088, A61P 21/00, C12N 2310/141, C12N 2330/51

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)  
 See Search History document

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2020/0248179 A1 (RESEARCH INSTITUTE AT NATIONWIDE CHILDREN'S HOSPITAL) 06 August 2020 (06.08.2020) para [0008]-[0019]; [0024]; [0033]; [0050]; [0062]-[0064]; [0077]-[0078]; claim 1; SEQ ID NO: 10941	1-18
Y	WO 2022/020616 A1 (THE BROAD INSTITUTE, INC. et al.) 27 January 2022 (27.01.2022) para [0002]-[0019]; [0101]; [0115]; [0342]; SEQ ID NO: 6	1-18

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  
 "D" document cited by the applicant in the international application  
 "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  
 06 July 2023 (06.07.2023)

Date of mailing of the international search report

JUL 31 2023

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Authorized officer  
 Kari Rodriguez  
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 23/65520

Box No. I Nucleotide and/or amino acid sequence(s) (Continuation of item 1.c of the first sheet)

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of a sequence listing:
  - a.  forming part of the international application as filed.
  - b.  furnished subsequent to the international filing date for the purposes of international search (Rule 13ter.1(a)),  
 accompanied by a statement to the effect that the sequence listing does not go beyond the disclosure in the international application as filed.
2.  With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this report has been established to the extent that a meaningful search could be carried out without a WIPO Standard ST.26 compliant sequence listing.
3. Additional comments: