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<110> MODERNATX, INC.

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<150> 62/338479
<151> 2016-05-18

<160> 157

<170> PatentIn version 3.5

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Gly Glu Ser Gln Pro Asn Pro Lys Thr Val Glu Leu Leu Ser Gly Val
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Val Asp Gln Thr Lys Asp Gly Leu Ile Ser Phe Gln Glu Phe Val Ala
65 70 75 80

Phe Glu Ser Val Leu Cys Ala Pro Asp Ala Leu Phe Met Val Ala Phe
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Lys Gln Val Phe Gly Gln Thr Thr Ile His Gln His Ile Pro Phe Asn

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Glu His Ala Lys Gln Ala Phe Val Gln Arg Asp Asn Ala Arg Thr Gly
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Arg Val Thr Ala Ile Asp Phe Arg Asp Ile Met Val Thr Ile Arg Pro
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                245                 250                 255

Ala Ala Gln Lys Phe Gly Gln Val Thr Pro Met Glu Val Asp Ile Leu
            260                 265                 270

Phe Gln Leu Ala Asp Leu Tyr Glu Pro Arg Gly Arg Met Thr Leu Ala
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Asp Ile Glu Arg Ile Ala Pro Leu Glu Glu Gly Thr Leu Pro Phe Asn
    290                 295                 300

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Phe Glu Ser Val Leu Cys Ala Pro Asp Ala Leu Phe Met Val Ala Phe
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Lys Gln Val Phe Gly Gln Thr Thr Ile His Gln His Ile Pro Phe Asn
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Trp Asp Ser Glu Phe Val Gln Leu His Phe Gly Lys Glu Arg Lys Arg
    130                 135                 140


His Leu Thr Tyr Ala Glu Phe Thr Gln Phe Leu Leu Glu Ile Gln Leu
145                 150                 155                 160


Glu His Ala Lys Gln Ala Phe Val Gln Arg Asp Asn Ala Arg Thr Gly
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Gly Thr Thr Ser His Gln Val Ser Phe Ser Tyr Phe Asn Gly Phe Asn
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Ala Ala Gln Lys Phe Gly Gln Val Thr Pro Met Glu Val Asp Ile Leu
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Phe Gln Leu Ala Asp Leu Tyr Glu Pro Arg Gly Arg Met Thr Leu Ala
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Asp Ile Glu Arg Ile Ala Pro Leu Glu Glu Gly Thr Leu Pro Phe Asn
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Pro Val Leu Leu Gln Val Ala Glu Ser Ala Tyr Arg Phe Gly Leu Gly
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Ser Val Ala Gly Ala Val Gly Ala Thr Ala Val Tyr Pro Ile Asp Leu
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Val Lys Thr Arg Met Gln Asn Gln Arg Ser Thr Gly Ser Phe Val Gly
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Glu Leu Met Tyr Lys Asn Ser Phe Asp Cys Phe Lys Lys Val Leu Arg
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Tyr Glu Gly Phe Phe Gly Leu Tyr Arg Gly Leu Leu Pro Gln Leu Leu
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Gly Val Ala Pro Glu Lys Ala Ile Lys Leu Thr Val Asn Asp Phe Val
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Arg Asp Lys Phe Met His Lys Asp Gly Ser Val Pro Leu Ala Ala Glu
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Ile Leu Ala Gly Gly Cys Ala Gly Gly Ser Gln Val Ile Phe Thr Asn
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Pro Leu Glu Ile Val Lys Ile Arg Leu Gln Val Ala Gly Glu Ile Thr
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Thr Gly Pro Arg Val Ser Ala Leu Ser Val Val Arg Asp Leu Gly Phe
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Lys Ala Leu Trp Lys Gly Ala Gly Ala Arg Val Phe Arg Ser Ser Pro
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Gln Phe Gly Val Thr Leu Leu Thr Tyr Glu Leu Leu Gln Arg Trp Phe
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aatggattta attcgctcct taacaacatg gaactcatta gaaagatcta tagcactctg      720

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gucggcgcca ccgccgugua ccccaucgac cuggugaaaa cacggaugca gaaccagagg 1080

agcaccggca gcuucguggg cgagcugaug uauaagaaca gcuuugacug cuucaagaag 1140

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gucgcccccg agaaagcaau caagcugacc gugaacgacu uugucaggga caaguucaug 1260

cacaaggacg gcuccgugcc ccucgccgcc gagauccugg ccggcggaug cgcgggggga 1320

agccagguga ucuuuacgaa cccccucgag aucgucaaga uuaggcugca gguggccggg 1380

gagaucacca ccgggcccag ggugagcgcc cugagcgugg ugcgcgaucu cggcuucuuc 1440

ggcaucuaca agggagccaa ggccugcuuc cugagggaca uccccuucag cgccaucuac 1500

uucccguguu acgcccacgu gaaggccucg uucgccaacg aggacggcca ggugagcccc 1560

gggucgcucc uccuggcggg agccauagcc ggcaugcccg ccgccucccu ggugacccca 1620

gcggacguga ucaagacccg gcuccaggug gccgccaggg ccgggcagac cacguauagc 1680

ggcgugaucg acugcuuccg aaaaauccug agggaggagg gccccaaggc ccuguggaaa 1740

ggcgcggggg ccaggguguu ccgcuccucc ccccaguucg gggugacgcu gcugacuuac 1800

gaguugcugc agaggugguu cuacaucgac uuuggcggcg ugaagcccau ggggagcgag 1860

ccggugccca agagccggau caaccucccа gcccccaacc ccgaccacgu gggcggauac 1920

aagcuggccg uggccaccuu ugccggcauc gaaaacaagu ucggccucua ccucccgcug 1980

uucaagccca gcguguccac gagcaaggcc aucggcgggg gcccc 2025

<210> 28
<211> 2025
<212> RNA
<213> Artificial Sequence

<220>
<223> Citrin-CO24

<400> 28
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uuucugaagu acgccuccau cgagaagaac ggcgaguuuu ucaugagccc caacgacuuc 120

gugacccgcu accugaacau cuucggcgag agccaaccaa accccaagac cguggagcug 180

cugucuggug uggucgacca gaccaaggau ggccugauau cguuccagga guucguggcc 240

uucgagagcg uccugugcgc ccccgacgcc cuguucaugg uggccuucca gcuguucgac 300

aaagccggca agggcgaggu gaccuucgag gacgucaaac agguguucgg ccagaccacc 360

auccaccaac acauaccguu caacugggau uccgaguucg uccagcuuca uuucgggaag 420

gaaaggaaga ggcaccugac cuaugccgag uuuacccagu uccuguugga gauccagcug 480

gagcacgcga agcaggccuu cgugcaacgg gacaacgccc ggaccgggag ggugaccgcc 540

aucgacuuca gagacauaau ggucaccauc aggccgcacg ugcucacccc cuucguggag 600

gaaugccugg uggccgccgc cggcgguacc accucccacc aggucagcuu cagcuacuuu 660

aacggcuuca acagccugcu gaacaacaug gagcugaucc gaaagauuua cagcacccug 720

gccggcacgc ggaaggacgu ggaagugacc aaggaggagu uuguacuggc cgcccagaag 780

uucggccagg ugacgcccau ggagguggac aucuuauucc agcuggcgga uuuauacgag 840

ccccgggggа ggaugacccu ggccgauauc gagaggaucg ccccccugga agagggcacc 900

cugcccuuca accuugccga ggcccagcgg caaaaagcua gcggcgacag ugcaaggccc 960

gugcugcugc agguggcgga gagcgccuac cgcuucggcc ugggcagcgu ggccggcgcc 1020

gucggagcca ccgccgugua ucccaucgac cuggucaaga ccaggaugca gaaccagcgg 1080

agcaccggca gcuucguggg ggaacugaug uacaagaaca gcuuugacug cuucaagaag 1140

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guggcccccg agaaggcaau caagcugacc gugaacgacu ucgugaggga caaguucaug 1260

cacaaggacg gaucagugcc acuggccgcc gagauacugg ccggcggcug ugccgggggc 1320

agccaaguga ucuucaccaa cccccuggag aucgugaaga uccgccugca ggucgccggc 1380

gagaucacca ccgggccuag gguguccgcc cugagcgugg ugagggaccu gggcuucuuu 1440

gggaucuaua agggcgccaa ggccugcuuc cugcgcgaca ucccauucuc ugccauauac 1500

uuccccugcu acgcccacgu gaaagccagc uucgccaacg aagacggcca ggugagcccc 1560

ggaagccugc ugcuggccgg cgccaucgcc ggaaugcccg ccgccucccu ggugaccccg 1620

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gagcugcugc aaaggugguu cuauaucgau uucggcggcg ugaagccgau gggcuccgag 1860

cccgugccca agagccggau caaccugccc gcccccaacc ccgaccacgu aggcggcuau 1920

aagcuggcag uggcaaccuu cgccgggauc gaaaacaaau ucggccugua ccucccccug 1980

uucaaaccca gcgugagcac gagcaaggcc aucggcggag gcccc 2025

<210> 29
<211> 2025
<212> RNA
<213> Artificial Sequence

<220>
<223> Citrin-CO25

<400> 29
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uuccugaaau acgccagcau agagaagaac ggcgaguucu ucaugagccc gaacgacuuc 120

gugacgcggu accugaacau cuucggggag agccagccca accccaagac cguggagcug 180

cugagcggcg ugguggauca gaccaaggac gggcugauca guuuccaaga guucguggcc 240

uucgagagcg ugcugugcgc ccccgacgcc cuguucaugg uggcuuucca gcuguucgac 300

aaggccggga agggggaggu gacauucgag gacgugaagc agguguucgg gcagaccacg 360

auccaccagc acaucccccuu caacugggac uccgaauuug ugcagcugca uuucggcaag 420

gagcggaaga ggcaccugac cuacgccgaa uucacccagu uccugcugga gauccagcug 480

gaacacgcca agcaggcauu cgugcagcgc gacaacgccc gcaccgguag ggugaccgcc 540

aucgacuucc gggacaucau ggugaccauc cggccgcacg ugcugacccc cuucguggag 600

gaaugccugg uggccgccgc cggcggcacc accagccacc aagugagcuu cagcuauuuc 660

aacggcuuca acagccugcu caacaauaug gagcugauca ggaaaaucua cagcacccug 720

gccgggacca ggaaggaugu ggaggugacc aaagaggaau uugugcucgc cgcccaaaag 780

uucggccagg ucacccccau ggaagucgac auccuguuuc agcuugccga ccucuaugag 840

cccaggggga gaaugacccu ggccgacauc gagaggaucg cuccccugga ggagggaaca 900

cugccguuca accuggccga ggcccagagg cagaaggcca gcggugacuc cgccaggccc 960

guacugcugc aaguggcgga guccgccuau agguucgggc ugggcagcgu ggccggggcc 1020

gugggggcca ccgcggugua cccaauagac cuggugaaaa cccggaugca aaaccagagg 1080

agcacgggua gcuucguggg ggagcugaug uauaagaaua gcuucgauug cuucaagaag 1140

guccuccggu acgagggauu cuucggccug uaccggggcc ugcugcccca gcugcugggu 1200

gucgcccccg agaaggccau aaagcugacc gugaacgauu ucgugcggga caaguucaug 1260

cacaaggacg gcucggugcc ccuggccgcc gaaauacugg cgggcgggug ugccggcggg 1320

ucccagguga ucuucaccaa cccgcuggag aucgugaaga uccgucugca gguggccggc 1380

gagaucacca ccggccccag aguguccgcg cugagcgucg ugcgugaccu gggcuucuuc 1440

gggaucuaca agggagccaa agccugcuuu cugagggaca uccccuucuc cgccaucuac 1500

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gccgacguga ucaagacgag gcuccaggug gccgccaggg cggggcagac uaccuacagc 1680

ggcguuaucg acugcuuuag gaagauccug agggaggagg ggcccaaggc ccucuggaag 1740

ggcgccggag ccaggguguu caggagcagc ccccaguuug ggguaacgcu ccugaccuac 1800

gagcugcugc agaggugguu uuacaucgau uucgggggcg ucaagcccau gggguccgag 1860

cccgugccca agagcaggau caaucugccc gcccccaauc ccgaccacgu gggggcuac 1920

aagcuggccg uggccacguu cgccgguauc gagaacaagu ucgggcugua ccugccccug 1980

uucaagcccu ccguauccac cagcaaggcg auaggagggg gaccc 2025

<210> 30
<211> 47
<212> RNA
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<220>
<223> (5' UTR)

<400> 30
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<210> 31
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-002

<400> 31
gggagaucag agagaaaaga agaguaagaa gaaauauaag agccacc 47

<210> 32
<211> 145
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-003

<400> 32
ggaauaaaag ucucaacaca acauauacaa aacaaacgaa ucucaagcaa ucaagcauuc 60

uacuucuauu gcagcaauuu aaaucauuuc uuuuaaagca aaagcaauuu ucugaaaauu 120

uucaccauuu acgaacgaua gcaac 145

<210> 33
<211> 42
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-004

<400> 33
gggagacaag cuuggcauuc cgguacuguu gguaaagcca cc 42

<210> 34
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-005

<400> 34
gggagaucag agagaaaaga agaguaagaa gaaauauaag agccacc 47

<210> 35
<211> 145
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-006

<400> 35
ggaauaaaag ucucaacaca acauauacaa aacaaacgaa ucucaagcaa ucaagcauuc 60

uacuucuauu gcagcaauuu aaaucauuuc uuuuaaagca aaagcaauuu ucugaaaauu 120

uucaccauuu acgaacgaua gcaac 145

<210> 36
<211> 42
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-007

<400> 36
gggagacaag cuuggcauuc cgguacuguu gguaaagcca cc 42

<210> 37
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-008

<400> 37
gggaauuaac agagaaaaga agaguaagaa gaaauauaag agccacc 47

<210> 38
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-009

<400> 38
gggaaauuag acagaaaaga agaguaagaa gaaauauaag agccacc 47

<210> 39
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-010

<400> 39
gggaaauaag agaguaaaga acaguaagaa gaaauauaag agccacc 47

<210> 40
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-011

<400> 40
gggaaaaaag agagaaaaga agacuaagaa gaaauauaag agccacc 47

<210> 41
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-012

<400> 41
gggaaauaag agagaaaaga agaguaagaa gauauauaag agccacc 47

<210> 42
<211> 47

<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-013

<400> 42
gggaaauaag agacaaaaca agaguaagaa gaaauauaag agccacc 47

<210> 43
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-014

<400> 43
gggaaauuag agaguaaaga acaguaagua gaauuaaaag agccacc 47

<210> 44
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-15

<400> 44
gggaaauaag agagaauaga agaguaagaa gaaauauaag agccacc 47

<210> 45
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-016

<400> 45
gggaaauaag agagaaaaga agaguaagaa gaaaauuaag agccacc 47

<210> 46
<211> 47
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-017

<400> 46

gggaaauaag agagaaaaga agaguaagaa gaaauuuaag agccacc 47

<210> 47
<211> 92
<212> RNA
<213> Artificial Sequence

<220>
<223> 5'UTR-018

<400> 47
ucaagcuuuu ggacccucgu acagaagcua auacgacuca cuauagggaa auaagagaga 60

aaagaagagu aagaagaaau auaagagcca cc 92

<210> 48
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR including miR142-3p binding site

<400> 48
ugauaauagu ccauaaagua ggaaacacua cagcuggagc cucgguggcc augcuucuug 60

ccccuugggc cuccccccag ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 49
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR including miR142-3p binding site

<400> 49
ugauaauagg cuggagccuc gguggcucca uaaaguagga aacacuacac augcuucuug 60

ccccuugggc cuccccccag ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 50
<211> 142
<212> RNA
<213> Artificial Sequence

<220>

<223> 3'UTR including miR142-3p binding site

<400> 50
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuuccauaaa guaggaaaca 60

cuacaugggc cucccccccag ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 51
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR including miR142-3p binding site

<400> 51
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuugggccuc cccccagucc 60

auaaaguagg aaacacuaca ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 52
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR including miR142-3p binding site

<400> 52
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuugggccuc cccccagccc 60

cuccuccccu ucuccauaaa guaggaaaca cuacacugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 53
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR including miR142-3p binding site

<400> 53
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuugggccuc cccccagccc 60

cuccuccccu uccugcaccc guacccccuc cauaaaguag gaaacacuac aguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 54
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR including miR142-3p binding site

<400> 54
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuugggccuc cccccagccc 60

cuccucccuu uccugcaccc guacccccgu ggucuuugaa uaaaguucca uaaaguagga 120

aacacuacac ugagugggcg gc 142

<210> 55
<211> 371
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-001

<400> 55
gcgccugccc accugccacc gacugcugga acccagccag ugggagggcc uggcccacca 60

gaguccugcu cccucacucc ucgccccgcc cccuguccca gagucccacc ugggggcucu 120

cuccacccuu cucagaguuc caguuucaac cagaguucca accaaugggc uccauccucu 180

ggauucuggc caaugaaaua ucucccuggc aggguccucu ucuuuuccca gagcuccacc 240

ccaaccagga gcucuaguua auggagagcu cccagcacac ucggagcuug ugcuuugucu 300

ccacgcaaag cgauaaauaa aagcauuggu ggccuuuggu cuuugaauaa agccugagua 360

ggaagucuag a 371

<210> 56
<211> 568
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-002

<400> 56
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aucucgugua gccauauaga guuugcuucu gagugucugc uuuguuuagu agaggugggc 120

aggaggagcu gaggggcugg ggcuggggug uugaaguugg cuuugcaugc ccagcgaugc 180

gccucccugu gggaugucau cacccuggga accgggagug gcccuuggcu cacuguguuc 240

ugcaugguuu ggaucugaau uaauuguccu uucuucuaaa ucccaaccga acuucuucca 300

accuccaaac uggcuguaac cccaaaucca agccauuaac uacaccugac aguagcaauu 360

gucugauuaa ucacuggccc cuugaagaca gcagaauguc ccuuugcaau gaggaggaga 420

ucugggcugg gcgggccagc uggggaagca uuugacuauc uggaacuugu gugugccucc 480

ucagguaugg cagugacuca ccugguuuua auaaaacaac cugcaacauc ucauggucuu 540

ugaauaaagc cugaguagga agucuaga 568

<210> 57
<211> 289
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-003

<400> 57
acacacucca ccuccagcac gcgacuucuc aggacgacga aucuucucaa ugggggggcg 60

gcugagcucc agccaccccg cagucacuuu cuuuguaaca acuuccguug cugccaucgu 120

aaacugacac aguguuuaua acguguacau acauuaacuu auuaccucau uuuguuauuu 180

uucgaaacaa agcccugugg aagaaaaugg aaaacuugaa gaagcauuaa agucauucug 240

uuaagcugcg uaaauggucu uugaauaaag ccugaguagg aagucuaga 289

<210> 58
<211> 379
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-004

<400> 58
caucacauuu aaaagcaucu cagccuacca ugagaauaag agaaagaaaa ugaagaucaa 60

aagcuuauuc aucuguuuuu cuuuuucguu gguguaaagc caacacccug ucuaaaaaac 120

auaaauuucu uuaaucauuu ugccucuuuu cucugugcuu caauuaauaa aaaauggaaa 180

gaaucuaaua gagugguaca gcacuguuau uuuucaaaga uguguugcua uccugaaaau 240

ucuguagguu cuguggaagu uccaguguuc ucucuuauuc cacuucggua gaggauuucu 300

aguuucuugu gggcuaauua aauaaaucau uaauacucuu cuaauggucu uugaauaaag 360

ccugaguagg aagucuaga 379

<210> 59
<211> 118
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-005

<400> 59
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cucuuggucu uugaauaaag ccugaguagg aaggcggccg cucgagcaug caucuaga 118

<210> 60
<211> 908
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-006

<400> 60
gccaagcccu ccccauccca uguauuuauc ucuauuuaau auuuaugucu auuuaagccu 60

cauauuuaaa gacagggaag agcagaacgg agccccaggc cucugugucc uucccugcau 120

uucugaguuu cauucuccug ccuguagcag ugagaaaaag cuccuguccu cccaucccu 180

ggacugggag guagauaggu aaauaccaag uauuuauuac uaugacugcu ccccagcccu 240

ggcucugcaa ugggcacugg gaugagccgc ugugagcccc ugguccugag ggucccacc 300

ugggacccuu gagaguauca ggucucccac gugggagaca agaaaucccu guuuaauauu 360

uaaacagcag uguucccau cuggguccuu gcaccccuca cucuggccuc agccgacugc 420

acagcggccc cugcaucccc uuggcuguga ggccccugga caagcagagg uggccagagc 480

ugggaggcau ggcccugggg ucccacgaau uugcugggga aucucguuuu ucuucuuaag 540

acuuuuggga caugguuuga cucccgaaca ucaccgacgc gucuccuguu uuucugggug 600

gccucgggac accugcccug cccccacgag ggucaggacu gugacucuuu uuagggccag 660

gcaggugccu ggacauuugc cuugcuggac ggggacuggg gaugugggag ggagcagaca 720

ggaggaauca ugucaggccu gugugugaaa ggaagcucca cugucacccu ccaccucuuc 780

acccccacu caccaguguc cccuccacug ucacauugua acugaacuuc aggauaauaa 840

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caucuaga 908

<210> 61
<211> 835
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-007

<400> 61
acucaaucua aauuaaaaaa gaaagaaauu ugaaaaaacu uucucuuugc cauuucuucu 60

ucuucuuuuu uaacugaaag cugaauccuu ccauuucuuc ugcacaucua cuugcuuaaa 120

uugugggcaa aagagaaaaa gaaggauuga ucagagcauu gugcaauaca guuucauuaa 180

cuccuucccc cgcucccccа aaaauuugaa uuuuuuuuuc aacacucuua caccuguuau 240

ggaaaauguc aaccuuugua agaaaaccaa aauaaaaauu gaaaaauaaa aaccauaaac 300

auuugcacca cuuguggcuu uugaauaucu uccacagagg gaaguuuaaa acccaaacuu 360

ccaaagguuu aaacuaccuc aaaacacuuu cccaugagug ugauccacau uguuaggugc 420

ugaccuagac agagaugaac ugagguccuu guuuuguuuu guucauaaua caaaggugcu 480

aauuaauagu auuucagaua cuugaagaau guugauggug cuagaagaau uugagaagaa 540

auacuccugu auugaguugu aucguguggu guauuuuuua aaaaauuuga uuuagcauuc 600

auauuuucca ucuuauuccc aauuaaaagu augcagauua uuugcccaaa ucuucuucag 660

auucagcauu uguucuuugc cagucucauu uucaucuucu uccaugguuc cacagaagcu 720

uuguuucuug ggcaagcaga aaaauuaaau uguaccuauu uuguauaugu gagauguuua 780

aauaaauugu gaaaaaaaug aaauaaagca uguuugguuu uccaaaagaa cauau 835

<210> 62
<211> 297
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-008

<400> 62

cgccgccgcc cgggccccgc agucgagggu cgugagccca ccccguccau ggugcuaagc 60

gggcccgggu cccacacggc cagcaccgcu gcucacucgg acgacgcccu gggccugcac 120

cucuccagcu ccucccacgg ggucccgua gccccggccc ccgcccagcc ccaggucucc 180

ccaggcccuc cgcaggcugc ccggccuccc ucccccugca gccaucccaa ggcuccugac 240

cuaccuggcc ccugagcucu ggagcaagcc cugacccaau aaaggcuuug aacccau 297

<210> 63
<211> 602
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-009

<400> 63
ggggcuagag cccucuccgc acagcgugga gacggggcaa ggaggggggu uauuaggauu 60

ggugguuuug uuuugcuuug uuuaaagccg ugggaaaaug gcacaacuuu accucugugg 120

gagaugcaac acugagagcc aagggguggg aguugggaua auuuuuauau aaaagaaguu 180

uuuccacuuu gaauugcuaa aaguggcauu uuuccuaugu gcagucacuc cucucauuuc 240

uaaaauaggg acguggccag gcacgguggc ucaugccugu aaucccagca cuuugggagg 300

ccgaggcagg cggcucacga ggucaggaga ucgagacuau ccuggcuaac acgguaaaac 360

ccugucucua cuaaaaguac aaaaaauuag cugggcgugg uggugggcac cuguaguccc 420

agcuacucgg gaggcugagg caggagaaag gcaugaaucc aagaggcaga gcuugcagug 480

agcugagauc acgccauugc acuccagccu gggcaacagu guuaagacuc ugucucaaau 540

auaaauaaau aaauaaauaa auaaauaaau aaauaaaaau aaagcgagau guugcccuca 600

aa 602

<210> 64
<211> 785
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-010

<400> 64
ggcccugccc cgucggacug cccccagaaa gccuccugcc cccugccagu gaaguccuuc 60

agugagcccc uccccagcca gcccuuuccu ggccccgccg gauguauaaa uguaaaaaug 120

aaggaauuac auuuuauaug ugagcgagca agccggcaag cgagcacagu auuauuucuc 180

caucccccucc cugccugcuc cuuggcaccc ccaugcugcc uucagggaga caggcaggga 240

gggcuugggg cugcaccucc uacccucccа ccagaacgca ccccacuggg agagcuggug 300

gugcagccuu ccccucccug uauaagacac uuugccaagg cucucccccuc ucgccccauc 360

ccugcuugcc cgcucccaca gcuuccugag ggcuaauucu gggaagggag aguucuuugc 420

ugccccuguc uggaagacgu ggcucugggu gagguaggcg ggaaaggaug gaguguuuua 480

guucuugggg gaggccaccc caaaccccag ccccaacucc aggggcaccu augagauggc 540

caugcucaac cccccuccca gacaggcccu cccugucucc agggccccca ccgagguucc 600

cagggcugga gacuuccucu gguaaacauu ccuccagccu ccccucccccu ggggacgcca 660

aggagguggg ccacacccag gaagggaaag cgggcagccc cguuuugggg acgugaacgu 720

uuuaauaauu uuugcugaau uccuuuacaa cuaaauaaca cagauauugu uauaaauaaa 780

auugu 785

<210> 65
<211> 3001
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-011

<400> 65
auauuaagga ucaagcuguu agcuaauaau gccaccucug caguuuuggg aacaggcaaa 60

uaaaguauca guauacaugg ugauguacau cuguagcaaa gcucuuggag aaaaugaaga 120

cugaagaaag caaagcaaaa acuguauaga gagauuuuuc aaaagcagua aucccucaau 180

uuuaaaaaag gauugaaaau ucuaaauguc uuucugugca uauuuuuugu guuaggaauc 240

aaaaguauuu uauaaaagga gaaagaacag ccucauuuua gauguagucc uguuggauuu 300

uuuaugccuc cucaguaacc agaaauguuu uaaaaaacua aguguuuagg auuucaagac 360

aacauuauac auggcucuga aauaucugac acaauguaaa cauugcaggc accugcauuu 420

uauguuuuuu uuuucaacaa augugacuaa uuugaaacuu uuaugaacuu cugagcuguc 480

cccuugcaau ucaaccgcag uuugaauuaa ucauaucaaa ucaguuuuaa uuuuuuaaau 540

uguacuucag agucuauauu ucaagggcac auuuucucac uacuauuuua auacauuaaa 600

ggacuaaaua aucuuucaga gaugcuggaa acaaaucauu ugcuuuauau guuucauuag 660

aauaccaaug aaacauacaa cuugaaaauu aguaauagua uuuuugaaga ucccauuucu 720

aauuggagau cucuuuaauu ucgaucaacu uauaaugugu aguacuauau uaagugcacu 780

ugaguggaau ucaacauuug acuaauaaaa ugaguucauc auguuggcaa gugauguggc 840

aauuaucucu ggugacaaaa gaguaaaauc aaauauuucu gccuguuaca aauaucaagg 900

aagaccugcu acuaugaaau agaugacauu aaucugucuu cacuguuuau aauacggaug 960

gauuuuuuuu caaaucagug uguguuuuga ggucuuaugu aauugaugac auuugagaga 1020

aaugguggcu uuuuuuagcu accucuuugu ucauuuaagc accaguaaag aucaugucuu 1080

uuuauagaag uguagauuuu cuuugugacu uugcuaucgu gccuaaagcu cuaaauauag 1140

gugaaugugu gaugaauacu cagauuauuu gucucucuau auaauuaguu ugguacuaag 1200

uuucucaaaa aauuauuaac acaugaaaga caaucucuaa accagaaaaa gaaguaguac 1260

aaauuuuguu acuguaaugc ucgcguuuag ugaguuuaaa acacacagua ucuuuugguu 1320

uuauaaucag uuucuauuuu gcugugccug agauuaagau cuguguaugu gugugugugu 1380

gugugugcgu uuguguguua aagcagaaaa gacuuuuuua aaaguuuuaa gugauaaaug 1440

caauuuguua auugaucuua gaucacuagu aaacucaggg cugaauuaua ccauguauau 1500

ucuauuagaa gaaaguaaac accaucuuua uuccugcccu uuuucuucuc ucaaaguagu 1560

uguaguuaua ucuagaaaga agcaauuuug auuucuugaa aagguaguuc cugcacucag 1620

uuuaaacuaa aaauaaucau acuuggauuu uauuuauuuu ugucauagua aaaauuuuaa 1680

uuuauauaua uuuuuauuua guauuaucuu auucuuugcu auuugccaau ccuuugucau 1740

caauuguguu aaaugaauug aaaauucaug cccuguucau uuuauuuuac uuuauugguu 1800

aggauauuua aaggauuuuu guauauauaa uuucuuaaau uaauauucca aaagguuagu 1860

ggacuuagau uauaaauuau ggcaaaaauc uaaaaacaac aaaaaugauu uuuauacauu 1920

cuauuucauu auuccucuuu uuccaauaag ucauacaauu gguagauaug acuuauuuua 1980

uuuuuguauu auucacuaua ucuuuaugau auuuaaguau aaauaauuaa aaaaauuuau 2040

uguaccuuau agucugucac caaaaaaaaa aaauuaucug uagguaguga aaugcuaaug 2100

uugauuuguc uuuaagggcu uguuaacuau ccuuuauuuu cucauuuguc uuaaauuagg 2160

aguuuguguu uaaauuacuc aucuaagcaa aaaauguaua uaaaucccau uacuggguau 2220

auacccaaag gauuauaaau caugcugcua uaaagacaca ugcacacgua uguuuauugc 2280

agcacuauuc acaauagcaa agacuuggaa ccaacccaaa uguccaucaa ugauagacuu 2340

gauuaagaaa augugcacau auacaccaug gaauacuaug cagccauaaa aaaggaugag 2400

uucauguccu uuguagggac auggauaaag cuggaaacca ucauucugag caaacuauug 2460

caaggacaga aaaccaaaca cugcauguuc ucacucauag gugggaauug aacaaugaga 2520

acacuuggac acaaggуggg gaacaccaca caccagggcc ugucaugggg ugggggggagu 2580

ggggagggau agcauuagga gauauaccua auguaaauga ugaguuaaug ggugcagcac 2640

accaacaugg cacauguaua cauauguagc aaaccugcac guugugcaca uguacccuag 2700

aacuuaaagu auaauuaaaa aaaaaaagaa aacagaagcu auuuauaaag aaguuauuug 2760

cugaaauaaa ugugaucuuu cccauuaaaa aaauaaagaa auuuuggggu aaaaaaacac 2820

aauauauugu auucuugaaa aauucuaaga gaguggaugu gaaguguucu caccacaaaa 2880

gugauaacua auugagguaa ugcacauauu aauuagaaag auuuugucau uccacaaugu 2940

auauauacuu aaaaauaugu uauacacaau aaauacauac auuaaaaaau aaguaaaugu 3000

a 3001

<210> 66
<211> 1037
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-012

<400> 66
cccacccugc acgccggcac caaacccugu ccucccaccc cuccccacuc aucacuaaac 60

agaguaaaau gugaugcgaa uuuucccgac caaccugauu cgcuagauuu uuuuuaagga 120

aaagcuugga aagccaggac acaacgcugc ugccugcuuu gugcaggguc cuccggggcu 180

cagcccugag uuggcaucac cugcgcaggg cccucugggg cucagcccug agcuaguguc 240

accugcacag ggcccucuga ggcucagccc ugagcuggcg ucaccugugc agggcccucu 300

ggggcucagc ccugagcugg ccucaccugg guuccccacc ccgggcucuc cugcccugcc 360

cuccugcccg cccucccucc ugccugcgca gcuccuuccc uaggcaccuc ugugcugcau 420

cccaccagcc ugagcaagac gcccucucgg ggccugugcc gcacuagccu cccucuccuc 480

ugucccaua gcugguuuuu cccaccaauc cucaccuaac aguuacuuua caauuaaacu 540

caaagcaagc ucuucuccuc agcuuggggc agccauuggc cucugucucg uuuugggaaa 600

ccaaggucag gaggccguug cagacauaaa ucucggcgac ucggccccgu cuccugaggg 660

uccugcuggu gaccggccug gaccuuggcc cuacagcccu ggaggccgcu gcugaccagc 720

acugaccccg accucagaga guacucgcag gggcgcuggc ugcacucaag acccucgaga 780

uuaacggugc uaaccccguc ugcuccuccc ucccgcagag acuggggccu ggacuggaca 840

ugagagcccc uuggugccac agagggcugu gucuuacuag aaacaacgca aaccucuccu 900

uccucagaau agugaugugu ucgacguuuu aucaaaggcc cccuuucuau guucauguua 960

guuuugcucc uucuguguuu uuuucugaac cauauccaug uugcugacuu uuccaaauaa 1020

agguuuucac uccucuc 1037

<210> 67
<211> 577
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-013

<400> 67
agaggccugc cuccagggcu ggacugaggc cugagcgcuc cugccgcaga gcuggccgcg 60

ccaaauaaug ucucugugag acucgagaac uuucauuuuu uuccaggcug guucggauuu 120

gggguggauu uugguuuugu uccccuccuc cacucucccc cacccccucc ccgcccuuuu 180

uuuuuuuuuu uuuuaaacug guauuuuauc uuugauucuc cuucagcccu caccccuggu 240

ucucaucuuu cuugaucaac aucuuuucuu gccucugucc ccuucucuca ucucuuagcu 300

ccccuccaac cuggggggca gugguguggga gaagccacag gccugagauu ucaucugcuc 360

uccuuccugg agcccagagg agggcagcag aagggggugg ugucuccaac cccccagcac 420

ugaggaagaa cggggcucuu cucauuucac cccucccuuu cucccccugcc cccaggacug 480

ggccacuucu ggguggggca guggguccca gauuggcuca cacugagaau guaagaacua 540

caaacaaaau uucuauuaaa uuaaauuuug ugucucc 577

<210> 68
<211> 2212
<212> RNA
<213> Artificial Sequence

<220>

<223> 3'UTR-014

<400> 68
cucccuccau cccaaccugg cucccuccca cccaaccaac uuuccccca acccggaaac 60

agacaagcaa cccaaacuga acccccucaa aagccaaaaa augggagaca auuucacaug 120

gacuuuggaa aauauuuuuu uccuuugcau ucaucucuca aacuuaguuu uuaucuuuga 180

ccaaccgaac augaccaaaa accaaaagug cauucaaccu uaccaaaaaa aaaaaaaaaa 240

aaagaauaaa uaaauaacuu uuuaaaaaag gaagcuuggu ccacuugcuu gaagacccau 300

gcggggguaa gucccuuucu gcccguuggg cuuaugaaac cccaaugcug cccuuucugc 360

uccuuucucc acaccccccu uggggccucc ccuccacucc uucccaaauc ugucucccca 420

gaagacacag gaaacaaugu auugucugcc cagcaaucaa aggcaaugcu caaacaccca 480

aguggccccc acccucagcc cgcuccugcc cgcccagcac ccccaggccc ugggggaccu 540

gggguucuca gacugccaaa gaagccuugc caucuggcgc ucccauggcu cuugcaacau 600

cucccccuucg uuuuugaggg ggucaugccg ggggagccac cagccccuca cuggguucgg 660

aggagaguca ggaagggcca cgacaaagca gaaacaucgg auuuggggaa cgcgugucaa 720

ucccuugugc cgcagggcug ggcgggagag acuguucugu uccuugugua acuguguugc 780

ugaaagacua ccucguucuu gucuugaugu gucaccgggg caacugccug ggggcgggga 840

ugggggcagg guggaagcgg cuccccauuu uauaccaaag gugcuacauc uaugugaugg 900

gugggguggg gagggaauca cuggugcuau agaaauugag augccccccc aggccagcaa 960

auguuccuuu uuguucaaag ucuauuuuua uuccuugaua uuuuucuuuu uuuuuuuuuu 1020

uuuuugugga uggggacuug ugaauuuuuc uaaaggugcu auuuaacaug ggaggagagc 1080

gugugcggcu ccagcccagc ccgcugcuca cuuuccaccc ucucuccacc ugccucuggc 1140

uucucaggcc ucugcucucc gaccucucuc cucugaaacc cuccuccaca gcugcagccc 1200

auccucccgg cucccuccua gucuguccug cguccucugu ccccggguuu cagagacaac 1260

uucccaaagc acaaagcagu uuuucccccu agggguggga ggaagcaaaa gacucuguac 1320

cuauuuugua uguguauaau aauuugagau guuuuuaauu auuuugauug cuggaauaaa 1380

gcauguggaa augacccaaa cauaauccgc aguggccucc uaauuuccuu cuuuggaguu 1440

gggggagggg uagacauggg gaaggggcuu uggggugaug ggcuugccuu ccauuccugc 1500

ccuuucccuc cccacuauuc ucuucuagau cccuccauaa ccccacuccc cuuucucuca 1560

cccuucuuau accgcaaacc uuucuacuuc cucuuucauu uucuauucuu gcaauuuccu 1620

ugcaccuuuu ccaaauccuc uucucccccug caauaccaua caggcaaucc acgugcacaa 1680

cacacacaca cacucuucac aucugggguu guccaaaccu cauacccacu ccccuucaag 1740

cccauccacu cuccaccccc uggaugcccu gcacuuggug gcggugggau gcucauggau 1800

acugggaggg ugaggggagu ggaacccgug aggaggaccu gggggccucu ccuugaacug 1860

acaugaaggg ucaucuggcc ucugcucccu ucucacccac gcugaccucc ugccgaagga 1920

gcaacgcaac aggagagggg ucugcugagc cuggcgaggg ucugggaggg accaggagga 1980

aggcgugcuc ccugcucgcu guccuggccc ugggggagug agggagacag acaccuggga 2040

gagcuguggg gaaggcacuc gcaccgugcu cuugggaagg aaggagaccu ggcccugcuc 2100

accacggacu gggugccucg accuccugaa uccccagaac acaacccccc ugggcugggg 2160

uggucugggg aaccaucgug cccccgccuc ccgccuacuc cuuuuuaagc uu 2212

<210> 69
<211> 729
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-015

<400> 69
uuggccaggc cugacccucu uggaccuuuc uucuuugccg acaaccacug cccagcagcc 60

ucugggaccu cgggguccca gggaacccag uccagccucc uggcuguuga cuucccauug 120

cucuuggagc caccaaucaa agagauucaa agagauuccu gcaggccaga ggcggaacac 180

accuuuaugg cuggggcucu ccgugguguu cuggacccag ccccuggaga caccauucac 240

uuuuacugcu uuguagugac ucgugcucuc caaccugucu uccugaaaaa ccaaggcccc 300

cuucccccac cucuuccaug gggugagacu ugagcagaac aggggcuucc ccaaguugcc 360

cagaaagacu gucuggguga gaagccaugg ccagagcuuc ucccaggcac agguguugca 420

ccagggacuu cugcuucaag uuuuggggua aagacaccug gaucagacuc caagggcugc 480

ccugagucug ggacuucugc cuccauggcu ggucaugaga gcaaaccgua gucccccugga 540

gacagcgacu ccagagaacc ucuugggaga cagaagaggc aucugugcac agcucgaucu 600

ucuacuugcc uguggggagg ggagugacag guccacacac cacacugggu cacccugucc 660

uggaugccuc ugaagagagg gacagaccgu cagaaacugg agaguuucua uuaaagguca 720

uuuaaacca 729

<210> 70
<211> 847
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-016

<400> 70
uccuccggga ccccagcccu caggauuccu gaugcuccaa ggcgacugau gggcgcugga 60

ugaaguggca cagucagcuu cccugggggc uggugucaug uugggcuccu ggggcggggg 120

cacggccugg cauuucacgc auugcugcca ccccaggucc accugucucc acuuucacag 180

ccuccaaguc uguggcucuu cccuucuguc cuccgagggg cuugccuucu cucgugucca 240

gugaggugcu cagugaucgg cuuaacuuag agaagcccgc ccccuccccu ucuccgucug 300

ucccaagagg gucugcucug agccugcguu ccuagguggc ucggccucag cugccugggu 360

uguggccgcc cuagcauccu guaugcccac agcuacugga aucccccgcug cugcuccggg 420

ccaagcuucu gguugauuaa ugagggcaug gggugguccc ucaagaccuu ccccuaccuu 480

uuguggaacc agugaugccu caaagacagu gucccccucca cagcugggug ccaggggcag 540

gggauccuca guauagccgg ugaacccuga uaccaggagc cugggccucc cugaaccccu 600

ggcuuccagc caucucaucg ccagccuccu ccuggaccuc uuggccccca gccccuuccc 660

cacacagccc cagaaggguc ccagagcuga ccccacucca ggaccuaggc ccagccccuc 720

agccucaucu ggagccccug aagaccaguc ccacccaccu uucuggccuc aucugacacu 780

gcuccgcauc cugcugugug uccuguucca uguuccgguu ccauccaaau acacuuucug 840

gaacaaa 847

<210> 71
<211> 110
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR-017

<400> 71
gcuggagccu cgguggccau gcuucuugcc ccuugggccu ccccccagcc ccuccucccc 60

uuccugcacc cguacccccg uggucuuuga auaaagucug agugggcggc 110

<210> 72
<211> 119
<212> RNA
<213> Artificial Sequence

<220>
<223> 3' UTR no miR binding sites

<400> 72
ugauaaauagg cuggagccuc gguggccaug cuucuugccc cuugggccuc cccccagccc 60

cuccucccccu uccugcaccc guacccccgu ggucuuugaa uaaagucuga gugggcggc 119

<210> 73
<211> 87
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-142

<400> 73
gacagugcag ucacccauaa aguagaaagc acuacuaaca gcacuggagg guguaguguu 60

uccuacuuua uggaugagug uacugug 87

<210> 74
<211> 23
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-142-3p

<400> 74
uguaguguuu ccuacuuuau gga 23

<210> 75
<211> 23
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-142-3p binding site

<400> 75
uccauaaagu aggaaacacu aca 23

<210> 76
<211> 21
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-142-5p

<400> 76
cauaaaguag aaagcacuac u 21

<210> 77
<211> 21
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-142-5p binding site

<400> 77
aguagugcuu ucuacuuuau g 21

<210> 78
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<223> Syn5 promoter

<400> 78
attgggcacc cgtaaggg 18

<210> 79
<211> 92
<212> RNA
<213> Artificial Sequence

<220>
<223> 5' UTR of Citrin in Example 12

<400> 79
ucaagcuuuu ggacccucgu acagaagcua auacgacuca cuauagggaa auaagagaga 60

aaagaagagu aagaagaaau auaagagcca cc 92

<210> 80
<211> 119
<212> RNA
<213> Artificial Sequence

<220>
<223> 3' UTR of Citrin in Example 12

<400> 80
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuuggggccuc ccccccagccc 60

cuccuccccu uccugcaccc guacccccgu ggucuuugaa uaaagucuga gugggcggc 119

<210> 81
<211> 133
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with miR 142-3p binding site)

<400> 81
gcuggagccu cgguggccau gcuucuugcc ccuugggccu ccccccagcc ccuccucccc 60

uuccugcacc cguacccccu ccauaaagua ggaaacacua caguggucuu ugaauaaagu 120

cugagugggc ggc 133

<210> 82
<211> 23
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 142-3p binding site)

<400> 82
uccauaaagu aggaaacacu aca 23

<210> 83
<211> 23
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 142-3p sequence)

<400> 83
uguaguguuu ccuacuuuau gga 23

<210> 84
<211> 21
<212> RNA
<213> Artificial Sequence

<220>

<223> (miR 142-5p sequence)

<400> 84
cauaaaguag aaagcacuac u 21

<210> 85
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 146-3p sequence)

<400> 85
ccucugaaau ucaguucuuc ag 22

<210> 86
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 146-5p sequence)

<400> 86
ugagaacuga auuccauggg uu 22

<210> 87
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 155-3p sequence)

<400> 87
cuccuacaua uuagcauuaa ca 22

<210> 88
<211> 23
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 155-5p sequence)

<400> 88
uuaaugcuaa ucgugauagg ggu 23

<210> 89

<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 126-3p sequence)

<400> 89
ucguaccgug aguaauaaug cg 22

<210> 90
<211> 21
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 126-5p sequence)

<400> 90
cauuauuacu uuugguacgc g 21

<210> 91
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 16-3p sequence)

<400> 91
ccaguauuaa cugugcugcu ga 22

<210> 92
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 16-5p sequence)

<400> 92
uagcagcacg uaaauauugg cg 22

<210> 93
<211> 21
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 21-3p sequence)

<400> 93
caacaccagu cgaugggcug u 21

<210> 94
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 21-5p sequence)

<400> 94
uagcuuauca gacugauguu ga 22

<210> 95
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 223-3p sequence)

<400> 95
ugucaguuug ucaaauaccc ca 22

<210> 96
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 223-5p sequence)

<400> 96
cguguauuug acaagcugag uu 22

<210> 97
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 24-3p sequence)

<400> 97
uggcucaguu cagcaggaac ag 22

<210> 98
<211> 22
<212> RNA

<213> Artificial Sequence

<220>
<223> (miR 24-5p sequence)

<400> 98
ugccuacuga gcugauauca gu 22

<210> 99
<211> 21
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 27-3p sequence)

<400> 99
uucacagugg cuaaguuccg c 21

<210> 100
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 27-5p sequence)

<400> 100
agggcuuagc ugcuugugag ca 22

<210> 101
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 126-3p binding site)

<400> 101
cgcauuauua cucacgguac ga 22

<210> 102
<211> 141
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with miR 126-3p binding site)

<400> 102
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuugggccuc cccccagccc 60

cuccucccu uccugcaccc guacccccg cauuauuacu cacgguacga guggucuuug 120

aauaaagucu gagugggcgg c 141

<210> 103
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> (3' UTR with miR 142-3p binding site)

<400> 103
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuuggccuc cccccagccc 60

cuccucccu uccugcaccc guacccccuc cauaaaguag gaaacacuac aguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 104
<211> 141
<212> RNA
<213> Artificial Sequence

<220>
<223> (3' UTR with miR 126-3p binding site)

<400> 104
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuuggccuc cccccagccc 60

cuccucccu uccugcaccc guacccccg cauuauuacu cacgguacga guggucuuug 120

aauaaagucu gagugggcgg c 141

<210> 105
<211> 164
<212> RNA
<213> Artificial Sequence

<220>
<223> (3' UTR with miR 142-3p and miR 126-3p binding sites)

<400> 105
ugauaauagu ccauaaagua ggaaacacua cagcuggagc cucgguggcc augcuucuug 60

ccccuugggc cucccccag ccccuccucc ccuuccugca cccguacccc ccgcauuauu 120

acucacggua cgaguggucu uugaauaaag ucugaguggg cggc 164

<210> 106

<211> 23
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 155-5p sequence)

<400> 106
uuaaugcuaa uugugauagg ggu 23

<210> 107
<211> 23
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 155-5p binding site)

<400> 107
accccuauca caauuagcau uaa 23

<210> 108
<211> 188
<212> RNA
<213> Artificial Sequence

<220>
<223> (3' UTR with 3 miR 142-3p binding sites)

<400> 108
ugauaauagu ccauaaagua ggaaacacua cagcuggagc cucgguggcc augcuucuug 60

ccccuugggc cuccauaaag uaggaaacac uacaucccc cagccccucc uccccuuccu 120

gcacccguac ccccuccaua aaguaggaaa cacuacagug gucuuugaau aaagucugag 180

ugggcggc 188

<210> 109
<211> 140
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with miR 142-5p binding site)

<400> 109
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuugggccuc cccccagccc 60

cuccuccccu uccugcaccc guacccccag uagugcuuuc uacuuuaugg uggucuuuga 120

auaaagucug agugggcggc 140

<210> 110
<211> 182
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with 3 miR 142-5p binding sites)

<400> 110
ugauaauaga guagugcuuu cuacuuuaug gcuggagccu cgguggccau gcuucuugcc 60

ccuugggcca guagugcuuu cuacuuuaug ucccccccagc cccuccuccc cuuccugcac 120

ccguaccccc aguagugcuu ucuacuuuau gguggucuuu gaauaaaguc ugagugggcg 180

gc 182

<210> 111
<211> 184
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with 2 miR 142-5p binding sites and 1 miR 142-3p binding site)

<400> 111
ugauaauaga guagugcuuu cuacuuuaug gcuggagccu cgguggccau gcuucuugcc 60

ccuugggccu ccauaaagua ggaaacacua caucccccca gccccuccuc cccuuccugc 120

acccguaccc ccaguagugc uuucuacuuu augguggucu uugaauaaag ucugaguggg 180

cggc 184

<210> 112
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with miR 155-5p binding site)

<400> 112
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuugggccuc cccccagccc 60

cuccucccccu uccugcaccc guacccccac cccuaucaca auuagcauua aguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 113
<211> 188
<212> RNA
<213> Artificial Sequence

<220>
<223> (3' UTR with 3 miR 155-5p binding sites)

<400> 113
ugauaauaga ccccuaucac aauuagcauu aagcuggagc cucgguggcc augcuucuug 60

ccccuugggc caccccuauc acaauuagca uuaaucccccc cagccccucc uccccuuccu 120

gcacccguac ccccacccu aucacaauua gcauuaagug gucuuugaau aaagucugag 180

ugggcggc 188

<210> 114
<211> 188
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with 2 miR 155-5p binding sites and 1 miR 142-3p binding site)

<400> 114
ugauaauaga ccccuaucac aauuagcauu aagcuggagc cucgguggcc augcuucuug 60

ccccuugggc cuccauaaag uaggaaacac uacaucccccc cagccccucc uccccuuccu 120

gcacccguac ccccacccu aucacaauua gcauuaagug gucuuugaau aaagucugag 180

ugggcggc 188

<210> 115
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with miR 142-3p binding site, P1 insertion)

<400> 115
ugauaauagu ccauaaagua ggaaacacua cagcuggagc cucgguggcc augcuucuug 60

ccccuugggc cucccccccag ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 116
<211> 142

<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with miR 142-3p binding site, P2 insertion)

<400> 116
ugauaauagg cuggagccuc gguggcucca uaaaguagga aacacuacac augcuucuug 60

ccccuugggc cucccccccag ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 117
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with miR 142-3p binding site, P3 insertion)

<400> 117
ugauaauagg cuggagccuc gguggccaug cuucuugccc cuugggccuc cauaaaguag 60

gaaacacuac aucccccccag ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 118
<211> 21
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR-142-5p binding site)

<400> 118
aguagugcuu ucuacuuuau g 21

<210> 119
<211> 87
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR-142)

<400> 119
gacagugcag ucacccauaa aguagaaagc acuacuaaca gcacuggagg guguaguguu 60

uccuacuuua uggaugagug uacugug 87

<210> 120
<211> 70
<212> RNA
<213> Artificial Sequence

<220>
<223> (5' UTR with miR142-3p binding site at position p1)

<400> 120
gggaaauaag aguccauaaa guaggaaaca cuacaagaaa agaagaguaa gaagaaauau 60

aagagccacc 70

<210> 121
<211> 70
<212> RNA
<213> Artificial Sequence

<220>
<223> (5' UTR with miR142-3p binding site at position p2)

<400> 121
gggaaauaag agagaaaaga agaguaaucc auaaaguagg aaacacuaca gaagaaauau 60

aagagccacc 70

<210> 122
<211> 70
<212> RNA
<213> Artificial Sequence

<220>
<223> (5' UTR with miR142-3p binding site at position p3)

<400> 122
gggaaauaag agagaaaaga agaguaagaa gaaauauaau ccauaaagua ggaaacacua 60

cagagccacc 70

<210> 123
<211> 23
<212> RNA
<213> Artificial Sequence

<220>
<223> (miR 155-5p binding site)

<400> 123
accccuauca caauuagcau uaa 23

<210> 124
<211> 181
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with 3 miR 142-5p binding sites)

<400> 124
ugauaauaga guagugcuuu cuacuuuaug gcuggagccu cgguggccau gcuucuugcc 60

ccuugggcca guagugcuuu cuacuuuaug ucccccccagc cccucucccc uuccugcacc 120

cguaccccca guagugcuuu cuacuuuaug guggucuuug aauaaagucu gagugggcgg 180

c 181

<210> 125
<211> 184
<212> RNA
<213> Artificial Sequence

<220>
<223> (3'UTR with 2 miR 142-5p binding sites and 1 miR 142-3p binding site)

<400> 125
ugauaauaga guagugcuuu cuacuuuaug gcuggagccu cgguggccau gcuucuugcc 60

ccuugggccu ccauaaagua ggaaacacua caucccccca gccccuccuc cccuuccugc 120

acccguaccc ccaguagugc uuucuacuuu augguggucu uugaauaaag ucugaguggg 180

cggc 184

<210> 126
<211> 70
<212> RNA
<213> Artificial Sequence

<220>
<223> (5' UTR with miR142-3p binding site at position p1)

<400> 126
gggaaauaag aguccauaaa guaggaaaca cuacaagaaa agaagaguaa gaagaaauau 60

aagagccacc 70

<210> 127
<211> 70
<212> RNA
<213> Artificial Sequence

<220>
<223> (5' UTR with miR142-3p binding site at position p2)

<400> 127
gggaaauaag agagaaaaga agaguaaucc auaaaguagg aaacacuaca gaagaaauau 60

aagagccacc 70

<210> 128
<211> 70
<212> RNA
<213> Artificial Sequence

<220>
<223> (5' UTR with miR142-3p binding site at position p3)

<400> 128
gggaaauaag agagaaaaga agaguaagaa gaaauauaau ccauaaagua ggaaacacua 60

cagagccacc 70

<210> 129
<211> 2025
<212> RNA
<213> Artificial Sequence

<220>
<223> Construct #1 ORF of Citrin gene

<400> 129
auggccgccg ccaaggucgc ccucaccaag agggcggacc ccgcggagcu caggaccauc 60

uuucucaagu acgccuccau cgagaagaac ggggaguucu ucaugagccc gaacgauuuc 120

gucaccaggu accucaacau cuucggcgag agccagccca acccgaagac cguagagcuc 180

cucagcggcg ucgucgacca gacgaaggac ggacucauua gcuuccagga guucgucgcc 240

uucgagagcg uccucugcgc gcccgacgcc cucuucaugg ucgcguucca gcuguucgau 300

aaggccggca agggcgaggu gaccuuugaa gaugugaagc agguguucgg ucagaccacc 360

auccaccagc acaucccuuu uaacugggac ucagaauucg uccagcugca cuucggcaag 420

gaaaggaagc gccaucugac cuacgccgag uucacacagu uucuccugga gauccagcug 480

gaacacgcca aacaggcguu cguucagcgg gacaacgcca ggaccggccg ggucaccgcg 540

aucgacuucc gugauaucau ggugaccauc aggccucacg uccugacgcc cuucguggaa 600

gagugccugg uggccgccgc ggggugggacc acgucccacc aggugagcuu cuccuauuuu 660

aacggguuca acagccuccu caacaacaug gagcugaucc ggaagaucua uagcacccug 720

gccgggacgc gcaaggacgu cgaggugacc aaggaagaau ucgugcuggc cgcccagaag 780

uuuggccagg ugacgcccau ggagguggac auccuguucc aacuggcgga ccuguacgaa 840

cccaggggcc ggaugacccu ggccgacauc gagcgcauug ccccgcucga ggagggcacc 900

cugcccuuca accuggcgga ggcccagcgc cagaaggcca gcggggacag cgccaggccc 960

guccugcugc agguggccga guccgcguac agguucgguc uggggagcgu cgcgggagcc 1020

gugggugcca ccgccgugua uccgaucgac cucgugaaga cccguaugca gaaucagagg 1080

uccaccggca gcuucguggg cgagcucaug uacaagaacu ccuucgacug uuucaagaag 1140

guucuccggu acgagggguu cuucggccuc uaccggggac ugcuacccca gcugcucggc 1200

guggcgcccg agaaggccau caagcucacg gucaacgacu uugugcggga caaguucaug 1260

cacaaggacg gcagcguccc acuggccgcc gagauucugg caggcggcug cgccggaggc 1320

agccagguca ucuuuaccaa cccacuggag aucgugaaga ucaggcugca aguggccggg 1380

gagauuacca ccggaccccg ugugagcgcc cugagcgugg ugagggaccu uggcuucuuu 1440

ggcauauaca agggagccaa ggccugcuuu cugagggaca ucccguuuuc cgccauauac 1500

uuucccugcu acgcccacgu gaaagcgagc uucgccaacg aggacggcca ggucaguccc 1560

ggcucccuac ugcuggccgg agccaucgcc gggaugcccg ccgccagccu ggugacgccc 1620

gcggacguua ucaagaccag gcugcaggug gcggccaggg cgggccagac caccuacagc 1680

ggcgugaucg acugcuuccg caagauccug cgggaggagg ggcccaaggc ccuguggaaa 1740

ggcgccgggg caaggguguu caggagcagc ccacaguucg gggugacccu gcuuaccuac 1800

gaacugcugc agcggugguu cuauaucgac uucggaggag ucaagcccau gggcuccgag 1860

ccugugccca agagcaggau caaucugccc gcgcccaacc cagaccacgu gggaggguac 1920

aaacuggccg uggccaccuu cgccggaauc gagaacaagu ucggccugua ucugccccug 1980

uucaaaccgu ccgucuccac cagcaaggcc aucggcggag gcccc 2025

<210> 130
<211> 2236
<212> RNA
<213> Artificial Sequence

<220>
<223> Construct #1 Full Citrin nucleic acid with UTRs

<400> 130
gggaaauaag agagaaaaga agaguaagaa gaaauauaag agccaccaug gccgccgcca 60

aggucgcccu caccaagagg gcggaccccg cggagcucag gaccaucuuu cucaaguacg 120

ccuccaucga gaagaacggg gaguucuuca ugagcccgaa cgauuucguc accagguacc 180

ucaacaucuu cggcgagagc cagcccaacc cgaagaccgu agagcuccuc agcggcgucg 240

ucgaccagac gaaggacgga cucauuagcu uccaggaguu cgucgccuuc gagagcgucc 300

ucugcgcgcc cgacgcccuc uucauggucg cguuccagcu guucgauaag gccggcaagg 360

gcgaggugac cuuugaagau gugaagcagg uguucgguca gaccaccauc caccagcaca 420

ucccuuuuaa cugggacuca gaauucgucc agcugcacuu cggcaaggaa aggaagcgcc 480

aucugaccua cgccgaguuc acacaguuuc uccuggagau ccagcuggaa cacgccaaac 540

aggcguucgu ucagcgggac aacgccagga ccggccgggu caccgcgauc gacuuccgug 600

auaucauggu gaccaucagg ccucacgucc ugacgcccuu cguggaagag ugccuggugg 660

ccgccgcggg ugggaccacg ucccaccagg ugagcuucuc cuauuuuaac ggguucaaca 720

gccuccucaa caacauggag cugauccgga agaucuauag cacccuggcc gggacgcgca 780

aggacgucga ggugaccaag gaagaauucg ugcuggccgc ccagaaguuu ggccagguga 840

cgcccaugga gguggacauc cuguuccaac uggcggaccu guacgaaccc aggggccgga 900

ugacccuggc cgacaucgag cgcauugccc cgcucgagga gggcacccug cccuucaacc 960

uggcggaggc ccagcgccag aaggccagcg gggacagcgc caggcccguc cugcugcagg 1020

uggccgaguc cgcguacagg uucggucugg ggagcgucgc gggagccgug ggugccaccg 1080

ccguguaucc gaucgaccuc gugaagaccc guaugcagaa ucagaggucc accggcagcu 1140

ucgugggcga gcucauguac aagaacuccu ucgacuguuu caagaagguu cuccgguacg 1200

aggguucuu cggccucuac cggggacugc uaccccagcu gcucggcgug gcgcccgaga 1260

aggccaucaa gcucacgguc aacgacuuug ugcgggacaa guucaugcac aaggacggca 1320

gcgucccacu ggccgccgag auucuggcag gcggcugcgc cggaggcagc caggucaucu 1380

uuaccaaccc acuggagauc gugaagauca ggcugcaagu ggccggggag auuaccaccg 1440

gaccccgugu gagcgcccug agcgugguga gggaccuugg cuucuuuggc auauacaagg 1500

gagccaaggc cugcuuucug agggacaucc cguuuuccgc cauauacuuu cccugcuacg 1560

cccacgugaa agcgagcuuc gccaacgagg acggccaggu caguccggc ucccuacugc 1620

uggccggagc caucgccggg augcccgccg ccagccuggu gacgcccgcg gacguuauca 1680

agaccaggcu gcagguggcg gccagggcgg gccagaccac cuacagcggc gugaucgacu 1740

gcuuccgcaa gauccugcgg gaggaggggc ccaaggcccu guggaaaggc gccggggcaa 1800

ggguguucag gagcagccca caguucgggg ugacccugcu uaccuacgaa cugcugcagc 1860

ggugguucua uaucgacuuc ggaggaguca agcccauggg cuccgagccu gugcccaaga 1920

gcaggaucaa ucugcccgcg cccaacccag accacguggg aggguacaaa cuggccgugg 1980

ccaccuucgc cggaaucgag aacaaguucg gccuguaucu gccccuguuc aaaccguccg 2040

ucuccaccag caaggccauc ggcggaggcc ccugauaaua guccauaaag uaggaaacac 2100

uacagcugga gccucggugg ccaugcuucu ugccccuugg gccucccccc agccccuccu 2160

ccccuuccug cacccguacc ccccgcauua uuacucacgg uacgaguggu cuuugaauaa 2220

agucugagug ggcggc 2236

<210> 131
<211> 675
<212> PRT
<213> Artificial Sequence

<220>
<223> Construct #1 Amino acid sequence of Citrin gene

<400> 131

Met Ala Ala Ala Lys Val Ala Leu Thr Lys Arg Ala Asp Pro Ala Glu
1 5 10 15

Leu Arg Thr Ile Phe Leu Lys Tyr Ala Ser Ile Glu Lys Asn Gly Glu
20 25 30

Phe Phe Met Ser Pro Asn Asp Phe Val Thr Arg Tyr Leu Asn Ile Phe
35 40 45

Gly Glu Ser Gln Pro Asn Pro Lys Thr Val Glu Leu Leu Ser Gly Val
50 55 60

Val Asp Gln Thr Lys Asp Gly Leu Ile Ser Phe Gln Glu Phe Val Ala
65 70 75 80

Phe Glu Ser Val Leu Cys Ala Pro Asp Ala Leu Phe Met Val Ala Phe
85 90 95

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Gln Leu Phe Asp Lys Ala Gly Lys Gly Glu Val Thr Phe Glu Asp Val
            100                 105                 110

Lys Gln Val Phe Gly Gln Thr Thr Ile His Gln His Ile Pro Phe Asn
        115                 120                 125

Trp Asp Ser Glu Phe Val Gln Leu His Phe Gly Lys Glu Arg Lys Arg
    130                 135                 140

His Leu Thr Tyr Ala Glu Phe Thr Gln Phe Leu Leu Glu Ile Gln Leu
145                 150                 155                 160

Glu His Ala Lys Gln Ala Phe Val Gln Arg Asp Asn Ala Arg Thr Gly
                165                 170                 175

Arg Val Thr Ala Ile Asp Phe Arg Asp Ile Met Val Thr Ile Arg Pro
            180                 185                 190

His Val Leu Thr Pro Phe Val Glu Glu Cys Leu Val Ala Ala Ala Gly
        195                 200                 205

Gly Thr Thr Ser His Gln Val Ser Phe Ser Tyr Phe Asn Gly Phe Asn
    210                 215                 220

Ser Leu Leu Asn Asn Met Glu Leu Ile Arg Lys Ile Tyr Ser Thr Leu
225                 230                 235                 240

Ala Gly Thr Arg Lys Asp Val Glu Val Thr Lys Glu Glu Phe Val Leu
                245                 250                 255

Ala Ala Gln Lys Phe Gly Gln Val Thr Pro Met Glu Val Asp Ile Leu
            260                 265                 270

Phe Gln Leu Ala Asp Leu Tyr Glu Pro Arg Gly Arg Met Thr Leu Ala
        275                 280                 285

Asp Ile Glu Arg Ile Ala Pro Leu Glu Glu Gly Thr Leu Pro Phe Asn
    290                 295                 300

Leu Ala Glu Ala Gln Arg Gln Lys Ala Ser Gly Asp Ser Ala Arg Pro
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305                 310                 315                 320

Val Leu Leu Gln Val Ala Glu Ser Ala Tyr Arg Phe Gly Leu Gly Ser
                325                 330                 335

Val Ala Gly Ala Val Gly Ala Thr Ala Val Tyr Pro Ile Asp Leu Val
            340                 345                 350

Lys Thr Arg Met Gln Asn Gln Arg Ser Thr Gly Ser Phe Val Gly Glu
        355                 360                 365

Leu Met Tyr Lys Asn Ser Phe Asp Cys Phe Lys Lys Val Leu Arg Tyr
    370                 375                 380

Glu Gly Phe Phe Gly Leu Tyr Arg Gly Leu Leu Pro Gln Leu Leu Gly
385                 390                 395                 400

Val Ala Pro Glu Lys Ala Ile Lys Leu Thr Val Asn Asp Phe Val Arg
                405                 410                 415

Asp Lys Phe Met His Lys Asp Gly Ser Val Pro Leu Ala Ala Glu Ile
            420                 425                 430

Leu Ala Gly Gly Cys Ala Gly Gly Ser Gln Val Ile Phe Thr Asn Pro
        435                 440                 445

Leu Glu Ile Val Lys Ile Arg Leu Gln Val Ala Gly Glu Ile Thr Thr
    450                 455                 460

Gly Pro Arg Val Ser Ala Leu Ser Val Val Arg Asp Leu Gly Phe Phe
465                 470                 475                 480

Gly Ile Tyr Lys Gly Ala Lys Ala Cys Phe Leu Arg Asp Ile Pro Phe
                485                 490                 495

Ser Ala Ile Tyr Phe Pro Cys Tyr Ala His Val Lys Ala Ser Phe Ala
            500                 505                 510

Asn Glu Asp Gly Gln Val Ser Pro Gly Ser Leu Leu Leu Ala Gly Ala
        515                 520                 525
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Ile Ala Gly Met Pro Ala Ala Ser Leu Val Thr Pro Ala Asp Val Ile
    530                 535                 540

Lys Thr Arg Leu Gln Val Ala Ala Arg Ala Gly Gln Thr Thr Tyr Ser
545                 550                 555                 560

Gly Val Ile Asp Cys Phe Arg Lys Ile Leu Arg Glu Glu Gly Pro Lys
                565                 570                 575

Ala Leu Trp Lys Gly Ala Gly Ala Arg Val Phe Arg Ser Ser Pro Gln
            580                 585                 590

Phe Gly Val Thr Leu Leu Thr Tyr Glu Leu Leu Gln Arg Trp Phe Tyr
        595                 600                 605

Ile Asp Phe Gly Gly Val Lys Pro Met Gly Ser Glu Pro Val Pro Lys
    610                 615                 620

Ser Arg Ile Asn Leu Pro Ala Pro Asn Pro Asp His Val Gly Gly Tyr
625                 630                 635                 640

Lys Leu Ala Val Ala Thr Phe Ala Gly Ile Glu Asn Lys Phe Gly Leu
                645                 650                 655

Tyr Leu Pro Leu Phe Lys Pro Ser Val Ser Thr Ser Lys Ala Ile Gly
            660                 665                 670

Gly Gly Pro
        675
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<210> 132
<211> 2025
<212> RNA
<213> Artificial Sequence

<220>
<223> Construct #2 ORF of Citrin gene

<400> 132
auggccgccg ccaaggucgc ccucaccaag agggcggacc ccgcggagcu caggaccauc 60

uuucucaagu acgccuccau cgagaagaac ggggaguucu ucaugagccc gaacgauuuc 120

gucaccaggu accucaacau cuucggcgag agccagccca acccgaagac cguagagcuc 180

cucagcggcg ucgucgacca gacgaaggac ggacucauua gcuuccagga guucgucgcc 240

uucgagagcg uccucugcgc ccccgacgcc cucuucaugg ucgcguucca gcuguucgau 300

aaggccggca agggcgaggu gaccuuugaa gaugugaagc agguguucgg ucagaccacc 360

auccaccagc acaucccuuu uaacugggac ucagaauucg uccagcugca cuucggcaag 420

gaaaggaagc gccaucugac cuacgccgag uucacacagu uucuccugga gauccagcug 480

gaacacgcca aacaggcguu cguucagcgg gacaacgcca ggaccggccg ggucaccgcg 540

aucgacuucc gugauaucau ggugaccauc aggccucacg uccugacccc cuucguggaa 600

gagugccugg uggccgccgc ggggugggacc acgucccacc aggugagcuu cuccuauuuu 660

aacggguuca acagccuccu caacaacaug gagcugaucc ggaagaucua uagcacccug 720

gccgggacgc gcaaggacgu cgaggugacc aaggaagaau ucgugcuggc cgcccagaag 780

uuuggccagg ugacccccau ggagguggac auccuguucc aacuggcgga ccuguacgaa 840

cccaggggcc ggaugacccu ggccgacauc gagcgcauug ccccgcucga ggagggcacc 900

cugcccuuca accuggcgga ggcccagcgc cagaaggcca gcggggacag cgccaggccc 960

guccugcugc agguggccga guccgcguac agguucgguc uggggagcgu cgcgggagcc 1020

gugggugcca ccgccgugua uccgaucgac cucgugaaga cccguaugca gaaucagagg 1080

uccaccggca gcuucguggg cgagcucaug uacaagaacu ccuucgacug uuucaagaag 1140

guucuccggu acgagggguu cuucggccuc uaccgggggc ugcuacccca gcugcucggc 1200

guggcgcccg agaaggccau caagcucacg gucaacgacu uugugcggga caaguucaug 1260

cacaaggacg gcagcguccc ccuggccgcc gagauucugg caggcggcug cgccggaggc 1320

agccagguca ucuuuaccaa ccccccuggag aucgugaaga ucaggcugca aguggccggg 1380

gagauuacca ccggaccccg ugugagcgcc cugagcgugg ugagggaccu uggcuucuuu 1440

ggcauauaca agggagccaa ggccugcuuu cugagggaca ucccguuuuc cgccauauac 1500

uuucccugcu acgcccacgu gaaagcgagc uucgccaacg aggacggcca ggucaguccc 1560

ggcucccuac ugcuggccgg agccaucgcc gggaugcccg ccgccagccu ggugaccccc 1620

gcggacguua ucaagaccag gcugcaggug gcggccaggg cgggccagac caccuacagc 1680

ggcgugaucg acugcuuccg caagauccug cgggaggagg ggcccaaggc ccuguggaaa 1740

ggcgccgggg caaggguguu caggagcagc ccccaguucg gggugacccu gcuuaccuac 1800

gaacugcugc agcggugguu cuauaucgac uucgggggag ucaagcccau gggcuccgag 1860

ccugugccca agagcaggau caaucugccc gcccccaacc cagaccacgu gggaggguac 1920

aaacuggccg uggccaccuu cgccggaauc gagaacaagu ucggccugua ucugccccug 1980

uucaaaccgu ccgucuccac cagcaaggcc aucggcgggg gcccc 2025

<210> 133
<211> 2236
<212> RNA
<213> Artificial Sequence

<220>
<223> Construct #2 Full Citrin nucleic acid with UTRs

<400> 133
gggaaauaag agagaaaaga agaguaagaa gaaauauaag agccaccaug gccgccgcca 60

aggucgcccu caccaagagg gcggaccccg cggagcucag gaccaucuuu cucaaguacg 120

ccuccaucga gaagaacggg gaguucuuca ugagcccgaa cgauuucguc accagguacc 180

ucaacaucuu cggcgagagc cagcccaacc cgaagaccgu agagcuccuc agcggcgucg 240

ucgaccagac gaaggacgga cucauuagcu uccaggaguu cgucgccuuc gagagcgucc 300

ucugcgcccc cgacgcccuc uucauggucg cguuccagcu guucgauaag gccggcaagg 360

gcgaggugac cuuugaagau gugaagcagg uguucgguca gaccaccauc caccagcaca 420

ucccuuuuaa cugggacuca gaauucgucc agcugcacuu cggcaaggaa aggaagcgcc 480

aucugaccua cgccgaguuc acacaguuuc uccuggagau ccagcuggaa cacgccaaac 540

aggcguucgu ucagcgggac aacgccagga ccggccgggu caccgcgauc gacuuccgug 600

auaucauggu gaccaucagg ccucacgucc ugacccccuu cguggaagag ugccuggugg 660

ccgccgcggg ugggaccacg ucccaccagg ugagcuucuc cuauuuuaac ggguucaaca 720

gccuccucaa caacauggag cugauccgga agaucuauag cacccuggcc gggacgcgca 780

aggacgucga ggugaccaag gaagaauucg ugcuggccgc ccagaaguuu ggccagguga 840

cccccaugga gguggacauc cuguuccaac uggcggaccu guacgaaccc aggggccgga 900

ugacccuggc cgacaucgag cgcauugccc cgcucgagga gggcacccug cccuucaacc 960

uggcggaggc ccagcgccag aaggccagcg gggacagcgc caggcccguc cugcugcagg 1020

uggccgaguc cgcguacagg uucggucugg ggagcgucgc gggagccgug ggugccaccg 1080

ccguguaucc gaucgaccuc gugaagaccc guaugcagaa ucagaggucc accggcagcu 1140

ucgugggcga gcucauguac aagaacuccu ucgacuguuu caagaagguu cuccgguacg 1200

agggguucuu cggccucuac cgggggcugc uaccccagcu gcucggcgug gcgcccgaga 1260

aggccaucaa gcucacgguc aacgacuuug ugcgggacaa guucaugcac aaggacggca 1320

gcgucccccu ggccgccgag auucuggcag gcggcugcgc cggaggcagc caggucaucu 1380

uuaccaaccc ccuggagauc gugaagauca ggcugcaagu ggccggggag auuaccaccg 1440

gaccccgugu gagcgcccug agcgugguga gggaccuugg cuucuuuggc auauacaagg 1500

gagccaaggc cugcuuucug agggacaucc cguuuuccgc cauauacuuu cccugcuacg 1560

cccacgugaa agcgagcuuc gccaacgagg acggccaggu caguccggc ucccuacugc 1620

uggccggagc caucgccggg augcccgccg ccagccuggu gacccccgcg gacguuauca 1680

agaccaggcu gcagguggcg gccagggcgg gccagaccac cuacagcggc gugaucgacu 1740

gcuuccgcaa gauccugcgg gaggaggggc ccaaggcccu guggaaaggc gccggggcaa 1800

ggguguucag gagcagcccc caguucgggg ugacccugcu uaccuacgaa cugcugcagc 1860

ggugguucua uaucgacuuc gggggaguca agcccauggg cuccgagccu gugcccaaga 1920

gcaggaucaa ucugcccgcc cccaacccag accacguggg aggguacaaa cuggccgugg 1980

ccaccuucgc cggaaucgag aacaaguucg gccuguaucu gccccuguuc aaaccguccg 2040

ucuccaccag caaggccauc ggcgggggcc ccugauaaua guccauaaag uaggaaacac 2100

uacagcugga gccucggugg ccaugcuucu ugccccuugg gccucccccc agccccuccu 2160

ccccuuccug cacccguacc ccccgcauua uuacucacgg uacgaguggu cuuugaauaa 2220

agucugagug ggcggc 2236

<210> 134
<211> 675
<212> PRT
<213> Artificial Sequence

<220>
<223> Construct #2 Amino acid sequence of Citrin gene

<400> 134

Met Ala Ala Ala Lys Val Ala Leu Thr Lys Arg Ala Asp Pro Ala Glu
1 5 10 15

Leu Arg Thr Ile Phe Leu Lys Tyr Ala Ser Ile Glu Lys Asn Gly Glu
20 25 30

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Phe Phe Met Ser Pro Asn Asp Phe Val Thr Arg Tyr Leu Asn Ile Phe
        35                  40                  45

Gly Glu Ser Gln Pro Asn Pro Lys Thr Val Glu Leu Leu Ser Gly Val
    50                  55                  60

Val Asp Gln Thr Lys Asp Gly Leu Ile Ser Phe Gln Glu Phe Val Ala
65                  70                  75                  80

Phe Glu Ser Val Leu Cys Ala Pro Asp Ala Leu Phe Met Val Ala Phe
                85                  90                  95

Gln Leu Phe Asp Lys Ala Gly Lys Gly Glu Val Thr Phe Glu Asp Val
            100                 105                 110

Lys Gln Val Phe Gly Gln Thr Thr Ile His Gln His Ile Pro Phe Asn
        115                 120                 125

Trp Asp Ser Glu Phe Val Gln Leu His Phe Gly Lys Glu Arg Lys Arg
    130                 135                 140

His Leu Thr Tyr Ala Glu Phe Thr Gln Phe Leu Leu Glu Ile Gln Leu
145                 150                 155                 160

Glu His Ala Lys Gln Ala Phe Val Gln Arg Asp Asn Ala Arg Thr Gly
                165                 170                 175

Arg Val Thr Ala Ile Asp Phe Arg Asp Ile Met Val Thr Ile Arg Pro
            180                 185                 190

His Val Leu Thr Pro Phe Val Glu Glu Cys Leu Val Ala Ala Ala Gly
        195                 200                 205

Gly Thr Thr Ser His Gln Val Ser Phe Ser Tyr Phe Asn Gly Phe Asn
    210                 215                 220

Ser Leu Leu Asn Asn Met Glu Leu Ile Arg Lys Ile Tyr Ser Thr Leu
225                 230                 235                 240

Ala Gly Thr Arg Lys Asp Val Glu Val Thr Lys Glu Glu Phe Val Leu
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                245                 250                 255

Ala Ala Gln Lys Phe Gly Gln Val Thr Pro Met Glu Val Asp Ile Leu
            260                 265                 270

Phe Gln Leu Ala Asp Leu Tyr Glu Pro Arg Gly Arg Met Thr Leu Ala
        275                 280                 285

Asp Ile Glu Arg Ile Ala Pro Leu Glu Glu Gly Thr Leu Pro Phe Asn
    290                 295                 300

Leu Ala Glu Ala Gln Arg Gln Lys Ala Ser Gly Asp Ser Ala Arg Pro
305                 310                 315                 320

Val Leu Leu Gln Val Ala Glu Ser Ala Tyr Arg Phe Gly Leu Gly Ser
                325                 330                 335

Val Ala Gly Ala Val Gly Ala Thr Ala Val Tyr Pro Ile Asp Leu Val
            340                 345                 350

Lys Thr Arg Met Gln Asn Gln Arg Ser Thr Gly Ser Phe Val Gly Glu
        355                 360                 365

Leu Met Tyr Lys Asn Ser Phe Asp Cys Phe Lys Lys Val Leu Arg Tyr
    370                 375                 380

Glu Gly Phe Phe Gly Leu Tyr Arg Gly Leu Leu Pro Gln Leu Leu Gly
385                 390                 395                 400

Val Ala Pro Glu Lys Ala Ile Lys Leu Thr Val Asn Asp Phe Val Arg
                405                 410                 415

Asp Lys Phe Met His Lys Asp Gly Ser Val Pro Leu Ala Ala Glu Ile
            420                 425                 430

Leu Ala Gly Gly Cys Ala Gly Gly Ser Gln Val Ile Phe Thr Asn Pro
        435                 440                 445

Leu Glu Ile Val Lys Ile Arg Leu Gln Val Ala Gly Glu Ile Thr Thr
    450                 455                 460
```

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Gly Pro Arg Val Ser Ala Leu Ser Val Val Arg Asp Leu Gly Phe Phe
465                 470                 475                 480

Gly Ile Tyr Lys Gly Ala Lys Ala Cys Phe Leu Arg Asp Ile Pro Phe
                485                 490                 495

Ser Ala Ile Tyr Phe Pro Cys Tyr Ala His Val Lys Ala Ser Phe Ala
            500                 505                 510

Asn Glu Asp Gly Gln Val Ser Pro Gly Ser Leu Leu Leu Ala Gly Ala
        515                 520                 525

Ile Ala Gly Met Pro Ala Ala Ser Leu Val Thr Pro Ala Asp Val Ile
    530                 535                 540

Lys Thr Arg Leu Gln Val Ala Ala Arg Ala Gly Gln Thr Thr Tyr Ser
545                 550                 555                 560

Gly Val Ile Asp Cys Phe Arg Lys Ile Leu Arg Glu Glu Gly Pro Lys
                565                 570                 575

Ala Leu Trp Lys Gly Ala Gly Ala Arg Val Phe Arg Ser Ser Pro Gln
            580                 585                 590

Phe Gly Val Thr Leu Leu Thr Tyr Glu Leu Leu Gln Arg Trp Phe Tyr
        595                 600                 605

Ile Asp Phe Gly Gly Val Lys Pro Met Gly Ser Glu Pro Val Pro Lys
    610                 615                 620

Ser Arg Ile Asn Leu Pro Ala Pro Asn Pro Asp His Val Gly Gly Tyr
625                 630                 635                 640

Lys Leu Ala Val Ala Thr Phe Ala Gly Ile Glu Asn Lys Phe Gly Leu
                645                 650                 655

Tyr Leu Pro Leu Phe Lys Pro Ser Val Ser Thr Ser Lys Ala Ile Gly
            660                 665                 670

Gly Gly Pro
        675
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<210> 135
<211> 2025
<212> RNA
<213> Artificial Sequence

<220>
<223> Construct #3 ORF of Citrin gene

<400> 135
auggccgccg ccaaggucgc acucaccaaa cgggccgacc ccgccgagcu caggaccauc 60

uuccucaagu acgccagcau cgagaagaac ggggaguucu ucaugagccc caacgacuuc 120

guaaccaggu accucaauau cuucggcgaa agccagccca acccgaagac cgucgagcuc 180

cucuccgggg ucgucgauca gaccaaggac gggcucaucu ccuuccagga guucguggcc 240

uucgaguccg uccucugcgc cccggacgcc cucuucaugg ucgccuucca acucuucgau 300

aaggccggga aaggcgaggu gaccuucgaa gaugugaagc agguuuucgg ccagaccacg 360

auccaccagc auauaccccuu uaacugggac agcgaguucg ugcagcugca cuucggcaaa 420

gagaggaaga ggcaccucac cuaugccgaa uucacacaau uccugcucga gauucagcug 480

gagcaugcca aacaagccuu uguccagcgg gacaacgcca ggaccggcag ggucaccgcg 540

aucgacuuuc gcgauaucau ggugaccauc aggccccacg ugcucacccc cuuuguggag 600

gagugccugg ucgccgccgc cggcgggacg accagccacc agguguccuu cucauacuuc 660

aacggguuca acagccugcu gaacaacaug gagcugaucc gcaagaucua cuccacccug 720

gccggcacca ggaaggacgu ggaagugacc aaggaggagu ucguucucgc cgcccagaaa 780

uucggacagg ugaccccgau ggagguggac auccucuucc agcuggccga ucucuacgag 840

ccccggggca ggaugacgcu cgccgacauc gagcgaaucg ccccccugga ggaggguacc 900

cuucccuuca accuggccga ggcccagcga cagaaagcca gcggcgacag ugccaggccc 960

gugcuccugc agguggccga auccgccuac agauuuggcc ugggcagcgu cgccggcgca 1020

gugggcgcca ccgccgugua cccgaucgac cuggucaaga ccaggaugca gaaccagaga 1080

agcaccggcu ccuuuguggg cgagcuuaug uacaagaaca gcuucgacug cuucaagaag 1140

guccugcguu acgagggcuu cuucgggcug uaccggggcc ugcugccgca gcugcuaggc 1200

gucgcgcccg agaaggccau uaagcugacc gugaacgacu ucguacggga caaauucaug 1260

cacaaggacg gcagugugcc ccuggccgca gagauccugg ccgggggcug ugccggcggg 1320

ucccagguga ucuuuacgaa cccccuggag auagugaaga uccggcugca gguggccggg 1380

gagaucacca ccggcccccg gguguccgcc cugagcgucg ugagggaucu gggguucuuu 1440

ggcaucuaua agggugccaa ggccugcuuc cugcgugaca uucccuuuag cgccaucuac 1500

uuccccugcu acgcccaugu caaggccagc uucgccaacg aagacggaca ggugagcccc 1560

gggucccugc ugcuggccgg cgccaucgca gggaugccgg ccgccucacu ggugaccccg 1620

gcggacguga uaaagacgag gcugcaggug gccgcccgcg caggccagac cacguacucg 1680

ggugugauag acugcuuccg gaagauccug agggaagaag gccccaaggc ccuguggaag 1740

ggggccggcg ccaggguguu ccgcagcagc ccccaguucg gggucacccu gcucacguac 1800

gagcuccugc agaggugguu cuacaucgac uuuggcgggg ucaagcccau gggcagugag 1860

ccggugccca agagccggau caaucugccc gcccccaacc cugaccacgu cggcggguac 1920

aaacuggcgg uggccaccuu cgccggcauc gagaacaagu uuggccugua ccugccgcug 1980

uuuaagccgu ccgugagcac cuccaaggcc aucgggggcg gccca 2025

<210> 136
<211> 2236
<212> RNA
<213> Artificial Sequence

<220>
<223> Construct #3 Full Citrin nucleic acid with UTRs

<400> 136
gggaaauaag agagaaaaga agaguaagaa gaaauauaag agccaccaug gccgccgcca 60

aggucgcacu caccaaacgg gccgaccccg ccgagcucag gaccaucuuc cucaaguacg 120

ccagcaucga gaagaacggg gaguucuuca ugagccccaa cgacuucgua accagguacc 180

ucaauaucuu cggcgaaagc cagcccaacc cgaagaccgu cgagcuccuc uccggggucg 240

ucgaucagac caaggacggg cucaucuccu uccaggaguu cguggccuuc gaguccgucc 300

ucugcgcccc ggacgcccuc uucauggucg ccuuccaacu cuucgauaag gccgggaaag 360

gcgaggugac cuucgaagau gugaagcagg uuuucggcca gaccacgauc caccagcaua 420

uccccuuuaa cugggacagc gaguucgugc agcugcacuu cggcaaagag aggaagaggc 480

accucaccua ugccgaauuc acacaauucc ugcucgagau ucagcuggag caugccaaac 540

aagccuuugu ccagcgggac aacgccagga ccggcagggu caccgcgauc gacuuucgcg 600

auaucauggu gaccaucagg ccccacgugc ucacccccuu uguggaggag ugccuggucg 660

ccgccgccgg cgggacgacc agccaccagg uguccuucuc auacuucaac ggguucaaca 720

gccugcugaa caacauggag cugauccgca agaucuacuc cacccuggcc ggcaccagga 780

aggacgugga agugaccaag gaggaguucg uucucgccgc ccagaaauuc ggacagguga 840

ccccgaugga gguggacauc cucuuccagc uggccgaucu cuacgagccc cggggcagga 900

ugacgcucgc cgacaucgag cgaaucgccc cccuggagga ggguacccuu cccuucaacc 960

uggccgaggc ccagcgacag aaagccagcg gcgacagugc caggcccgug cuccugcagg 1020

uggccgaauc cgccuacaga uuuggccugg gcagcgucgc cggcgcagug ggcgccaccg 1080

ccguguaccc gaucgaccug gucaagacca ggaugcagaa ccagagaagc accggcuccu 1140

uugugggcga gcuuauguac aagaacagcu ucgacugcuu caagaagguc cugcguuacg 1200

agggcuucuu cgggcuguac cggggccugc ugccgcagcu gcuaggcguc gcgcccgaga 1260

aggccauuaa gcugaccgug aacgacuucg uacgggacaa auucaugcac aaggacggca 1320

gugugccccu ggccgcagag auccuggccg ggggcugugc cggcgggucc caggugaucu 1380

uuacgaaccc ccuggagaua gugaagaucc ggcugcaggu ggccggggag aucaccaccg 1440

gcccccgggu guccgcccug agcgucguga gggaucuggg guucuuuggc aucuauaagg 1500

gugccaaggc cugcuuccug cgugacauuc ccuuuagcgc caucuacuuc cccugcuacg 1560

cccaugucaa ggccagcuuc gccaacgaag acggacaggu gagccccggg ucccugcugc 1620

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ggugguucua caucgacuuu ggcgggguca agcccauggg cagugagccg gugcccaaga 1920

gccggaucaa ucugcccgcc cccaacccug accacgucgg cggguacaaa cuggcggugg 1980

ccaccuucgc cggcaucgag aacaaguuug gccuguaccu gccgcuguuu aagccguccg 2040

ugagcaccuc caaggccauc gggggcggcc caugauaaua guccauaaag uaggaaacac 2100

uacagcugga gccucggugg ccaugcuucu ugccccuugg gccucccccc agccccuccu 2160

ccccuuccug cacccguacc ccccgcauua uuacucacgg uacgaguggu cuuugaauaa 2220

agucugagug ggcggc 2236

<210> 137
<211> 675
<212> PRT
<213> Artificial Sequence

<220>
<223> Construct #3 Amino acid sequence of Citrin gene

<400> 137

Met Ala Ala Ala Lys Val Ala Leu Thr Lys Arg Ala Asp Pro Ala Glu
1 5 10 15

Leu Arg Thr Ile Phe Leu Lys Tyr Ala Ser Ile Glu Lys Asn Gly Glu
20 25 30

Phe Phe Met Ser Pro Asn Asp Phe Val Thr Arg Tyr Leu Asn Ile Phe
35 40 45

Gly Glu Ser Gln Pro Asn Pro Lys Thr Val Glu Leu Leu Ser Gly Val
50 55 60

Val Asp Gln Thr Lys Asp Gly Leu Ile Ser Phe Gln Glu Phe Val Ala
65 70 75 80

Phe Glu Ser Val Leu Cys Ala Pro Asp Ala Leu Phe Met Val Ala Phe
85 90 95

Gln Leu Phe Asp Lys Ala Gly Lys Gly Glu Val Thr Phe Glu Asp Val
100 105 110

Lys Gln Val Phe Gly Gln Thr Thr Ile His Gln His Ile Pro Phe Asn
115 120 125

Trp Asp Ser Glu Phe Val Gln Leu His Phe Gly Lys Glu Arg Lys Arg
130 135 140

His Leu Thr Tyr Ala Glu Phe Thr Gln Phe Leu Leu Glu Ile Gln Leu
145 150 155 160

Glu His Ala Lys Gln Ala Phe Val Gln Arg Asp Asn Ala Arg Thr Gly
165 170 175

Arg Val Thr Ala Ile Asp Phe Arg Asp Ile Met Val Thr Ile Arg Pro

```
            180                 185                 190

His Val Leu Thr Pro Phe Val Glu Glu Cys Leu Val Ala Ala Ala Gly
        195                 200                 205

Gly Thr Thr Ser His Gln Val Ser Phe Ser Tyr Phe Asn Gly Phe Asn
    210                 215                 220

Ser Leu Leu Asn Asn Met Glu Leu Ile Arg Lys Ile Tyr Ser Thr Leu
225                 230                 235                 240

Ala Gly Thr Arg Lys Asp Val Glu Val Thr Lys Glu Glu Phe Val Leu
                245                 250                 255

Ala Ala Gln Lys Phe Gly Gln Val Thr Pro Met Glu Val Asp Ile Leu
            260                 265                 270

Phe Gln Leu Ala Asp Leu Tyr Glu Pro Arg Gly Arg Met Thr Leu Ala
        275                 280                 285

Asp Ile Glu Arg Ile Ala Pro Leu Glu Glu Gly Thr Leu Pro Phe Asn
    290                 295                 300

Leu Ala Glu Ala Gln Arg Gln Lys Ala Ser Gly Asp Ser Ala Arg Pro
305                 310                 315                 320

Val Leu Leu Gln Val Ala Glu Ser Ala Tyr Arg Phe Gly Leu Gly Ser
                325                 330                 335

Val Ala Gly Ala Val Gly Ala Thr Ala Val Tyr Pro Ile Asp Leu Val
            340                 345                 350

Lys Thr Arg Met Gln Asn Gln Arg Ser Thr Gly Ser Phe Val Gly Glu
        355                 360                 365

Leu Met Tyr Lys Asn Ser Phe Asp Cys Phe Lys Lys Val Leu Arg Tyr
    370                 375                 380

Glu Gly Phe Phe Gly Leu Tyr Arg Gly Leu Leu Pro Gln Leu Leu Gly
385                 390                 395                 400
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```
Val Ala Pro Glu Lys Ala Ile Lys Leu Thr Val Asn Asp Phe Val Arg
                405                 410                 415

Asp Lys Phe Met His Lys Asp Gly Ser Val Pro Leu Ala Ala Glu Ile
            420                 425                 430

Leu Ala Gly Gly Cys Ala Gly Gly Ser Gln Val Ile Phe Thr Asn Pro
        435                 440                 445

Leu Glu Ile Val Lys Ile Arg Leu Gln Val Ala Gly Glu Ile Thr Thr
    450                 455                 460

Gly Pro Arg Val Ser Ala Leu Ser Val Val Arg Asp Leu Gly Phe Phe
465                 470                 475                 480

Gly Ile Tyr Lys Gly Ala Lys Ala Cys Phe Leu Arg Asp Ile Pro Phe
                485                 490                 495

Ser Ala Ile Tyr Phe Pro Cys Tyr Ala His Val Lys Ala Ser Phe Ala
            500                 505                 510

Asn Glu Asp Gly Gln Val Ser Pro Gly Ser Leu Leu Leu Ala Gly Ala
        515                 520                 525

Ile Ala Gly Met Pro Ala Ala Ser Leu Val Thr Pro Ala Asp Val Ile
    530                 535                 540

Lys Thr Arg Leu Gln Val Ala Ala Arg Ala Gly Gln Thr Thr Tyr Ser
545                 550                 555                 560

Gly Val Ile Asp Cys Phe Arg Lys Ile Leu Arg Glu Glu Gly Pro Lys
                565                 570                 575

Ala Leu Trp Lys Gly Ala Gly Ala Arg Val Phe Arg Ser Ser Pro Gln
            580                 585                 590

Phe Gly Val Thr Leu Leu Thr Tyr Glu Leu Leu Gln Arg Trp Phe Tyr
        595                 600                 605

Ile Asp Phe Gly Gly Val Lys Pro Met Gly Ser Glu Pro Val Pro Lys
    610                 615                 620
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Ser Arg Ile Asn Leu Pro Ala Pro Asn Pro Asp His Val Gly Gly Tyr
625                 630                 635                 640

Lys Leu Ala Val Ala Thr Phe Ala Gly Ile Glu Asn Lys Phe Gly Leu
                645                 650                 655

Tyr Leu Pro Leu Phe Lys Pro Ser Val Ser Thr Ser Lys Ala Ile Gly
            660                 665                 670

Gly Gly Pro
        675
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<210> 138
<211> 2025
<212> RNA
<213> Artificial Sequence

<220>
<223> Construct #4 ORF of Citrin gene

<400> 138

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gucaccaggu accuaaacau cuucggcgag agccagccga accccaagac cgucgaauug      180

cuaucgggcg ucgucgacca gaccaaggac gggcucauca gcuuccagga guucgucgcc      240

uucgaguccg uccucugcgc ccccgacgcc cucuucaugg uagcauucca guuguucgac      300

aaggccggaa agggggaggu gaccuucgag gacgugaagc agguguuugg ucagaccacc      360

auccaucagc acaucccguu uaacugggac ucggaguucg ugcagcucca cuucggcaag      420

gaacgaaagc ggcaccucac cuacgccgag uucacccagu uccugcugga gauccagcug      480

gaacacgcca agcaggccuu cgugcagcga gacaaugcga ggaccgggcg cgugacugcc      540

aucgauuuca gggacaucau ggugaccauc cggccccacg ugcugacucc cuucguggag      600

gagugccugg ucgcagccgc cgggguacc accucccacc aggugagcuu cagcuacuuc      660

aacggcuuca acagccugcu caacaacaug gaacugaucc gcaagaucua uuccacacuc      720

gccggcacca ggaaggaugu ggaggugacc aaggaggagu uugugcuggc ggcccagaag      780

uuugggcagg ucacccccau ggagguggac auccucuucc agcuggccga ccuguacgag      840

cccaggggca ggaugacccu ggccgacauc gaacgaaucg ccccccugga ggagggcaca      900
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cugcccuuca accuggccga ggcccagagg cagaaggccu ccggcgacag cgcccgaccc 960

gugcuucugc aaguggccga gagcgccuac cgcuuuggcc ugggauccgu ggccggcgcc 1020

gucggugcca ccgccgugua cccaaucgac cuagugaaga cacgcaugca gaaccagcgc 1080

agcaccggcu ccuuugucgg ggagcugaug uauaagaaca gcuucgacug cuucaagaag 1140

gugcugcgcu acgagggcuu cuucggccug uacaggggggc ugcugcccca acugcugggc 1200

guggcccccg agaaggccau caagcugacc guuaacgacu ucgugcgaga caaguucaug 1260

cacaaggacg gcagcgugcc cuuggccgca gagauacugg ccgggggcug cgccggcggg 1320

ucgcagguga ucuucaccaa cccccucgag aucguaaaga ucaggcucca aguggccggg 1380

gagaucacca ccggccccag gguguccgcc cugucggugg ucagggaccu gggguucuuc 1440

gggauauaca agggcgcgaa ggccugcuuc cugagggaca uccccuucag cgccaucuac 1500

uuucccugcu acgcccacgu caaggccagc uucgccaacg aggauggcca ggugucccg 1560

ggcucccugc uccuggccgg ugcuaucgcg ggaaugcccg ccgcgagccu ggugaccccc 1620

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gaacugcugc agaggugguu cuacaucgac uucgggggcg ugaagcccau gggcuccgag 1860

ccggugccua agagccggau caaucugccc gcccccaacc ccgaccacgu ggggggcuac 1920

aagcuggccg uggcuaccuu cgccgguauc gagaacaagu ucggccugua ccugccccug 1980

uucaagcccu ccgugagcac gagcaaggcc aucgggggcg gcccc 2025

<210> 139
<211> 2236
<212> RNA
<213> Artificial Sequence

<220>
<223> Construct #4 Full Citrin nucleic acid with UTRs

<400> 139
gggaaauaag agagaaaaga agaguaagaa gaaauauaag agccaccaug gccgccgcua 60

aggucgcccu cacgaagcgg gccgaucccg ccgagcuccg gaccaucuuu cucaaauacg 120

ccagcaucga gaagaacggc gaguucuuca ugucccccaa cgacuucguc accagguacc 180

uaaacaucuu cggcgagagc cagccgaacc ccaagaccgu cgaauugcua ucgggcgucg 240

ucgaccagac caaggacggg cucaucagcu uccaggaguu cgucgccuuc gaguccgucc 300

ucugcgcccc cgacgcccuc uucaugguag cauuccaguu guucgacaag gccggaaagg 360

gggaggugac cuucgaggac gugaagcagg uguuugguca gaccaccauc caucagcaca 420

ucccguuuaa cugggacucg gaguucgugc agcuccacuu cggcaaggaa cgaaagcggc 480

accucaccua cgccgaguuc acccaguucc ugcuggagau ccagcuggaa cacgccaagc 540

aggccuucgu gcagcgagac aaugcgagga ccgggcgcgu gacugccauc gauuucaggg 600

acaucauggu gaccauccgg ccccacgugc ugacucccuu cguggaggag ugccuggucg 660

cagccgccgg ggguaccacc ucccaccagg ugagcuucag cuacuucaac ggcuucaaca 720

gccugcucaa caacauggaa cugauccgca agaucuauuc cacacucgcc ggcaccagga 780

aggaugugga ggugaccaag gaggaguuug ugcuggcggc ccagaaguuu gggcagguca 840

cccccaugga gguggacauc cucuuccagc uggccgaccu guacgagccc aggggcagga 900

ugacccuggc cgacaucgaa cgaaucgccc cccuggagga gggcacacug cccuucaacc 960

uggccgaggc ccagaggcag aaggccuccg gcgacagcgc ccgacccgug cuucugcaag 1020

uggccgagag cgccuaccgc uuuggccugg gauccguggc cggcgccguc ggugccaccg 1080

ccguguaccc aaucgaccua gugaagacac gcaugcagaa ccagcgcagc accggcuccu 1140

uugucgggga gcugauguau aagaacagcu ucgacugcuu caagaaggug cugcgcuacg 1200

agggcuucuu cggccuguac agggggcugc ugccccaacu gcugggcgug gcccccgaga 1260

aggccaucaa gcugaccguu aacgacuucg ugcgagacaa guucaugcac aaggacggca 1320

gcgugcccuu ggccgcagag auacuggccg ggggcugcgc cggcgggucg caggugaucu 1380

ucaccaaccc ccucgagauc guaaagauca ggcuccaagu ggccggggag aucaccaccg 1440

gccccagggu guccgcccug ucggugguca gggaccuggg guucuucggg auauacaagg 1500

gcgcgaaggc cugcuuccug agggacaucc ccuucagcgc caucuacuuu cccugcuacg 1560

cccacgucaa ggccagcuuc gccaacgagg auggccaggu gucccgggc ucccugcucc 1620

uggccggugc uaucgcggga augcccgccg cgagccuggu gacccccgcc gaugugauca 1680

agaccaggcu gcaagucgcg gcgagggccg gucagaccac cuacuccggg gucaucgauu 1740

gcuuuaggaa gauccuccgg gaggaggggc ccaaggcacu guggaagggg gccggggcca 1800

ggguguuccg uagcucccccc caguuuggcg ugacccugcu gaccuacgaa cugcugcaga 1860

ggugguucua caucgacuuc gggggcguga agcccauggg cuccgagccg gugccuaaga 1920

gccggaucaa ucugcccgcc cccaaccccg accacguggg gggcuacaag cuggccgugg 1980

cuaccuucgc cgguaucgag aacaaguucg gccuguaccu gccccuguuc aagcccuccg 2040

ugagcacgag caaggccauc gggggcggcc ccugauaaua guccauaaag uaggaaacac 2100

uacagcugga gccucggugg ccaugcuucu ugccccuugg gccucccccc agccccuccu 2160

ccccuuccug cacccguacc ccccgcauua uuacucacgg uacgaguggu cuuugaauaa 2220

agucugagug ggcggc 2236

<210> 140
<211> 675
<212> PRT
<213> Artificial Sequence

<220>
<223> Construct #4 Amino acid sequence of Citrin gene

<400> 140

Met Ala Ala Ala Lys Val Ala Leu Thr Lys Arg Ala Asp Pro Ala Glu
1 5 10 15

Leu Arg Thr Ile Phe Leu Lys Tyr Ala Ser Ile Glu Lys Asn Gly Glu
20 25 30

Phe Phe Met Ser Pro Asn Asp Phe Val Thr Arg Tyr Leu Asn Ile Phe
35 40 45

Gly Glu Ser Gln Pro Asn Pro Lys Thr Val Glu Leu Leu Ser Gly Val
50 55 60

Val Asp Gln Thr Lys Asp Gly Leu Ile Ser Phe Gln Glu Phe Val Ala
65 70 75 80

Phe Glu Ser Val Leu Cys Ala Pro Asp Ala Leu Phe Met Val Ala Phe
85 90 95

Gln Leu Phe Asp Lys Ala Gly Lys Gly Glu Val Thr Phe Glu Asp Val
100 105 110

Lys Gln Val Phe Gly Gln Thr Thr Ile His Gln His Ile Pro Phe Asn

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        115                 120                 125

Trp Asp Ser Glu Phe Val Gln Leu His Phe Gly Lys Glu Arg Lys Arg
    130                 135                 140

His Leu Thr Tyr Ala Glu Phe Thr Gln Phe Leu Leu Glu Ile Gln Leu
145                 150                 155                 160

Glu His Ala Lys Gln Ala Phe Val Gln Arg Asp Asn Ala Arg Thr Gly
                165                 170                 175

Arg Val Thr Ala Ile Asp Phe Arg Asp Ile Met Val Thr Ile Arg Pro
            180                 185                 190

His Val Leu Thr Pro Phe Val Glu Glu Cys Leu Val Ala Ala Ala Gly
        195                 200                 205

Gly Thr Thr Ser His Gln Val Ser Phe Ser Tyr Phe Asn Gly Phe Asn
    210                 215                 220

Ser Leu Leu Asn Asn Met Glu Leu Ile Arg Lys Ile Tyr Ser Thr Leu
225                 230                 235                 240

Ala Gly Thr Arg Lys Asp Val Glu Val Thr Lys Glu Glu Phe Val Leu
                245                 250                 255

Ala Ala Gln Lys Phe Gly Gln Val Thr Pro Met Glu Val Asp Ile Leu
            260                 265                 270

Phe Gln Leu Ala Asp Leu Tyr Glu Pro Arg Gly Arg Met Thr Leu Ala
        275                 280                 285

Asp Ile Glu Arg Ile Ala Pro Leu Glu Glu Gly Thr Leu Pro Phe Asn
    290                 295                 300

Leu Ala Glu Ala Gln Arg Gln Lys Ala Ser Gly Asp Ser Ala Arg Pro
305                 310                 315                 320

Val Leu Leu Gln Val Ala Glu Ser Ala Tyr Arg Phe Gly Leu Gly Ser
                325                 330                 335
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Val Ala Gly Ala Val Gly Ala Thr Ala Val Tyr Pro Ile Asp Leu Val
            340                 345                 350

Lys Thr Arg Met Gln Asn Gln Arg Ser Thr Gly Ser Phe Val Gly Glu
        355                 360                 365

Leu Met Tyr Lys Asn Ser Phe Asp Cys Phe Lys Lys Val Leu Arg Tyr
    370                 375                 380

Glu Gly Phe Phe Gly Leu Tyr Arg Gly Leu Leu Pro Gln Leu Leu Gly
385                 390                 395                 400

Val Ala Pro Glu Lys Ala Ile Lys Leu Thr Val Asn Asp Phe Val Arg
                405                 410                 415

Asp Lys Phe Met His Lys Asp Gly Ser Val Pro Leu Ala Ala Glu Ile
            420                 425                 430

Leu Ala Gly Gly Cys Ala Gly Gly Ser Gln Val Ile Phe Thr Asn Pro
        435                 440                 445

Leu Glu Ile Val Lys Ile Arg Leu Gln Val Ala Gly Glu Ile Thr Thr
    450                 455                 460

Gly Pro Arg Val Ser Ala Leu Ser Val Val Arg Asp Leu Gly Phe Phe
465                 470                 475                 480

Gly Ile Tyr Lys Gly Ala Lys Ala Cys Phe Leu Arg Asp Ile Pro Phe
                485                 490                 495

Ser Ala Ile Tyr Phe Pro Cys Tyr Ala His Val Lys Ala Ser Phe Ala
            500                 505                 510

Asn Glu Asp Gly Gln Val Ser Pro Gly Ser Leu Leu Leu Ala Gly Ala
        515                 520                 525

Ile Ala Gly Met Pro Ala Ala Ser Leu Val Thr Pro Ala Asp Val Ile
    530                 535                 540

Lys Thr Arg Leu Gln Val Ala Ala Arg Ala Gly Gln Thr Thr Tyr Ser
545                 550                 555                 560
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Gly Val Ile Asp Cys Phe Arg Lys Ile Leu Arg Glu Glu Gly Pro Lys
                565                 570                 575

Ala Leu Trp Lys Gly Ala Gly Ala Arg Val Phe Arg Ser Ser Pro Gln
            580                 585                 590

Phe Gly Val Thr Leu Leu Thr Tyr Glu Leu Leu Gln Arg Trp Phe Tyr
        595                 600                 605

Ile Asp Phe Gly Gly Val Lys Pro Met Gly Ser Glu Pro Val Pro Lys
    610                 615                 620

Ser Arg Ile Asn Leu Pro Ala Pro Asn Pro Asp His Val Gly Gly Tyr
625                 630                 635                 640

Lys Leu Ala Val Ala Thr Phe Ala Gly Ile Glu Asn Lys Phe Gly Leu
                645                 650                 655

Tyr Leu Pro Leu Phe Lys Pro Ser Val Ser Thr Ser Lys Ala Ile Gly
            660                 665                 670

Gly Gly Pro
        675
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<210> 141
<211> 70
<212> RNA
<213> Artificial Sequence

<220>
<223> mRNA encoding non-translated Factor IX (NTFIX

<400> 141
gggaaauaag agagaaaaga agaguaaucc auaaaguagg aaacacuaca gaagaaauau 60

aagagccacc 70

<210> 142
<211> 85
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-126

<400> 142
cgcuggcgac gggacauuau uacuuuuggu acgcgcugug acacuucaaa cucguaccgu 60

gaguaauaau gcgccgucca cggca 85

<210> 143
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-126-3p

<400> 143
ucguaccgug aguaauaaug cg 22

<210> 144
<211> 22
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-126-3p binding site

<400> 144
cgcauuauua cucacgguac ga 22

<210> 145
<211> 21
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-126-5p

<400> 145
cauuauuacu uuugguacgc g 21

<210> 146
<211> 21
<212> RNA
<213> Artificial Sequence

<220>
<223> miR-126-5p binding site

<400> 146
cgcguaccaa aaguaauaau g 21

<210> 147

<211> 166
<212> RNA
<213> Artificial Sequence

<220>
<223> 3' UTR with miR 142-3p and miR 126-3p binding sites variant 2

<400> 147
ugauaauagu ccauaaagua ggaaacacua cagcuggagc cucgguggcc uagcuucuug 60

ccccuugggc cucccccccag ccccuccucc ccuuccugca cccguacccc ccgcauuauu 120

acucacggua cgaguggucu uugaauaaag ucugaguggg cggcsd 166

<210> 148
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3' UTR with miR 142-3p binding site variant 2

<400> 148
ugauaauagg cuggagccuc gguggccuag cuucuugccc cuuggggccuc cccccagccc 60

cuccuccccu uccugcaccc guacccccuc cauaaaguag gaaacacuac aguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 149
<211> 119
<212> RNA
<213> Artificial Sequence

<220>
<223> 3' UTR, no miR binding sites variant 2

<400> 149
ugauaauagg cuggagccuc gguggccuag cuucuugccc cuuggggccuc cccccagccc 60

cuccuccccu uccugcaccc guacccccgu ggucuuugaa uaaagucuga gugggcggc 119

<210> 150
<211> 141
<212> RNA
<213> Artificial Sequence

<220>
<223> 3' UTR with miR 126-3p binding site variant 3

<400> 150
ugauaauagg cuggagccuc gguggccuag cuucuugccc cuuggggccuc cccccagccc 60

cuccucccu uccugcaccc guacccccg cauuauuacu cacgguacga guggucuuug 120

aauaaagucu gagugggcgg c 141

<210> 151
<211> 188
<212> RNA
<213> Artificial Sequence

<220>
<223> 3' UTR with 3 miR 142-3p binding sites variant 2

<400> 151
ugauaauagu ccauaaagua ggaaacacua cagcuggagc cucgguggcc uagcuucuug 60

ccccuugggc cuccauaaag uaggaaacac uacaucccc cagccccucc uccccuuccu 120

gcacccguac ccccuccaua aaguaggaaa cacuacagug gucuuugaau aaagucugag 180

ugggcggc 188

<210> 152
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR with miR 142-3p binding site, P1 insertion variant 2

<400> 152
ugauaauagu ccauaaagua ggaaacacua cagcuggagc cucgguggcc uagcuucuug 60

ccccuugggc cuccccccag ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 153
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR with miR 142-3p binding site, P2 insertion variant 2

<400> 153
ugauaauagg cuggagccuc gguggcucca uaaaguagga aacacuacac uagcuucuug 60

ccccuugggc cuccccccag ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 154
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR with miR 142-3p binding site, P3 insertion variant 2

<400> 154
ugauaauagg cuggagccuc gguggccuag cuucuugccc cuugggccuc cauaaaguag 60

gaaacacuac auccccccag ccccuccucc ccuuccugca cccguacccc cguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 155
<211> 142
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR with miR 155-5p binding site variant 2

<400> 155
ugauaauagg cuggagccuc gguggccuag cuucuugccc cuugggccuc cccccagccc 60

cuccuccccu uccugcaccc guacccccac cccuaucaca auuagcauua aguggucuuu 120

gaauaaaguc ugagugggcg gc 142

<210> 156
<211> 188
<212> RNA
<213> Artificial Sequence

<220>
<223> 3' UTR with 3 miR 155-5p binding sites variant 2

<400> 156
ugauaauaga ccccuaucac aauuagcauu aagcuggagc cucgguggcc uagcuucuug 60

ccccuugggc caccccuauc acaauuagca uuaaucccccc cagccccucc uccccuuccu 120

gcacccguac ccccacccccu aucacaauua gcauuaagug gucuuugaau aaagucugag 180

ugggcggc 188

<210> 157
<211> 188
<212> RNA
<213> Artificial Sequence

<220>
<223> 3'UTR with 2 miR 155-5p binding sites and 1 miR 142-3p binding site variant 2

<400> 157
ugauaauaga ccccuaucac aauuagcauu aagcuggagc cucgguggcc uagcuucuug 60

ccccuugggc cuccauaaag uaggaaacac uacaucccc cagccccucc uccccuuccu 120

gcacccguac ccccacccu aucacaauua gcauuaagug gucuuugaau aaagucugag 180

ugggcggc 188